doi:10.7289/V5/MDR-OER-EX1101

NOAA *Okeanos Explorer* Program

MAPPING REPORT

CRUISE EX1101

Ship Shakedown and Patch Test

March 16 – April 1, 2011
San Francisco CA to Sand Diego CA

Report Contributors:
PS Elizabeth “Meme” Lobecker, SST Colleen Peters, LT Nicola VerPlanck Ashley “Ash” Harris, Adam Argento, Anthony Lukach, David Armstrong

19 November 2014

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 unique combination of scientific and technological tools positions it to systematically explore new areas of our largely unknown ocean. These explorations will generate scientific questions leading to further scientific inquiries.

Using a high-definition multibeam sonar with water column capabilities, a deep water remotely operated vehicle, and telepresence technology, *Okeanos Explorer* provides NOAA the ability to foster scientific developments by identifying new targets in real time, diving on those targets shortly after initial detection, 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 better understanding.

Through the *Okeanos Explorer* Program, NOAA's Office of Ocean Exploration and Research provides the nation with important capabilities to discover and investigate new ocean areas 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

NOAA Ship *Okeanos Explorer* 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. NOAA's Office of Ocean Exploration and Research is responsible for operating the cutting-edge ocean exploration systems on the vessel. It is the only federal ship dedicated to systematic exploration of the planet's largely unknown ocean.

Table of Contents

2. Report Purpose

The purpose of this mapping report is to describe the data collection and processing methods to enable maximum usability of the mapping dataset. This report briefly describes the data acquisition and processing for EX1101 data, without going into a very detailed description of the multibeam and ancillary sensor arrangement. For details about arrangement of the mapping equipment and sensors, please refer to 'NOAA Ship *Okeanos Explorer* 2011 Readiness Report' which can be obtained from the ship (noaa.ship.okeanos.explorer@noaa.gov).

3. Cruise Objectives

The overall purpose of the cruise was to conduct the annual ship shakedown and performance testing following the 2010 / 2011 winter in port shipyard period. Annual performance testing includes a multibeam patch test and data quality evaluation. Continuous multibeam data collection occurred, and is described in this report. There were no ROV or other scientific operations during this cruise. Members of the telepresence team were onboard to prepare for the upcoming field season.

The mapping departments cruise objectives included:

1. Conduct multibeam patch test in vicinity of Monterey Bay.
2. Test the new subrack replacement in the EM 302 transceiver.
3. Update the 2011 Mapping Readiness Report.
4. Map ROV dive site locations in preparation for the ROV Shakedown cruise (EX1102).
5. Use ship shakedown time to map targets of interest requested by the Office of National Marine Sanctuaries (ONMS) and the National Ocean Service (NOS). The targets of interest are clearly described in the cruise plan. A summary table is provided in Appendix I.
6. Test new folder structures, file naming conventions and data record keeping to streamline data management efforts and metadata generation.

4. Summary of Major Findings

The multibeam system was found to be capable of acquiring high quality data for the 2011 field season. The new subrack in the EM 302 transceiver did not destroy any transmit boards, and patch test and crossline analysis results were favorable. Channel 30 of RX board 4 was in 'failed' status throughout the cruise. Kongsberg engineering indicated this would not impact system performance or data quality. Mapping department goals for testing multibeam and mapping ROV targets for EX1102 and to aid sanctuaries management were completed. The date pipeline was tested and continues to be refined for practicality.

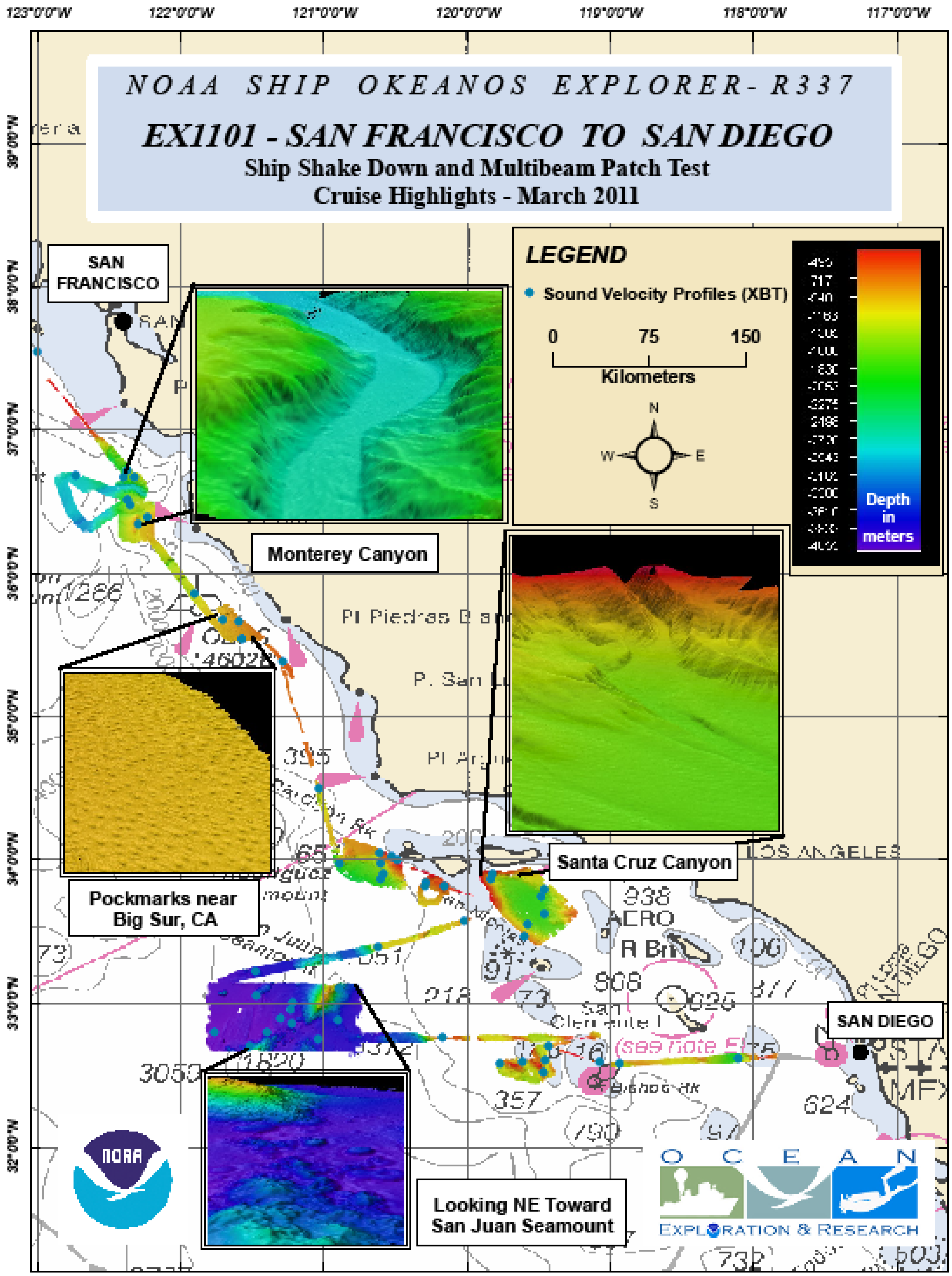


Figure 1. Summary map of EM 302 multibeam data collected during EX-11-01.

5. Participating Personnel (mapping mission only)

NAME	ROLE	AFFILIATION

CDR Robert Kamphaus	Commanding Officer	NOAA Corps
LT Nicola VerPlanck	Field Operations Officer	NOAA Corps
Adam Argento	Mapping Watchstander	NOAA PHB
David Armstrong	Mapping Watchstander	NOAA OER / UCAR Intern
Ashley Harris (Ash)	Mapping Watchstander	UCAR
Elizabeth Lobecker (Meme)	Mapping Team Lead	NOAA OER (ERT Inc.)
Anthony Lukach	Mapping Watchstander	NOAA PHB
Colleen Peters	Senior Survey Technician	NOAA OMAO

6. Mapping Statistics

Dates	3/16/11 – 4/1/11
Weather delays	0
Total non-mapping days	0
Total survey mapping days	14.5 days
Total transit mapping days	n/a
Line kilometers of survey	4,564.5 km
Square kilometers mapped	15,800 sq km
Number of bathymetric multibeam files	318
Data volume of raw multibeam data files	33 GB
Number of water column multibeam files	314
Data volume of water column multibeam files	114 GB
Number of subbottom files	0
Number of singlebeam files	0
Number of XBT casts	56
Number of CTD casts	1

7. Mapping Sonar Setup

The NOAA Ship *Okeanos Explorer* is equipped with a 30 kHz Kongsberg EM 302 multibeam sonar. During this cruise bottom bathymetric and backscatter data were collected. Additionally, for testing purposes during this shakedown cruise, water column backscatter data was also continuously collected. The ship used a POS MV, ver. 4, to record and correct the multibeam data for vessel motion. A 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 the sonar head, draft, sensor offsets) are applied during real time data acquisition. XBT casts (Sippican Deep Blue, T5, or T6) were taken every 6 hours and/or as necessary to correct for sound speed. XBT cast data were converted to Seafloor Information System (SIS) compliant format using NOAA Velocipy.

Reson SVP 70 data was applied in real time for sound velocity correction at the sonar head. The backup thermosalinograph was also briefly and tested, with success.

See Appendix E for a complete list of software used for data processing.

8. Data Acquisition Summary

Table 1 lists the transducer and attitude sensor offsets determined during the EX1101 deep water patch test. For the complete processing unit setup utilized for the cruise, refer to Appendix D.

Table 1. Angular offsets in degrees 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	-0.725	0.0

Multibeam data (bathymetry, bottom backscatter, and water column backscatter) were continuously recorded during the entire cruise between San Francisco, CA and San Diego, CA, including during transits between survey areas. Short interruptions in data continuity are due to built in system tests (BIST) periodically run on the multibeam system for approximately 10 to 40 minutes, and other system testing. All data is within the US Exclusive Economic Zone. A large portion of the data falls within the boundaries of Monterey National Marine Sanctuary and Channel Islands National Marine Sanctuary. Permits to operate within sanctuary boundaries were obtained and are provided as Appendix G.

All multibeam and associated data are time stamped with UTC time. The daily cruise log included in this report uses local ship's time (Pacific Daylight Savings Time). The conversion from local to UTC is local + 7 hrs.

The majority of the mapping areas were requests from other NOAA offices. These requests were integrated with the overall mapping shakedown objectives for the cruise. Specifically, the Office of National Marine Sanctuaries requested the survey areas within Monterey Bay National Marine Sanctuary (MBNMS) and the Channel Islands National Marine Sanctuary (CINMS), and the offshore area in the vicinity of San Juan Seamount. The Center for Coastal Environmental Health and Bimolecular Research within the National Ocean Service, and the Southwest Fisheries Science Center within National Marine Fisheries Service jointly requested surveys over Hancock Seamount and "109" Seamount.

A joint permit was obtained for XBT operations within sanctuary boundaries from CIMNS and MBNMS. A letter with suggested operational guidelines was obtained from Southwest National Marine Fisheries Service. A categorical exclusion letter required under the National Environmental Protect Act (NEPA) was obtained from John McDonough, Acting Deputy Director of OER. These documents can be found in the appendices section of this report.

9. Data Archival Procedures

All multibeam data are publically available, including metadata records, within approximately three months from the end of the cruise via the NGDC website (www.ngdc.noaa.gov). All raw and processed data products are in WGS84 coordinate system.

The data are archived in the following formats:
Level 00

- Raw, full resolution data are archived in native Kongsberg binary format files (*.all and *.wcd).

Level 01

- ASCII xyz text files of all accepted soundings (ungridded)

Level 02

- ASCII xyz text file of gridded data, with grid cell size specified in the filename
- Georeferenced tiff image
- IVS3D Fledermaus v.7 SD object
- Google Earth KMZ file summarizing multibeam from the entire cruise

Additionally, all sound velocity profiles (XBT and CTD) are archived alongside the multibeam data as ancillary files.

See Appendix A for an overview map of all bathymetry data collected.

10. Multibeam Data Quality Assessment and Data Processing

Multibeam Patch Test
A patch test was conducted on March 17 over a section of Monterey Bay Canyon. The Canyon provided an ideal combination of required conditions including a steep slope for pitch, timing, and gyro lines, and a nearby flat, featureless area provided ideal conditions for roll lines. The patch test was initially run with all offsets in SIS zeroed out. Screen shots of the CARIS 6.1 Calibration Tool are provided in the appendix section.

Timing and Pitch

A 19 kilometer line was run to determine timing and pitch offsets. The line traversed both a flat seabed and a sloped seabed, with a maximum slope of 18°. For timing, the line was run in the same direction at different speeds (5 kts & 8 kts). For pitch, the line was run in reciprocal directions at the same speed. The lines were repeated after offsets were applied to verify offset values.

Heading

A pair of parallel 12.4 kilometer lines were run in the same direction at the same speed, with the one wall of Monterey Canyon caught in the outer beams of each line. The pair of lines were 2.1 kilometers apart.

Roll

Roll lines were run over a flat seabed near Monterey Canyon. The same 12 kilometer line was run twice, in reciprocal directions at 6 knots.

Crossline Analysis

Two crosslines were collected, one in the shallower water south of Santa Rosa Island, and one in the deeper offshore survey area in the vicinity of San Juan Seamount.

Shallow water crossline

Crossline file 0178_20110323_160923_EX1101.all was run at a heading of 220° in the survey area south of Santa Rosa Island in the Channel Islands. The crossline spanned water depths of ~216 meters to ~720 meters. The crossline crossed the following mainscheme lines at a 90° angle:

0157_20110323_071813_EX1101.all
0159_20110323_083710_EX1101.all
0162_20110323_095310_EX1101.all
0166_20110323_110359_EX1101.all
0168_20110323_120113_EX1101.all
0172_20110323_130350_EX1101.all
0174_20110323_140403_EX1101.all

The cleaned mainscheme data were gridded in a 25 meter CARIS base surface. The base surface was exported as ASCII text and converted to a Fledermaus SD object. The cleaned crossline was exported using the CARIS HIPS to ASCII routine, which preserves every accepted sounding within the file. Fledermaus CrossCheck was then used to compare the mainscheme SD object to the crossline soundings.

Details of the reported results from CrossCheck are as follows. The crossing analysis compared 709,990 data points. The standard deviation was 2.15 meters, and the mean +2 standard deviations was 4.65 meters. The difference range was -36.69 meters to 28.27 meters.

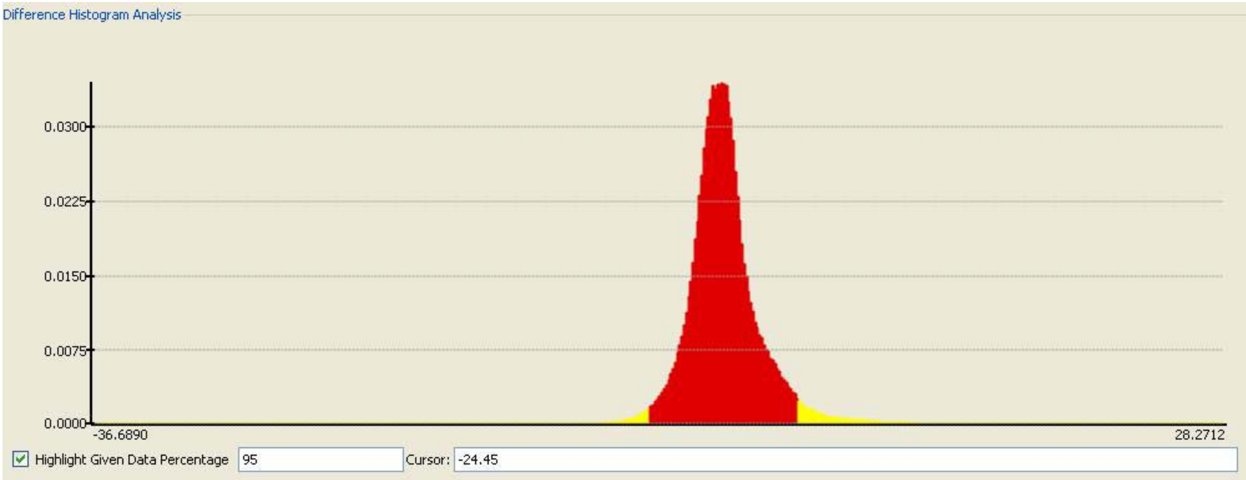


Figure 2. Screenshot of Fledermaus Crosscheck difference histogram analysis comparing crossline 0178 to mainscheme lines. Red highlight indicating 95% of the data fall within 4.65 meters, or the data mean + 2 standard deviations.

Deep water crossline

Crossline file 0267_20110329_041253_EX1101.all was run at a heading of 180° in the offshore survey area near San Juan Seamount. The crossline spanned water depths of ~3584 meters to ~3849 meters. The crossline crossed the following mainscheme lines at a 90° angle:
0250_20110327_164658_EX1101.all
0252_20110327_222318_EX1101.all
0256_20110328_075313_EX1101.all
0258_20110328_111214_EX1101.all

The cleaned mainscheme data were gridded in a 75 meter CARIS base surface. The base surface was exported as ASCII text and converted to a Fledermaus SD object. The cleaned crossline was exported using the CARIS HIPS to ASCII routine, which preserves every accepted sounding within the file. Fledermaus CrossCheck was then used to compare the mainscheme SD object to the crossline soundings.

Details of the reported results from CrossCheck are as follows. The crossing analysis compared 166,320 data points. The standard deviation was 5.24 meters, and the mean +2 standard deviations was 15.34 meters. The difference range was -79.78 meters to 41.69 meters.

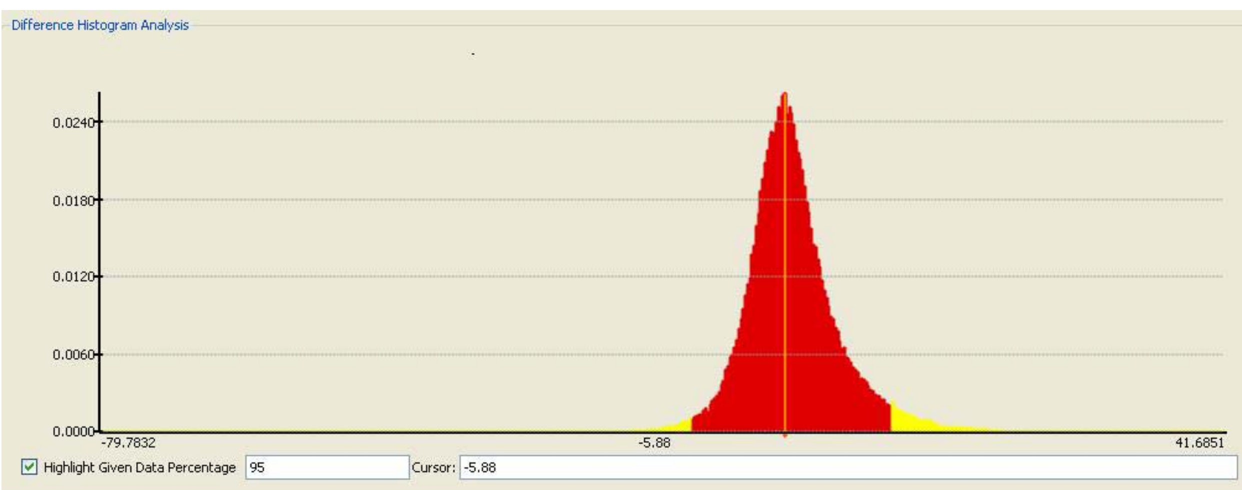


Figure 3. Screenshot of Fledermaus CrossCheck difference histogram analysis comparing crossline 0267 to mainscheme lines. Red highlight indicating 95% of the data fall within15.34 meters, or the data mean +2 standard deviations.

The crossline was then also filtered to reject all data beyond 25° to port and starboard. The purpose of this exercise was to compare the most reliable beams from the crossline to all beams from the mainscheme lines. The resulted accepted soundings were then exported using the CARIS HIPS to ASCII routine, and compared to the mainscheme reference surface in CrossCheck. Details of the reported results from CrossCheck are as follows. The crossing analysis compared 88,262 data points. The standard deviation was 3.53 meters, and the mean+2 standard deviations was 13.42 meters. The difference range was -46.46 meters to 41.69 meters.

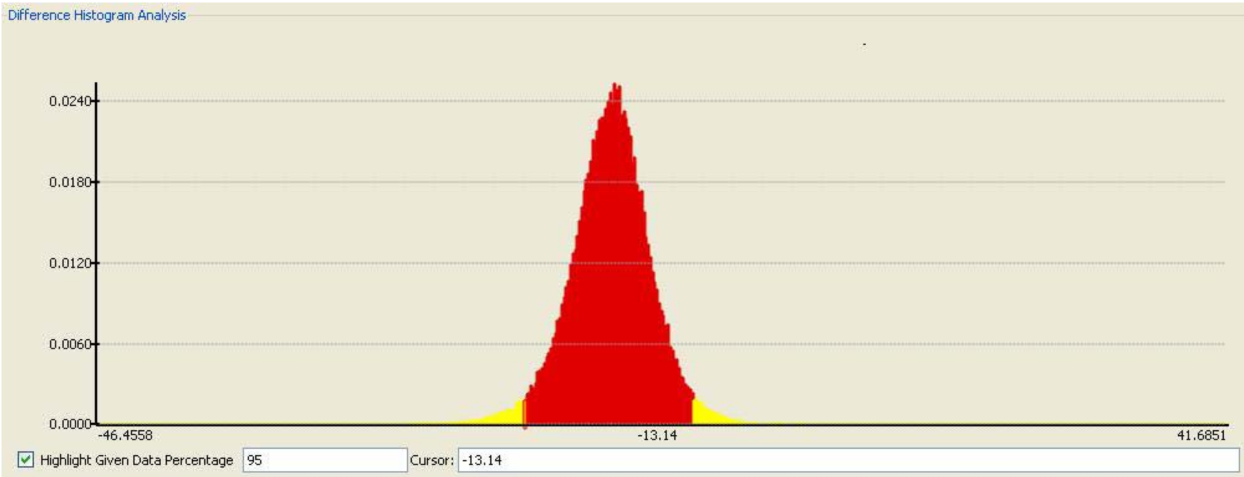


Figure 4. Screenshot of Fledermaus CrossCheck difference histogram analysis comparing inner beams of crossline 0267 to mainscheme lines. Red highlight indicating 95% of the data fall within 13.42 meters, or the data mean +2 standard deviations.

Built In System Tests (BISTS)

BISTs were run at least once per day to monitor TRU system performance. A BIST log is included in Appendix B. RX (receive) noise levels were monitored and were in acceptable range throughout the cruise. BISTs revealed that Channel 30 of RX board 4 was in failed status throughout the cruise. Kongsberg engineering indicated this would not impact system performance or data quality.

11. Cruise Calendar

March/April 2011						
Sun	Mon	Tues	Wed	Thurs	Fri	Sat
					MARCH 12 Telepresence Lead Pinner arrives to ship, Pier 27 San Francisco CA	13
14 Mapping Lead Lobecker arrives to ship	15 Mission personnel arrives to ship: Argento, Armstrong, Brian, Diffendale, Harris, Lukach	16 Depart dock 1720 PDT Conduct restricted data survey over Puerto Rican shipwreck	17 Conduct multibeam patch test at Monterey Canyon	18 Conduct Sur Ridge survey	19 Conduct Southern MBNMS survey	20 DP testing outside sanctuaries boundaries, heavy weather. Commence survey west of San Miguel Island.

21 Continue survey west of San Miguel Island	22 Commence 10-Story Mystery Survey	23 Complete 10-Story Mystery Survey incl crossline, Commence Santa Cruz Canyon survey, Safety Drills	24 Continue Santa Cruz Canyon Survey	25 Complete Santa Cruz Canyon Survey. Transit offshore to San Juan Seamount and commence deep survey.	26 Continue offshore survey in vicinity of San Juan Seamount.	27 Continue offshore survey in vicinity of San Juan Seamount.
28 Continue survey in vicinity of San Juan Seamount.	29 Complete offshore survey in vicinity of San Juan Seamount. Transit to seamounts Hancock and 109.	30 Survey Hancock and 109 Seamounts. Commence transit to San Diego.	31 Cruise wrap up for mission personnel. Arrive at dock in San Diego Naval Base, pier 8.			
				APRIL 1 In port. Argento departs the ship.	2 In port. Remaining visiting mapping personnel departs ship.	

12. Daily Cruise Log

All times listed are ship's local time (Pacific Daylight Savings Time / PDT).

15 March 2010
Preparations for getting underway are being made by all departments. The ship has been in the shipyard since November.

The survey department's safety stand down included: tag out / lock out procedures for electrical equipment; slips, trips and falls; everyday habits; review of standing orders; XBT and CTD operational safety; and a ship tour highlighting safety equipment and procedures.

Science orientation included a review of the cruise plan, restrictions on shipwreck data, multibeam patch test plans, data collection and processing, data logs, XBT operations, and general ship expectations.

The scheduled Kongsberg technician was unable to sail due to family emergency. Contingency plans are being explored to bring another technician on board later in the cruise or possibly during EX1102. The plan was for the technician to be onboard during the multibeam patch test and to evaluate the performance of the new TRU subrack. The subrack in the EM 302 was replaced during the winter in port. It was suspected that the old subrack was responsible for destroying several TX 36 boards in slot #16.

The permit for conducting XBT operations within Monterey Bay National Marine Sanctuary and Channel Islands National Marine Sanctuary was received. The NMFS permit addressing the Marine Mammal Protection Act and the Endangered Species Act is expected tomorrow.

16 March 2010

The ship departed the dock at 1720 and headed out of San Francisco Bay. The multibeam was powered on at 1745.

The seas were 10-14 feet throughout the evening. A detailed weather log for the cruise can be found at the end of this report.

Several Built In System Tests (BISTs) were run and four tests failed. Specifically, RX board 4, channel 30 is failing. This failure has not been previously observed on the Okeanos. Pertinent results of the BISTs run throughout the cruise can be found at the end of this report.

The ship commenced the Puerto Rican wreck survey at 2150. The data will be archived separately from the rest of the data from EX1101 due to the sensitivity of cultural resources within the boundaries of the Gulf of the Farallones National Marine Sanctuary. SCS data was logged in a separate dataset and was not sent back to shore in realtime to prevent ship survey lines from appearing in NOAA ShipTracker and SAMOS. These data can be obtained by contacting the National Coastal Data Development Center at oer.info.mgmt@noaa.gov.

Later, the ship transited to the deep water patch test site in the vicinity of Monterey Bay.

17 March 2010

The seas varied through the day from 6-12 feet from the northwest. The winds were 15-18 kts for most of the day.

The ship arrived at the deep water patch test site at 0445. A Sippican T5 XBT, which collects data to1830 meters depth, was conducted and the patch test commenced at 0500. A deep CTD was not possible because the recent CTD deck reinforcements have not been load tested yet. This testing is planned for a later date. The patch test lines traversed a section of Monterey Canyon. The pitch lines and timing offset lines were run in tandem, at 5 and 8 knots, and the initial pitch/timing lines were run with the pitch offset zeroed out in SIS. Due to heavy following seas, the ship was unable to slow to less than 5 knots. The pitch offset was determined to be -0.725 degrees in CARIS HIPS and SIPS 6.1. This offset value was later verified in SIS.

The timing, heading, and roll offsets were determined to be zero, which is consistent with previous years.

The pitch offset was applied and the pitch lines were rerun to verify the offset.

A screenshot taken in CARIS of patch test data is provided below. Further details of the patch test are found in the data analysis section of this report and in Appendix F.

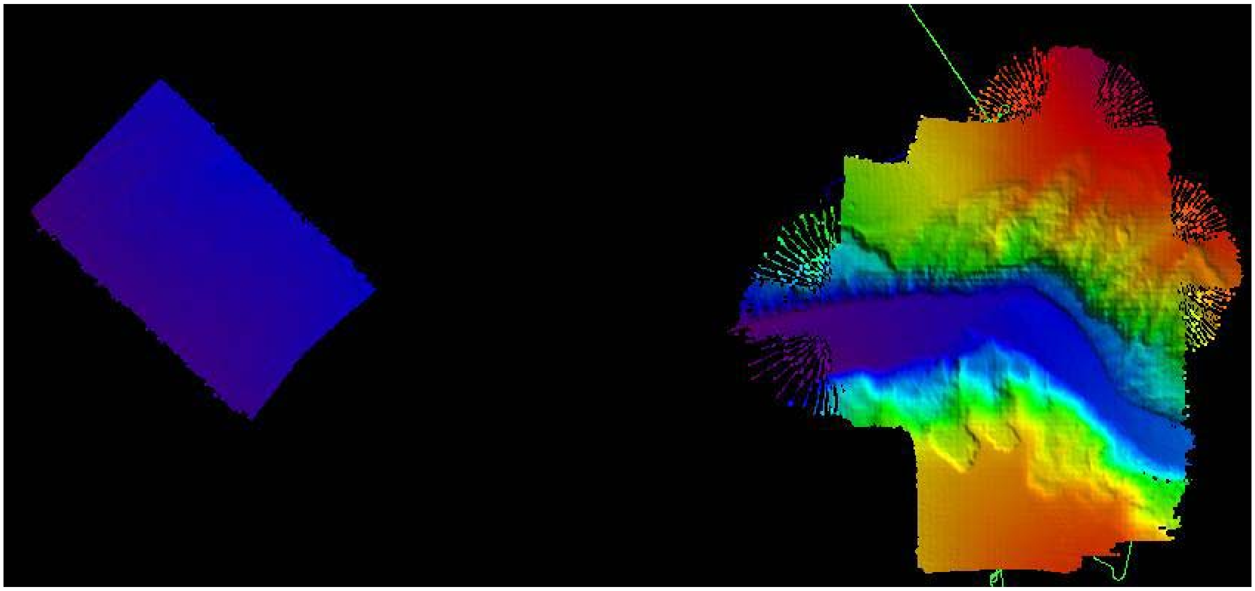


Figure 5. Screenshot of multibeam data collected over Monterey Canyon during patch test, shown in CARIS.

18 March 2010
Throughout the day, the seas were an 8-10 foot swell from the northwest.

The multibeam patch test over Monterey Canyon was completed, including a pair of lines to confirm the application of the determined pitch offset of -0.725. The ship then transited out of Monterey National Marine Sanctuary to empty the CHT tanks, then returned to the sanctuary to conduct a survey over Sur Ridge. The data will be used by the National Marine Sanctuaries program for deep water coral habitat identification.

A conference call was conducted between members of the onboard and onshore members of the mapping team and a Kongsberg technician to discuss the recent BIST failure at Receive Board 4 channel 30, the value of updating to the newest versions of SIS and the transceiver unit (TRU) software, and whether it is necessary to reschedule a Kongsberg technician to come to the ship in April. It was decided that the BIST failures are minor and the cause of the failures is in no way impacting data quality or coverage, nor is any further damage being done to the system while operating with these tests in failed status. It was hypothesized that some of the failures may be due to environmental conditions, since we have been in a 6-15 foot swell since leaving the dock. It was also decided that if it is possible during EX1101 to download the software updates recommended by Kongsberg for SIS and the TRU, they will possibly be installed near the end of the cruise, with enough time to run a reference survey, install the upgrade, then rerun the same survey. An attempt to download the software is currently underway with the high speed internet link. It was decided that whether or not to reschedule a Kongsberg technician will be decided at a later date.

A letter was received from National Marine Fisheries Service (NMFS), outlining guidelines on operating the multibeam, singlebeam, and subbottom sonars during EX1101 with respect to the Marine Mammal Protection Act. Implementation procedures onboard are:
1. If the sonar is stopped and restarted in a new area, make sure no marine mammals have been spotted by bridge watchstanders in the last 30 minutes.
2. If the sonar is restarted, test the soft start function of the EM 302
3. If a marine mammal is observed on the sea surface within 750 m of the ship, turn off the sonar and wait to turn it on until the mammal has not been observed for 15 minutes or is further away than 750m

A successful remote desktop test was performed with PS Mashkoor Malik in Silver Spring. He was able to control the EM 302 computer from his cubicle with almost no time delay observed. A free trial version of Adobe Connect was used for the test.

XBT files are now being renamed according to the automated data processing pipeline plan. The naming convention is: EX1101_XBT##_YYYYMMDD.

Late in the evening, with the support of the survey department, the ship's Commanding Officer decided to cancel the USS Macon survey due to the fact that the AIS would reveal the location of the Okeanos Explorer while conducting survey over this historically and culturally important artifact.

19 March 2010
The survey of the southern portion of Monterey Bay National Marine Sanctuary commenced and will continue into tomorrow. On the northbound lines heading into the weather, minor bubble sweepdown events are occurring. The sweepdown events are minorly discernable in the bathymetry data. The backscatter data is more affected, as expected. Reducing ship speed throughout the day reduced bubble sweepdown down events.

Interesting, previously known pockmarks of ~120 m in diameter and ~10 meters depth are prevalent in the southern section of Monterey Bay National Marine Sanctuary, and are shown in the screen capture below. Nadir penetration of a few meters below the seafloor occurred in this survey area in water depths of 700 meters to 1000 meters, seen as linear artifacts in the screen capture. Reducing to a shallower mode in SIS did not reduce this penetration. Changing the along direction angle to +2° worked best by reducing power hitting the seafloor directly below the transducer.

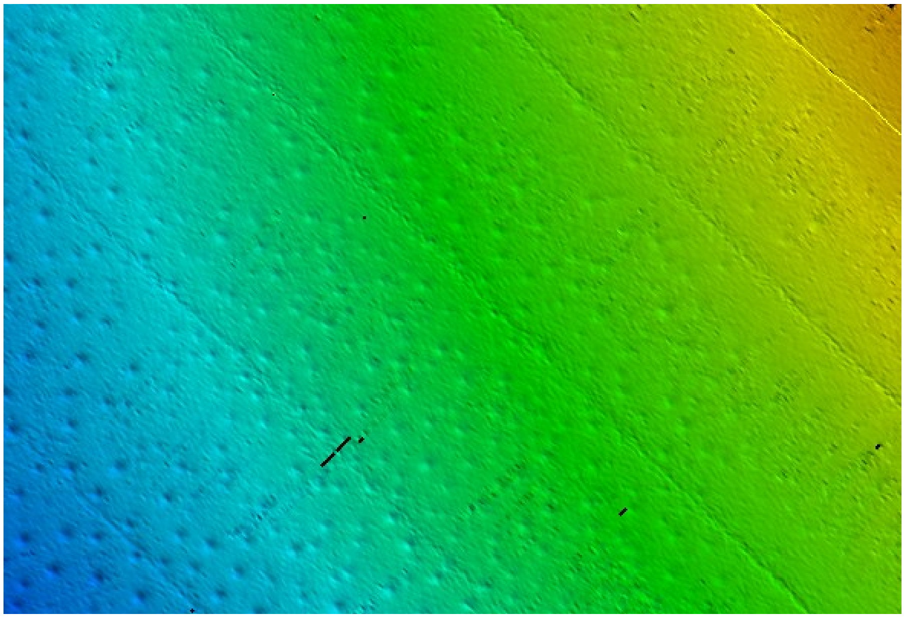


Figure 6. Pockmarks of 120 meter diameter observed near the southern border of Monterey Bay National Marine Sanctuary. Nadir penetration artifact at nadir also seen as parallel striping. Screen shot taken of gridded data (25 meter cell size, depths 600-800 meters) in CARIS.

Visiting mapping watchstanders have been taking on minor side projects as time allows between data collection and processing. David Armstrong plans to do a map of the "10 Story Mystery" in the Channel Islands. Ash Harris made the line plans for the today's survey. Tony Lukach is working on line plans for the San Juan Seamount. Adam Argento is working on a description of CUBE implementation into a standard multibeam processing workflow.

The seawater system maintained a steady flow during seas up to 10-12 feet swells in 40 knots wind without interruption. The flow was turned off at 2343 on because the ship was pitching heavily, and the watchstanders wanted to prevent damage. Flow was resumed in the morning around 0900 on 3/20/11 when the SST returned to duty to monitor the system.

20 March 2011

The multibeam and TSG pump were secured for four hours during the early morning due to heavy seas. Later, a ½ hour multibeam file over a flat area was collected while the ship was testing DP. This file might be useful during CUBE uncertainty modeling.

The survey department continued to work on side tasks, including line planning and documentation.

It was determined that it is not possible to collect a multibeam file in SIS without a sound profile applied and without a realistic SSV value applied.

The EM 302 was forced into very deep mode to test the system at higher power and longer pulse lengths, a temporary test scenario until we can work in deeper water in the next few days. It is a priority to get offshore to deeper water as soon as weather allows, specifically the San Juan

Seamount survey area. Going offshore to work in deeper water will be a better test for the new subrack and TX slot 16.

The southern MBNMS survey area was completed.

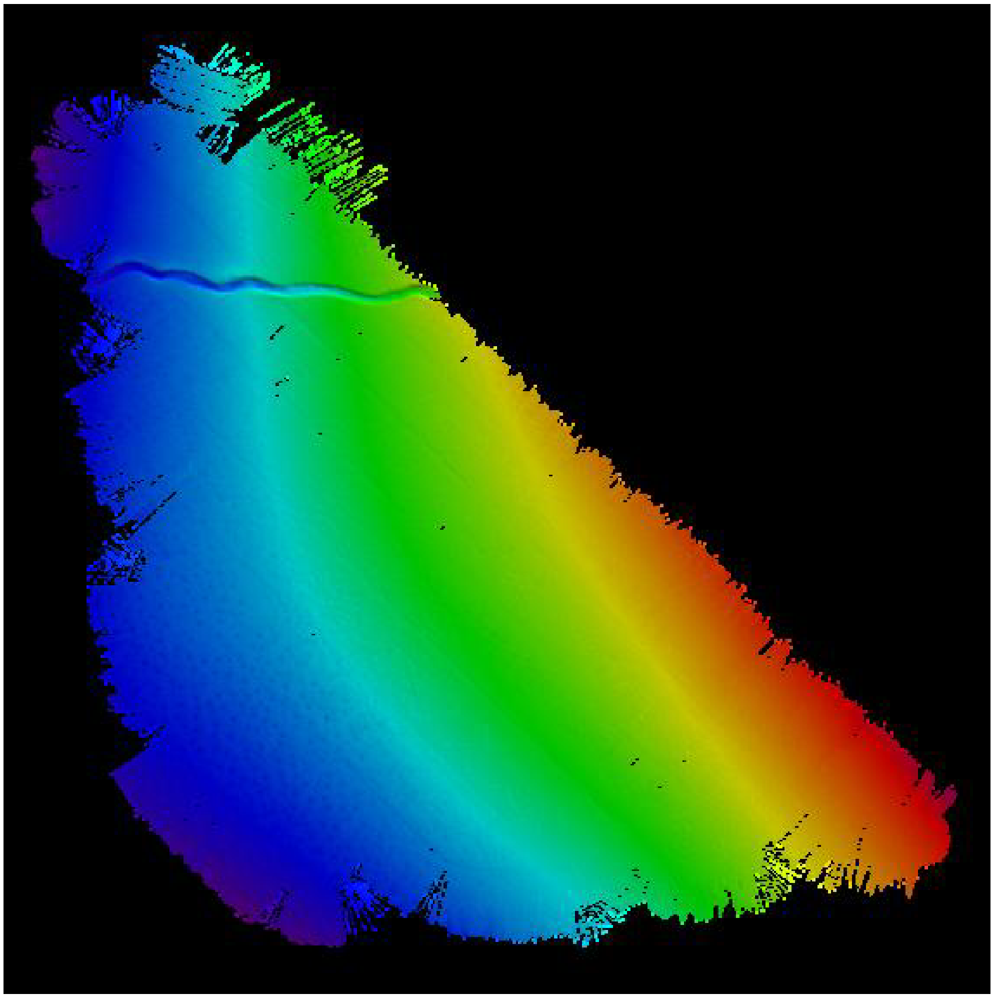


Figure 7. Screenshot of multibeam data collected in the southern MBNMS survey area, shown in CARIS.

The survey area west of San Miguel Island commenced at 2245. In 2000 meters of water, the system is obtaining 5800 meters coverage, or nearly 3 times water depth, which in the current sea state, is very good.

21 March 2011

The multibeam survey west of San Miguel Island continued throughout the day. The survey area spans depths from 300 - 2200 meters. Observed coverage was 3-5 times the water depth. The survey will be completed in the late morning on 3/22.

Dolphins were spotted inside the 750 meter safety zone on three separate occasions. The survey team stopped pinging for ~30-45 minutes each time, and the ship circled and came back online after dolphins were not seen at the surface for 15 minutes.

The weather has calmed down significantly from previous days. We are able to survey at 9 kts heading south and 7-7.5 kts heading north into the swell.

22 March 2011

The mainscheme lines of the multibeam survey west of San Miguel Island were completed before noon.

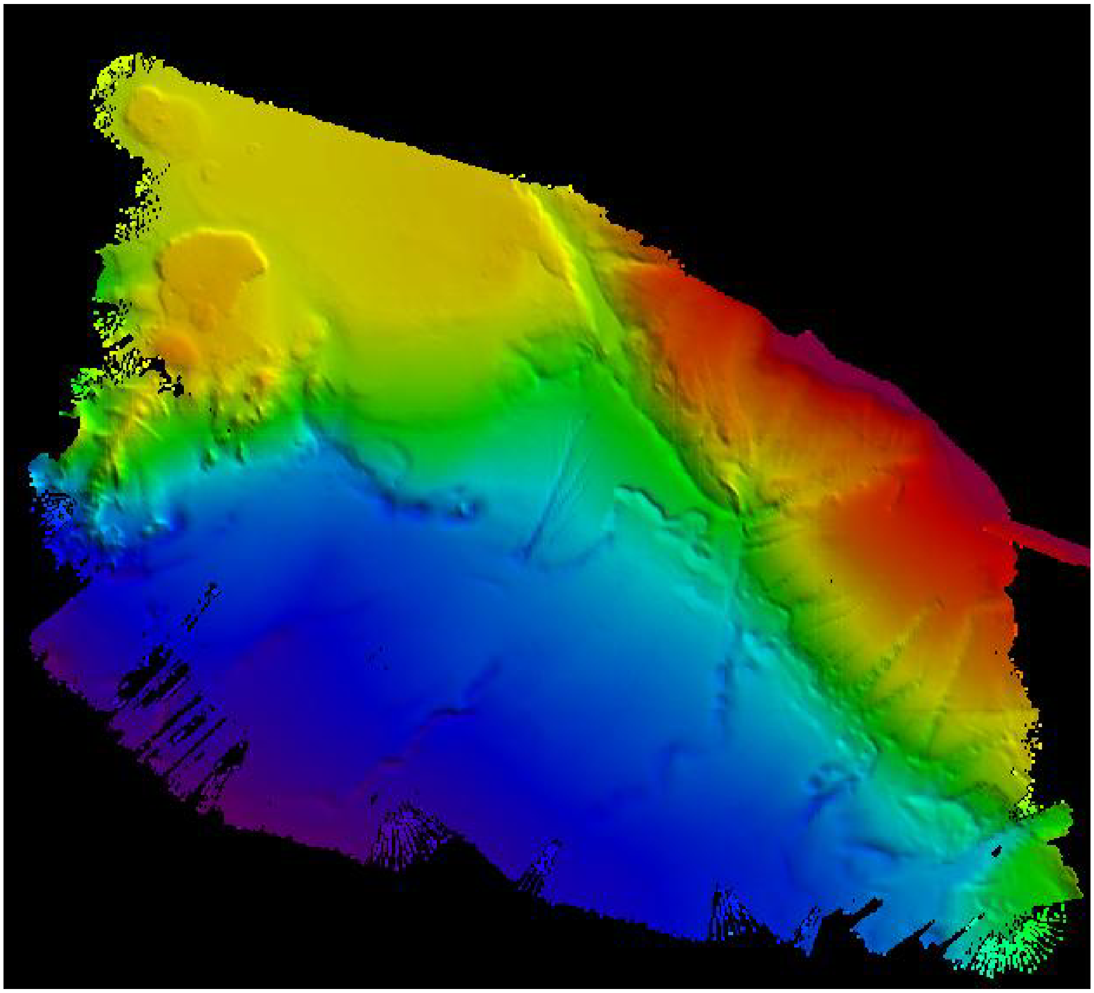


Figure 8. Screenshot of multibeam data collected in survey area south of San Miguel Island in CINMS, shown in CARIS.

Small boat ops were conducted from 1200-1600, including launch and recovery training, and man overboard drills. It took 16 minutes to recover OSCAR (the man overboard dummy). Last year’s best time was 7 minutes, achieved during the last MOB drill of the year. Several of the crew members are new to the ship, and all are still coming up to speed with procedures.

The “10-Story Mystery” survey south of Santa Rosa Island commenced after dinner. One of three multibeam passes over the position provided by the sanctuaries office showed possible detection of the anomaly. An intern was interested in the anomaly and produced a one-pager describing the data and results in ArcMap, which is provided in the appendices section of this report.

23 March 2011
The multibeam continues to perform well, with swath coverage of 3 to 5 times water depth. The daily BIST reveals no fried TX36 boards, and shows RX noise levels well within acceptable range ~40-50's dB.

The survey south of Santa Rosa Island was completed.

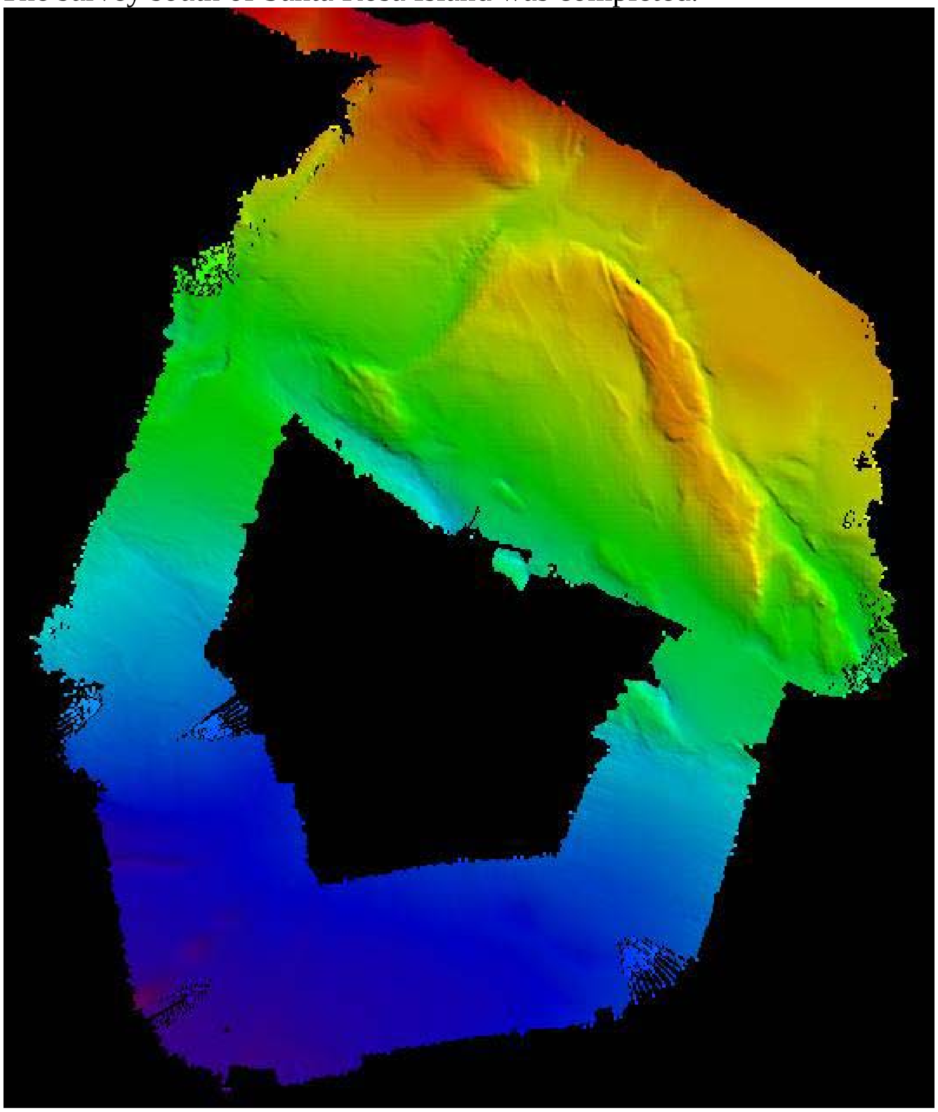


Figure 9. Screenshot of multibeam data collected in survey area south of Santa Rosa Island in CINMS, shown in CARIS.

Getting offshore to San Juan Seamount for water testing is still a priority. We have been waiting for a 48 hour weather window but may have to head out regardless if the forecast does not improve.

A series of narrow features ~35 m high anomalies were detected on a slope in the "10 Story Mystery" survey area in the Channel Islands. The anomalies were detected in only 1 of 3 passes with the multibeam.

A comparison cast was conducted between a 500 meter CTD (file EX1101_CTD01_20110323) and a Deep Blue XBT (file EX1101_XBT26_20110323). The results are shown below.

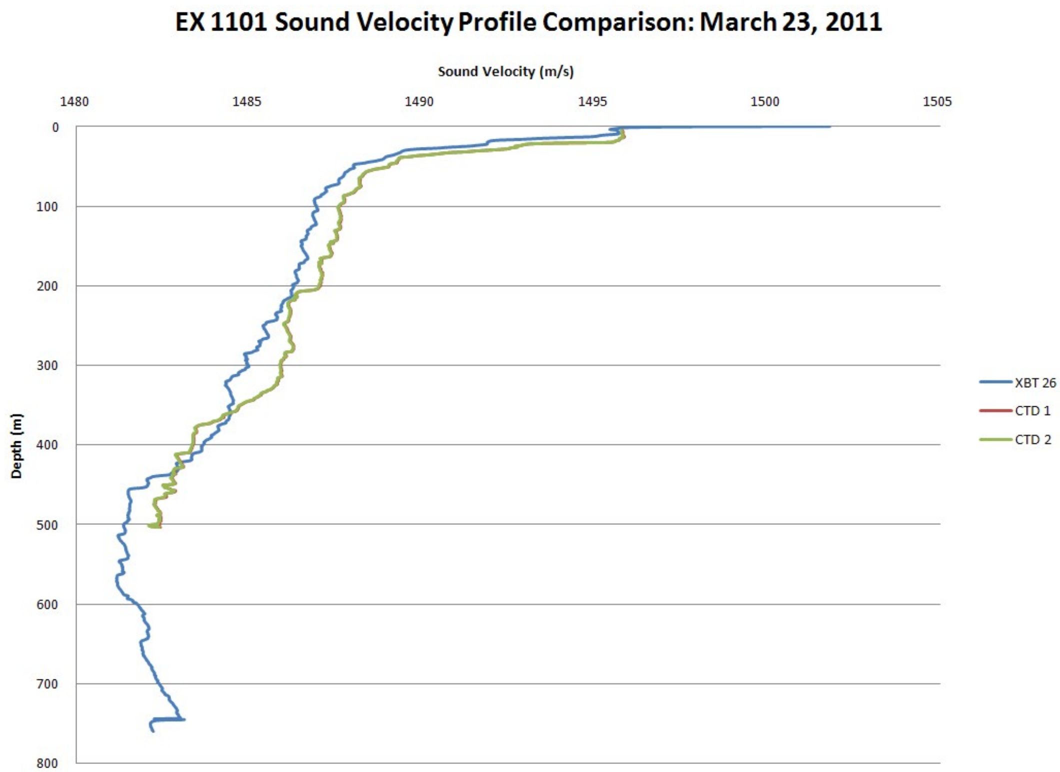


Figure 10. Comparison of Seabird SBE09Plus S/N 09P47490-0905 to Sippican Deep Blue XBT probe (shown in blue).

24 March 2011

The survey over Santa Cruz Canyon south of Santa Cruz Island in the Channel Islands continued. This survey area is expected to provide sheltered ROV targets up to ~1850 meters deep for the ROV Shakedown Cruise EX1102. Occasional acoustic interference was observed throughout the day likely due to Navy instrument installations or activities.

25 March 2011

The survey over Santa Cruz Canyon was completed.

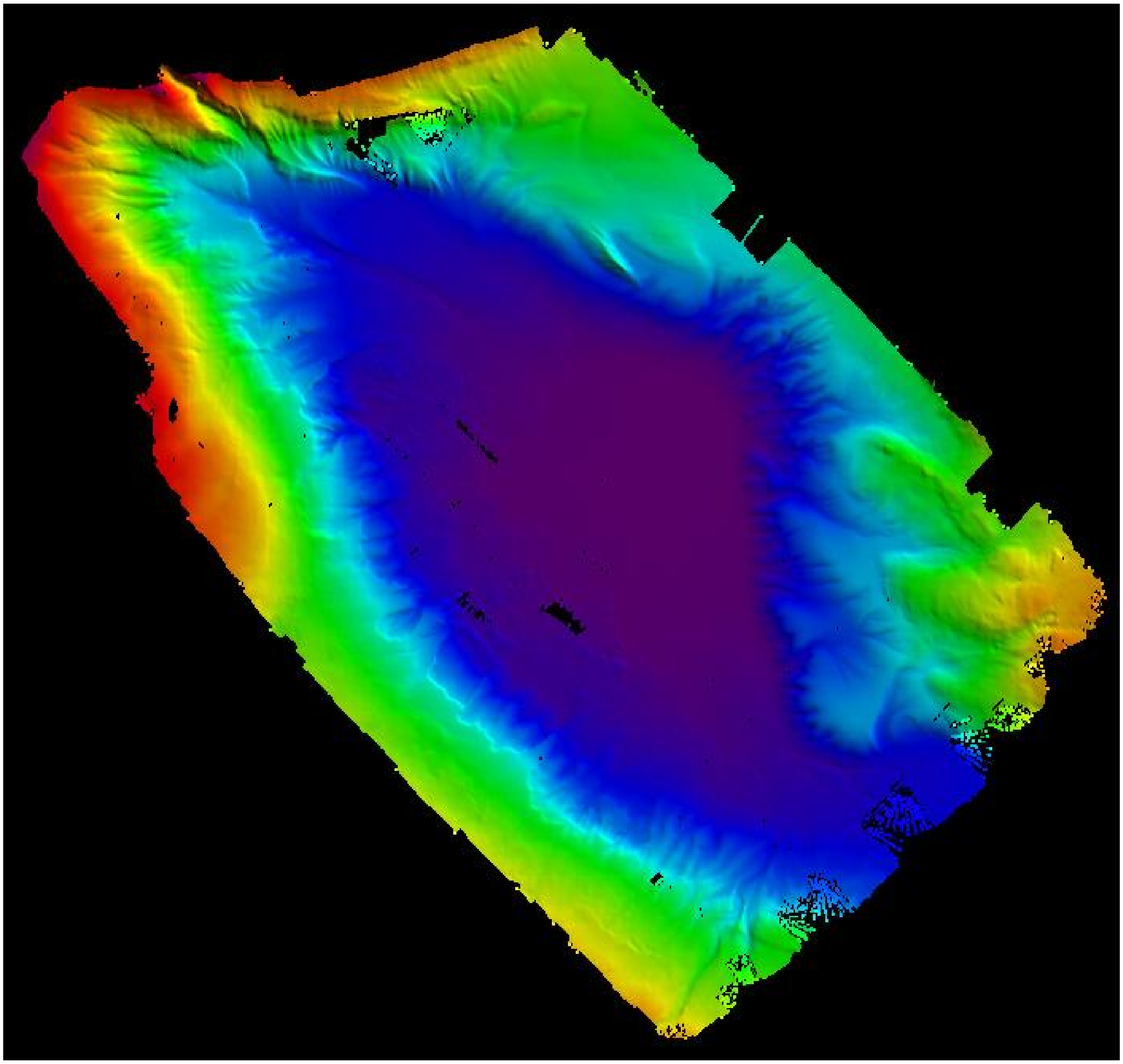


Figure 11. Screenshot of multibeam data collected in survey area south of Santa Cruz Island in CINMS, shown in CARIS.

At 1750, interference was observed, and the bridge was confirmed to have been running their fathometer. At survey's request, fathometer was secured.

The ship transited offshore to the survey area in the vicinity of San Juan Seamount, which will provide ~4000 m depths to push the sonar electronics, particularly the new subrack in the TRU and its impact on TX boards in slot 16. TX board slot 16 has been responsible for the destruction of several boards over the last two survey seasons.

The multibeam was shut down twice today due to the presence of marine mammals, for a total of 40 minutes.

During the 2010/2011 drydock period, modifications were made to the *Okeanos Explorer's* surface sound velocity measurement capabilities.

The intake for the the scientific seawater system (thermosalinograph, or TSG) was relocated and a de-bubbler was installed. The de-bubbler was installed between the seawater intake hole and the seawater pump in order to mitigate against pump overheating due to air intake during heavy seas. During the March 10, 2011 one-day sea trial, the system was run and inspected by engineering for leaks.

Additionally, a new RESON SVP-70 Sound Velocity Probe was installed on the transducer fairing near the EM 302 multibeam transducer. During the March 10, 2011 sea trials, the new probe was integrated into the multibeam acquisition system (SIS) and into the Scientific Computer System (SCS). The RESON SVP-70 is now the primary surface sound velocity sensor for the multibeam. The TSG is still a viable backup for this system as a source for surface sound velocity correction at the sonar head.

A shallow CTD for surface sound velocity comparison was conducted (SCS CTD file CTD-RAW_20110325-000000.Raw). The CTD was held at the approximate depths of the sound velocity probe and seawater system, 4.5 and 4 meters, respectively. The results are shown below.

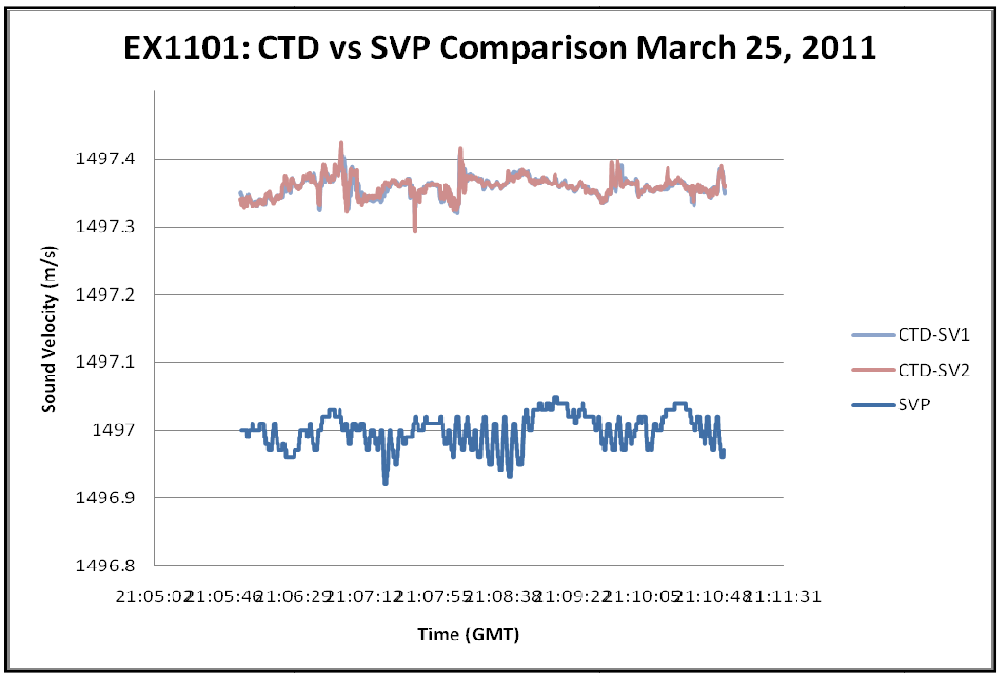


Figure 12. Comparison sea surface sound velocities calculated by Seabird SBE09Plus S/N 09P4790-0905 (shown in red and green underneath) to Reson 70 SVP probe (shown in blue).

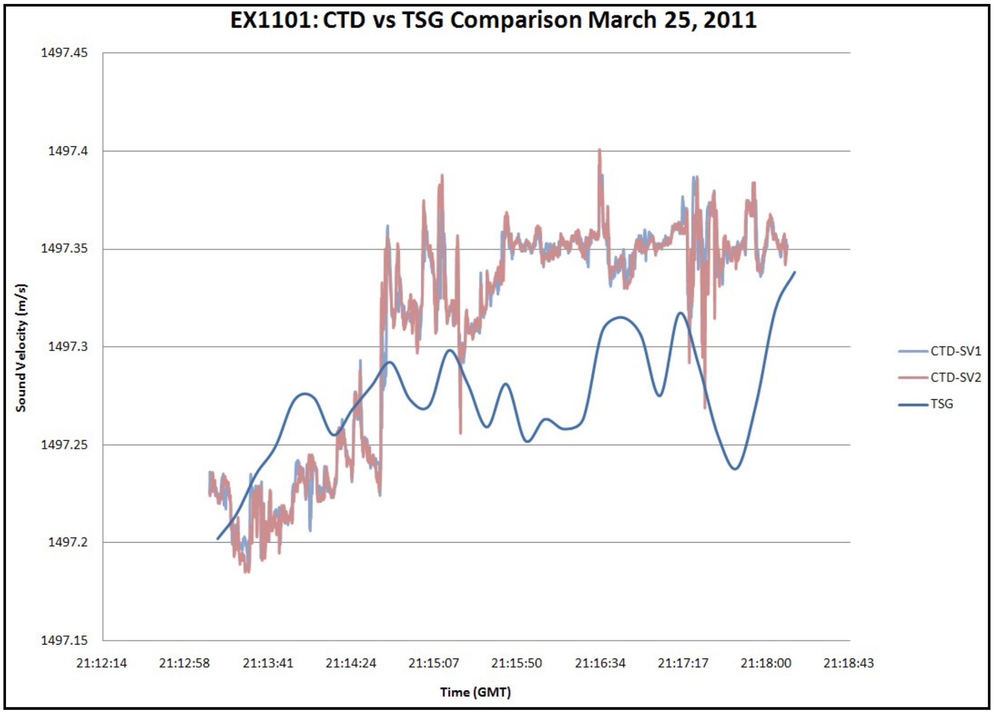


Figure 13. Comparison of sea surface sound velocity values calculated by Seabird SBE09Plus S/N 09P4790-0905 (shown in red and green underneath), and the thermosalinograph (TSG) (shown in blue).

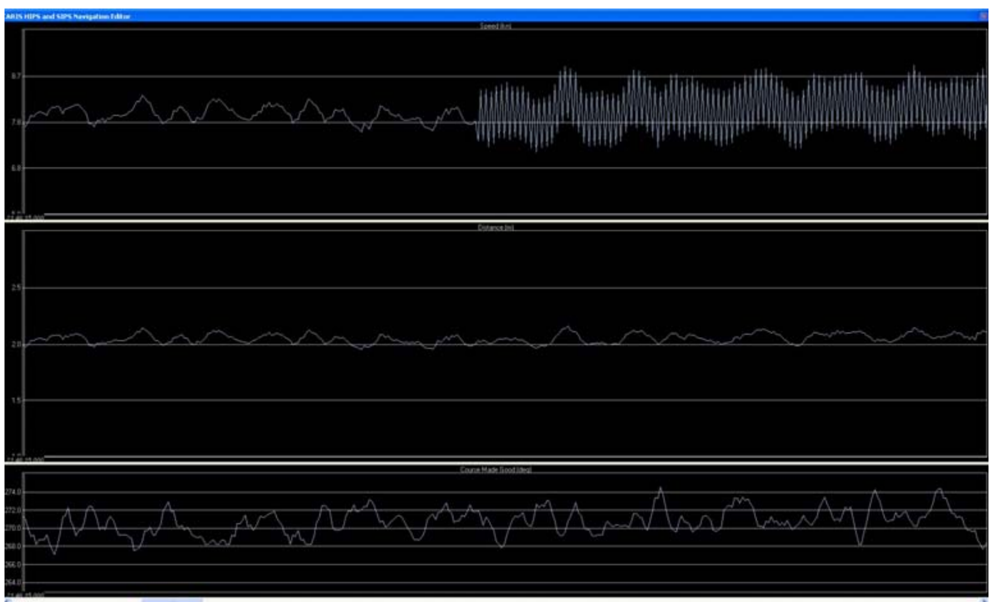


Figure 14. Screen shot of CARIS Navigation Editor showing initial detection of speed jumps in line 0223.

Speed jumps were observed in files 0223 – 0230. The cause of the speed jumps is unknown until further analysis can be done, and it is noted that no errors were observed in SIS or the POSMV Controller software. It is also noted that the speed jumps do not seem to affect distance or CMG. Just prior to the start of the jumps, a shallow CTD was conducted, and it is has been observed in the past that after being on station for an amount of time, the system has experienced other anomalies, such as SIS locking up, which may be related. CNAV, the POSMV, and the EM 302 workstation were all restarted during the transit to the offshore working grounds. This appeared to clear up the speed anomaly.

26 March 2011

The transit overnight to the offshore survey in the vicinity of San Juan Seamount was rough with numerous bubble sweepdown events. The 12-14 ft swell was from 300°, and the ships heading was 230°. The weather laid down considerably a few hours before the ship approached the survey area at ~0800.

A BIST was run before commencing the deep water San Juan Seamount survey area. The multibeam had been operating in very deep mode for ~8 hours. TX board 16 is not showing any errors. RX Noise levels are well within acceptable range (40 dB to low 50 dB).

The first three lines were run in the survey in the vicinity of San Juan Seamount. Swath coverage was excellent at 7.8 km in 4000 m water depth.

It was realized that one way to improve backscatter quality at nadir, specifically to remove the skunk stripe at nadir resulting from stronger normal incidence returns is to increase the along direction angle to 2°. This results in a sharp decrease in the near nadir artifact. This may be useful if the normal incidence angle setting does not produce expected results in the future.

27 March 2011

The offshore survey in the vicinity of San Juan Seamount continued.

At 0430 on bridge, autopilot waypoint control kicked the ship off course. The effect of this was observed in CARIS as course made good variation of 20° for 15 minutes.

A sharp surface temperature increase of 2°C was detected at the extreme west end of the San Juan Seamount survey lines. The anomaly was detected by both the Reson 70 SVP probe and the TSG system. The engineering department also detected the temperature change and reported it to the bridge.

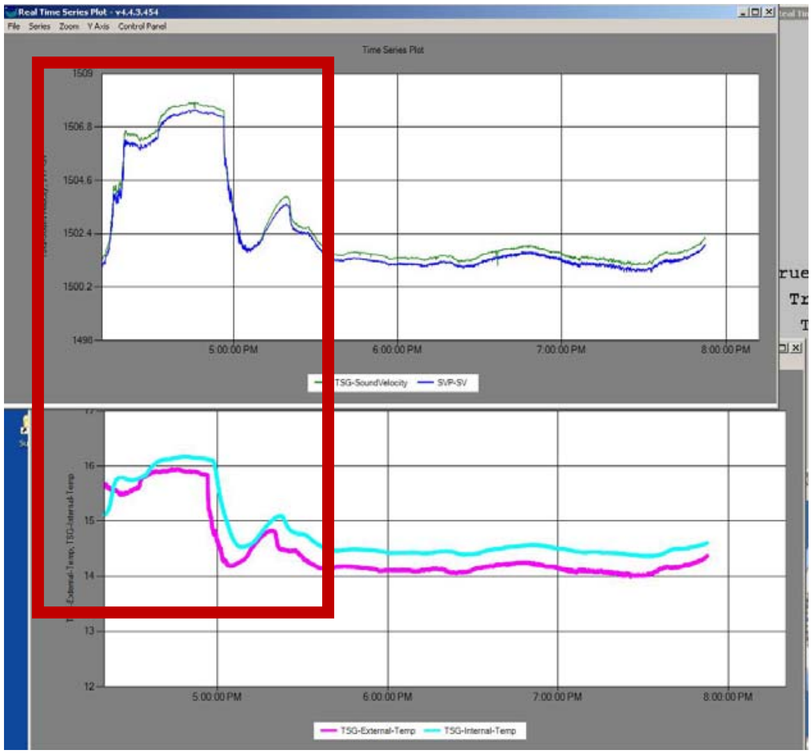


Figure 15. Screenshot of SCS display showing surface sound speed at west end of San Juan Seamount survey lines.

The EM 302 ping mode was forced into Extra Deep to stress-test the TRU.

The Knudesen was run to check synchronization with the EM 302. It was observed that positional data was not being provided to the Knudsen computer and the SST and ET were notified.

28 March 2011

The offshore survey in the vicinity of San Juan Seamount continued in water depths up to ~4000 meters.

The ship was made aware of Navy missile operations that will encompass the remaining survey areas (three seamounts: San Juan, Hancock, and 109). The safety zone around the operations area is a 95 nautical mile radius circle with a center at 32° 27’N 120° 58’W. Contingency plans for mapping alternative areas are being considered.

After dinner the ship turned north to head into the seas to reach the final line of the survey area over the seamount and to catch a deep water crossline heading south. These lines will complete survey data collection the San Juan Seamount survey.

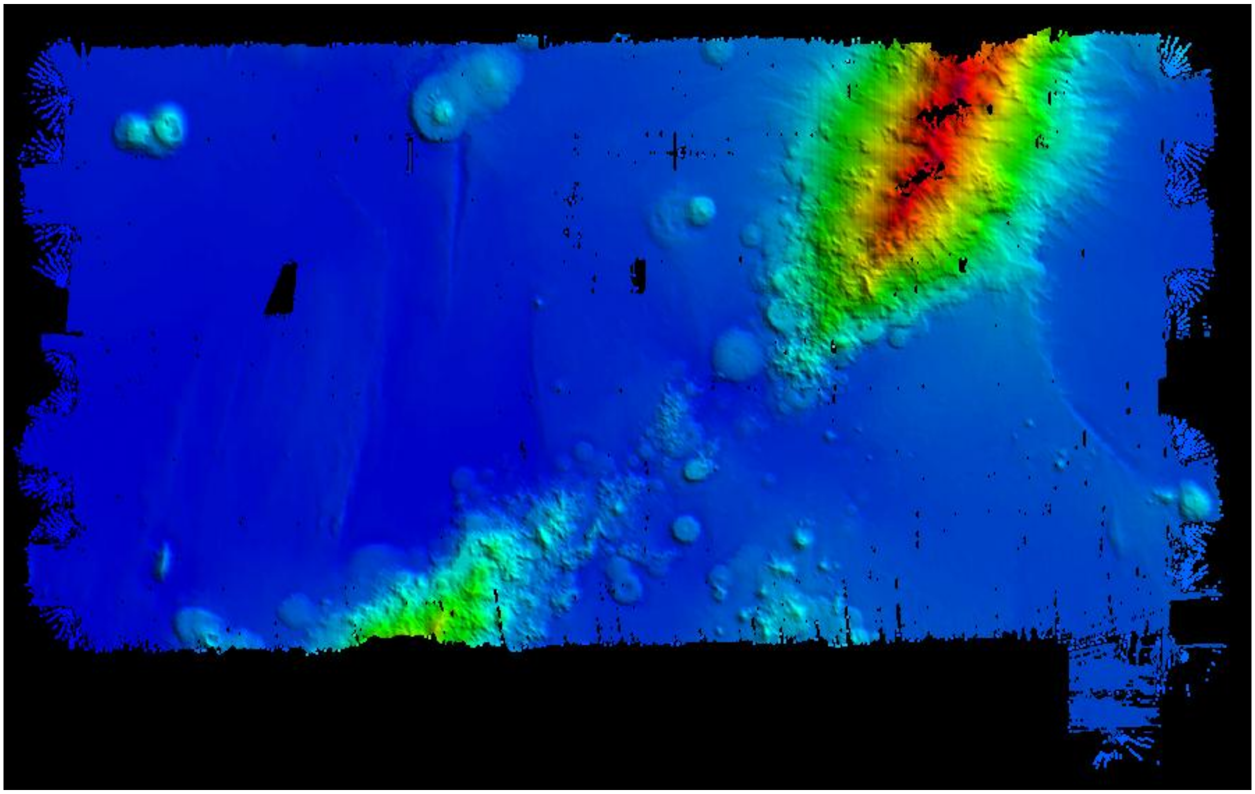


Figure 16. Screenshot of multibeam data collected in the vicinity of San Juan Seamount, shown in CARIS.

Overnight, the ship headed east to exit the missile testing area by 1300 on 3/29.

The stave display showed an anomaly that was suspected to be related to the RX board 4 channel 30 BIST failure.

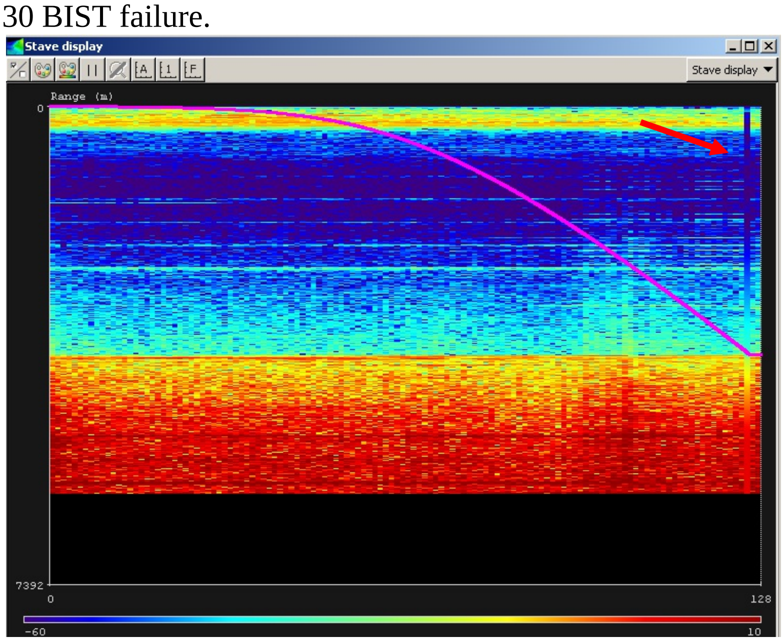


Figure 17. Screenshot of SIS Stave Display, red arrow indicating anomoly.

29 March 2011

The ship transited away from the San Juan survey area and out of the Navy missile operations safety zone. The ship crossed the safety line at ~0845 and conducted DP operations outside the missile safety zone. The bow thrusters showed signs of overheating after a few hours of DP ops.

The ship re-entered the safety zone at 1300 and transited to the Hancock and 109 Seamount survey areas. These surveys are expected to take approximately 12 hours to complete total and the data will be used by NOS for deep water coral research.

The ET tested the Lemon amplifier box and confirmed it is sending out two nav feeds. The feeds were tested and successfully received on the CTD computer and Knudsen SBP deck unit. The amplifier box can output up to 5 feeds.

Plans to return offshore to the San Juan Seamount survey area were cancelled due to early buoy reports of 15 ft seas and 35 kt winds.

The possibility of heading into San Diego one day early is being investigated.

30 March 2011

The surveys over Hancock and 109 Seamounts were completed.

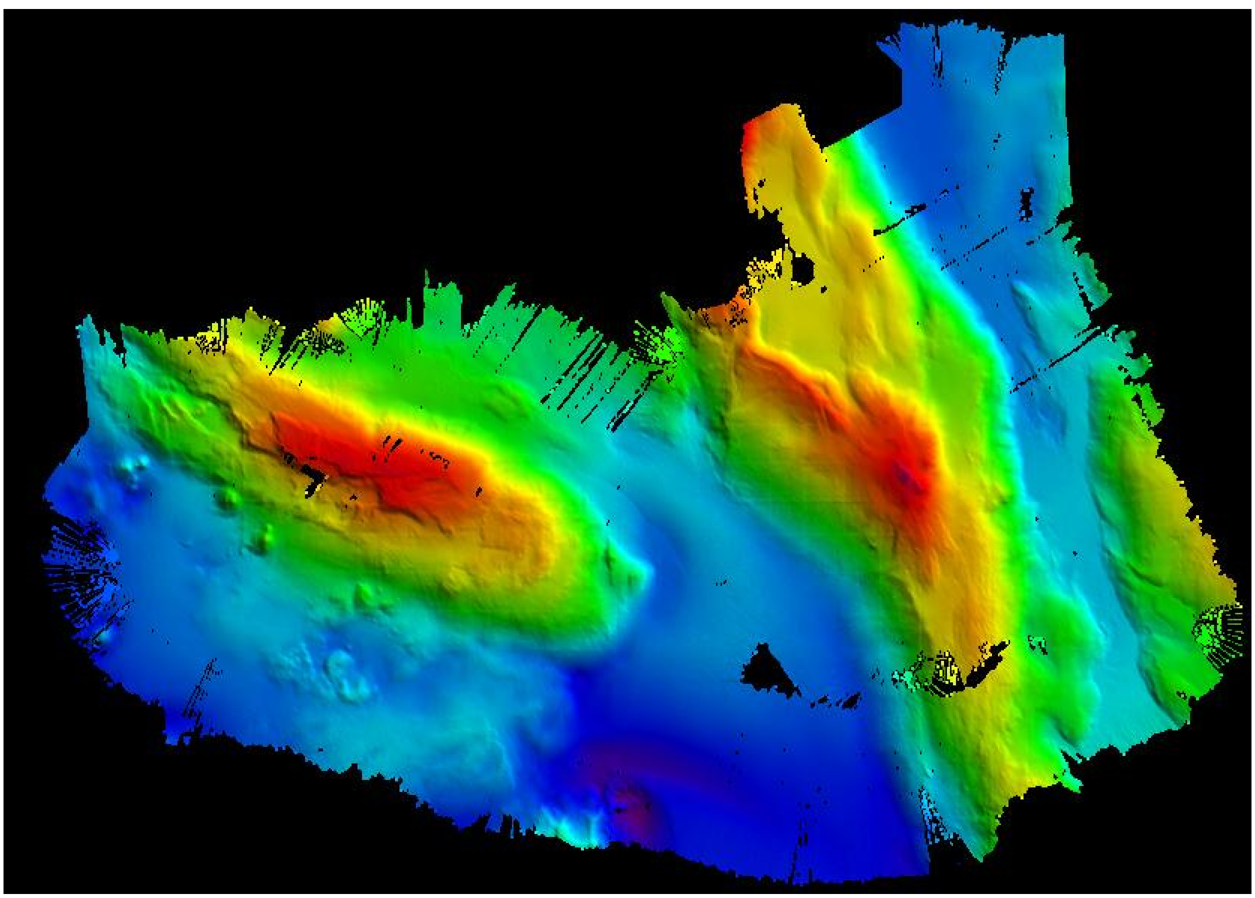


Figure 18. Screenshot of multibeam data collected over Hancock and 109 Seamounts, shown in CARIS.

The ship commenced transit towards San Diego. Data was collected during transit to San Diego. Data processing of all cruise data continued. Mapping watchstander's professional development projects continued.

BISTs were conducted at speeds of 3, 5, 7 and 9 knots to assess relative noise levels. Noise levels were low, and increased with speed, as expected.

Marine mammals were sighted within 750 meters of the ship at 1547 and the multibeam was secured for 20 minutes.

31 March 2011

The ship transited to San Diego from the survey working grounds. The multibeam was secured at 0800 and a final BIST was run. The ship pulled into the 32nd Street Naval Base, Quay Wall North, Pier 8 at 1330.

All visiting personnel and the mapping department participated in cleaning the survey spaces. The science debrief meeting was conducted on the bow. Mapping watchstanders presented their professional development projects.

01 April 2011

The ship was in port at the San Diego Naval Base.

13. Appendices

Appendix A: Field Products

Following are products and reports developed in the field by mapping watchstanders as time allowed in addition to their normal mapping duties. These products are intended for field training purposes only, and do not necessarily represent the final opinion of NOAA OER.

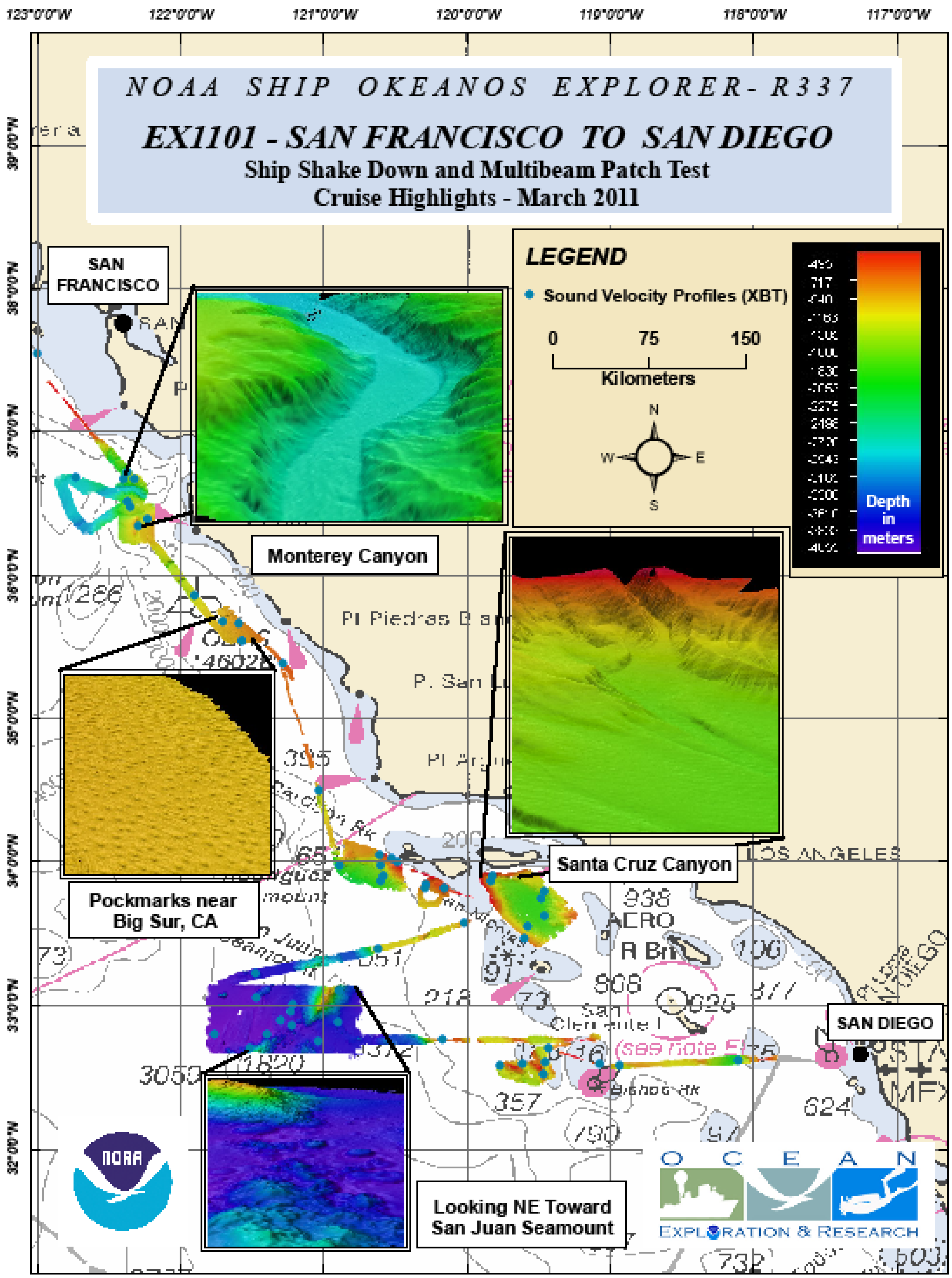


Figure 19. Cruise Highlights Map Sheet created in ArcMap by mapping watchstander Ash Harris, showing multibeam coverage and XBT locations collected during the cruise. Higher resolution version available.

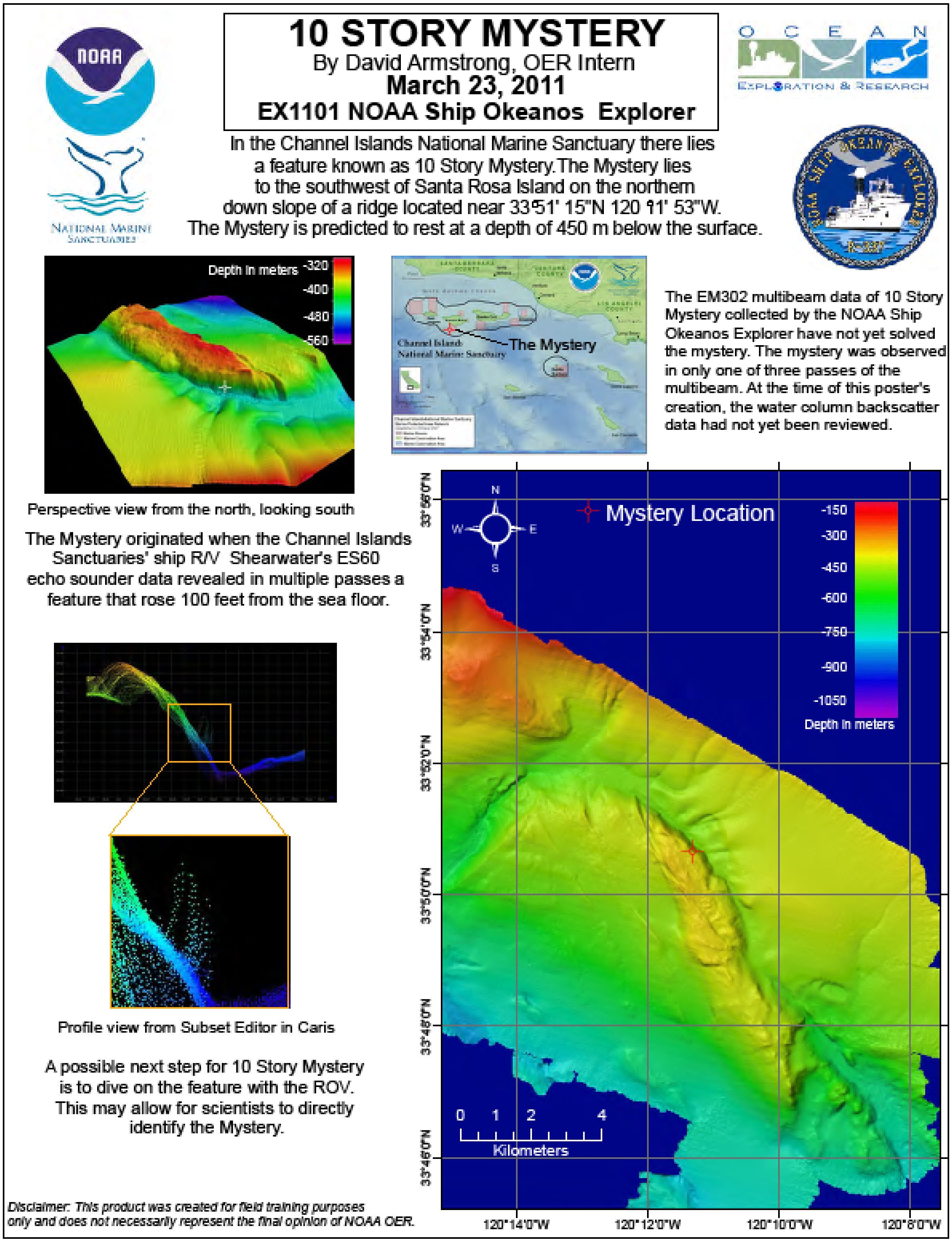


Figure 20. '10-Story Mystery' one-pager created by Mapping Intern David Armstrong.

Sound Velocity Sensor Evaluation Report 2011
Author: SST Colleen Peters

2010 EX drydock:

- A new intake for the scientific seawater system was installed
    - A new de-bubbler was installed between the intake and the pump
- A new RESON SVP-70 Sound Velocity Probe was installed on the transducer fairing near the EM302 multibeam transducer.
    - The SVP was integrated into the Multibeam acquisition system
    - The SVP was integrated into SCS

EX Sea Trials, on March 10, 2011:

- The SVP was integrated into the EM302 SIS software.
- The seawater system was run and inspected by engineering for leaks.
- The SV values were compared between the SVP and TSG, and were observed within 0.3-0.5 m/s.

EX1101 Shakedown, March 16-31, 2011:

- The seawater system maintained a steady flow during seas up to 10-12 feet swells in 40 knots wind without interruption. The flow was turned off at 2343 on 3/19/11 because the ship was pitching heavily, and the watchstanders wanted to prevent damage. Flow was resumed in the morning around 0900 on 3/20/11 when the SST returned to duty to monitor the system.

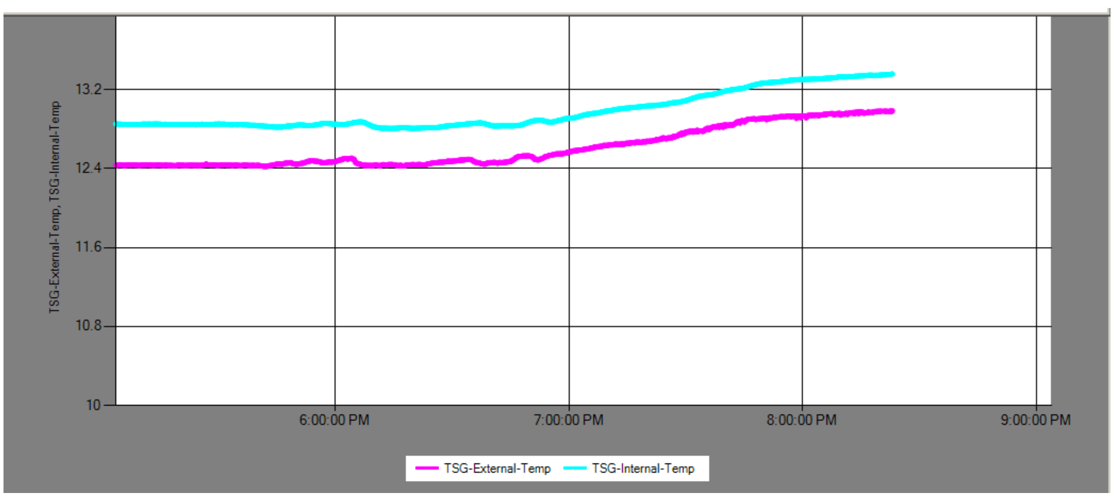


Figure 1: Seawater System temperature values on 3/20/11 (times in GMT).

- The SVP and TSG values were observed within 0.3-0.5 m/s.
- The SVP appears to suffer from bubble sweep-down issues in conjunction with the Multibeam. This is depicted in the figure below as spikes in the data, observe to show up on the EM302 backscatter data at approximately the same time.

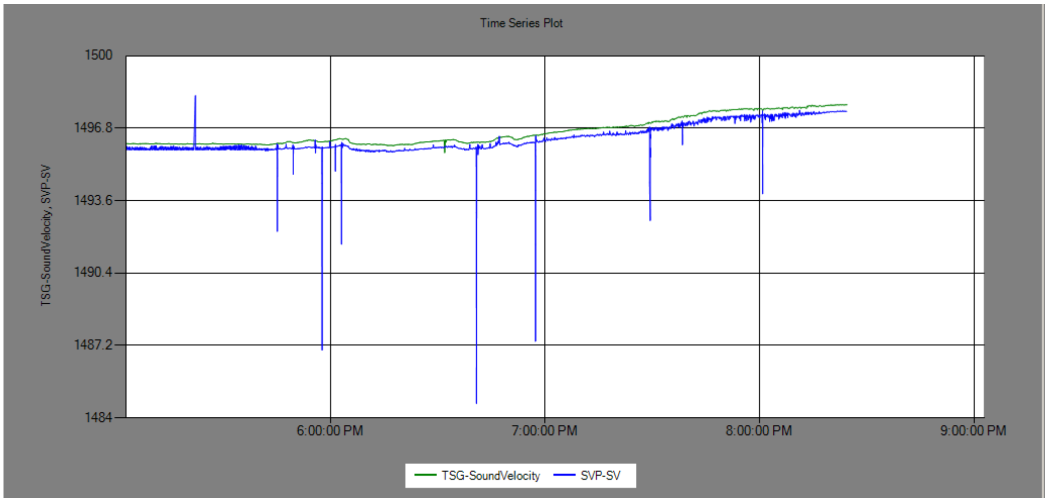


Figure 2: Seawater System sound velocity vs. Reson Sound Velocity Probe sound velocity on 3/20/11.

March 23, 2011:
A CTD cast was conducted to test the system and sensors. The CTD was lowered to a depth of approximately 4 meters, which is the depth of the Scientific Seawater System intake.

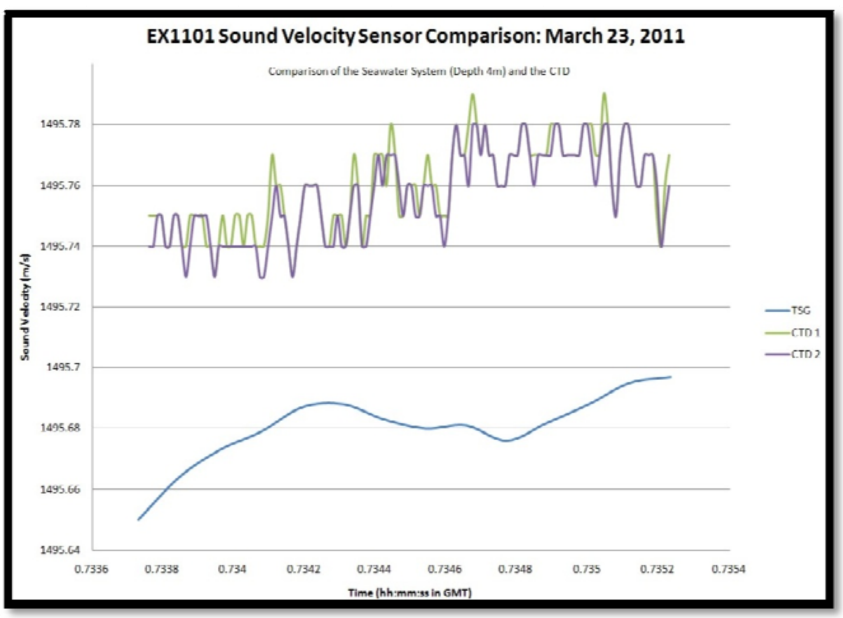
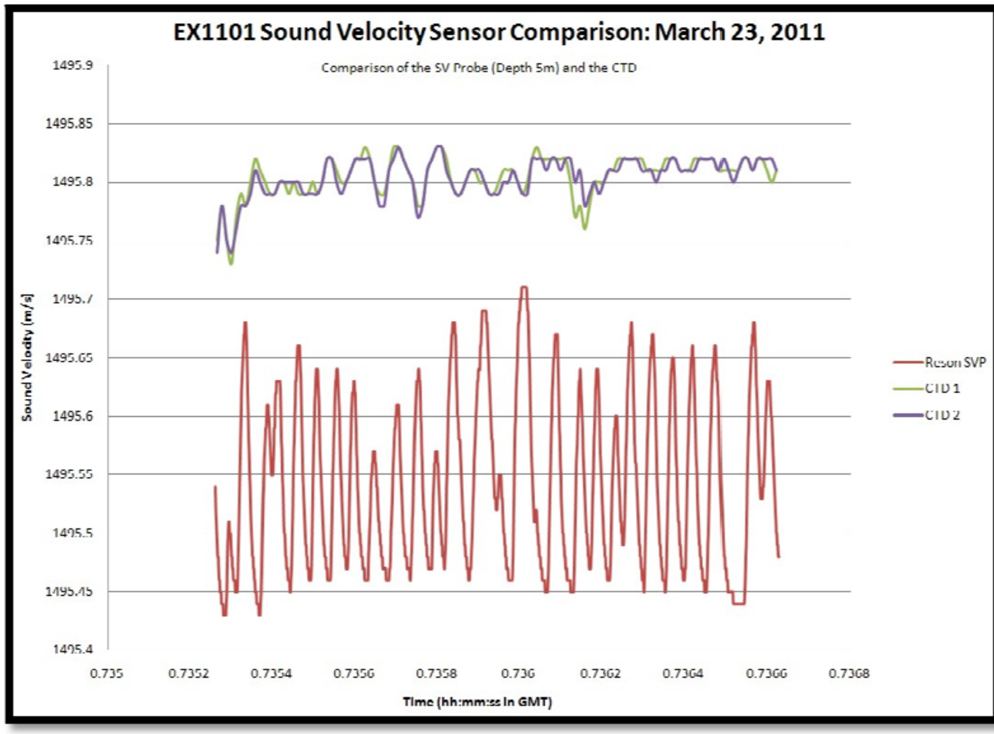


Figure 3: TSG vs. CTD

The CTD was then lowered to 4.5 – 5 meters, which is the depth of the Reson Sound Velocity Probe.

Figure 4: Reson SVP vs. CTD.



The CTD was then brought to surface to begin a profile cast. This was to test winch, CTD and provide a profile to compare to XBT cast.

the

the

an

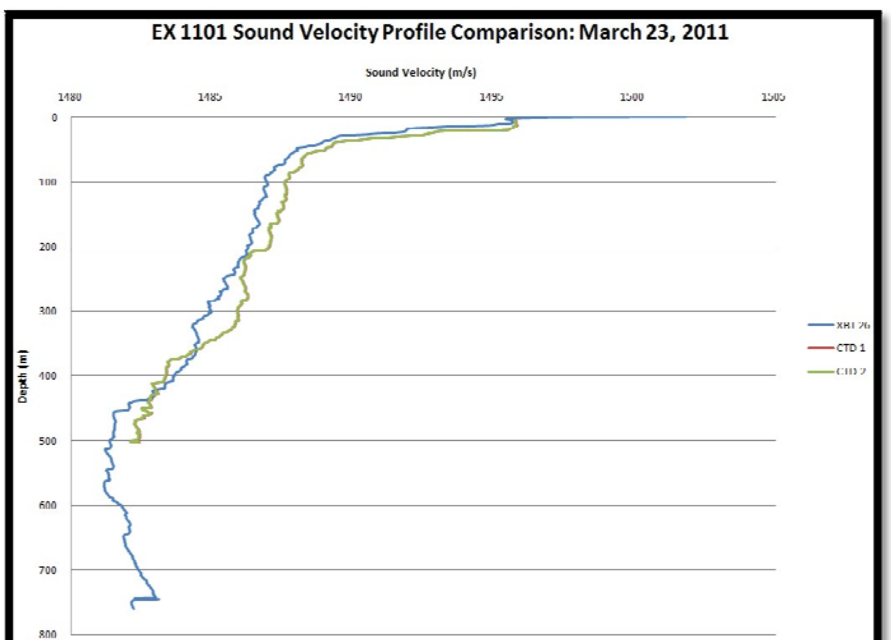


Figure 5: XBT.

CTD vs.

March 25, **2011:**

A second sound comparison conducted. was held at approximate the sound

CTD velocity was The CTD the depths of velocity probe and seawater system, 4.5 and 4 meters, respectively.

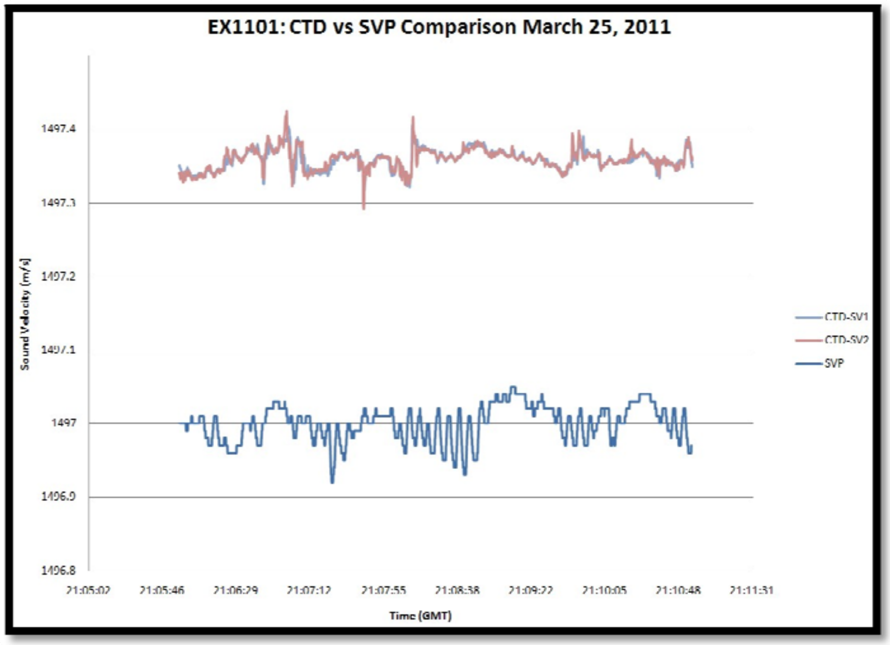


Figure 6: CTD vs SVP.

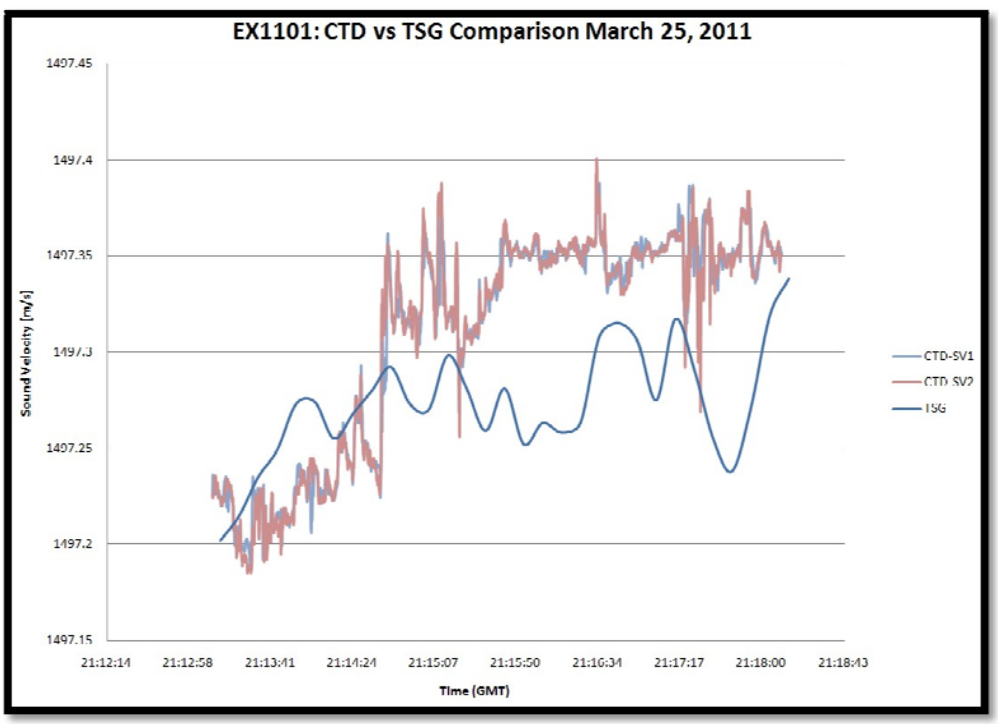


Figure 7: CTD vs TSG

Appendix B: Tables of Data Files Collected

EX1101 Multibeam Log

EX1101 MULTIBEAM LOG						
KEY: DNP = DO NOT PROCESS, DNE = DOES NOT EXIST, RESTRICTED = DATA OVER DATA OVER PROTECTED CULTURAL RESOURCE						
MB LINE FILE NAME	SVP APPLIED	JULIAN DAY	DATE (GMT)	SOG	HDG	FINAL PRODUCT (ASCII text, Geotiff, IVS3D, GoogleEarth)
0000_20110317_024516_EX1101.all	no XBT applied	076	3/17/11	VAR	VAR	DNP
0001_20110317_025544_EX1101.all	no XBT applied	076	3/17/11	VAR	VAR	DNP
0002_20110317_030356_EX1101.all	no XBT applied	076	3/17/11	VAR	VAR	DNP
0003_20110317_031305_EX1101.all	EX1101_XBT01_20110317_Restricted.asvp	076	3/17/11	4	225	DNP
0004_20110317_040102_EX1101.all	EX1101_XBT01_20110317_Restricted.asvp	076	3/17/11	4	180	DNP
0005_20110317_045727_EX1101.all	EX1101_XBT01_20110317_Restricted.asvp	076	3/17/11	4	230	EX1101_MB_FNL_Restricted
0006_20110317_053012_EX1101.all	EX1101_XBT01_20110317_Restricted.asvp	076	3/17/11	4	50	EX1101_MB_FNL_Restricted
0007_20110317_053612_EX1101.all	EX1101_XBT01_20110317_Restricted.asvp	076	3/17/11	4	50	EX1101_MB_FNL_Restricted
0008_20110317_055149_EX1101.all	EX1101_XBT01_20110317_Restricted.asvp	076	3/17/11	10	157	EX1101_MB_FNL_Restricted
0009_20110317_065635_EX1101.all	EX1101_XBT01_20110317_Restricted.asvp	076	3/17/11	6	180	EX1101_MB_FNL_Transit_North
0010_20110317_074852_EX1101.all	EX1101_XBT02_20110317.asvp	076	3/17/11	5	180	EX1101_MB_FNL_Transit_North
0011_20110317_120538_EX1101.all	EX1101_XBT02_20110317.asvp	076	3/17/11	5	180	EX1101_MB_FNL_PatchTest
0012_20110317_123121_EX1101.all	EX1101_XBT02_20110317.asvp	076	3/17/11	4-5	180	EX1101_MB_FNL_PatchTest
0013_20110317_135114_EX1101.all	EX1101_XBT02_20110317.asvp	DNP	DNP	DNP	DNP	DNP
0014_20110317_140259_EX1101.all	EX1101_XBT02_20110317.asvp	076	3/17/11	5.5	000	EX1101_MB_FNL_PatchTest
0015_20110317_155714_EX1101.all	EX1101_XBT02_20110317.asvp					DNP
0016_20110317_160750_EX1101.all	EX1101_XBT02_20110317.asvp	076	3/17/11	8.0	181	EX1101_MB_FNL_PatchTest
0017_20110317_171746_EX1101.all	EX1101_XBT02_20110317.asvp	076	3/17/11	8	181	DNP
0018_20110317_172923_EX1101.all	EX1101_XBT02_20110317.asvp		3/17/11	8	000	EX1101_MB_FNL_PatchTest
0019_20110317_184156_EX1101.all	EX1101_XBT02_20110317.asvp	076	3/17/11	8.7	VAR	DNP
0020_20110317_185237_EX1101.all	EX1101_XBT02_20110317.asvp	076	3/17/11	8.7	VAR	DNP
0021_20110317_191035_EX1101.all	EX1101_XBT03_20110317.asvp		3/17/11	8.5	VAR	DNP
0022_20110317_191907_EX1101.all	EX1101_XBT03_20110317.asvp	076	3/17/11	7.5	VAR	EX1101_MB_FNL_PatchTest
0023_20110317_192103_EX1101.all	EX1101_XBT03_20110317.asvp	076	3/17/11	8	089	EX1101_MB_FNL_PatchTest
0024_20110317_202116_EX1101.all	EX1101_XBT03_20110317.asvp		3/17/11	8	VAR	EX1101_MB_FNL_PatchTest
0025_20110317_203240_EX1101.all	EX1101_XBT03_20110317.asvp	076	3/17/11	7	273	EX1101_MB_FNL_PatchTest
0026_20110317_212627_EX1101.all	EX1101_XBT03_20110317.asvp	076	3/17/11	8	VAR	EX1101_MB_FNL_PatchTest
0027_20110317_213703_EX1101.all	EX1101_XBT03_20110317.asvp		3/17/11	7	087	EX1101_MB_FNL_PatchTest
0028_20110317_223513_EX	EX1101_XBT03_20110317.asvp	076	3/17/11	10	VAR	EX1101_MB_FNL_PatchTest

EX1101 MULTIBEAM LOG						
KEY: DNP = DO NOT PROCESS, DNE = DOES NOT EXIST, RESTRICTED = DATA OVER DATA OVER PROTECTED CULTURAL RESOURCE						
MB LINE FILE NAME	SVP APPLIED	JULIAN DAY	DATE (GMT)	SOG	HDG	FINAL PRODUCT (ASCII text, Geotiff, IVS3D, GoogleEarth)
1101.all						
0029_20110317_232419_EX 1101.all	EX1101_XBT03_20110317.asvp	077	3/17/11	6.6	358	EX1101_MB_FNL_PatchTest
0030_20110318_004441_EX 1101.all	EX1101_XBT03_20110317.asvp	077	3/17/11	7.3	VAR	EX1101_MB_FNL_PatchTest
0031_20110318_005809_EX 1101.all	EX1101_XBT03_20110317.asvp EX1101_XBT04_20010318.asvp	077	3/18/11	7.0	179	EX1101_MB_FNL_PatchTest
0032_20110318_021600_EX 1101.all	EX1101_XBT04_20010318.asvp	077	3/18/11	7.9	294	EX1101_MB_FNL_Transit_North
0033_20110318_052244_EX 1101.all	EX1101_XBT04_20010318.asvp EX1101_XBT05_20010318.asvp	077	3/18/11	7.8	125	EX1101_MB_FNL_Transit_North
0034_20110318_053621_EX 1101.all	EX1101_XBT05_20110318.asvp	077	3/18/11	7.7	134	EX1101_MB_FNL_PatchTest
0035_20110318_061644_EX 1101.all	EX1101_XBT05_20110318.asvp	077	3/18/11	6.4	123	DNP
0036_20110318_062512_EX 1101.all	EX1101_XBT05_20110318.asvp	077	3/18/11	7.0	308	DNP
0037_20110318_062811_EX 1101.all	EX1101_XBT05_20110318.asvp	077	3/18/11	7.5	314	EX1101_MB_FNL_PatchTest
0038_20110318_072032_EX 1101.al	EX1101_XBT05_20110318.asvp	077	3/18/11	8.7	VAR	EX1101_MB_FNL_Transit_North
0039_20110318_104527_EX 1101.all	EX1101_XBT05_20110318.asvp	077	3/18/11	8.5	55	EX1101_MB_FNL_Transit_North
0040_20110318_121637_EX 1101.all	EX1101_XBT05_20110318.asvp	077	3/18/11	6 TO 8	VAR	EX1101_MB_FNL_Transit_North
0041_20110318_130106_EX 1101.all	EX1101_XBT06_20110318.asvp	077	3/18/11	8	001	EX1101_MB_FNL_PatchTest
0042_20110318_140505_EX 1101.all	EX1101_XBT06_20110318.asvp	077	3/18/11	6	VAR	DNP
0043_20110318_141731_EX 1101.all	EX1101_XBT06_20110318.asvp	077	3/18/11	7.7	181	EX1101_MB_FNL_PatchTest
0044_20110318_152715_EX 1101.all	EX1101_XBT06_20110318.asvp	077	3/18/11	8.5	210	EX1101_MB_FNL_SurRidge
0045 skipped by SIS						DNE
0046_20110318_160001_EX 1101.all	EX1101_XBT06_20110318.asvp	077	3/18/11	8.5	180	EX1101_MB_FNL_SurRidge
0047_20110318_173323_EX 1101.all	EX1101_XBT06_20110318.asvp	077	3/18/11	8.5	90	EX1101_MB_FNL_SurRidge
0048_20110318_174417_EX 1101.all	EX1101_XBT06_20110318.asvp	077	3/18/11		180	EX1101_MB_FNL_SurRidge
0049_20110318_190250_EX 1101.all	EX1101_XBT06_20110318.asvp	077	3/18/11		VAR	EX1101_MB_FNL_SurRidge
0050_20110318_191503_EX 1101.all	EX1101_XBT06_20010318.asvp EX1101_XBT07_20110318.asvp	077	3/18/11	7.5	185	EX1101_MB_FNL_SurRidge
0051_20110318_204646_EX 1101.all	EX1101_XBT07_20110318.asvp	077	3/18/11	VAR	VAR	EX1101_MB_FNL_SurRidge
0052_20110318_221531_EX 1101.all	EX1101_XBT07_20110318.asvp	077	3/18/11	8	346	EX1101_MB_FNL_SurRidge
0053_20110318_235207_EX 1101.all	EX1101_XBT07_20110318.asvp	077	3/18/11	7.5	VAR	EX1101_MB_FNL_SurRidge
0054_20110319_000246_EX 1101.all	EX1101_XBT07_20110318.asvp EX1101_XBT08_20110319.asvp	078	3/19/11	7.5	188	EX1101_MB_FNL_SurRidge
0055_20110319_015214_EX 1101.all	EX1101_XBT08_20110319.asvp	078	3/19/11	7.4	96	EX1101_MB_FNL_SurRidge
0056_20110319_020333_EX 1101.all	EX1101_XBT08_20110319.asvp	078	3/19/11	7.1	359	EX1101_MB_FNL_SurRidge
0057_20110319_033456_EX 1101.all	EX1101_XBT08_20110319.asvp	078	3/19/11	6.7	359	EX1101_MB_FNL_SurRidge

EX1101 MULTIBEAM LOG						
KEY: DNP = DO NOT PROCESS, DNE = DOES NOT EXIST, RESTRICTED = DATA OVER DATA OVER PROTECTED CULTURAL RESOURCE						
MB LINE FILE NAME	SVP APPLIED	JULIAN DAY	DATE (GMT)	SOG	HDG	FINAL PRODUCT (ASCII text, Geotiff, IVS3D, GoogleEarth)
0058_20110319_035504_EX 1101.all	EX1101_XBT08_20110319.asvp	078	3/19/11	7.1	88	EX1101_MB_FNL_SurRidge
0059_20110319_040802_EX 1101.all	EX1101_XBT08_20110319.asvp	078	3/19/11	8.0	179	EX1101_MB_FNL_SurRidge
0060_20110319_054737_EX 1101.all	EX1101_XBT08_20110319.asvp	078	3/19/11	8.4	89	EX1101_MB_FNL_SurRidge
0061_20110319_055802_EX 1101.all	EX1101_XBT08_20110319.asvp EX1101_XBT09_20110319.asvp	078	3/19/11	8.3	359	EX1101_MB_FNL_SurRidge
0062_20110319_073806_EX 1101.all	EX1101_XBT09_20110319.asvp	078	3/19/11	8.2	99	EX1101_MB_FNL_SurRidge
0063_20110319_075225_EX 1101.all	EX1101_XBT09_20110319.asvp	078	3/19/11	8.2	180	EX1101_MB_FNL_SurRidge
0064_20110319_093352_EX 1101.all	EX1101_XBT09_20110319.asvp	078	3/19/11	8	150	EX1101_MB_FNL_Transit_North
0065_20110319_114520_EX 1101.ALL	EX1101_XBT09_20110319.asvp EX1101_XBT10_20110319.asvp	078	3/19/11	8.7	150	EX1101_MB_FNL_Transit_North
0066_20110319_150117_EX 1101.all	EX1101_XBT10_20110319.asvp	078	3/19/11	8.7	150	EX1101_MB_FNL_SouthMBNMS
0067_20110319_150719_EX 1101.all	EX1101_XBT10_20110319.asvp	078	3/19/11	8.7	130	EX1101_MB_FNL_SouthMBNMS
0068_20110319_152329_EX 1101.all	EX1101_XBT10_20110319.asvp	078	3/19/11	8	VAR	EX1101_MB_FNL_SouthMBNMS
0069_20110319_153152_EX 1101.all	EX1101_XBT10_20110319.asvp	078	3/19/11	7	320	EX1101_MB_FNL_SouthMBNMS
0070_20110319_160213_EX 1101.all	EX1101_XBT10_20110319.asvp	078	3/19/11	8	VAR	EX1101_MB_FNL_SouthMBNMS
0071_20110319_162619_EX 1101.all	EX1101_XBT10_20110319.asvp	078	3/19/11	8.7	130	EX1101_MB_FNL_SouthMBNMS
0072_20110319_171150_EX 1101.all	EX1101_XBT10_20110319.asvp EX1101_XBT11_20110319.asvp	078	3/19/11	6.5	100	EX1101_MB_FNL_SouthMBNMS
0073_20110319_175409_EX 1101.all	EX1101_XBT12_20110319.asvp	078	3/19/2011	5.5	VAR	EX1101_MB_FNL_SouthMBNMS
0074_20110319_193020_EX 1101.all	EX1101_XBT12_20110319.asvp	078	3/19/2011	8	134	EX1101_MB_FNL_SouthMBNMS
0075_20110319_210110_EX 1101.all	EX1101_XBT12_20110319.asvp/ EX1101_XBT11_20110319.asvp	078	3/19/2011	5.5	VAR	EX1101_MB_FNL_SouthMBNMS
0076_20110319_211944_EX 1101.all	EX1101_XBT12_20110319T.asvp / EX1101_XBT11_20110319.asvp	78	3/19/2011	6.5	313	EX1101_MB_FNL_SouthMBNMS
0077_20110319_234226_EX 1101.all	EX1101_XBT12_20110319.asvp	78	3/19/2011	7.2	VAR	EX1101_MB_FNL_SouthMBNMS
0078_20110320_000029_EX 1101.all	EX1101_XBT12_20110319.asvp	079	3/20/2011	6	130	EX1101_MB_FNL_SouthMBNMS
0079_20110320_004540_EX 1101.all	EX1101_XBT13_20110320.asvp	79	3/20/2011	7	130	EX1101_MB_FNL_SouthMBNMS
0080_20110320_024417_EX 1101.all	EX1101_XBT13_20110320.asvp	79	3/20/2011	6.2	81.4	EX1101_MB_FNL_SouthMBNMS
0082_20110320_051727_EX 1101.all	EX1101_XBT13_20110320.asvp	79	3/20/2011	4.8	39.6	EX1101_MB_FNL_SouthMBNMS
0081_20110320_030312_EX 1101.all	EX1101_XBT13_20110320.asvp	79	3/20/2011	7.9	313.4	EX1101_MB_FNL_SouthMBNMS
0083_20110320_054629_EX 1101.all	EX1101_XBT13_20110320.asvp	79	3/20/2011	3.2	134.7	EX1101_MB_FNL_SouthMBNMS
0084_20110320_104959_EX 1101.all	EX1101_XBT13_20110320.asvp EX1101_XBT14_20110320.asvp	79	3/20/2011	6	160	EX1101_MB_FNL_Transit_North
0085_20110320_133121_EX 1101.all	EX1101_XBT14_20110320.asvp	79	3/20/2011	6.7	340	EX1101_MB_FNL_Transit_North
0086_20110320_143138_EX	EX1101_XBT14_20110320.asvp	79	3/20/2011	6.8	VAR	EX1101_MB_FNL_Transit_North

EX1101 MULTIBEAM LOG						
KEY: DNP = DO NOT PROCESS, DNE = DOES NOT EXIST, RESTRICTED = DATA OVER DATA OVER PROTECTED CULTURAL RESOURCE						
MB LINE FILE NAME	SVP APPLIED	JULIAN DAY	DATE (GMT)	SOG	HDG	FINAL PRODUCT (ASCII text, Geotiff, IVS3D, GoogleEarth)
1101.all						
0087_20110320_152711_EX 1101.all	EX1101_XBT14_20110320.asvp	79	3/20/2011	6.9	VAR	EX1101_MB_FNL_Transit_North
0088_20110320_174309_EX 1101.all	EX1101_XBT14_20110320.asvp	79	3/20/2011	5.6	159	EX1101_MB_FNL_Transit_North
0089_20110320_195523_EX 1101.all	EX1101_XBT14_20110320.asvp	79	3/20/2011	5.3	168	EX1101_MB_FNL_Transit_North
0090_20110320_204305_EX 1101.all	EX1101_XBT14_20110320.asvp	79	3/20/2011	6.5	163	EX1101_MB_FNL_Transit_North
0091_20110320_225531_EX 1101.all	EX1101_XBT14_20110320.asvp	79	3/20/2011	7.5	166	EX1101_MB_FNL_Transit_North
0092_20110321_010828_EX 1101.all	EX1101_XBT14_20110320.asvp, EX1101_XBT15_20110320.asvp, EX1101_XBT16_20110320.asvp	79	3/20/2011	8.2	166	EX1101_MB_FNL_Transit_North
0093_20110321_054554_EX 1101.all	EX1101_XBT16_20110321.asvp	80	3/21/2011	7.3	133	EX1101_MB_FNL_CINMS
0094_20110321_062728_EX 1101.all	EX1101_XBT16_20110321.asvp	80	3/21/2011	6.7	102	EX1101_MB_FNL_CINMS
0095_20110321_070615_EX 1101.all	EX1101_XBT16_20110321.asvp	80	3/21/2011	6.38	313	EX1101_MB_FNL_CINMS
0096_20110321_083738_EX 1101.all	EX1101_XBT16_20110321.asvp	80	3/21/2011	6.8	18.3	EX1101_MB_FNL_CINMS
0097_20110321_090109_EX 1101.all	EX1101_XBT16_20110321.asvp	80	3/21/2011	6.8	138	EX1101_MB_FNL_CINMS
0098_20110321_111142_EX 1101.all	EX1101_XBT16_20110321.asvp	80	3/21/2011	6.8	136	EX1101_MB_FNL_CINMS
0099_20110321_111457_EX 1101.all	EX1101_XBT16_20110321.asvp	80	3/21/2011	6.8	104	EX1101_MB_FNL_CINMS
0100_20110321_114443_EX 1101.all	EX1101_XBT16_20110321.asvp	80	3/21/2011	VAR	VAR	EX1101_MB_FNL_CINMS
0101_20110321_115135_EX 1101.all	EX1101_XBT16_20110320.asvp EX1101_XBT17_20110321.asvp	80	3/21/2011	6.0	315	EX1101_MB_FNL_CINMS
0102_20110321_144816_EX 1101.all	EX1101_XBT17_20110321.asvp	80	3/21/2011	6.0	18	EX1101_MB_FNL_CINMS
0103_20110321_145353_EX 1101.all	EX1101_XBT17_20110321.asvp	80	3/21/2011	7.0	20	EX1101_MB_FNL_CINMS
0104_20110321_150034_EX 1101.all	EX1101_XBT17_20110321.asvp	80	3/21/2011	7	VAR	EX1101_MB_FNL_CINMS
0105_20110321_150326_EX 1101.all	EX1101_XBT17_20110321.asvp	80	3/21/2011	6.5	134	EX1101_MB_FNL_CINMS
0106_20110321_155038_EX 1101.all	EX1101_XBT17_20110321.asvp	80	3/21/2011	8	133	EX1101_MB_FNL_CINMS
0107_20110321_174150_EX 1101.all	EX1101_XBT17_20110321.asvp	80	3/21/2011	8	120	EX1101_MB_FNL_CINMS
0108_20110321_181225_EX 1101.all	EX1101_XBT17_20110321.asvp	80	3/21/2011	8	316	EX1101_MB_FNL_CINMS
0109_20110321_183524_EX 1101.all	EX1101_XBT17_20110321.asvp / EX1101_XBT18_20110321.asvp	80	3/21/2011	8	314	EX1101_MB_FNL_CINMS
0110_20110321_213154_EX 1101.all	EX1101_XBT18_20110321.asvp	80	3/21/2011	9	106	EX1101_MB_FNL_CINMS
0111_20110321_233227_EX 1101.all	EX1101_XBT18_20110321.asvp	80	3/21/2011	7	197	EX1101_MB_FNL_CINMS
0112_20110321_234616_EX 1101.all	EX1101_XBT18_20110321.asvp	80	3/21/2011	7.8	317	EX1101_MB_FNL_CINMS
0113_20110322_000445_EX 1101.all	EX1101_XBT18_20110321.asvp	81	3/22/2011	8.4	134	EX1101_MB_FNL_CINMS
0114_20110322_004617_EX 1101.all	EX1101_XBT18_20110321.asvp	81	3/22/2011	7.5	166	EX1101_MB_FNL_CINMS
0115_20110322_005658_EX	EX1101_XBT19_20110322.asvp	81	3/22/2011	8.3	133	EX1101_MB_FNL_CINMS

EX1101 MULTIBEAM LOG						
KEY: DNP = DO NOT PROCESS, DNE = DOES NOT EXIST, RESTRICTED = DATA OVER DATA OVER PROTECTED CULTURAL RESOURCE						
MB LINE FILE NAME	SVP APPLIED	JULIAN DAY	DATE (GMT)	SOG	HDG	FINAL PRODUCT (ASCII text, Geotiff, IVS3D, GoogleEarth)
1101.all						
0116_20110322_022123_EX 1101.all	EX1101_XBT19_20110322.asvp	81	3/22/2011	5.8	133	EX1101_MB_FNL_CINMS
0117_20110322_022401_EX 1101.all	EX1101_XBT19_20110322.asvp	81	3/22/2011	7.5	133	EX1101_MB_FNL_CINMS
0118_20110322_025657_EX 1101.all	EX1101_XBT19_20110322.asvp	81	3/22/2011	6.8	204	EX1101_MB_FNL_CINMS
0119_20110322_030412_EX 1101.all	EX1101_XBT19_20110322.asvp	81	3/22/2011	7.5	313	EX1101_MB_FNL_CINMS
0120_20110322_041049_EX 1101.all	EX1101_XBT19_20110322.asvp	81	3/22/2011	7.6	297	EX1101_MB_FNL_CINMS
0121_20110322_042244_EX 1101.all	EX1101_XBT19_20110322.asvp	81	3/22/2011	8.0	179	EX1101_MB_FNL_CINMS
0122_20110322_042813_EX 1101.all	EX1101_XBT19_20110322.asvp	81	3/22/2011	8.3	133	EX1101_MB_FNL_CINMS
0123_20110322_053919_EX 1101.all	EX1101_XBT19_20110322.asvp	81	3/22/2011	7.6	188	EX1101_MB_FNL_CINMS
0124_20110322_054759_EX 1101.all	EX1101_XBT19_20110322.asvp / EX1101_XBT20_20110322.asvp	81	3/22/2011	7.8	313	EX1101_MB_FNL_CINMS
0125_20110322_072115_EX 1101.all	EX1101_XBT20_20110322.asvp	81	3/22/2011	8.0	301	EX1101_MB_FNL_CINMS
0126_20110322_073512_EX 1101.all	EX1101_XBT20_20110322.asvp	81	3/22/2011	8.0	242	EX1101_MB_FNL_CINMS
0127_20110322_074018_EX 1101.all	EX1101_XBT20_20110322.asvp	81	3/22/2011	8.4	134	EX1101_MB_FNL_CINMS
0128_20110322_092743_EX 1101.all	EX1101_XBT20_20110322.asvp	81	3/22/2011	8.4	170	EX1101_MB_FNL_CINMS
0129_20110322_093709_EX 1101.all	EX1101_XBT20_20110322.asvp	81	3/22/2011	6	VAR	EX1101_MB_FNL_CINMS
0130_20110322_094159_EX 1101.all	EX1101_XBT20_20110322.asvp	81	3/22/2011	7.5	318	EX1101_MB_FNL_CINMS
0131_20110322_114437_EX 1101.all	EX1101_XBT20_20110322.asvp	81	3/22/2011	6.5	VAR	EX1101_MB_FNL_CINMS
0132_20110322_114846_EX 1101.all	EX1101_XBT20_20110322.asvp	81	3/22/2011	6.8	VAR	EX1101_MB_FNL_CINMS
0133_20110322_115709_EX 1101.all	EX1101_XBT20_20110322.asvp	81	3/22/2011	6.5	VAR	EX1101_MB_FNL_CINMS
0134_20110322_120107_EX 1101.all	EX1101_XBT20_20110322.asvp EX1101_XBT22_20110322.asvp	81	3/22/2011	8	132	EX1101_MB_FNL_CINMS
0135_20110322_140650_EX 1101.all	EX1101_XBT22_20110322.asvp	81	3/22/2011	7.5	170	EX1101_MB_FNL_CINMS
0136_20110322_142115_EX 1101.all	EX1101_XBT22_20110322.asvp	81	3/22/2011	6	VAR	EX1101_MB_FNL_CINMS
0137_20110322_142627_EX 1101.all	EX1101_XBT22_20110322.asvp	81	3/22/2011	6.9	313	EX1101_MB_FNL_CINMS
0138_20110322_160728_EX 1101.all	EX1101_XBT22_20110322.asvp	81	3/22/2011	7.8	313	EX1101_MB_FNL_CINMS
0139_20110322_180525_EX 1101.all	EX1101_XBT22_20110322.asvp	81	3/22/2011	8.4	VAR	EX1101_MB_FNL_CINMS
0140_20110322_181233_EX 1101.all	EX1101_XBT22_20110322.asvp	81	3/22/2011	9.2	107	EX1101_MB_FNL_CINMS
0141_20110322_231431_EX 1101.all	EX1101_XBT22_20110322.asvp	81	3/22/2011	9.5	111	EX1101_MB_FNL_CINMS
0142_20110323_005138_EX 1101.all	EX1101_XBT22_20110322.asvp	82	3/23/2011	9.5	125	EX1101_MB_FNL_CINMS
0143_20110323_011431_EX 1101.all	EX1101_XBT22_20110322.asvp	82	3/23/2011	6.5	358	EX1101_MB_FNL_CINMS
0144_20110323_011826_EX 1101.all	EX1101_XBT22_20110322.asvp	82	3/23/2011	7.9	177	EX1101_MB_FNL_CINMS

EX1101 MULTIBEAM LOG						
KEY: DNP = DO NOT PROCESS, DNE = DOES NOT EXIST, RESTRICTED = DATA OVER DATA OVER PROTECTED CULTURAL RESOURCE						
MB LINE FILE NAME	SVP APPLIED	JULIAN DAY	DATE (GMT)	SOG	HDG	FINAL PRODUCT (ASCII text, Geotiff, IVS3D, GoogleEarth)
0145_20110323_012301_EX1101.all	EX1101_XBT22_20110322.asvp EX1101_XBT23_20110322.asvp	82	3/23/2011	9.3	139	EX1101_MB_FNL_CINMS
0146_20110323_014706_EX1101.all	EX1101_XBT23_20110323.asvp		3/23/2011	9.1	109	EX1101_MB_FNL_CINMS
0147_20110323_030219_EX1101.all	EX1101_XBT23_20110323.asvp	82	3/23/2011	8.9	126	EX1101_MB_FNL_CINMS
0148_20110323_034350_EX1101.all	EX1101_XBT23_20110323.asvp	82	3/23/2011	8.7	178	EX1101_MB_FNL_CINMS
0149_20110323_034721_EX1101.all	EX1101_XBT23_20110323.asvp	82	3/23/2011	8.8	201	EX1101_MB_FNL_CINMS
0150_20110323_044140_EX1101.all	EX1101_XBT23_20110323.asvp	82	3/23/2011	8.1	251	EX1101_MB_FNL_CINMS
0151_20110323_044421_EX1101.all	EX1101_XBT23_20110323.asvp	82	3/23/2011	3.5	261	EX1101_MB_FNL_CINMS
0152_20110323_060106_EX1101.all	EX1101_XBT23_20110323.asvp	82	3/23/2011	9	VAR	EX1101_MB_FNL_CINMS
0153_20110323_061532_EX1101.all	EX1101_XBT23_20110323.asvp	82	3/23/2011	9.5	354	EX1101_MB_FNL_CINMS
0154_20110323_063228_EX1101.all	EX1101_XBT23_20110323.asvp	82	3/23/2011	9	308	EX1101_MB_FNL_CINMS
0155_20110323_063445_EX1101.all	EX1101_XBT23_20110323.asvp	82	3/23/2011	9.2	26	EX1101_MB_FNL_CINMS
0156_20110323_071409_EX1101.all	EX1101_XBT23_20110323.asvp	82	3/23/2011	9	VAR	EX1101_MB_FNL_CINMS
0157_20110323_071813_EX1101.all	EX1101_XBT23_20110322.asvp EX1101_XBT24_20110323.asvp	82	3/23/2011	6.5	120	EX1101_MB_FNL_CINMS
0158_20110323_082550_EX1101.all	EX1101_XBT24_20110323.asvp	82	3/23/2011	6-8	VAR	EX1101_MB_FNL_CINMS
0159_20110323_083710_EX1101.all	EX1101_XBT24_20110323.asvp	82	3/23/2011	8	308	EX1101_MB_FNL_CINMS
0160_20110323_094348_EX1101.all	EX1101_XBT24_20110323.asvp	82	3/23/2011	6.8	VAR	EX1101_MB_FNL_CINMS
0161_20110323_094756_EX1101.all	EX1101_XBT24_20110323.asvp	82	3/23/2011	6.8	VAR	EX1101_MB_FNL_CINMS
0162_20110323_095310_EX1101.all	EX1101_XBT24_20110323.asvp	82	3/23/2011	7.4	125	EX1101_MB_FNL_CINMS
0163_20110323_105709_EX1101.all	EX1101_XBT24_20110323.asvp	82	3/23/2011	7.6	VAR	EX1101_MB_FNL_CINMS
0164_20110323_110024_EX1101.all	EX1101_XBT24_20110323.asvp	82	3/23/2011	8.7	VAR	EX1101_MB_FNL_CINMS
0165_20110323_110211_EX1101.all	EX1101_XBT24_20110323.asvp	82	3/23/2011	8.7	VAR	EX1101_MB_FNL_CINMS
0166_20110323_110359_EX1101.all	EX1101_XBT24_20110323.asvp	82	3/23/2011	8.7	305	EX1101_MB_FNL_CINMS
0167_20110323_115546_EX1101.all	EX1101_XBT24_20110323.asvp	82	3/23/2011	6.6	VAR	EX1101_MB_FNL_CINMS
0168_20110323_120113_EX1101.all	EX1101_XBT24_20110323.asvp	82	3/23/2011	7.8	125	EX1101_MB_FNL_CINMS
0169_20110323_125825_EX1101.all	EX1101_XBT24_20110323.asvp	82	3/23/2011	8.3	VAR	EX1101_MB_FNL_CINMS
0170_20110323_130110_EX1101.all	EX1101_XBT24_20110323.asvp	82	3/23/2011	9.7	VAR	EX1101_MB_FNL_CINMS
0171_20110323_130258_EX1101.all	EX1101_XBT24_20110323.asvp	82	3/23/2011	9.1	VAR	EX1101_MB_FNL_CINMS
0172_20110323_130350_EX1101.all	EX1101_XBT25_20110323.asvp	82	3/23/2011	8.7	126	EX1101_MB_FNL_CINMS
0173_20110323_135352_EX1101.all	EX1101_XBT25_20110323.asvp	82	3/23/2011	7.4	VAR	EX1101_MB_FNL_CINMS
0174_20110323_140403_EX1101.all	EX1101_XBT25_20110323.asvp	82	3/23/2011	7.9	125	EX1101_MB_FNL_CINMS

EX1101 MULTIBEAM LOG						
KEY: DNP = DO NOT PROCESS, DNE = DOES NOT EXIST, RESTRICTED = DATA OVER DATA OVER PROTECTED CULTURAL RESOURCE						
MB LINE FILE NAME	SVP APPLIED	JULIAN DAY	DATE (GMT)	SOG	HDG	FINAL PRODUCT (ASCII text, Geotiff, IVS3D, GoogleEarth)
0175_20110323_145421_EX1101.all	EX1101_XBT25_20110323.asvp	82	3/23/2011	7.8	VAR	EX1101_MB_FNL_CINMS
0176_20110323_150143_EX1101.all	EX1101_XBT25_20110323.asvp	82	3/23/2011	8.1	304	EX1101_MB_FNL_CINMS
0177_20110323_155204_EX1101.all	EX1101_XBT25_20110323.asvp	82	3/23/2011	7.4	VAR	EX1101_MB_FNL_CINMS
0178_20110323_160923_EX1101.all	EX1101_XBT25_20110323.asvp	82	3/23/2011	7.0	220	EX1101_MB_FNL_CINMS
0179_20110323_183819_EX1101.all	EX1101_XBT26_20110323.asvp	82	3/23/2011	7.2	102	EX1101_MB_FNL_CINMS
0180_20110323_215123_EX1101.all	EX1101_XBT26_20110323asvp	82	3/23/2011	6.5	157	EX1101_MB_FNL_CINMS
0181_20110323_224225_EX1101.all	EX1101_XBT26_20110323.asvp	82	3/23/2011	8.5	137	EX1101_MB_FNL_CINMS
0182_20110324_013357_EX1101.all	EX1101_XBT26_20110323.asvp EX1101_XBT27_20110324.asvp	83	3/24/2011	7.8	VAR	EX1101_MB_FNL_CINMS
0183_20110324_015556_EX1101.all	EX1101_XBT27_20110324.asvp	83	3/24/2011	8.5	315	EX1101_MB_FNL_CINMS
0184_20110324_044109_EX1101.all	EX1101_XBT27_20110324.asvp	83	3/24/2011	8.7	VAR	EX1101_MB_FNL_CINMS
0185_20110324_044520_EX1101.all	EX1101_XBT27_20110324.asvp	83	3/24/2011	9	44	EX1101_MB_FNL_CINMS
0186_20110324_045127_EX1101.all	EX1101_XBT27_20110324.asvp	83	3/24/2011	9	VAR	EX1101_MB_FNL_CINMS
0187_20110324_045431_EX1101.all	EX1101_XBT27_20110324.asvp	83	3/24/2011	9	139	EX1101_MB_FNL_CINMS
0188_20110324_075142_EX1101.all	EX1101_XBT27_20110324.asvp EX1101_XBT28_20110324.asvp	83	3/24/2011	8	45	EX1101_MB_FNL_CINMS
0189_20110324_080357_EX1101.all	EX1101_XBT28_20110324.asvp	83	3/24/2011	7.5	VAR	EX1101_MB_FNL_CINMS
0190_20110324_080605_EX1101.all	EX1101_XBT28_20110324.asvp	83	3/24/2011	8	320	EX1101_MB_FNL_CINMS
0191_20110324_122317_EX1101.all	EX1101_XBT28_20110324.asvp	83	3/24/2011	7.5	VAR	EX1101_MB_FNL_CINMS
0192_20110324_122618_EX1101.all	EX1101_XBT28_20110324.asvp	83	3/24/2011	8	40	EX1101_MB_FNL_CINMS
0193_20110324_123819_EX1101.all	EX1101_XBT28_20110324.asvp	83	3/24/2011	7.5	VAR	EX1101_MB_FNL_CINMS
0194_20110324_124148_EX1101.all	EX1101_XBT28_20110324.asvp EX1101_XBT29_20110324.asvp	83	3/24/2011	8.5	139	EX1101_MB_FNL_CINMS
0195_20110324_154350_EX1101.all	EX1101_XBT29_20110324.asvp	83	3/24/2011	8.5	139	EX1101_MB_FNL_CINMS
0196_20110324_170256_EX1101.all	EX1101_XBT28_20110324.asvp EX1101_XBT29_20110324.asvp	83	3/24/2011	8.5	VAR	EX1101_MB_FNL_CINMS
0197_20110324_170411_EX1101.all	EX1101_XBT29_20110324.asvp	83	3/24/2011	8.5	VAR	EX1101_MB_FNL_CINMS
0198_20110324_171624_EX1101.all	EX1101_XBT29_20110324.asvp	83	3/24/2011	8.5	VAR	EX1101_MB_FNL_CINMS
0199_20110324_171747_EX1101.all	EX1101_XBT29_20110324.asvp	83	3/24/2011	8.5	315	EX1101_MB_FNL_CINMS
0200_20110324_195137_EX1101.all	EX1101_XBT29_20110324.asvp/ EX1101_XBT30_20110324.asvp	83	3/24/2011	8.5	315	EX1101_MB_FNL_CINMS
0201_20110324_214354_EX1101.all	EX1101_XBT30_20110324.asv	83	3/24/2011	8.5	082	EX1101_MB_FNL_CINMS
0202_20110324_220711_EX1101.all	EX1101_XBT30_20110324.asvp / EX1101_XBT31_20110325.asvp	83	3/24/2011	8.5	135	EX1101_MB_FNL_CINMS
0203_20110325_020610_EX	EX1101_XBT31_20110325.asvp	84	3/25/2011	8.9	29.8	EX1101_MB_FNL_CINMS

EX1101 MULTIBEAM LOG						
KEY: DNP = DO NOT PROCESS, DNE = DOES NOT EXIST, RESTRICTED = DATA OVER DATA OVER PROTECTED CULTURAL RESOURCE						
MB LINE FILE NAME	SVP APPLIED	JULIAN DAY	DATE (GMT)	SOG	HDG	FINAL PRODUCT (ASCII text, Geotiff, IVS3D, GoogleEarth)
1101.all						
0204_20110325_022548_EX 1101.all	EX1101_XBT31_20110325.asvp	84	3/25/2011	8.3	315	EX1101_MB_FNL_CINMS
0205_20110325_052124_EX 1101.all	EX1101_XBT31_20110325.asvp	84	3/25/2011	8.5	49.4	EX1101_MB_FNL_CINMS
0206_20110325_053546_EX 1101.all	EX1101_XBT31_20110325.asvp / EX1101_XBT32_20110325.asvp	84	3/25/2011	8.4	134.1	EX1101_MB_FNL_CINMS
0207_20110325_083735_EX 1101.all	EX1101_XBT32_20110325.asvp	84	3/25/2011	8.5	24	EX1101_MB_FNL_CINMS
0208_20110325_084636_EX 1101.all	EX1101_XBT32_20110325.asvp	84	3/25/2011	8.5	315	EX1101_MB_FNL_CINMS
0209_20110325_114211_EX 1101.all	EX1101_XBT32_20110325.asvp	84	3/25/2011	8.9	35	EX1101_MB_FNL_CINMS
0210_20110325_115224_EX 1101.all	EX1101_XBT32_20110325.asvp	84	3/25/2011	8.4	100	EX1101_MB_FNL_CINMS
0211_20110325_115449_EX 1101.all	EX1101_XBT32_20110325.asvp EX1101_XBT33_20110325.asvp	84	3/25/2011	8.7	140	EX1101_MB_FNL_CINMS
0212_20110325_144559_EX 1101.all	EX1101_XBT33_20110325.asvp	84	3/25/2011	8.7	VAR	EX1101_MB_FNL_CINMS
0213_20110325_145809_EX 1101.all	EX1101_XBT33_20110325.asvp	84	3/25/2011	8.5	318	EX1101_MB_FNL_CINMS
0214_20110325_153557_EX 1101.all	EX1101_XBT33_20110325.asvp	84	3/25/2011	8.5	318	EX1101_MB_FNL_CINMS
0215_20110325_170619_EX 1101.all	EX1101_XBT33_20110325.asvp	84	3/25/2011	8.5	318	EX1101_MB_FNL_CINMS
0216_20110325_171837_EX 1101.all	EX1101_XBT33_20110325.asvp	84	3/25/2011	8.5	318	EX1101_MB_FNL_CINMS
0217_20110325_181642_EX 1101.all	EX1101_XBT33_20110325.asvp	84	3/25/2011	8.5	260	EX1101_MB_FNL_CINMS
0218_20110325_182144_EX 1101.all	EX1101_XBT33_20110325.asvp	84	3/25/2011	8.5	260	EX1101_MB_FNL_CINMS
0219_20110325_192656_EX 1101.all	EX1101_XBT33_20110325.asvp	84	3/25/2011	9	275	EX1101_MB_FNL_CINMS
0220_20110325_200809_EX 1101.all	EX1101_XBT33_20110325.asvp	84	3/25/2011	8.5	VAR	EX1101_MB_FNL_CINMS
0221_20110325_201431_EX 1101.all	EX1101_XBT33_20110325.asvp EX1101_XBT34_20110325.asvp	84	3/25/2011	8.5	92	EX1101_MB_FNL_CINMS
0222_20110325_205231_EX 1101.all	EX1101_XBT34_20110325.asvp	84	3/25/2011	8.5	VAR	DNP
0223_20110325_213959_EX 1101.all	EX1101_XBT34_20110325.asvp	84	3/25/2011	8.5	272	EX1101_MB_FNL_CINMS
0224_20110325_222708_EX 1101.all	EX1101_XBT34_20110325.asvp	84	3/25/2011	8.5	213.2545 254	EX1101_MB_FNL_CINMS
0225_20110325_223902_EX 1101.all	EX1101_XBT34_20110325.asvp	84	3/25/2011	8	156.6919 129	EX1101_MB_FNL_CINMS
0226_20110325_225738_EX 1101.all	EX1101_XBT34_20110325.asvp	84	3/25/2011	8	323.5725 453	EX1101_MB_FNL_CINMS
0227_20110325_231630_EX 1101.all	EX1101_XBT34_20110325.asvp	84	3/25/2011	8	338.9834 678	EX1101_MB_FNL_CINMS
0228_20110325_232501_EX 1101.all	EX1101_XBT34_20110325.asvp	84	3/25/2011	8	221.9322 349	EX1101_MB_FNL_CINMS
0229_20110325_232945_EX 1101.all	EX1101_XBT34_20110325.asvp	84	3/25/2011	8	162.3582 36	EX1101_MB_FNL_CINMS
0230_20110325_233622_EX 1101.all	EX1101_XBT34_20110325.asvp	84	3/25/2011	8	185.2872 999	EX1101_MB_FNL_CINMS
0231_20110325_234409_EX 1101.all	EX1101_XBT34_20110325.asvp	84	3/25/2011	8	142.5171 637	EX1101_MB_FNL_CINMS
0232_20110326_010147_EX 1101.all	EX1101_XBT34_20110325.asvp	85	3/26/2011	8.7	226.9138 82	EX1101_MB_FNL_CINMS

EX1101 MULTIBEAM LOG						
KEY: DNP = DO NOT PROCESS, DNE = DOES NOT EXIST, RESTRICTED = DATA OVER DATA OVER PROTECTED CULTURAL RESOURCE						
MB LINE FILE NAME	SVP APPLIED	JULIAN DAY	DATE (GMT)	SOG	HDG	FINAL PRODUCT (ASCII text, Geotiff, IVS3D, GoogleEarth)
0233_20110326_022122_EX 1101.all	EX1101_XBT34_20110325.asvp EX1101_XBT35_20110326.asvp	85	3/26/2011	8.7	243.8944 359	EX1101_MB_FNL_Transit_South
0234_20110326_030944_EX 1101.all	EX1101_XBT35_20110326.asvp	85	3/26/2011	7.5	250.8164 442	EX1101_MB_FNL_Transit_South
0235_20110326_090952_EX 1101.all	EX1101_XBT36_20110326.asvp / EX1101_XBT37_20110326.asvp	85	3/26/2011	7.5	250	EX1101_MB_FNL_Transit_South
0236_20110326_145838_EX 1101.all	EX1101_XBT37_2011326.asvp	85	3/26/2011	9	23	EX1101_MB_FNL_SanJuanSmnt
0237_20110326_151337_EX 1101.all	EX1101_XBT37_2011326.asvp EX1101_XBT38_20110326.asvp	85	3/26/2011	8	90	EX1101_MB_FNL_SanJuanSmnt
0238_20110326_202009_EX 1101.all	EX1101_XBT38_20110326.asvp	85	3/26/2011	8	176	EX1101_MB_FNL_SanJuanSmnt
0239_20110326_204315_EX 1101.all	EX1101_XBT38_20110326.asvp	85	3/26/2011	8.0	269.0	EX1101_MB_FNL_SanJuanSmnt
0240_20110327_001436_EX 1101.all	EX1101_XBT38_20110326.asvp EX1101_XTB39_20110326.asvp	85	3/27/2011	8.0	269.3	EX1101_MB_FNL_SanJuanSmnt
0241_20110327_030553_EX 1101.all	EX1101_XTB39_20110326.asvp	85	3/27/2011	10.2	172.7	EX1101_MB_FNL_SanJuanSmnt
0242_20110327_032454_EX 1101.all	EX1101_XTB39_20110326.asvp	86	3/27/2011	8.4	89.3	EX1101_MB_FNL_SanJuanSmnt
0243_20110327_061225_EX 1101.all	EX1101_XTB39_20110326.asvp EX1101_XBT40_20110327.asvp	86	3/27/2011	7.9	89.1	EX1101_MB_FNL_SanJuanSmnt
0244_20110327_093725_EX 1101.all	EX1101_XBT40_20110327.asvp	86	3/27/2011	7.6	175.5	EX1101_MB_FNL_SanJuanSmnt
0245_20110327_100213_EX 1101.all	EX1101_XBT40_20110327.asvp EX1101_XBT41_20110327.asvp	86	3/27/2011	8.5	273	EX1101_MB_FNL_SanJuanSmnt
0246_20110327_131241_EX 1101.all	EX1101_XBT41_20110327.asvp	86	3/27/2011	8.5	274	EX1101_MB_FNL_SanJuanSmnt
0247_20110327_151418_EX 1101.all	EX1101_XBT41_20110327.asvp	86	3/27/2011	8.5	276	EX1101_MB_FNL_SanJuanSmnt
0248_20110327_162514_EX 1101.all	EX1101_XBT41_20110327.asvp	86	3/27/2011	8.5	VAR	EX1101_MB_FNL_SanJuanSmnt
0249_20110327_163839_EX 1101.all	EX1101_XBT41_20110327.asvp	86	3/27/2011	10	VAR	EX1101_MB_FNL_SanJuanSmnt
0250_20110327_164658_EX 1101.all	EX1101_XBT41_20110327.asvp / EX1101_XBT42_20110327.asvp	86	3/27/2011	9	90	EX1101_MB_FNL_SanJuanSmnt
0251_20110327_220030_EX 1101.all	EX1101_XBT_42_20110327.asvp	86	3/27/2011	9	137	EX1101_MB_FNL_SanJuanSmnt
0252_20110327_222318_EX 1101.all	EX1101_XBT42_20110327.asvp	86	3/27/2011			EX1101_MB_FNL_SanJuanSmnt
0253_20110328_000941_EX 1101.all	EX1101_XBT42_20110327.asvp / EX1101_XBT43_20110328.asvp	87	3/28/2011	8.4	269	EX1101_MB_FNL_SanJuanSmnt
0254_20110328_042231_EX 1101.all	EX1101_XBT43_20110328.asvp	87	3/28/2011	10.1	VAR	EX1101_MB_FNL_SanJuanSmnt
0255_20110328_044119_EX 1101.all	EX1101_XBT43_20110328.asvp / EX1101_XBT44_20110328.asvp / EX1101_XBT45_20110328.asvp	87	3/28/2011	8.4	89.5	EX1101_MB_FNL_SanJuanSmnt
0256_20110328_075313_EX 1101.all	EX1101_XBT45_20110328.asvp	87	3/28/2011	8.5	90	EX1101_MB_FNL_SanJuanSmnt
0257_20110328_104804_EX 1101.all	EX1101_XBT45_20110328.asvp	87	3/28/2011	8.5	VAR	EX1101_MB_FNL_SanJuanSmnt
0258_20110328_111214_EX 1101.all	EX1101_XBT45_20110328.asvp EX1101_XBT46_20110328.asvp	87	3/28/2011	8.5	275	EX1101_MB_FNL_SanJuanSmnt

EX1101 MULTIBEAM LOG						
KEY: DNP = DO NOT PROCESS, DNE = DOES NOT EXIST, RESTRICTED = DATA OVER DATA OVER PROTECTED CULTURAL RESOURCE						
MB LINE FILE NAME	SVP APPLIED	JULIAN DAY	DATE (GMT)	SOG	HDG	FINAL PRODUCT (ASCII text, Geotiff, IVS3D, GoogleEarth)
0259_20110328_142147_EX1101.all	EX1101_XBT46_20110328.asvp EX1101_XBT44_20110328.asvp	87	3/28/2011	8.5	275	EX1101_MB_FNL_SanJuanSmnt
0260_20110328_172812_EX1101.all	EX1101_XBT44_20110328.asvp	87	3/28/2011		181	EX1101_MB_FNL_SanJuanSmnt
0261_20110328_174843_EX1101.all	EX1101_XBT44_20110328.asvp / EX1101_XBT47_20110328.asvp	87	3/28/2011	9.2	90	EX1101_MB_FNL_SanJuanSmnt
0262_20110328_231815_EX1101.all	EX1101_XBT47_20110328.asvp	87	3/28/2011	9.5	140	EX1101_MB_FNL_SanJuanSmnt
0263_20110328_233603_EX1101.all	EX1101_XBT47_20110328.asvp	87	3/28/2011	8.5	217	EX1101_MB_FNL_SanJuanSmnt
0264_20110328_234033_EX1101.all	EX1101_XBT47_20110328.asvp	87	3/28/2011	6.9	267	EX1101_MB_FNL_SanJuanSmnt
0265_20110329_000002_EX1101.all	EX1101_XBT47_20110328.asvp	89	3/29/2011	6.0	340	EX1101_MB_FNL_SanJuanSmnt
0266_20110329_031201_EX1101.all	EX1101_XBT47_20110328.asvp / EX1101_XBT48_20110329.asvp	89	3/29/2011	5.8	344	EX1101_MB_FNL_SanJuanSmnt
0267_20110329_041253_EX1101.al	EX1101_XBT48_20110329.asvp	89	3/29/2011	8.6	179	EX1101_MB_FNL_SanJuanSmnt
0268_20110329_052747_EX1101.all	EX1101_XBT48_20110329.asvp/ EX1101_XBT49_20110329.asvp	89	3/29/2011	9	87	EX1101_MB_FNL_Transit_South
0269_20110329_110307_EX1101.all	EX1101_XBT49_20110329.asvp	89	3/29/2011	7.76	086	EX1101_MB_FNL_Transit_South
0270_20110329_170308_EX1101.all	EX1101_XBT49_20110329.asvp	89	3/29/2011	0	075	EX1101_MB_FNL_Transit_South
0271_20110329_182114_EX1101.all	EX1101_XBT49_20110329.asvp	89	3/29/2011	2	199	EX1101_MB_FNL_Transit_South
0272_20110329_195105_EX1101.all	EX1101_XBT49_20110329.asvp	89	3/29/2011	9.5	254	EX1101_MB_FNL_Transit_South
0273_20110329_201102_EX1101.all	EX1101_XBT49_20110329.asvp EX1101_XBT51_20110329.asvp	89	3/29/2011	8.63	254	EX1101_MB_FNL_Transit_South
0274_20110329_204321_EX1101.all	EX1101_XBT51_20110329.asvp	89	3/29/2011	8.46	251	EX1101_MB_FNL_Transit_South
0275_20110329_222706_EX1101.all	EX1101_XBT51_20110329.asvp	89	3/29/2011	9.56	146	EX1101_MB_FNL_Hancock_109_Seamnts
0276_20110329_224742_EX1101.all	EX1101_XBT51_20110329.asvp	89	3/29/2011	9.9	146	EX1101_MB_FNL_Hancock_109_Seamnts
0277_20110329_232431_EX1101.all	EX1101_XBT51_20110329.asvp	89	3/29/2011	9.2	TURN	EX1101_MB_FNL_Hancock_109_Seamnts
0278_20110329_233531_EX1101.all	EX1101_XBT51_20110329.asvp	89	3/29/2011	6.6	328	EX1101_MB_FNL_Hancock_109_Seamnts
0279_20110330_000020_EX1101.all	EX1101_XBT51_20110329.asvp	89	3/30/2011	6.5	328	EX1101_MB_FNL_Hancock_109_Seamnts
0280_20110330_003855_EX1101.all	EX1101_XBT51_20110329.asvp	89	3/30/2011	6.5	TURN	EX1101_MB_FNL_Hancock_109_Seamnts
0281_20110330_004732_EX1101.all	EX1101_XBT51_20110329.asvp	89	3/30/2011	9.6	146	EX1101_MB_FNL_Hancock_109_Seamnts
0282_20110330_012933_EX1101.all	EX1101_XBT51_20110329.asvp	89	3/30/2011	7.7	TURN	EX1101_MB_FNL_Hancock_109_Seamnts
0283_20110330_013442_EX1101.all	EX1101_XBT51_20110329.asvp / EX1101_XBT52_20110330.asvp	89	3/30/2011	6.0	119.6	EX1101_MB_FNL_Hancock_109_Seamnts
0284_20110330_024133_EX1101.all	EX1101_XBT52_20110330.asvp	89	3/30/2011	6.5	216	EX1101_MB_FNL_Hancock_109_Seamnts
0285_20110330_024628_EX1101.all	EX1101_XBT52_20110330.asvp	89	3/30/2011	8.7	145.2	EX1101_MB_FNL_Hancock_109_Seamnts
0286_20110330_032841_EX1101.all	EX1101_XBT52_20110330.asvp	89	3/30/2011	6.8	253	EX1101_MB_FNL_Hancock_109_Seamnts
0287_20110330_033735_EX	EX1101_XBT52_20110330.asvp	89	3/30/2011	5.8	325	EX1101_MB_FNL_Hancock_109_Seamnts

EX1101 MULTIBEAM LOG						
KEY: DNP = DO NOT PROCESS, DNE = DOES NOT EXIST, RESTRICTED = DATA OVER DATA OVER PROTECTED CULTURAL RESOURCE						
MB LINE FILE NAME	SVP APPLIED	JULIAN DAY	DATE (GMT)	SOG	HDG	FINAL PRODUCT (ASCII text, Geotiff, IVS3D, GoogleEarth)
1101.all						
0288_20110330_043954_EX 1101.all	EX1101_XBT52_20110330.asvp	89	3/30/2011	7.2	225	EX1101_MB_FNL_Hancock_109_Seamnts
0289_20110330_045028_EX 1101.all	EX1101_XBT52_20110330.asvp	89	3/30/2011	8.6	144	EX1101_MB_FNL_Hancock_109_Seamnts
0290_20110330_053112_EX 1101.all	EX1101_XBT52_20110330.asvp	89	3/30/2011	6.1	155	EX1101_MB_FNL_Hancock_109_Seamnts
0291_20110330_053543_EX 1101.all	EX1101_XBT52_20110330.asvp	89	3/30/2011	5.6	313	EX1101_MB_FNL_Hancock_109_Seamnts
0292_20110330_062823_EX 1101.all	EX1101_XBT52_20110330.asvp / EX1101_XBT53_20110330.asvp	89	3/30/2011	5.5	301	EX1101_MB_FNL_Hancock_109_Seamnts
0293_20110330_071729_EX 1101.all	EX1101_XBT53_20110330.asvp	89	3/30/2011	6.2	259	EX1101_MB_FNL_Hancock_109_Seamnts
0294_20110330_073840_EX 1101.all	EX1101_XBT53_20110330.asvp	89	3/30/2011	8.1	121	EX1101_MB_FNL_Hancock_109_Seamnts
0295_20110330_083032_EX 1101.all	EX1101_XBT53_20110330.asvp	89	3/30/2011	7.6	209	EX1101_MB_FNL_Hancock_109_Seamnts
0296_20110330_084051_EX 1101.all	EX1101_XBT53_20110330.asvp	89	3/30/2011	5.9	301	EX1101_MB_FNL_Hancock_109_Seamnts
0297_20110330_100711_EX 1101.all	EX1101_XBT53_20110330.asvp	89	3/30/2011	6.7	260	EX1101_MB_FNL_Hancock_109_Seamnts
0298_20110330_101557_EX 1101.all	EX1101_XBT53_20110330.asvp	89	3/30/2011	8.0	122	EX1101_MB_FNL_Hancock_109_Seamnts
0299_20110330_112344_EX 1101.all	EX1101_XBT53_20110330.asvp	89	3/30/2011	6.0	VAR	EX1101_MB_FNL_Hancock_109_Seamnts
0300_20110330_113221_EX 1101.all	EX1101_XBT53_20110330.asvp	89	3/30/2011	6.5	306	EX1101_MB_FNL_Hancock_109_Seamnts
0301_20110330_130337_EX 1101.all	EX1101_XBT53_20110330.asvp	89	3/30/2011	6.5	VAR	EX1101_MB_FNL_Hancock_109_Seamnts
0302_20110330_132245_EX 1101.all	EX1101_XBT53_20110330.asvp EX1101_XBT54_20110330.asvp	89	3/30/2011	8.0	123	EX1101_MB_FNL_Hancock_109_Seamnts
0303_20110330_142821_EX 1101.all	EX1101_XBT54_20110330.asvp	89	3/30/2011	7.5	VAR	EX1101_MB_FNL_Hancock_109_Seamnts
0304_20110330_144351_EX 1101.all	EX1101_XBT54_20110330.asvp	89	3/30/2011	6.6	300	EX1101_MB_FNL_Hancock_109_Seamnts
0305_20110330_154219_EX 1101.all	EX1101_XBT54_20110330.asvp	89	3/30/2011	7.3	200	EX1101_MB_FNL_Hancock_109_Seamnts
0306_20110330_155215_EX 1101.all	EX1101_XBT54_20110330.asvp	89	3/30/2011	8	90	EX1101_MB_FNL_Hancock_109_Seamnts
0307_20110330_181724_EX 1101.all	EX1101_XBT54_20110330.asvp / EX1101_XBT55_20110330.asvp	89	3/30/2011	7	330	EX1101_MB_FNL_Hancock_109_Seamnts
0308_20110330_195013_EX 1101.all	E1101_XBT55_20110330.asvp	89	3/30/2011	6	63	EX1101_MB_FNL_Hancock_109_Seamnts
0309_20110330_195426_EX 1101.all	E1101_XBT55_20110330.asvp	89	3/30/2011	6	90	EX1101_MB_FNL_Hancock_109_Seamnts
0310_20110330_210341_EX 1101.all	E1101_XBT55_20110330.asvp	89	3/30/2011	9	106	EX1101_MB_FNL_Transit_South
0311_20110330_222733_EX 1101.all	E1101_XBT55_20110330.asvp	89	3/30/2011	9	106	EX1101_MB_FNL_Transit_South
0312_20110330_231025_EX 1101.all	EX1101_XBT56_20110330.asvp	89	3/30/2011	8.3	90	EX1101_MB_FNL_Transit_South
LINE 313 NOT COLLECTED	DNE	DNE	DNE	DNE	DNE	DNE - LINE # SKIPPED BY SIS
0314_20110331_032619_EX 1101.all	EX1101_XBT56_20110330.asvp / EX1101_XBT57_20110331.asvp / EX1101_XBT58_20110331.asvp	90	3/30/2011	8.7	86	EX1101_MB_FNL_Transit_South
0315_20110331_092617_EX 1101.all	EX1101_XBT58_20110331.asvp	90	3/30/2011	5.8	84	EX1101_MB_FNL_Transit_South

EX1101 MULTIBEAM LOG						
KEY: DNP = DO NOT PROCESS, DNE = DOES NOT EXIST, RESTRICTED = DATA OVER DATA OVER PROTECTED CULTURAL RESOURCE						
MB LINE FILE NAME	SVP APPLIED	JULIAN DAY	DATE (GMT)	SOG	HDG	FINAL PRODUCT (ASCII text, Geotiff, IVS3D, GoogleEarth)
0316_20110331_110952_EX 1101.all	EX1101_XBT58_20110331.asvp	90	3/30/2011	6.0	88	EX1101_MB_FNL_Transit_South
0317_20110331_112424_EX 1101.all	EX1101_XBT58_20110331.asvp	90	3/30/2011	5.5	95	EX1101_MB_FNL_Transit_South

EX1101 Sound Velocity Profile Log

EX1101 SVP LOG					
DATE (GMT)	TIME (GMT)	XBT/CTD FILE NAME	LAT/LONG (WGS84)	PROBE TYPE	NOTES
3/17/2011	0425	EX1101_XBT01_20110317_Restricted.asvp	POSITION WITHHELD	DEEP BLUE	RESTRICTED
3/17/2011	1134	EX1101_XBT02_20110317.asvp	36.714807 N /122.371631 W	DEEP BLUE	
3/17/2011	1919	EX1101_XBT03_20110317.asvp	36.666483N / 122.400928W	DEEP BLUE	
3/18/2011	0105	EX1101_XBT04_20010318.asvp	36.661226N / 122.321061W	DEEP BLUE	
3/18/2011	0509	EX1101_XBT05_20110318.asvp	36.672201N / 122.731901W	DEEP BLUE	
3/18/2011	1233	EX1101_XBT06_20110318.asvp	36.506848N / 122.367448W	DEEP BLUE	
3/18/2011	1909	EX1101_XBT07_20110318.asvp	36.472286N / 122.352328W	DEEP BLUE	
3/19/2011	0105	EX1101_XBT08_20110319.asvp	36.345292N / 122.294822W	DEEP BLUE	
3/19/2011	0655	EX1101_XBT09_20110319.asvp	36.384208N / 122.229492W	DEEP BLUE	
3/19/2011	1247	EX1101_XBT10_20110319.asvp	35.852494N / 121.900293W	DEEP BLUE	
3/19/2011	1727	EX1101_XBT11_20110319.asvp	35.542041N / 121.568050W	DEEP BLUE	SVP VALUES FROM 670m TO 720m REMOVED DUE TO CABLE CONTACT WITH SHIP
3/19/2011	1925	EX1101_XBT12_20110319.asvp	35.670211N / 121.706071W	DEEP BLUE	
3/19/2011	2032	EX1101_XBT11_20110319.asvp	35.542041N / 121.568050W	DEEP BLUE	
3/20/2011	0130	EX1101_XBT13_20110320.asvp	35.658720 N /121.592562W	DEEP BLUE	
3/20/2011	1929	EX1101_XBT14_20110320.asvp	35.389038N / 121.282503W	DEEP BLUE	
3/21/2011	0139	EX1101_XBT15_20110321.asvp	34.493860N / 121.035482W	DEEP BLUE	
3/21/2011	0536	EX1101_XBT16_20110321.asvp	33.973372N / 120.891553W	DEEP BLUE	
3/21/2011	1218	EX1101_XBT17_20110321.asvp	33.863704N / 120.606250W	DEEP BLUE	
3/21/2011	1900	EX1101_XBT18_20110321.asvp	33.895752N / 120.585384W	DEEP BLUE	
3/22/2011	0100	EX1101_XBT19_20110322.asvp	34.019902 N/ 120.525928W	DEEP BLUE	
3/22/2011	0716	EX1101_XBT20_20110322.asvp	34.049137 N/ 120.610270W	DEEP BLUE	
3/22/2011	1249	EX1101_XBT22_20110322.asvp	33.970687N / 120.604525W	DEEP BLUE	XBT#21 FAILED WHEN COPPER WIRE WAS BROKEN
3/22/2011	2030	EX1101_XBT23_20110323.asvp	34.000427N/ 120.485351W	DEEP BLUE	
3/23/2011	0721	EX1101_XBT24_20110323.asvp	33.844665N/ 120.287988W	DEEP BLUE	
3/23/2011	1310	EX1101_XBT25_20110323.asvp	33.821317N/ 120.161996W	DEEP BLUE	
3/23/2011	1850	EX1101_XBT26_20110323asvp	33.822469N / 120.293701W	DEEP BLUE	
3/24/2011	0111	EX1101_XBT27_20110324.asvp	33.457291N / 119,60425W	DEEP BLUE	
3/24/2011	0650	EX1101_XBT28_20110324.asvp	33.543804N /119.577173W	DEEP BLUE	
3/24/2011	1308	EX1101_XBT29_20110324.asvp	33.865657N / 119.836224W	DEEP BLUE	
3/24/2011	2004	EX1101_XBT30_20110324.asvp	33.757362N /119.663461W	DEEP BLUE	
3/25/2011	0111	EX1101_XBT31_20110325.asvp	33.621959N / 119.458661W	DEEP BLUE	

3/25/2011	0657	EX1101_XBT32_20110325.asvp	33.745137N / 119.486290W	DEEP BLUE	
3/25/2011	1302	EX1101_XBT33_20110325.asvp	33.794840N/119.462468W	DEEP BLUE	
3/25/2011	2010	EX1101_XBT34_20110325.asvp	33.900580N / 119.824270W	DEEP BLUE	
3/26/2011	0245	EX1101_XBT35_201103026.asvp	33.570260N / 120.019971W	DEEP BLUE	
3/26/2011	0656	EX1101_XBT36_20110326.asvp	33.390373N / 120.623844W	DEEP BLUE	
3/26/2011	1255	EX1101_XBT37_20110326.asvp	33.217171N / 121.477816W	T-5	
3/26/2011	1941	EX1101_XBT38_20110326.asvp	33.099068N / 120.893164W	DEEP BLUE	
3/27/2011	0109	EX1101_XBT39_20110327.asvp	33.050183N / 121.472331W	DEEP BLUE	
3/27/2011	0648	EX1101_XBT40_20110327.asvp	33.000106N /121.215088W	DEEP BLUE	
3/27/2011	1250	EX1101_XBT41_20110327.asvp	32.950761N /121.231934W	DEEP BLUE	
3/27/2011	1910	EX1101_XBT42_20110327.asvp	32.901017N / 121.302621W	T-5	
3/28/2011	0115	EX1101_XBT43_20110328.asvp	32.851265N / 121.222738W	T-5	
3/28/2011	0449	EX1101_XBT44_20110328.asvp	32.802637N / 121.760156W	T-5	
3/28/2011	0659	EX1101_XBT45_20110328.asvp	32.802112N / 121.397038W	T-5	
3/28/2011		EX1101_XBT46_20110328.asvp	32.752083 N / 121.037630W	T-5	
3/28/2011	1935	EX1101_XBT47_20110328.asvp	32.702873N / 121.518424W	T-5	
3/29/2011	0342	EX1101_XBT48_2010328.asvp	32.880306N / 120.901839W	T-5	DATA ENTERED IN FILE INCORRECTLY AS 3/28/2011
3/29/2011	0942	EX1101_XBT49_2010329.asvp	32.757259N / 120.169596W	DEEP BLUE	
3/29/2011	2143	EX1101_XBT51_20110329.asvp	32.698242N / 119.432438W	DEEP BLUE	# 50 BAD XBT, REPEATED
3/30/2011	0135	EX1101_XBT52_20110330.asvp	32.514079N / 119.468506W	DEEP BLUE	
3/30/2011	0654	EX1101_XBT53_20110330.asvp	32.584578N / 119.610661W	DEEP BLUE	
3/30/2011	1327	EX1101_XBT54_20110330.asvp	32.577958N / 119.767546w	DEEP BLUE	VALUES PAST 655 METERS WERE REMOVED IN THE .ASVP DUE TO ABERRANT VALUES (PROBABLY THE COPPER WIRE TOUCHING THE HULL)
3/30/2011	1920	EX1101_XBT55_20110330.asvp	32.603711N / 119.457699W	T-5	
3/30/2011	2258	EX1101_XBT56_20110330.asvp	32.583785N/119.074691W	T-5	
3/31/2011	0358	EX1101_XBT57_20110331.asvp	32.576485N/118.938509W	T-5	
3/31/2011	0905	EX1101_XBT58_20110331.asvp	32.615922N/118.111654W	T-5	

EX1101 Built In System Test Log

EX1101 BIST LOG										
BIST FILE NAME	DATE (LOCAL)	DATE (UTC)	TIME (LOCAL)	TIME (GMT)	Board / Channel / Max RX Noise (dB)	Avg RX Noise Board 1 (dB)	Avg RX Noise Board 2 (dB)	Avg RX Noise Board 3 (dB)	Avg RX Noise Board 4 (dB)	NOTES
EX1101_1.txt	3/17/2011	3/18/11	1802	0102	4/28/54.3	52.5	52.5	52.8	53.1	No failures
EX1101_2.txt	3/17/2011	3/18/11	1809	0109	4/31/55.3	53.2	53.5	53.5	53.7	No failures
EX1101_3.txt	3/17/2011	3/18/11	1818	0118	4/29/58.6	57.4	57.3	57.5	57.6	No failures
EX1101_4.txt	3/17/2011	3/18/11	1842	0142	1/15/79.7	74.5	72.9	73.4	73.3	Multiple test failures: Spectral noise RX boards 2,3,4; Receiver impedence limits, transducer impedence limits,

EX1101 BIST LOG										
BIST FILE NAME	DATE (LOCAL)	DATE (UTC)	TIME (LOCAL)	TIME (GMT)	Board / Channel / Max RX Noise (dB)	Avg RX Noise Board 1 (dB)	Avg RX Noise Board 2 (dB)	Avg RX Noise Board 3 (dB)	Avg RX Noise Board 4 (dB)	NOTES
										receiver phase limits, transducer phase limits, TX board 4 channel 30; test 7 - numerous channels with high z values
EX1101_5.txt	3/17/2011	3/18/11	1851	0151	4/17/82.6	71.1	64.7	64.3	67.8	Receiver impedence limits, transducer impedence limits, transducer phase limits, TX board 4 channel 30
EX1101_6.txt	3/17/2011	3/18/11	1858	0158	1/11/74.1	70.5	71.4	70.3	68.0	Receiver impedence limits, transducer impedence limits, receiver phase limits, transducer phase limits, TX board 4 channel 30
EX1101_7.txt	3/17/2011	3/18/11	1922	0222	4/7/74.1	69	70.2	68.6	70.6	No failures
EX1101_8.txt	3/17/2011	3/18/11	1930	0230	1/1/64.3	58.3	57.9	56.1	57.1	No failures
EX1101_9.txt	3/17/2011	3/18/11	2055	0355	2/12/69.8	62.4	55.7	54.6	55.5	Receiver impedence limits, transducer impedence limits, receiver phase limits, transducer phase limits, TX board 4 channel 30
EX1101_10.txt	3/17/11	3/17/11	0145	0745	4/29/61.7	44.5	43.8	45	52	"
EX1101_11.txt	3/18/11	3/19/11	2214	0514	4/29/61.7	45.9	44.8	44.3	49.8	"
EX1101_12.txt	3/18/11	3/19/11	2222	0522	4/29/61.7	49.7	48.6	48.4	51.3	Receiver impedence limits, transducer impedence limits, transducer phase limits, TX board 4 channel 30
EX1101_13.txt	3/20/11	3/20/11	1016	1716	4/29/61.7	50.4	48.8	48.5	51.5	Receiver impedence limits, transducer impedence limits, receiver phase limits, transducer phase limits, TX board 4 channel 30
EX1101_14.txt	3/20/11	3/20/11	1341	2041	1/20/71.3	57.3	51.2	61.4	7.2	"
EX1101_15.txt	3/20/11	3/20/11	1539	2239	4/9/77.2	61.4	64.5	61.2	67.2	Receiver impedence limits, transducer impedence limits, transducer phase limits, TX board 4 channel 30; test 7 - numerous channels with high z and/or phase values
EX1101_15_TXChannelsTest7.txt	3/20/11	3/20/11	1547	2247						numerous channels with high z and/or phase values
EX1101_16.txt	3/21/11	3/21/11	0849	1549	4/8/65.7	48.4	48.8	50.4	56.1	Receiver impedence limits, transducer impedence limits,

EX1101 BIST LOG										
BIST FILE NAME	DATE (LOCAL)	DATE (UTC)	TIME (LOCAL)	TIME (GMT)	Board / Channel / Max RX Noise (dB)	Avg RX Noise Board 1 (dB)	Avg RX Noise Board 2 (dB)	Avg RX Noise Board 3 (dB)	Avg RX Noise Board 4 (dB)	NOTES
										receiver phase limits, transducer phase limits, TX board 4 channel 30
EX1101_17.txt	3/22/11	3/22/11	0905	1605	4/8/62.3	46.0	45.5	46.4	53.1	"
EX1101_18.txt	3/22/11	3/22/11	1407	2107	4/29/61.7	45.4	43.9	43.1	48.8	"
EX1101_19.txt	3/23/11	3/23/11	0906	1606	4/29/61.7	46.7	46.0	46.1	49.9	"
EX1101_20.txt	3/25/11	3/26/11	1823	0123	1/3/66.4	59.3	54.6	53.9	53.9	"
EX1101_21_7only.txt	3/25/11	3/26/11	1832	0132						"
EX1101_22.txt	3/26/11	3/26/11	0755	1455	4/29/61.7	44.9	44.1	44.0	49.3	"
EX1101_23.txt	3/27/11	3/27/11	0935	1635	4/29/61.7	51.1	51.9	52.9	53.4	"
EX1101_24.txt	3/27/11	3/27/11	1510	2210	4/29/61.7	44.3	43.9	43.8	49.2	"
EX1101_25.txt	3/28/11	3/28/11	1631	2331	4/29/61.7	48.0	47.9	49.0	49.5	"
EX1101_26.txt	3/29/11	3/29/11	1303	2003	4/29/61.7	45.6	46.3	45.9	49.5	"
EX1101_27_3knots.txt	3/30/11	3/30/11	1325	2025	4/29/61.7	46.6	47	45.8	50	Receiver impedence limits, transducer impedence limits, transducer phase limits, TX board 4 channel 30
EX1101_28_5knots.txt	3/30/11	3/30/11	1335	2035	4/29/61.7	46.7	45.6	52.2	50	Receiver impedence limits, transducer impedence limits, receiver phase limits, transducer phase limits, TX board 4 channel 30
EX1101_29_7knots.txt	3/30/11	3/30/11	1345	2045	4/29/61.7	45.5	44.7	44.4	49.3	"
EX1101_30_9knots.txt	3/30/11	3/30/11	1355	2055	4/29/61.7	44.5	43.9	43.6	51.5	Receiver impedence limits, transducer impedence limits, transducer phase limits, TX board 4 channel 30
EX1101_31_Mammals.txt	3/30/11	3/30/11	1555	2255	4/29/61.7	48.5	47	46.7	50.3	Receiver impedence limits, transducer impedence limits, receiver phase limits, transducer phase limits, TX board 4 channel 30
EX1101_32_Final.txt	3/31/11	3/31/11	0809	1509	4/29/61.7	42.2	41.6	40.9	48	"

EX1101Weather Log

EX1101 Weather Log							
Local Date	Local Time	UTC Time	Wind Direction (deg)	Wind Speed (kts)	Swell Height (ft)	Swell Direction (deg)	Wave Height (ft)

EX1101 Weather Log							
Local Date	Local Time	UTC Time	Wind Direction (deg)	Wind Speed (kts)	Swell Height (ft)	Swell Direction (deg)	Wave Height (ft)
3/16/2011	1940	0240	320	15	12-14	255	
3/17/2011	0110	0810	320	9	10	270	
3/17/2011	0510	1210	340	15	6	340	
3/17/2011	1045	1743	197	23	4-6	340	
3/17/2011	1400	2100	110	15	10-12	315	
3/17/2011	1840	0140	050	18	6-8	320	
3/18/2011	1135	1835	190	22	8-10	300	3-5
3/18/2011	1342	2042	068	20	10	300	
3/18/20011	1600	2300	136	14	8-10	300	
3/18/20011	2001	0301	220	16	3-6	290	
3/18/20011	2345	0645	230	15	10-12	290	
3/19/2011	0435	1135	240	15	6-8	280	
3/19/2011	0730	1430	220	11	8-10	290	
3/19/2011	0800	1500	230	6	10-12	290	
3/19/2011	1120	1820	160	13	12-14	300	3-4
3/19/2011	1732	0032	150	29	10-14	310	
3/19/2011	2115	0415	160	30	12-14	310	
3/19/2011	0200	0900	190	24	8-10	300	
3/19/2011	0515	1215	150	20	low viz	low viz	
3/20/2011	1344	2044	220	10	8-12	270/180	
3/20/2011	1747	2347	350	18			
3/20/2011	2000	0300	VAR	LT	6-8	190	
3/21/2011	0000	0700	240	12	6-8	190	
3/21/2011	0300	1000	250	13	6-8	190	
3/21/2011	0800	1500	300	12	5-8	280	
3/21/2011	1244	1944	300	10	6-8	280	
3/21/2011	1848	0148	290	15	5-7	290	
3/21/2011	2000	0300	310	18	7-9	290	
3/21/2011	2300	0600	310	18	8	280	
3/22/2011	0200	0900	310	8	8	280	
3/22/2011	0500	1200	320	8	5-8	290	
3/22/2011	0800	1500	315	7	6-8	290	
3/22/2011	1815	0115	160	10	4-6	290	
3/22/2011	2005	0315	190	LT	5	290	
3/22/2011	2315	0615	180	10	6	300	
3/23/2011	0215	0915	160	10	4-6	300	
3/23/2011	0515	1215	150	17	3-5	300	
3/23/2011	0830	1530	140	20	3-5	280	3-5
3/23/2011	1145	1845	161	25	4-6	290	
3/23/2011	1950	0250	280	15	6	280	
3/23/2011	2305	0605	250	9	5	280	
3/24/2011	0200	0900	270	15	4-6	280	
3/24/2011	0500	1200	060	6	4-6	wnw	

EX1101 Weather Log							
Local Date	Local Time	UTC Time	Wind Direction (deg)	Wind Speed (kts)	Swell Height (ft)	Swell Direction (deg)	Wave Height (ft)
3/24/2011	1215	1915	180	8	6-8	280	
3/24/2011	1554	2254	175	4	5-7	270	
3/24/2011	1943	0243	155	11			
3/24/2011	2040	0340	170	12	4-6	270	
3/25/2011	0010	0710	200	15	5-7	270	
3/25/2011	0310	1010	240	15	5-7	270	
3/25/2011	0610	1310	280	6	5-7	290	
3/25/2011	1125	1825	260	18	5-6	270	
2/25/2011	1919	0219	280	17	10-12	290	
3/25/2020	2210	0510	300	12	12-14	305	
3/26/2011	0130	0830	270	8	12-14	300	
3/26/2011	0405	1105	250	12	14	280	
3/26/2011	0700	1400	250	19	10	280	
3/26/2011	1030	1730	280	12	8-10	280	
3/26/2011	1200	1900	280	9	8-10	280	
3/26/2011	1932	0232	260	12	8	275	
3/26/2011	2230	0530	300	10	8	280	
3/27/2011	0200	0900	320	15	8	280	
3/27/2011	0530	1230	340	15	6-8	280	
3/27/2100	1003	1703	340	12	5-7	90	2-3
3/27/2011	1553	2254	320	20	7	290	
3/27/2011	1853	0153	290	19	8-10	290	
3/27/2011	2000	0300	335	20	8-9	290	
3/27/2011	2305	0605	320	20	8	290	
3/28/2011	0215	0915	325	20	7-9	290	4-6
3/28/2011	1322	2022	310	14	7-10	290	
3/28/2011	1642	2342	320	29-35	6-8	290	
3/28/2011	2015	0315	320	25-30	10	320	
3/29/2011	2330	0630	320	25-30	10	290	10-12
3/29/2011	0305	1005	320	25-30	10	290	10-12
3/29/2011	0620	1320	320	16	5-7	320	
3/29/2011	1221	1921	var	light	6-8	300	
3/29/2011	1610	0010	330	14	10-12	300	
3/29/2011	2010	0310	320	20	8-10	305	
3/29/2011	2345	0645	335	15-20	8-10	310	
3/30/2011	0315	1015	340	12	8-10	310	
3/30/2011	0640	1340	340	13	8-10	300	
3/30/2011	1227	1927	var	light	8-10	300	1-2
3/30/2011	2048	0348	300	5	7	300	
3/30/2011	2320	0620	230	185	7	300	
3/31/2011	0208	0908	230	5	4-6	300	1-2
3/31/2011	0550	1250	230	li/var	2-4	290	

Appendix C: List of acronyms

BIST – Built In System Test
CINMS – Channel Islands National Marine Sanctuary
CO – Commanding Officer
CTD – conductivity temperature and depth (equipment)
CW – continuous wave
dB – decibels
DGPS –Differential Global Positioning System
EEZ –Exclusive Economic Zone
ERT – Earth Resources Technology, Inc.
ET – Electronics Technician
EX – NOAA Ship *Okeanos Explorer*
FM – frequency modulation
FOO – Field Operations Officer
GMT – Greenwich Mean Time
Km – kilometers
KM – Kongsberg Maritime AS
Kt(s) – knots
LT – lieutenant
MBES – multibeam echosounder
MBNMS – Monterey Bay National Marine Sanctuary
NMFS – National Marine Fisheries Service
NOAA – National Oceanic and Atmospheric Administration
OAR – NOAA Office of Oceanic and Atmospheric Research
OARS – Offshore Analysis and Research Solutions
OER – NOAA Office of Ocean Exploration and Research
OMAO – NOAA Office of Marine and Aviation Operations
PHB – Pacific Hydro Branch
SIS – Seafloor Information System – Kongsberg proprietary software
SST – Senior Survey Technician
TRU – transmit and receive unit
UNH-CCOM/JHC – University of New Hampshire Center for Coastal and Ocean Mapping / Joint Hydrographic Center
UPS – uninterruptable power supply
XBT – eXpendable BathyThermograph
WD – water depth

Appendix D: EM 302 PU Parameters in use during cruise

#// Database Parameters

#// Seafloor Information System
#// Kongsberg Maritime AS
#// Saved: 2011.03.17 02:38:00

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

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

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

#// ***
#// Installation parameters

#{ Input Setup #// All Input setup parameters

#{ COM1 #// Link settings.

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

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

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

#} COM1

#{ COM2 #// Link settings.

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

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

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

#} COM2

#{ COM3 #// Link settings.

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

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

#{ Input Formats #// Format input settings.
#* Attitude [0] [0]
#* MK39 Mod2 Attitude, [0] [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, EM 302 and EM710, currently
#* Attitude 1 [1] [1]
#* Attitude 2 [1] [0]
#* Use Ethernet 2 [1] [1]
#* Port: [5602]
#* IP addr.: [192.168.2.20]
#* Net mask: [255.255.255.0]
#} Attitude Velocity settings

#} UDP5

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

#} Input Setup

#{ Output Setup #// All Output setup parameters

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

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

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

#} Host UDP1

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

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

#} Host UDP2

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

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

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

  #} Host UDP3


  #{ Host UDP4 #// Host UDP4 Port
16103

    #{ Datagram subscription #//
      #* Depth               [1] [1]
      #* Raw range and beam a [1] [0]
      #* Seabed Image        [1] [0]
      #* Central Beams       [1] [0]
      #* 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] [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  [1] [1]
      #* Runtime Parameters   [1] [1]
      #* Installation Paramet [1] [1]
      #* BIST Reply          [1] [1]
      #* Status parameters    [1] [1]
      #* 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              [0] #// System
      #* 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 [0.00] #// Roll
#* S1P [0.00] #// Pitch
#* S1H [359.98] #// Heading
#} TX Transducer:

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

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

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

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

#} Offset angles (deg.)

#} Angular Offsets

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

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

#} ROV. Specific

#{ System Parameters #// All system parameters

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

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

#} System Parameters

#// ***
#// Runtime parameters

#{ Sounder Main #//

#{ Sector Coverage #//

#{ Max. angle (deg.): #//
#* MPA [75] #// Port
#* MSA [75] #// Starboard
#} Max. angle (deg.):

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

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

#} Sector Coverage

#{ Depth Settings #//
#* FDE [450] #// Force Depth (m)
#* MID [2] #// Min. Depth (m):
#* MAD [35] #// Max. Depth (m):
#* DSM [0] #// Dual swath mode: OFF
#* PMO [0] #// Ping Mode: AUTO
#* FME [1] #// FM enable
#} Depth Settings

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

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

#} Stabilization
#} Sounder Main

#{ Sound Speed #//

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

#} Sound Speed

#{ Filter and Gains #//

#{ Filtering #//
#* SFS [2] #// Spike Filter Strength: MEDIUM
#* PEF [0] #// Penetration Filter Strength: OFF
#* RGS [1] #// Range Gate: NORMAL
#* SLF [1] #// Slope
#* AEF [1] #// Aeration
#* STF [1] #// Sector Tracking
#* IFF [1] #// Interference
#} Filtering

#{ Absorption Coefficient #//
#* ABC [7.065] #// 31.5 kHz
#} Absorption Coefficient

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

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

#{ Data Cleaning #//
#* Active rule: [STANDARD] #//
#{ STANDARD #//
#* PingProc.maxPingCountRadius [10]
#* PingProc.radiusFactor [0.050000]
#* PingProc.medianFactor [1.500000]
#* PingProc.beamNumberRadius [3]
#* PingProc.sufficientPointCount [40]
#* PingProc.neighborhoodType [Elliptical]
#* PingProc.timeRule.use [false]
#* PingProc.overhangRule.use [false]
#* PingProc.medianRule.use [false]
#* PingProc.medianRule.depthFactor [0.050000]

#* PingProc.medianRule.minPointCount [6]
#* PingProc.quantileRule.use [false]
#* PingProc.quantileRule.quantile [0.100000]
#* PingProc.quantileRule.scaleFactor [6.000000]
#* PingProc.quantileRule.minPointCount [40]
#* GridProc.minPoints [8]
#* GridProc.depthFactor [0.200000]
#* GridProc.removeTooFewPoints [false]
#* GridProc.surfaceFitting.surfaceDegree [1]
#* GridProc.surfaceFitting.tukeyConstant [6.000000]
#* GridProc.surfaceFitting.maxIteration [10]
#* GridProc.surfaceFitting.convCriterion [0.010000]
#* GridProc.surfaceDistanceDepthRule.use [false]
#* GridProc.surfaceDistanceDepthRule.depthFactor [0.050000]
#* GridProc.surfaceDistancePointRule.use [false]
#* GridProc.surfaceDistancePointRule.scaleFactor [1.000000]
#* GridProc.surfaceDistanceUnitRule.use [false]
#* GridProc.surfaceDistanceUnitRule.scaleFactor [1.000000]
#* GridProc.surfaceDistanceStDevRule.use [false]
#* GridProc.surfaceDistanceStDevRule.scaleFactor [2.000000]
#* GridProc.surfaceAngleRule.use [false]
#* GridProc.surfaceAngleRule.minAngle [20.000000]
#* SonarProc.use [false]
#* SonarProc.gridSizeFactor [4]
#* SonarProc.mergerType [Average]
#* SonarProc.interpolatorType [TopHat]
#* SonarProc.interpolatorRadius [1]
#* SonarProc.fillInOnly [true]
#} STANDARD

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

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

Appendix E: Software versions in use during 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
Fledermaus	7.2 Professional	Multibeam QC
Hypack	9.0.0.22	Survey planning
Hypack	9.0.4.0	Realtime monitoring
Kongsberg SIS (installed 2/12/10)	3.6.4 build 174	EM 302 data acquisition
Velocipy (NOAA)	10.7 (r2982)	XBT processing

Appendix F: Built In System Test (BIST) Results showing RX Board 4 Channel 30 failure

Saved: 2011.03.31 15:09:00

Sounder Type: 302, Serial no.: 101

Date   Time
Ser. No.   BIST
Result

2011.03.31 14:58:39.290
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

2011.03.31 14:58:40.806
101   1   OK

High Voltage Br. 1

TX36   Spec: 90.0 - 145.0
0-1   116.8
0-2   116.8
0-3   116.4
0-4   116.4
0-5   116.4
0-6   116.0
0-7   116.4
0-8   115.1
0-9   116.4
0-10   116.8
0-11 116.8
0-12 115.1
0-13 117.6
0-14 116.4
0-15 117.2
0-16 116.8
0-17 116.0
0-18 116.4
0-19 116.0
0-20 116.4
0-21 116.0
0-22 116.8
0-23 115.6
0-24 116.4

High Voltage Br. 2

TX36   Spec: 90.0 - 145.0
0-1   116.4
0-2   116.4
0-3   116.4
0-4   116.0
0-5   116.0
0-6   116.0
0-7   116.0
0-8   115.6
0-9   116.8
0-10   116.4

```
0-11  116.0
0-12  116.0
0-13  115.1
0-14  116.8
0-15  116.8
0-16  116.8
0-17  116.0
0-18  116.4
0-19  116.0
0-20  116.0
0-21  116.4
0-22  116.8
0-23  116.0
0-24  116.4


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   12.0
0-17   11.9
0-18   11.9
0-19   11.9
0-20   11.9
0-21   11.9
0-22   11.9
0-23   11.8
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    38.0
0-2    37.6
0-3    38.0
0-4    38.0
0-5    38.0
0-6    38.8
0-7    39.2
0-8    39.2
0-9    38.8
0-10    36.4
0-11   36.4
0-12   36.8
0-13   38.0
0-14   39.6
0-15   38.0
0-16   38.8
0-17   39.2
0-18   39.6
0-19   38.8
0-20   39.2
0-21   39.2
0-22   38.4
0-23   38.8
0-24   38.4


Input Current 12V
-----------------
TX36   Spec:  0.3  -  1.5
0-1     0.6
0-2     0.5
0-3     0.5
0-4     0.5
0-5     0.5
0-6     0.5
0-7     0.6
0-8     0.5
0-9     0.6
0-10     0.5
0-11    0.6
0-12    0.6
0-13    0.6
0-14    0.6
0-15    0.6
0-16    0.5
0-17    0.8
0-18    0.7
0-19    0.6
0-20    0.6
0-21    0.7
0-22    0.5
0-23    0.6
0-24    0.6


TX36   power test passed

IO   TX   MB Embedded
PPC Embedded     PPC
Download
2.11 One CPU1.13 Reduced
Performance: 1 voice/Mar  5
2007/1.07 Jun 17 2008/1.11

TX36 unique firmware test
OK



---------------------------
---------------------------
---------------------------
---

2011.03.31 14:58:40.990
101         2         OK
```

```
Input voltage 12V
-----------------
RX32   Spec: 11.0  - 13.0
7-1    11.6
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     2.5
7-2     2.5
7-3     2.4
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    48.0
7-2    45.0
7-3    45.0
7-4    42.0


Input Current 12V
-----------------
RX32   Spec:  0.4  -  1.5
7-1     0.9
7-2     0.7
7-3     0.7
7-4     0.7


Input Current 6V
----------------
RX32   Spec:  2.4  -  3.3
7-1     2.7
7-2     2.8
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




---------------------------
---------------------------
---------------------------
---

2011.03.31 14:58:41.123
101         3         OK

High Voltage Br. 1
------------------
TX36   Spec: 90.0  - 145.0
0-1   116.8
0-2   116.8
0-3   116.4
0-4   116.4
0-5   116.4
0-6   116.0
0-7   116.4
0-8   115.1
0-9   116.4
0-10   116.4
0-11  116.8
0-12  115.1
0-13  117.6
0-14  116.4
0-15  117.2
0-16  116.8
0-17  116.0
0-18  116.4
0-19  116.0
0-20  116.4
0-21  116.0
0-22  116.8
0-23  115.6
0-24  116.4


High Voltage Br. 2
------------------
TX36   Spec: 90.0  - 145.0
0-1   116.4
0-2   116.4
0-3   116.0
0-4   116.0
0-5   116.0
0-6   116.0
0-7   116.0
0-8   115.6
0-9   116.8
0-10   116.4
0-11  116.4
0-12  116.0
0-13  115.1
0-14  116.8
0-15  116.8
```

```
0-16  116.4
0-17  116.0
0-18  116.4
0-19  115.6
0-20  116.4
0-21  116.4
0-22  116.8
0-23  116.0
0-24  116.4

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   12.0
0-17   11.9
0-18   11.9
0-19   11.9
0-20   11.9
0-21   11.9
0-22   11.9
0-23   11.8
0-24   11.9


RX32   Spec: 11.0  - 13.0
7-1    11.6
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




---------------------------
---------------------------
---------------------------
---

2011.03.31 14:58:41.306
101         4         OK

EM 302 High Voltage Ramp
Test
```

Test Voltage:20.00
Measured Voltage: 19.00
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: 121.00
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

2011.03.31 15:01:14.265
101 5 OK
BSP 1 RXI TO RAW FIFO: ok
BSP 2 RXI TO RAW FIFO: ok

2011.03.31 15:01:18.616
101 6 OK

Receiver impedance limits [600.0 1000.0] ohm
Board 1 2 3 4
1: 853.8 836.3 806.3 838.1
2: 825.8 854.0 807.8 844.7
3: 807.7 834.8 836.7 804.9
4: 839.5 821.3 825.0 845.3
5: 840.5 827.8 789.6 836.1
6: 851.0 841.1 821.4 831.8
7: 827.0 839.8 816.1 831.5
8: 836.4 828.1 839.4 750.1
9: 828.7 830.0 809.3 855.0
10: 813.1 847.4 769.1 823.2
11: 832.6 818.8 820.6 838.6
12: 840.3 814.9 844.3 844.5
13: 834.3 820.0 802.1 816.0
14: 818.0 823.5 842.3 831.6
15: 816.4 836.0 835.1 806.8
16: 843.1 813.2 837.6 869.7
17: 818.0 872.2 844.0 845.8
18: 842.0 828.2 845.5 813.2
19: 808.5 823.3 835.2 826.3
20: 822.1 861.4 835.1 838.6
21: 852.4 828.5 867.1 867.9
22: 868.2 839.6 818.8 831.5
23: 861.8 853.4 841.7 846.8
24: 874.8 876.7 859.0 843.7
25: 834.7 823.1 826.8 859.6
26: 837.1 813.1 835.5 838.3
27: 819.4 824.9 828.3 841.6
28: 808.4 824.5 802.1 824.6
29: 806.5 838.3 825.9 828.9
30: 846.7 814.8 835.9 0.0*
31: 821.7 815.9 838.2 829.5
32: 844.2 866.5 847.9 862.3

Transducer impedance limits [250.0 2000.0] ohm
Board 1 2 3 4
1: 334.2 363.2 350.9 355.9
2: 355.3 358.7 365.9 353.0
3: 340.2 340.3 367.1 359.4
4: 344.1 353.0 376.3 346.9
5: 336.0 356.7 366.3 351.5
6: 326.4 339.7 360.0 366.2
7: 337.1 354.8 390.2 364.5
8: 327.2 340.4 361.9 393.7
9: 362.8 361.5 387.7 349.9
10: 352.5 350.5 378.6 352.2
11: 330.8 358.6 362.4 357.6
12: 347.5 366.3 358.4 348.9
13: 338.6 354.4 375.9 366.2
14: 367.9 345.1 376.3 349.4
15: 336.3 344.1 367.5 353.6
16: 329.3 364.2 382.1 356.9
17: 333.9 356.2 350.4 361.0
18: 341.3 353.0 357.6 376.5
19: 353.3 356.5 352.2 361.1
20: 349.6 345.3 355.7 348.6
21: 344.8 350.7 353.3 365.7
22: 361.5 356.5 365.6 357.5
23: 359.4 346.7 366.1 363.9
24: 353.2 365.9 345.8 344.1
25: 338.3 365.8 353.9 347.9
26: 348.2 377.4 361.1 358.0
27: 335.7 356.7 356.9 349.4
28: 350.4 368.0 368.5 347.3
29: 349.4 362.4 371.0 369.5
30: 329.0 351.7 345.0 0.1*
31: 347.6 362.7 358.7 357.3
32: 334.7 357.3 361.9 366.3

Receiver Phase limits [-50.0 20.0] deg
Board 1 2 3 4
1: -2.4 2.4 4.8 -0.6
2: 1.1 -5.5 3.9 -3.7
3: 3.8 -1.7 -0.6 4.0
4: -1.4 2.0 1.6 -4.3
5: -1.0 1.5 4.6 0.8
6: -3.7 -2.2 0.1 0.6

7: 2.0 -0.4 3.8
0.2
8: -1.6 0.8 -3.1
12.2
9: -0.2 2.6 3.8 -
2.1
10: 2.9 -3.2 7.6 -
0.4
11: -2.3 2.7 -0.5
0.6
12: -1.1 1.7 -4.9 -
1.9
13: 0.9 1.9 4.6
4.4
14: 2.4 0.5 -0.3
0.2
15: 1.1 -3.8 -1.1
3.9
16: -2.0 3.3 -1.5 -
6.4
17: 0.8 -4.2 -3.3
0.1
18: -3.3 2.4 -3.0
3.6
19: 2.2 2.7 -4.3
2.4
20: 2.1 -3.7 -0.8
1.2
21: -0.5 2.8 -4.7 -
2.9
22: -1.7 -1.8 1.9 -
0.3
23: 0.1 -3.3 -0.4 -
0.4
24: -2.8 -4.4 -3.6 -
1.8
25: -0.5 2.5 1.5 -
4.3
26: -1.0 5.1 -2.6 -
1.2
27: 1.9 -0.8 0.3 -
3.5
28: 5.4 -0.8 2.4
1.5
29: 2.9 1.5 0.5
2.3
30: -2.5 1.8 -1.8
195.8*
31: 1.2 2.2 -1.3
1.0
32: -2.8 -4.6 -3.1 -
5.3

Transducer Phase limits [-
100.0 0.0] deg
Board 1 2 3
4
1: -38.6 -40.8 -37.6 -
43.0
2: -38.6 -42.8 -34.4 -
47.9
3: -34.6 -45.5 -38.3 -
44.0
4: -41.6 -38.8 -40.8 -
40.3
5: -42.3 -43.3 -42.7 -
41.9
6: -40.4 -39.5 -38.6 -
39.4
7: -37.6 -42.0 -39.1 -
43.2
8: -40.8 -42.7 -45.1 -
36.9
9: -41.0 -38.6 -38.4 -
44.2
10: -45.3 -41.4 -32.2 -
38.2
11: -40.4 -41.3 -45.5 -
42.3
12: -38.1 -40.5 -48.7 -
42.2
13: -38.8 -45.0 -35.5 -
43.5
14: -40.0 -46.3 -39.1 -
42.0
15: -33.4 -50.2 -40.6 -
35.2
16: -41.2 -43.5 -39.0 -
39.7
17: -35.4 -40.6 -44.5 -
41.5
18: -37.8 -39.3 -42.0 -
39.4
19: -39.9 -38.8 -40.8 -
40.5
20: -37.4 -44.0 -44.5 -
42.6
21: -37.5 -41.3 -39.5 -
41.8
22: -38.9 -44.5 -35.4 -
39.3
23: -40.0 -47.6 -39.6 -
38.3
24: -39.5 -44.8 -43.8 -
35.8
25: -33.9 -39.1 -41.0 -
42.0
26: -44.1 -40.2 -38.0 -
44.0
27: -34.8 -41.1 -38.4 -
44.8
28: -40.5 -41.0 -36.8 -
38.9
29: -41.4 -44.9 -40.9 -
41.5
30: -37.7 -42.4 -42.4
93.9*
31: -43.8 -43.9 -38.9 -
34.3
32: -42.2 -43.5 -39.0 -
43.0
Rx Channels test passed

2011.03.31 15:01:45.651
101 7 OK

Tx Channels test passed

2011.03.31 15:04:40.144
101 8 OK

RX NOISE LEVEL

Board No: 1 2
3 4

0: 45.1 41.6
41.9 39.4 dB
1: 44.1 40.9
39.7 39.1 dB
2: 42.9 42.8
40.3 40.6 dB
3: 42.4 40.3
39.5 38.4 dB
4: 42.7 45.2
40.6 43.0 dB
5: 42.6 42.2
42.0 41.6 dB
6: 42.6 42.9
41.6 40.3 dB
7: 41.9 41.5
40.8 40.9 dB
8: 41.7 43.0
40.8 42.8 dB
9: 41.6 41.1
39.8 41.4 dB
10: 42.4 40.8
41.5 43.3 dB
11: 41.8 42.3
40.5 43.4 dB
12: 42.5 43.8
41.9 42.9 dB
13: 41.1 42.0
42.4 43.6 dB
14: 41.3 42.8
42.3 44.0 dB
15: 41.9 42.0
41.1 41.8 dB
16: 39.4 39.6
36.2 37.2 dB
17: 40.8 40.3
36.8 36.7 dB
18: 40.9 39.9
36.9 38.0 dB
19: 40.7 38.8
37.1 36.7 dB
20: 41.0 40.9
38.2 40.7 dB
21: 42.4 39.9
41.0 43.3 dB
22: 42.6 39.0
41.0 44.4 dB
23: 42.6 42.2
41.2 44.3 dB
24: 42.5 40.8
43.4 44.8 dB
25: 42.5 42.5
41.1 42.5 dB
26: 42.1 40.9
41.8 43.8 dB
27: 41.8 41.1
41.8 44.5 dB
28: 42.9 40.6
42.1 44.9 dB
29: 41.6 40.7
39.9 61.7 dB
30: 40.8 41.1
40.6 44.9 dB

31:        42.1   41.5
41.8   43.4   dB

Maximum noise at Board 4
Channel 29 Level: 61.7 dB

Broadband noise test

Average noise at Board 1
42.2 dB   OK
Average noise at Board 2
41.6 dB   OK
Average noise at Board 3
40.9 dB   OK
Average noise at Board 4
48.0 dB   OK

2011.03.31 15:04:45.878
101   9   OK

RX NOISE SPECTRUM

Board No: 1   2
3   4

26.1 kHz: 47.0
45.7   44.5   62.7
dB
26.3 kHz: 46.0
45.6   43.5   43.3
dB
26.5 kHz: 45.4
45.6   45.3   46.0
dB
26.7 kHz: 47.8
49.1   50.1   51.3
dB
26.9 kHz: 48.0
48.7   49.1   50.3
dB
27.1 kHz: 47.0
47.3   46.9   47.8
dB
27.3 kHz: 46.3
45.5   45.1   46.6
dB
27.5 kHz: 44.8
44.3   43.0   47.7
dB
27.7 kHz: 44.7
43.9   41.0   43.0
dB
27.9 kHz: 44.6
44.1   40.7   39.7
dB
28.1 kHz: 43.3
42.2   40.0   39.7
dB
28.3 kHz: 43.0
41.7   39.5   39.2
dB
28.5 kHz: 42.6
41.8   39.4   39.9
dB
28.7 kHz: 42.8
41.2   39.6   39.8
dB
28.9 kHz: 42.8
42.6   39.7   39.8
dB
29.1 kHz: 42.9
42.4   39.5   39.6
dB
29.3 kHz: 43.8
42.9   40.2   40.1
dB
29.5 kHz: 42.0
41.5   39.5   40.6
dB
29.7 kHz: 42.5
42.2   39.9   39.9
dB
29.9 kHz: 45.2
44.0   40.9   39.5
dB
30.1 kHz: 43.3
42.8   39.9   39.2
dB
30.3 kHz: 43.1
42.3   39.5   39.1
dB
30.5 kHz: 42.1
41.8   39.3   38.9
dB
30.7 kHz: 41.7
41.3   39.0   38.9
dB
30.9 kHz: 42.5
41.9   39.2   38.6
dB
31.1 kHz: 41.8
40.9   39.0   39.8
dB
31.4 kHz: 42.6
41.5   39.1   38.8
dB
31.6 kHz: 42.0
41.4   39.2   39.4
dB
31.8 kHz: 41.0
40.5   38.5   38.7
dB
32.0 kHz: 40.5
39.8   38.7   39.1
dB
32.2 kHz: 40.2
39.7   38.4   39.0
dB
32.4 kHz: 41.4
40.0   39.0   38.5
dB
32.6 kHz: 43.7
43.1   42.4   41.9
dB
32.8 kHz: 45.7
45.6   46.2   43.2
dB
33.0 kHz: 48.0
47.5   45.1   43.6
dB
33.2 kHz: 47.9
47.7   44.5   41.9
dB
33.4 kHz: 45.0
44.7   41.7   38.5
dB
33.6 kHz: 39.4
38.4   36.9   36.2
dB
33.8 kHz: 42.1
40.4   37.6   36.8
dB
34.0 kHz: 42.3
39.6   37.2   36.9
dB

Maximum noise at Board 4
Frequency 26.1 kHz Level:
62.7 dB

Spectral noise test

Average noise at Board 1
44.3 dB   OK
Average noise at Board 2
43.9 dB   OK
Average noise at Board 3
42.7 dB   OK
Average noise at Board 4
48.2 dB   OK

2011.03.31 15:04:51.611
101   10   OK

CPU: KOM CP6011
Clock 1795 MHz
Die   40 oC (peak: 61 oC @
2011-03-20 - 21:51:40)
Board 41 oC (peak: 53 oC @
2011-03-20 - 08:50:43)
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

2011.03.31 15:04:51.711
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 LC version : Jun 17 2008 Rev 1.11 VxWorks 5.5.1 Build 1.2/2-IX0100 May 16 2007, 11:31:17	--

Appendix G: Multibeam Patch Test Calibration Lines shown in CARIS 6.1 Calibration Tool

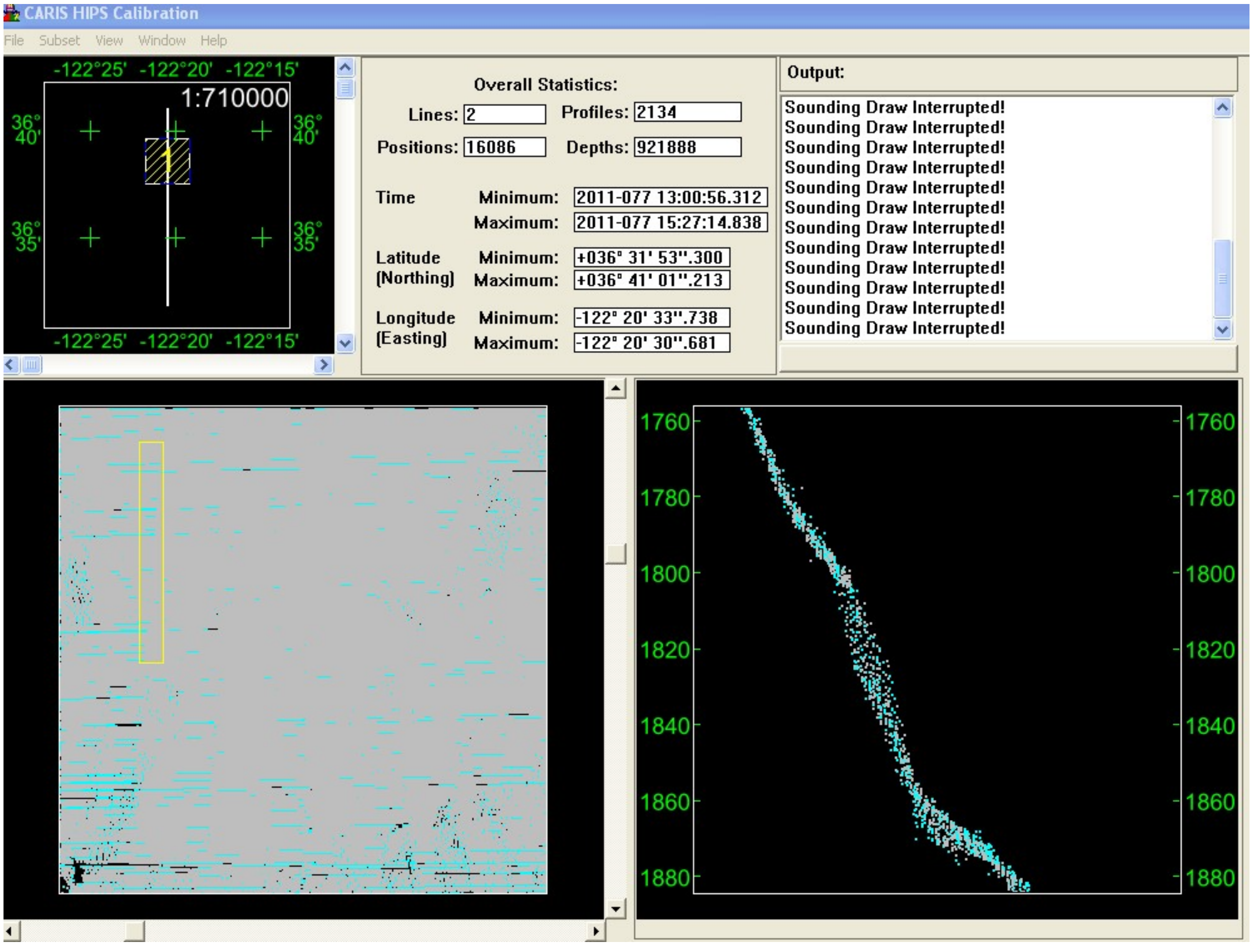


Figure 21. Screengrab of pitch calibration lines shown in CARIS. EM 302 multibeam lines 0041 and 0043. Pitch offset of -0.725 is shown applied here.

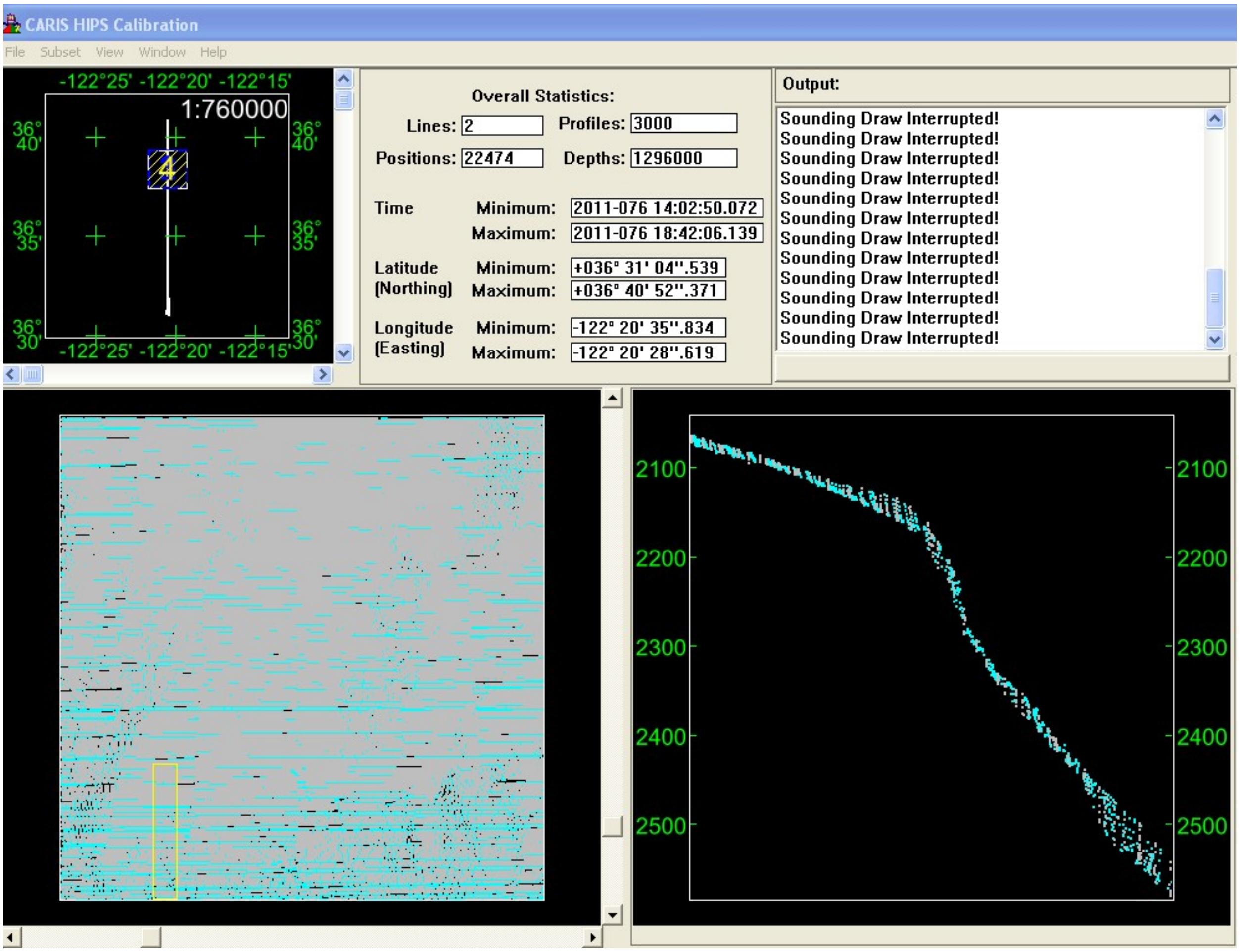


Figure 22. Screengrab of timing calibration lines shown in CARIS. EM 302 multibeam line files 0014 and 0018.

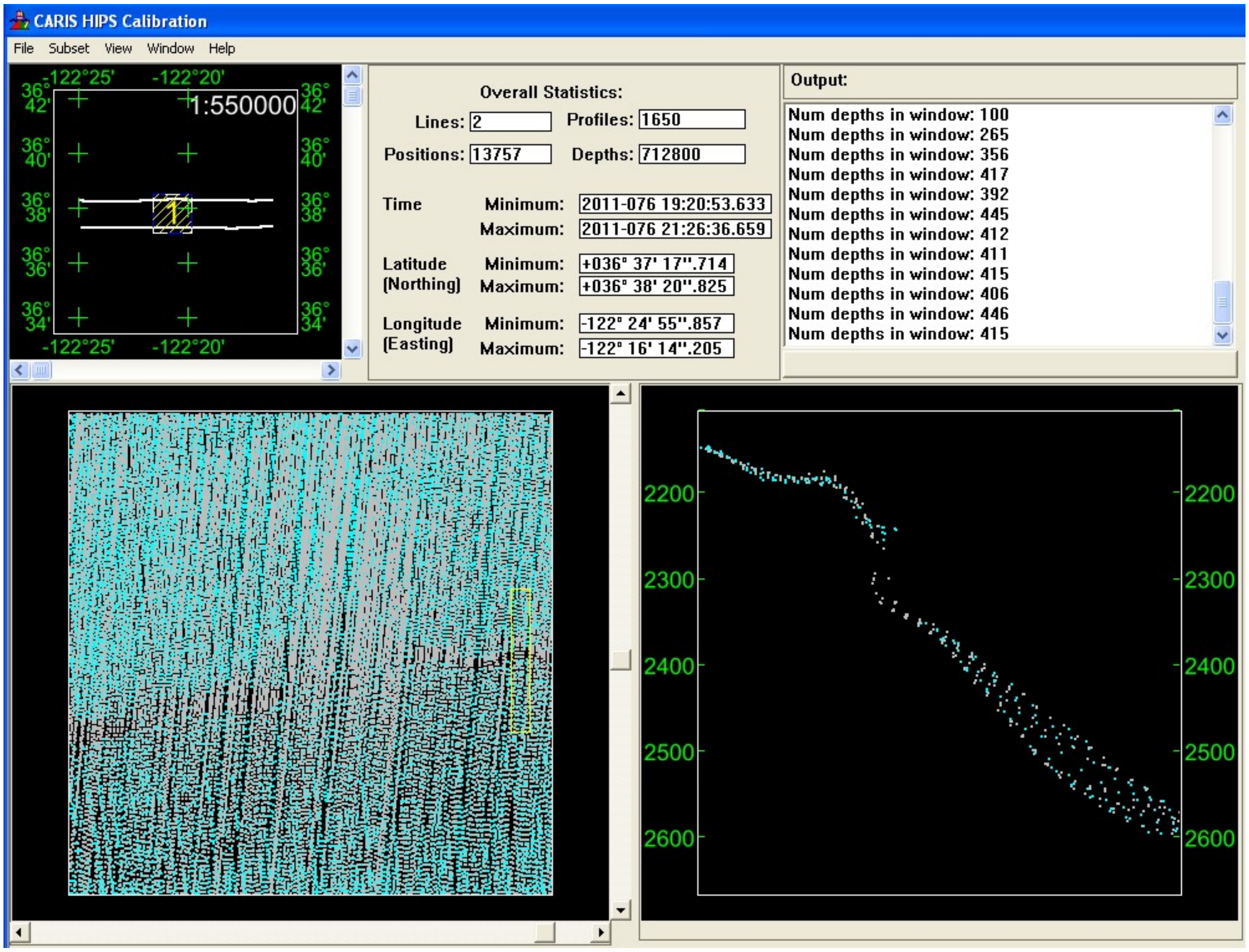


Figure 23. Screengrab of heading calibration lines shown in CARIS. EM 302 multibeam line files 0023 and 0025.

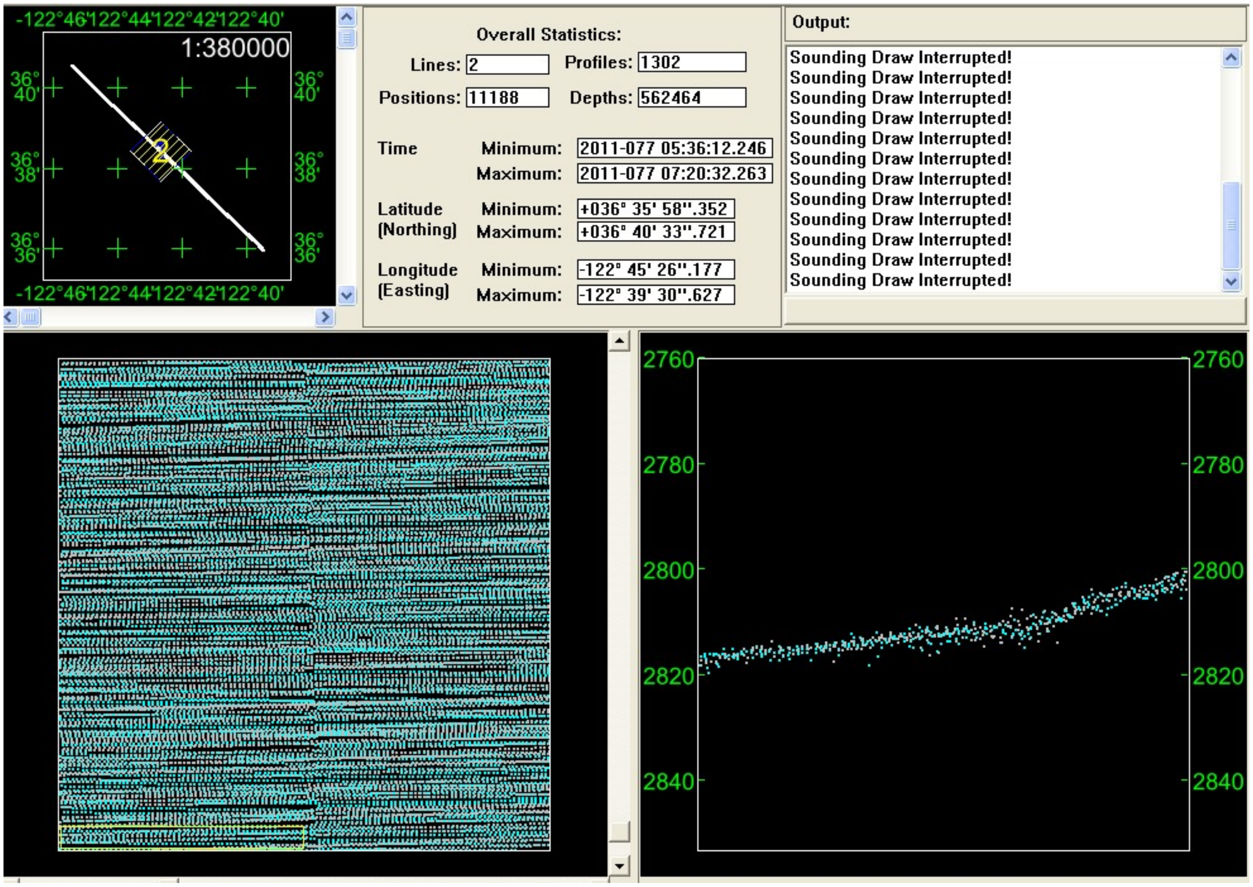


Figure 24. Screengrab of roll line calibration in CARIS. EM 302 multibeam line files 0034 and 0037.

Appendix H: Operating Permits

MEMORANDUM FOR: The Record

FROM: John McDonough
Deputy Director NOAA Office of Ocean Exploration and Research (OER)

SUBJECT: Categorical Exclusion for NOAA Ship *Okeanos Explorer* cruise EX1101

NAO 216-6, Environmental Review Procedures, requires all proposed projects to be reviewed with respect to environmental consequences on the human environment. This memorandum addresses the NOAA Ship *Okeanos Explorer's* scientific sensors possible affect on the human environment.

Description of Projects

This project is part of the Office of Ocean Exploration's "Science Program." It will conduct multi-disciplinary ocean mapping and exploration activities designed to increase knowledge of the marine environment. This project is entitled "EX1101 Ship Shakedown and Multibeam Patch Test" and will be led by Meme Lobecker, a physical scientist for the *Okeanos Explorer* program within OER. The work will be conducted in March and possibly April offshore from California, at various locations between San Francisco and San Diego. The Kongsberg EM 302 multibeam (30 kHz), Kongsberg EA 60 singlebeam (12 kHz), and possibly the Knudsen 3260 subbottom profiler (3.5 kHz chirp) will be operated during the project. Additionally, eXpendable BathyThermograph (XBT) and CTD operations will be conducted in conjunction with multibeam data collection.

Effects of the Projects

As ocean research with limited time or presence in the marine environment this project will not have the potential for significant impacts. Knowledgeable experts who are aware of the sensitivities of the marine environment will conduct the at-sea portions of these projects.

Categorical Exclusion

This project would not result in any changes to the human environment. As defined in Sections 5.05 and 6.03.c.3 (a) of NAO 216-6, these are research projects of limited size or magnitude or with only short-term effects on the environment and for which any cumulative effects are negligible. As such, this project is categorically excluded from the need to prepare an Environmental Assessment.

Signed: ______________________ Date: 3/16/11
John McDonough, Deputy Director

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE

Monterey Bay National Marine Sanctuary
299 Foam Street
Monterey, CA 93940

March 14, 2011

Dr. Elizabeth Lobecker
NOAA Office of Ocean Exploration and Research
24 Colovos Road
UNH-IOCM
Durham, NH 03824

Dear Dr. Lobecker:

The National Oceanic and Atmospheric Administration, Office of National Marine Sanctuaries (ONMS) has approved the issuance of permit number MULTI-2011-002 to conduct activities within Monterey Bay National Marine Sanctuary (MBNMS or sanctuary), and Channel Islands National Marine Sanctuary (CINMS or sanctuary) for research purposes. Activities are to be conducted in accordance with the permit application and all supporting materials submitted to the sanctuary, and the terms and conditions of permit number MULTI-2011-002 (enclosed).

This permit is not valid until signed and returned to the ONMS. Retain one signed copy and carry it with you while conducting the permitted activities. Additional copies must be signed and returned, by either mail or email, to the following individuals within 30 days of issuance and before commencing any activity authorized by this permit:

Erica Burton
Research Permit Coordinator
Monterey Bay National Marine Sanctuary
299 Foam Street
Monterey, CA 93940
Erica.Burton@noaa.gov

National Permit Coordinator
NOAA Office of National Marine Sanctuaries
1305 East-West Highway (N/ORM6)
SSMC4, 11th Floor
Silver Spring, MD 20910
nmspermits@noaa.gov

Your permit contains specific terms, conditions and reporting requirements. Review them closely and fully comply with them while undertaking permitted activities.

If you have any questions, please contact Erica Burton at 831-647-4246. Thank you for your continued cooperation with the ONMS.

Sincerely,

Paul Michel
Paul Michel
Superintendent

Enclosure

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE

Monterey Bay National Marine Sanctuary
299 Foam Street
Monterey, CA 93940

OFFICE OF NATIONAL MARINE SANCTUARIES
RESEARCH PERMIT

Permittee:
Dr. Elizabeth Lobecker
NOAA Office of Ocean Exploration and Research
24 Colovos Road
UNH-IOCM
Durham, NH 03824

Permit Number: MULTI-2011-002
Effective Date: March 16, 2011
Expiration Date: April 30, 2011

Project Title: NOAA Ship Okeanos Explorer cruise EX1101

This permit is issued for activities in accordance with the National Marine Sanctuaries Act (NMSA), 16 USC §1431 *et seq.*, and regulations thereunder (15 CFR Part 922). All activities must be conducted in accordance with those regulations and law. No activity prohibited in 15 CFR Part 922 is allowed except as specified in the activity description below.

Subject to the terms and conditions of this permit, the National Oceanic and Atmospheric Administration (NOAA), Office of National Marine Sanctuaries (ONMS) hereby authorizes the permittee listed above to conduct research activities within Monterey Bay National Marine Sanctuary (MBNMS or sanctuary), and Channel Islands National Marine Sanctuary (CINMS or sanctuary). All activities are to be conducted in accordance with this permit and the permit application received March 08, 2011. The permit application is incorporated into this permit by reference; provided, however, that if there are any conflicts between the permit application and the terms and conditions of this permit, the terms and conditions of this permit shall be controlling.

Permitted Activity Description:
The following activities are authorized by this permit:

Discharge of approximately thirty expendable bathythermographs (XBTs).

No further violation of sanctuary regulations is allowed.

Permitted Activity Location:
The permitted activity is allowed throughout the MBNMS and CINMS.

Special Terms and Conditions:

1. All authorized activities may be conducted from March 16, 2011 through April 30, 2011. The permittee may request an amendment from the MBNMS Superintendent in advance of this expiration date, to extend the effective date of this permit.

2. Permitted activities shall include the discharge of expendable bathythermographs (XBTs), which are expendable, degradable equipment necessary to conduct research, and cannot be practicably retrieved.

3. The equipment and support structures authorized by this permit shall be used in accordance with the methods and objectives identified in the permit application and Special Conditions included here. Disturbance of any other sanctuary resources is prohibited.

4. No activity authorized by this permit shall disturb or impact any historical or marine archaeological resources of the sanctuary. If historical or marine archaeological resources are encountered at any time, the permittee shall cease all further activities under this permit and immediately contact the MBNMS Superintendent.

5. If sanctuary staff conclude that permitted activities are in danger of creating a disturbance to natural resources of the MBNMS or CINMS, the permit holder shall be immediately notified and the project shall be suspended, altered, or postponed to eliminate disturbance of such natural resources.

6. If contacted by Sanctuary Integrated Monitoring Network (SIMoN) staff, the permittee agrees to provide project metadata from these permitted activities to the Sanctuary Integrated Monitoring Network via a web-based interface. The permittee shall provide the information to SIMoN within three (3) months of the request date. See http://www.sanctuarysimon.org for more information.

7. The permittee shall submit a final report of all activities conducted under this permit to the MBNMS Permit Coordinator no later than **May 31, 2011**. The report should include information regarding daily activities such as location (latitude and longitude) of deployments or samples, discovery or disturbance of historical artifacts, problems encountered, equipment lost, etc. The annual report shall also include a synopsis of research results to date.

8. This activity may also require permission from other agencies. The enclosed permit is not valid until all other necessary permits and/or authorizations are obtained. Any direct or incidental harassment of marine mammals requires a permit from the National Marine Fisheries Service (contact Monica DeAngelis at 562-980-3232) and/or U.S. Fish and Wildlife Service (contact Douglass Cooper at 805-644-1766). Direct or incidental harassment of seabirds requires a permit from the U.S. Fish and Wildlife Service. Deployment of mooring or surface buoys may require authorization from the US Coast Guard (contact Brian Aldrich at 510-437-2983). Research conducted within California state waters or California State marine protected areas (MPA) may require permission

from the California Department of Fish and Game (contact Angela Louie at alouie@dfg.ca.gov). Permission to drill into rock or install devices may require permission from the California State Lands Commission (contact Mary Hayes at 916-574-1812).

9. The permittee may be required to pay any or all expenses associated with the locating of and/or removal by NOAA or its designee of any equipment that is not recovered by the permittee.

General Terms and Conditions:

1. Within 30 (thirty) days of the date of issuance, the permittee must sign and date this permit for it to be considered valid. Once signed, the permittee must send copies, via mail or email, to the following individuals:

Erica Burton
Research Permit Coordinator
Monterey Bay National Marine Sanctuary
299 Foam Street
Monterey, CA 93940
Erica.Burton@noaa.gov

National Permit Coordinator
NOAA Office of National Marine Sanctuaries
1305 East-West Highway (N/ORM6)
SSMC4, 11th Floor
Silver Spring, MD 20910
nmspermits@noaa.gov

2. It is a violation of this permit to conduct any activity authorized by this permit prior to the ONMS having received a copy signed by the permittee.

3. This permit may only be amended by the ONMS. The permittee may not change or amend any part of this permit at any time. The terms of the permit must be accepted in full, without revision; otherwise, the permittee must return the permit to the sanctuary office unsigned with a written explanation for its rejection. Amendments to this permit must be requested in the same manner the original request was made.

4. All persons participating in the permitted activity must be under the supervision of the permittee, and the permittee is responsible for any violation of this permit, the NMSA, and sanctuary regulations for activities conducted under, or in junction with, this permit. The permittee must assure that all persons performing activities under this permit are fully aware of the conditions herein.

5. This permit is non-transferable and must be carried by the permittee at all times while engaging in any activity authorized by this permit.

6. This permit may be suspended, revoked, or modified for violation of the terms and conditions of this permit, the regulations at 15 CFR Part 922, the NMSA, or for other good cause. Such action will be communicated in writing to the applicant or permittee, and will set forth the reason(s) for the action taken.

7. This permit may be suspended, revoked or modified if requirements from previous ONMS permits or authorizations issued to the permittee are not fulfilled by their due date.

8. Permit applications for any future activities in the sanctuary or any other sanctuary in the system by the permittee might not be considered until all requirements from this permit are fulfilled.

9. This permit does not authorize the conduct of any activity prohibited by 15 CFR § 922, other than those specifically described in the "Permitted Activity Description" section of this permit. If the permittee or any person acting under the permittee's supervision conducts, or causes to be conducted, any activity in the sanctuary not in accordance with the terms and conditions set forth in this permit, or who otherwise violates such terms and conditions, the permittee may be subject to civil penalties, forfeiture, costs, and all other remedies under the NMSA and its implementing regulations at 15 CFR Part 922.

10. Any publications and/or reports resulting from activities conducted under the authority of this permit must include the notation that the activity was conducted under National Marine Sanctuary Permit MULTI-2011-002 and be sent to the ONMS officials listed in general condition number 1.

11. This permit does not relieve the permittee of responsibility to comply with all other federal, state and local laws and regulations, and this permit is not valid until all other necessary permits, authorizations, and approvals are obtained. Particularly, this permit does not allow disturbance of marine mammals or seabirds protected under provisions of the Endangered Species Act, Marine Mammal Protection Act, or Migratory Bird Treaty Act. Authorization for incidental or direct harassment of species protected by these acts must be secured from the U.S. Fish and Wildlife Service and/or NOAA Fisheries, depending upon the species affected.

12. The permittee shall indemnify and hold harmless the Office of National Marine Sanctuaries, NOAA, the Department of Commerce and the United States for and against any claims arising from the conduct of any permitted activities.

13. Any question of interpretation of any term or condition of this permit will be resolved by NOAA.

Your signature below, as permittee, indicates that you accept and agree to comply with all terms and conditions of this permit. This permit becomes valid when you, the permittee, countersign and date below. Please note that the expiration date on this permit is already set and will not be extended by a delay in your signing.

3/15/11

Elizabeth Lobecker — Date
NOAA Office of Ocean Exploration and Research

3-15-11

Paul Michel — Date
Superintendent
Monterey Bay National Marine Sanctuary

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802- 4213

In response, refer to:
150308SWR2011PR00153:MLD

MAR 18 2011

Craig W. Russell
Program Manager
Okeanos Explorer Program
NOAA Ocean Exploration and Research
7600 Sand Point Way NE
Tsunami West, Bldg 1
Seattle, WA 98115 USA

Dear Mr. Russell:

The National Marine Fisheries Service (NMFS) has reviewed the information provided for the cruise plan for the *Okeanos Explorer* ship shakedown and the Kongsberg EM302 multibeam system patch test from March 16-April 1, 2011. The operating area is the Pacific Ocean between San Francisco, California and San Diego, California. A one to two day patch test will also take place south of San Francisco, in the vicinity of Monterey Bay, California over Sur Ridge. The Kongsberg EM 302 multibeam (30kHz), Kongsberg EA 60 singlebeam (12kHz), and possible the Knudsen 3260 subbottom profiler (3.5 kHz chirp) will be operated during the project. In addition, eXpendable BathyThermograph (XBT) casts and conductivity-temperature-depth (CTD) operations will be conducted in conjunction with multibeam data collection. The Monterey Bay and Channel Islands National Marine Sanctuaries will be issuing a multi-Sanctuary permit to allow the discharge of XBTs (Permit # MULTI-2011-002, dated March 15, 2011).

The ship has been in drydock since November 2010 and it is our understanding that the purpose of the ship shakedown and patch test cruise is scheduled to provide an opportunity to get underway, to ensure that all ship mission and equipment is operational and the necessary preparations have been made prior to conducting ROV integration/shakedown. After the patch tests are completed it is expected that while in transit from the Monterey Bay area to San Diego, archaeological and seafloor habitat targets of interest selected by the National Marine Sanctuaries program will be explored, although it is not expected that all targets shown in Figure 1 below (copied from the March 7, 2011 Project Instruction document) will be mapped. During transit, the multibeam data will be collected 24 hours a day and XBT casts will be conducted every 6 hours.

The Kongsberg EM 302 multibeam echo sounder is designed to perform seabed mapping with high resolution and accuracy to a maximum depth of 7000 m. According to the manufacturer's website, the specifications for the EM 302 indicate that it operates at a frequency of 30 kHz. The transmit pulse rate and length will depend on the swath rate being used. The EM 302 has swath widths ranging from 275 m to 8000 m, ping rates from 3.2 to 0.04 pings/second. The system has up to 288 beams/432 soundings per swath with pointing angles automatically adjusted according to achievable coverage or operator defined limits. According to the manufacturer, the maximum sound generated by the EM 302 is about 214 dB re 1 μPa (angular coverage of about 150 degrees) and the lowest level will be less than 180 dB re 1 μPa for ranges larger than 20 m from the transmit transducer (we assumed based on the units reported that these sound measurements correspond to sound pressure levels, although they were not specifically reported as such). The normal pulse length is 5 ms, but for deeper waters (more than 1000 m), an FM chirp will be used in the outer sectors. For shallow waters the pulse length of 0.7 ms may be used and for intermediate waters a pulse length of 2 ms may also be used.

The EM 302 is also equipped with a function to reduce the transmission power in order to avoid injuring marine mammals. This would be accomplished by starting the pinging with a flexible soft-start as a possible means of inducing marine mammals to leave the area of high intensity sound. The Okeanos Explorer intends to test the implementation of this function during the shakedown cruise.

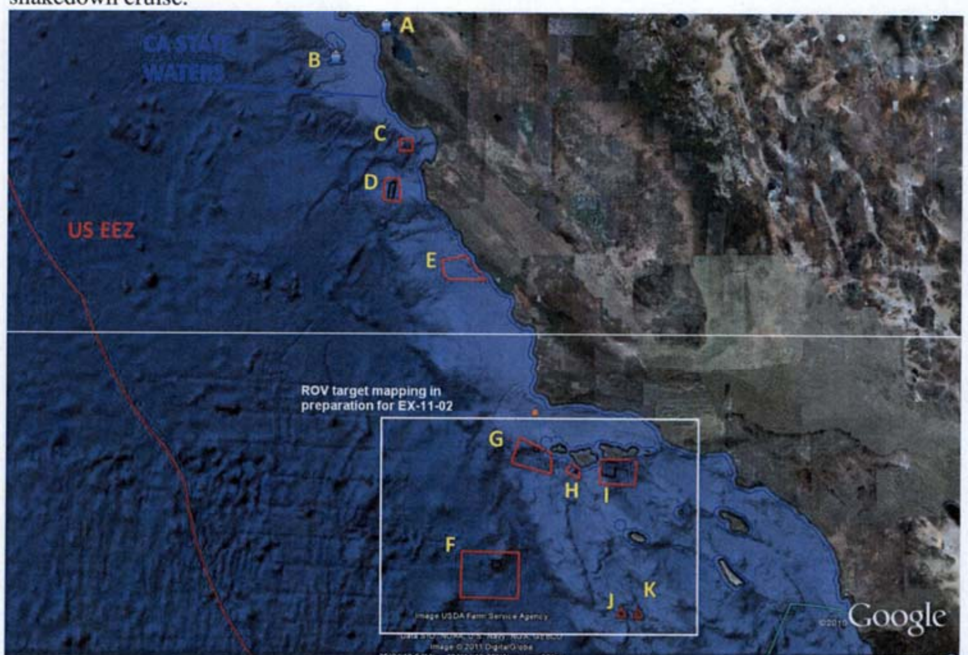


Figure 1. Operating area, from San Francisco, CA to San Diego, CA. Screen grab taken from Google Earth. Not for Navigation.

Recommendations

Whales, dolphins, porpoises, seals, and sea lions are protected under the Marine Mammal Protection Act (MMPA). *See* 16 U.S.C. § 1361 *et seq.* Under the MMPA, it is generally illegal to "take" a marine mammal without prior authorization from NMFS. "Take" is defined as harassing, hunting, capturing, or killing, or attempting to harass, hunt, capture, or kill any marine mammal. Except with respect to military readiness activities and certain scientific research conducted by, or on behalf of, the Federal Government, "harassment" is defined as any act of pursuit, torment, or annoyance which has the potential to injure a marine mammal in the wild, or has the potential to disturb a marine mammal in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering.

Sounds introduced into the sea by man-made devices could have a deleterious effect on marine mammals by causing stress or injury, interfering with communication and predator/prey detection, and changing behavior. Acoustic exposure to loud sounds may result in a temporary or permanent loss of hearing (termed a temporary (TTS) or permanent (PTS) threshold shift) depending upon the location of the marine mammal in relation to the source of the sound. NMFS is currently in the process of determining safety criteria (*i.e.,* guidelines) for marine species exposed to underwater sound. However, pending adoption of these guidelines, we have preliminarily determined, based on past projects, consultations with experts, and published studies, that 180 dB re $1 \mu Pa_{RMS}$ (190 dB re $1 \mu Pa_{RMS}$ for pinnipeds) is the impulse sound pressure level that can be received by marine mammals without injury. Marine mammals have shown behavioral changes when exposed to impulse sound pressure levels of 160 dB re $1 \mu Pa_{RMS}$.

Harassment of marine mammals may occur if hauled animals flush a haul out site and/or move out of the immediate aquatic area to increase their distance from ship-related activities. Please note the definition of a "take" under the MMPA and that the rapid exit from the project area could be considered harassment under the MMPA.

Based on the manufacturer's information, the likelihood of PTS is low as animals would have to be either very close (tens to a few hundred meters) and/or remain near sources for many repeated pings to receive overall exposures sufficient to cause even the onset of TTS. There could, however, be some behavioral reactions from animals whose hearing range most overlaps with the output frequency such, as odontocetes. Although it is not clear what the source level will be for the Kongsberg or Knudsen devices when operated during *Okeanos Explorer* activities, based on the manufacturer's specifications for what sound pressure level are capable of being produced for the EM 320 (and using the maximum of 214 dB re $1 \mu Pa$), for example, the sound pressure levels are expected to attenuate rather quickly and could drop below 160 dB re $1 \mu Pa_{RMS}$ beyond 610 m from the source. NMFS recommends a precautionary zone of at least a 750 m range (assuming a maximum source level of 214 dB re $1 \mu Pa$ for all potential sources that may be employed during *Okeanos Explorer* activities) to be visually monitored during employment of the Kongsberg multibeam, Kongsberg EA 60 singlebeam, and the Knudsen 3260 subbottom profiler. It is recommended that as soon as possible, the actual measurements of the source level and corresponding impulse sound pressure levels should be taken. The estimated 750 m range mentioned above should then be modified to correspond to the impulse sound pressure levels of 190 dB re 1μPa_{RMS}, 180 dB re 1μPa_{RMS}, and 160 dB re 1μPa_{RMS}.

The impact zones for the sound sources are likely small enough that visual detection of marine mammals within the proposed project areas is reasonably likely. To avoid Level B behavioral harassment of, or Level A harassment (injury) of, marine mammals during the proposed project, safety zones of 160 dB re 1μPa_{RMS} isopleths will be established by the *Okeanos Explorer* and monitored by NMFS-qualified marine mammal observers. For this activity, a sound pressure level of 160 dB is currently used for estimating the onset of Level B behavioral harassment for impulse noise sounds. In addition, it is recommended that work only be conducted during daylight hours to allow maximum visual visibility. Whenever a marine mammal enters or appears as if it is going to enter the safety zone, the source will be shut down to avoid the onset of Level B harassment.

In addition to the above, NMFS recommends the following mitigation and monitoring measures to ensure that no takes of marine mammals will occur during the proposed Okeanos Explorer activities:

- NMFS-approved marine mammal monitors will monitor the proposed surveys for marine mammals. Monitoring will begin at least 30 minutes before the start of the sound source, continuous throughout the mapping survey, and last at least 30 minutes after the sound source is turned off.

- Whenever a detected marine mammal enters or appears as if it is going to enter the 160 dB safety zone, the sound source will be immediately shut down or will not be started up. The survey will not resume or start up until the marine mammal is confirmed to be out of the safety zone or 15 minutes have passed since the last sighting of the marine mammal within the safety zone, whichever is later.

- The Okeanos Explorer will use the "soft start" practice to start the sound source; that is, when initiating the survey, the sound sources shall be turned on at 50% (or as recommended by the manufacturer, in particular for the EM 302 as it is stated in the manufacturer's information) of its capacity and gradually increased to full capacity. This practice will allow undetected marine mammals to vacate the area.

Please note, that in the event of a vessel collision with a marine mammal, Mr. Joseph Cordaro, the NMFS Southwest Regional Office's Stranding Coordinator must be immediately contacted at 562-980-4017 and a report must be sent to the NMFS Southwest Regional Office.

NMFS believes that if the aforementioned mitigation and monitoring measures are implemented, the potential for actual and the actual take of marine mammals is not likely to occur; thus, an Incidental Harassment Authorization (IHA) is not necessary pursuant to the MMPA. If for any reason, the *Okeanos Explorer* does not implement these mitigation measures, then our determination does not apply, and we would recommend that the *Okeanos Explorer* apply for an IHA under section 101 (a)(5) of the MMPA. The same would apply if the *Okeanos Explorer* subsequently obtains information during activities that indicates that marine mammals may be disturbed by the proposed activities.

Thank you for coordinating with NMFS regarding this project. We appreciate your efforts to comply with Federal regulations and to conserve and protect marine mammals. Please contact Monica DeAngelis at (562) 980-3232 or Monica.DeAngelis@noaa.gov if you have any questions concerning this letter or if you require additional information.

Sincerely,

for Chris Yates
Assistant Regional Administrator
for Protected Resources

Appendix I: Survey Areas Summary Table

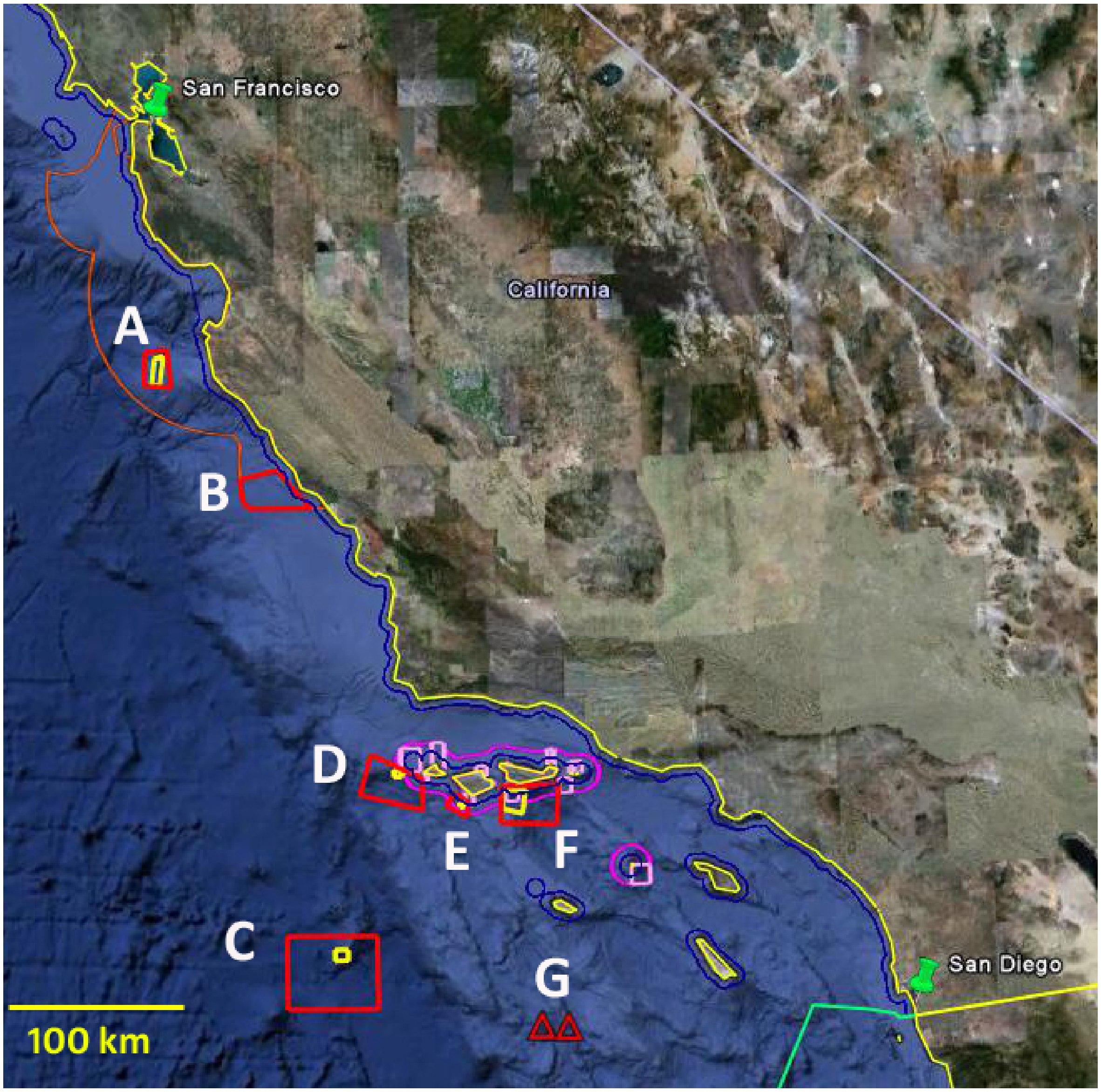


Figure 25. Screenshot from Google Earth showing EX1101 survey areas. Red outlines are overall survey areas, yellow outlines within red are priority areas as defined by ONMS. Pink borders indicate Channel Islands National Marine Sanctuary boundaries. Orange borders indicate Monterey National Marine Sanctuary boundary. Blue borders indicate California state water boundary. Turquoise border indicates US / Mexico EEZ boundary. A one kilometer bar is drawn for scale. Image shown north up.

ID	Name	Category
A	Sur Ridge	MBNMS Deep water coral habitat
B	Southern MBNMS	MBNMS deep water coral habitat
C	San Juan Seamount / “Crazy Caldera”	Seamount / potential ROV shakedown target
D	Area West of San Miguel Island	CINMS deep water coral habitat/ potential ROV shakedown target
E	“10 Story Building Mystery”	CINMS deep water coral habitat/ potential ROV shakedown target
F	Santa Cruz Canyon	CINMS deep water coral habitat/ potential ROV shakedown target

G	Hancock Seamount	Seamount/ potential ROV shakedown target
G	109 Seamount	Seamount/ potential ROV shakedown target