NOAA *Okeanos Explorer* Program

MAPPING REPORT

CRUISE EX1105

Water Column Exploration, 2011

August 22, 2011 to September 10, 2011

Key West, FL – Pascagoula, MS

Report Contributors:

Dr. Thomas Weber, Dr. Jonathan Beaudoin, Colleen Peters, Lillian Stuart, Glen Rice, LTjg, Gustav Karl Kagesten, Kevin Jerram, Maddie Schroth-Miller and Mashkoor Malik

20 September, 2011

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, NOAA Ship *Okeanos Explorer* (EX) 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 position it to systematically explore new areas of our largely unknown oceans. 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, *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 real-time collaboration with scientists and experts based 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 to 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 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

1. Purpose

The purpose of this report is to briefly describe the data acquisition and processing of EM 302 multibeam system, EK 60 single beam echo sounder and Knudsen sub-bottom profiler during EX1105 (August 22 – September 10, 2011). For details about setup of the various mapping equipment / sensors please refer to 'NOAA Ship *Okeanos Explorer* Mapping Readiness Report 2011' which can be obtained from the ship.

Crew of the EX is greatly appreciated for their efforts in helping make the cruise a success.

The expedition was conducted jointly by NOAA's Office of Ocean Exploration and Research (OER); the University of New Hampshire's Center for Coastal and Ocean Mapping; the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE); and NOAA's Southeast Fisheries Science Center.

2. Participating personnel

Robert Kamphaus, CDR	Commanding Officer
Mashkoor Malik	Expedition coordinator
Megan Nadeau, LT	Field Operations Officer
Dr. Thomas Weber	Lead scientist
Jonathan Beaudoin	Lead scientist
Bill Shedd	BOEMRE representative
Colleen Peters	Senior Survey Technician
Lillian Stuart	Senior Survey Technician
Glen Rice, LTjg	Mapping watch stander
Gustav Karl Kagesten	Mapping watch stander
Kevin Jerram	Mapping watch stander
Maddie Schroth-Miller	Mapping watch stander

3. Background of EX 1105 Expedition

In 2010 BP oil spill originating after Deep Water Horizon (DWH) incident resulted in the biggest oil spill in the history of Gulf of Mexico. Following the oil spill, several federal agencies, academic institutions, and other environmental groups focused their efforts (and still continue to do so) on understanding the extent and impact of the oil spill.

Single beam sonars have been used extensively to map gas seeps but do not provide as much coverage as typically collected by multibeam systems. Since multibeam sonars obtain information from a wide fan-shape of beams, they map wider areas more quickly and efficiently than single beam sonars. This cruise is part of an ongoing effort to better understand the deep water seep detection capability of the EX multibeam sonar. The EX is equipped with a unique multibeam sonar that is capable of providing high resolution water column backscatter. It has been indicated earlier (Gardner and Malik, 2009) that EM 302 is capable of detecting gaseous plumes but this cruise (EX1105) is the first comprehensive test of the EM 302 to detect gaseous plumes. To compare the results of the multibeam sonar, the EX was outfitted with a single beam fisheries sonar (EK 60 at 18 kHz) specifically for this expedition in May 2010.

The expedition was conducted in northern Gulf of Mexico. The northern Gulf of Mexico is an ideal site to achieve the testing objectives because of the large number of known naturally-occurring seeps. Underwater gaseous seeps are fed by the natural underground accumulations of oil and natural gas. Once released from the seafloor, the gas bubbles often rise through the water column, creating oil slicks on the sea surface. Scientists have been using satellite imagery of these surface slicks to identify many areas in the Gulf of Mexico where they believe oil is likely seeping from the ocean floor [Reference]. However, matching a surface slick to a location on the seafloor is often quite difficult due to currents and weather conditions.

Expedition Objectives:

Expedition objectives as highlighted in [Project instructions] are provided below. All the objectives were met during the cruise. Please see below a brief discussion of cruise objectives and corresponding activities during the expedition.

1. Integration of EK 60:

Kongsebrg EK 60 single beam echo sounder was installed onboard the EX in May 2011. The harbor acceptance trials were completed in June 2010. During the initial phase of the cruise, calibration of the system was attempted as well as noise measurements at different speeds using a small solid sphere. The synchronization between EM 302 and EK 60 were also completed during the expedition. Detailed SOPs for EK 60 calibration were developed. The procedures used along with the results are provided as Appendix A.

2. Test EM 302 / EK 60 and Knudsen SBP capability to detect gaseous seeps / water column targets:

Previous work in GoMex [1 and references therein] has shown presence of several deep water gaseous seeps. One of the primary expedition objectives was to use EM 302 to collect water column and seafloor backscatter over these gaseous seeps locations. The data from the ships' (*Okeanos Explorer* and *Pisces*) EK 60 sonars were then used as comparison data sets. The seafloor backscatter data collected by the EX were also analyzed to infer if gaseous seeps present any signal in the seafloor backscatter data.

The capability of water column backscatter data to detect targets of different sizes depends on the frequency used. This cruise presented an interesting scenario where a broad spectrum of frequencies were used. The EX's 3.5 kHz Knudsen sub-bottom profiler, 18 kHz EK 60 and 30 kHz EM 302 were all used to collect data over the gas seeps. In addition, the *Pisces* EK 60 (at 38 kHz) was also utitlized to collect control data sets over the known seep locations. The data results provided in this report describe details about these tests.

1 Mineral Management Service, Gulf of Mexico OCS Region, Gulf of Mexico OCS Oil and Gas Lease Sales: 2007-2012, Draft Environmental Impact Statement, Volume I, MMS 2006-062, New Orleans, 2006.

Recommended settings for EM 302 for optimizing the water column data are provided as Appendix ?

3. Seafloor backscatter comparison

NOAA Ship *Pisces* is outfitted with a fisheries multibeam sonar ME 70 (~ 70-120 kHz) that is capable of providing calibrated seafloor backscatter data. Both ships ran a small survey in shallow waters (ME 70 depth range < 200m) to collect comparison data sets.

Seafloor backscatter comparison ……..

4. Upgrade of EM 302 TRU / SIS software

Kongbserg engineers sailed for the first two days with the ship and upgraded the EM 302 TRU / SIS software from ? to ?. A survey line going over different depths were run before and after the upgrade. The results of the comparison showed that there is no degradation in the data quality before and after the software upgrade. The cruise report from Kongsberg is attached as Appendix B.

4. Mapping sonar data acquisition and processing setup

The EX is equipped with a 30 kHz Kongsberg EM 302 multibeam sonar, a 3.5 kHz Knudsen SBP 3260 sub-bottom profiler, and an 18 kHz Kongsberg EK 60 single-beam sonar. During this cruise EM 302 seafloor bathymetry and backscatter data along with water column backscatter data were collected. Additionally, EK 60 and EM 302 water column data were continuously logged. Knudsen sub-bottom profiler data were collected at selected locations for testing purposes.

The ship used the onboard Applanix POS/MV (ver. 4) to record and correct multibeam data for any ship's motion before being logged by SIS software. The C-NAV GPS satellite service system provided DGPS correctors to the POS/MV with positional accuracy expected to be better than 2.0m.

All the corrections (motion, sound speed profile, sound speed at sonar head, draft, sensor offsets) were applied during real time data acquisition in Kongsberg data acquisition software Seafloor Information System (SIS) ver. 3.8.3. Sippican XBT casts (Deep Blue, max depth 760 m) were taken every 6 hours and more frequently if needed. XBT cast data were converted to SIS-compliant format using the NOAA in-house tool for XBT processing: Velocipy. The World Ocean Atlas was also utilized to generate sound speed profiles as well as extend XBT casts in lieu of Velocipy. The sound speed profiles used for each line are identified in Table #. Please consult Appendix A for details about parameters and settings used for EM 302 data acquisition.

Onboard processing of bathymetric data was performed using CARIS HIPS ver. 6.1. The data was cleaned using the CARIS 'Swath Editor' and 'Subset Editor' tools. A nominal grid cell size of 50 m was chosen for the bathymetric grids. Onboard processing of seabed and water column backscatter data was conducted using IVS Fledermaus ver. 7.3 FMGT and FM Midwater respectively. Additional water column backscatter data processing was completed by using UNB SwathEd tools as well as efforts to develop tools in Matlab (More details needed here).

Simrad EK60 data processing

A Simrad EK60 split-beam echosounder was used to collect water column data for the duration of EX1105. This system operates much like an 18-kHz single beam echosounder with a -3 dB beam width of 11°, but features four receiving quadrants which allow positioning of targets within the beam. The EK60 was calibrated twice during the data collection period, allowing comparison of Kongsberg EM302 multibeam echosounder water column data near nadir to a calibrated standard.

EK60 data were processed with IVS Fledermaus FMMidwater and a MATLAB split-beam processing routine. IVS Fledermaus FMMidwater was used to identify seep and plume features, create water column visualizations compatible with other IVS Fledermaus programs, and provide working estimates of seep locations using vessel positioning data. A processing example is presented in Figure NUMBER.

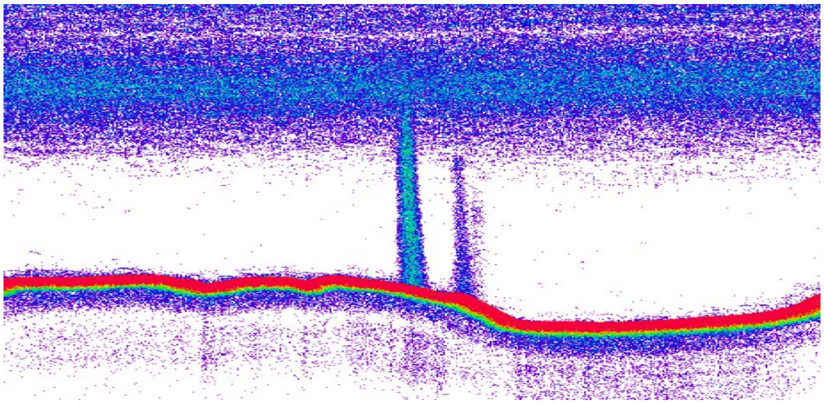


Figure NUMBER - IVS Fledermaus Midwater visualization of neighboring methane seep plumes.

MATLAB split-beam processing routines were used to take advantage of phase angle data within the EK60 raw data files for improved characterization of seep location and plume shape. In this routine, a volumetric scattering strength threshold was applied to examine only "strong" targets, such as methane bubbles. Electronic phase angles for received signals from water column targets within the 11° beam were converted to mechanical angles within the transducer reference frame. These mechanical angles were coupled with target ranges and vessel positioning and motion data to enable target position estimates in the geographic reference frame which may be more precise than using IVS Fledermaus FMMidwater alone. Subsets of targets were analyzed for the base of each plume to yield mean latitude and longitude near the seafloor. An example of MATLAB processing results for the plume feature on the left in Figure NUMBER is presented in Figure NUMBER+1.

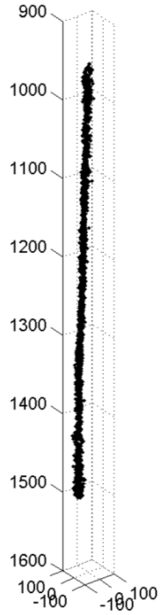


Figure NUMBER+1 - MATLAB split-beam processing example.

Seafloor backscatter processing was completed in IVS FMGT – (More details needed here)

Daily mapping products were made available to the shore through the FTP server that included bathymetry grids (in ASCII Latitude, Longitude and Depth), Fledermaus ver. 7 SD object, Geotiff image of gridded Bathymetric data, Google Earth KMZ of bathymetric data and Bathymetric grid in ArcView.

Patch test results

A separate patch test after the TRU/SIS upgrade was considered but not conducted in interest of time. Also the patch test was considered not essential after data comparison in SIS where lines running in different orientations and speed lined up very well.

Angular offsets (based on patch test conducted in May 2011) are tabulated as below. For complete processing unit setup (PU Setup) utilized for the cruise, please refer to Appendix A.

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

Table 2: Angular offsets for Transmit (TX) and Receive (RX) transducer as determined during a patch test conducted in May 2011.

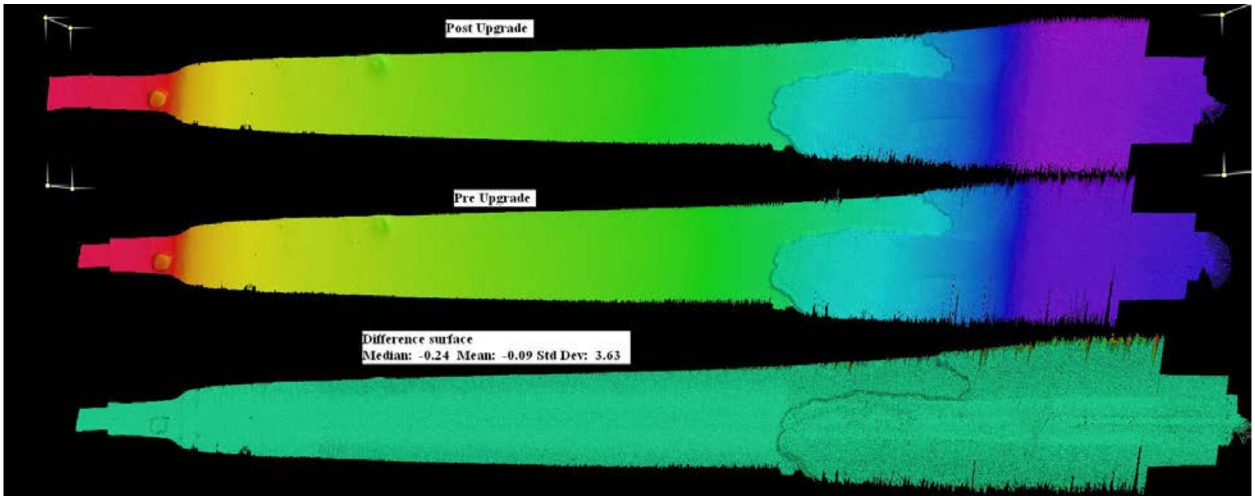
Data acquisition plan

Pre-EM302 Upgrade

The EX was using SIS v. 3.8.3. Newer versions of the software had been available earlier in the field season, but not installed until Kongsberg representatives could be present. The EX ran several lines before doing the upgrade to both the SIS software and TRU so that comparisons could be made.

Post-EM302 Upgrade

After the upgrade was complete, the same lines were run covering depth range of ~ 200 – 1300 m. Comparisons showed no appreciable degradation of data quality. The difference between pre and post up grade resulted in mean and mean of 9 cm and 24 cm respectively. Additional assessment of effects of the upgrade will be conducted in future while working in different depths and bottom types. For details about the changes in the upgraded SIS 3.8.3 and EM 302 1.1.1 software please refer to respective release notes [4,5].



EK60 Calibration

EK60 calibration was conducted on August 22, 2011. There were no suitable anchorages outside of Key West, so the calibration was performed while the ship was drifting. The mapping team set up the downriggers and poles and put the sphere in the water. While conducting the calibration, one of the three lines on the sphere parted, so the calibration was not completed. Please see EX_SOP_EK60 Calibration for more details on conducting the calibration.

Transit to Primary working grounds

Once the Kongsberg representatives were ferried ashore, the EX headed towards the Gulf of Mexico. Shortly after, one crew member needed to be returned to port, so the EX headed back towards the nearest port, Key West, to drop him off. Once the crew member was ashore, the EX headed off again to the Gulf of Mexico, and mapped along the shelf break known as the Florida Escarpment. During this transit, the UNH team trained with the EX team on operating systems, collecting data on all of the sonars, and fine tuning of the settings for optimal acquisition.

Running lines over Biloxi dome

EK60 Calibration #2

On August 29, the EK60 calibration was conducted again. This time, the calibration was completed and successful.

Start running the main survey lines

Oil slick report –

Coming back to lines over Biloxi dome (JB lines)

Running lines over Macando well

Multiple lines were run over the Macando well in various directions. The EM302 bathymetry, backscatter and water column backscatter were all able to detect the wreckage of the DWH as well as some naturally occurring seeps in the vicinity.

Florida escarpment mapping

With Tropical Storm/Hurricane Lee approaching the EX working grounds, the weather was degraded so that it had become difficult to collect useful data. By late afternoon on September 1, the EX departed the primary working area to find a calmer area to survey. The EX headed to the Florida Escarpment where oil sheens had been previously observed.

Return to working grounds

On September 5, the EX was able to start working back towards the primary working grounds in an effort to finish collecting data for the water column backscatter testing over known natural seep areas.

5a. Data Results

Overall the ship mapped approximately 17477 sq km in depth range of ~ 30 m to 3400 m. The following image showed the overall results of the cruise:

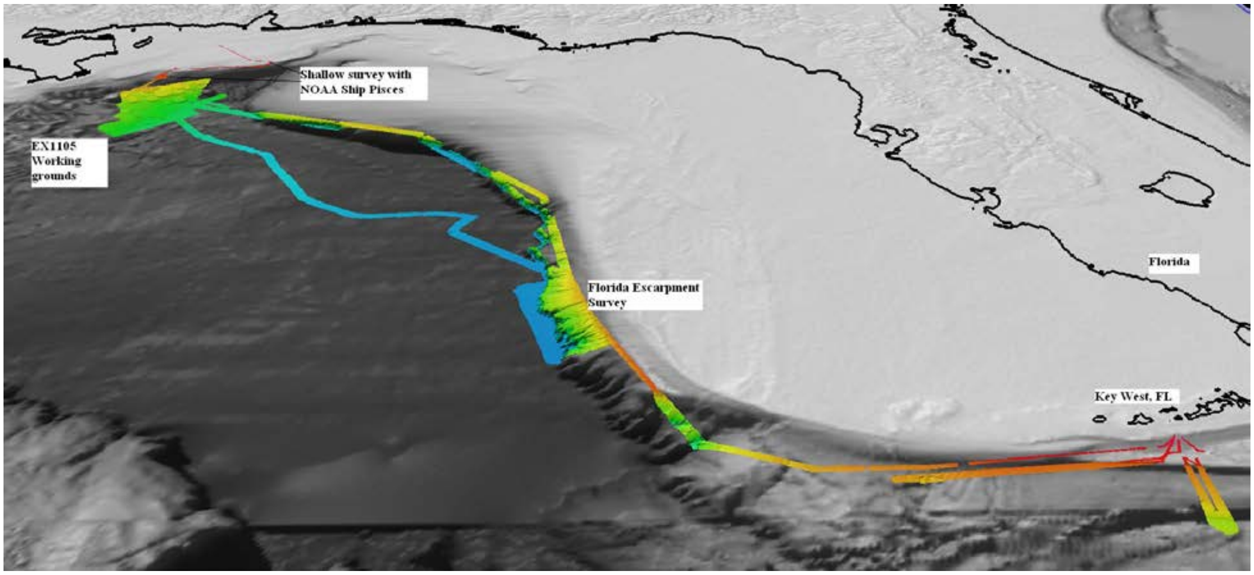


Figure : Perspective view showing the multibeam mapping collected during EX1105.

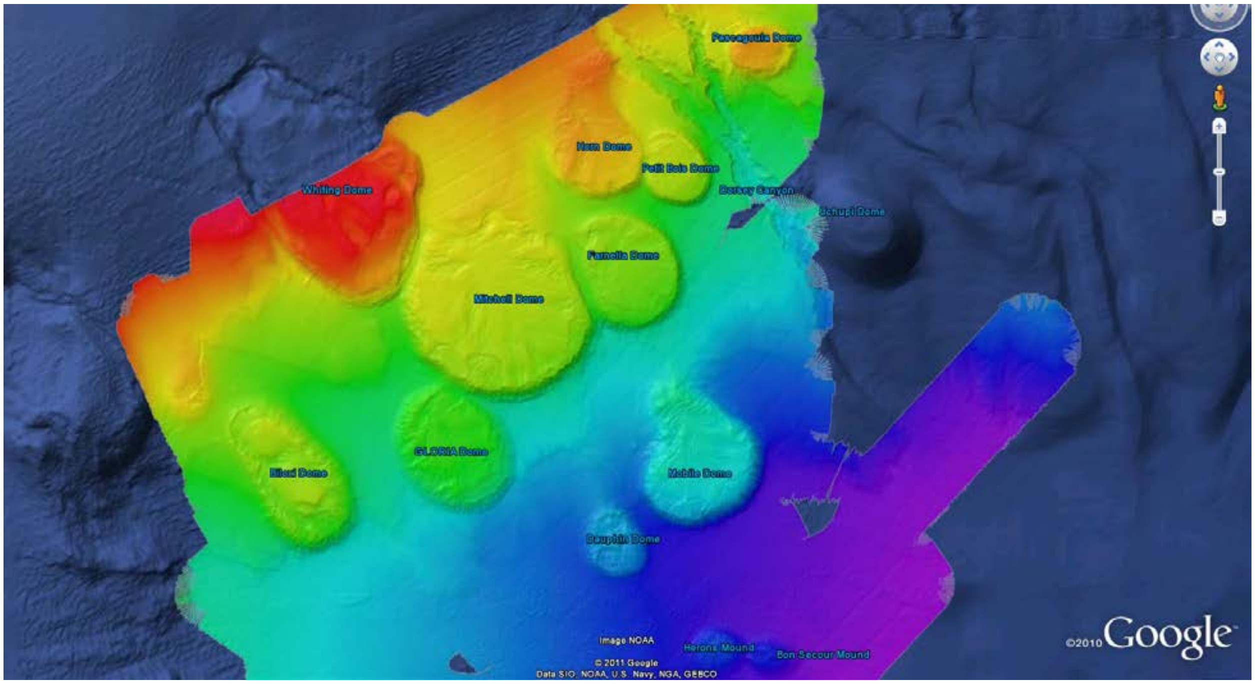


Figure : Zoomed in view of the EX1105 working grounds showing the multibeam bathymetry over the salt domes.

Efficacy of EM 302 to detect gas seeps

The EM 302 water column data analysis showed that the multibeam is capable of detecting gas seeps. The availability of EK 60 data helped in reaching to this conclusion where all the seeps that were detected by EK 60 were successfully detected by EM 302 also.

The multibeam ability of gas seep detected however decreased significantly in the outer beams.

(more details here)

5b. Table of Cruise Statistics

Dates	8/22/2011 – 9/10/2011
Weather delays	4
Line kilometers surveyed	6852
Total area mapped	17477 sq km
Number of CTD casts	4
Number of XBT casts	70
Beginning draft	Fwd: 14'6" Aft: 14' 9"
End draft	Fwd: 14'3" Aft: 14'7"

6. Cruise Calendar

August 2011						
Mon	**Tue**	**Wed**	**Thu**	**Fri**	**Sat**	**Sun**
22 The ship departed Key West, FL Conducted EK 60 calibration	23 EM 302 upgrade completed. Transfer Kongberg personnel by small boat to Key West, FL.	24 Return to Key West to drop off injured personnel via small boat.	25 In transit to working grounds in vicinity of DWH site	26 Arrived at DWH site at 0852 EST. Observed a minute of silence in respect of victims who lost their lives. Started testing different settings over Biloxi dome	27 Continued working over Biloxi dome running lines at different settings and offsets to optimize settings and line spacing for the seep detections	28 Started running the survey to systematically map the area.
29 CTD cast conducted.	30 RV with *Pisces* run the	31 Running lines in				

EK 60 calibration conducted followed by Knudsen operations over a feature of interest detected by EM 302	same line an hour apart over the known seep sites. A small overflying plan reported an oil slick. The ship transited to investigate the oil slick	vicinity of the Macando well				
			September 2011			
			1 Running lines in vicinity of Macando well. Weather picked up to 8-10 feet.	2 In transit to Florida escarpment. Started running lines in the Florida escarpment area.	3 Continue to run lines in Florida escarpment	4 Continue to run lines in Florida escarpment
5 Started heading towards primary working grounds	6 Continue heading towards/arrive at primary working grounds	7 CTD casts conducted on Dauphine dome	8 Continue running survey lines	9 Continue running survey lines	10 Arrived Pascagoula, MS	

7. Tables of data files collected

Table 7a: XBT/CTD data collected during the cruise for the Multibeam Sound Speed computation

EX1105 Sound Speed profiles LOG					
DATE (GMT)	**TIME (GMT)**	**XBT/CTD FILE NAME**		**LAT/LONG (WGS84)**	**NOTES**
8/23/2011	00:07:03	EX1105_XBT01_110823	24 10.5166N	81 44.5542W	
8/23/2011	23:30:25	EX1105_XBT02_110823	24 13.34399N	82 41.87891W	
8/24/2011	04:16:50	EX1105_XBT03_110824	24 12.27222N	82 41.68262W	
8/24/2011	10:25:51	EX1105_XBT04_110824	24 23.60498N	81 50.71875W	
8/24/2011	22:48:53	EX1105_XBT05_110824	24 15.0061N	83 14.53223W	
8/25/2011	04:17:25	EX1105_XBT06_110825	24 39.0791N	84 7.88672W	
8/25/2011	10:32:56	EX1105_XBT07_110825	25 36.26392N	84 39.75586W	
8/25/2011	17:49:42	EX1105_XBT08_110825	26 56.55737N	85 1.50293W	Bad Cast
8/25/2011	18:00:14	EX1105_XBT09_110825	26 57.98999N	85 2.92383W	
8/25/2011	23:52:34	EX1105_XBT10_110825	27 47.54248N	85 52.09863W	
8/26/2011	05:27:02	EX1105_XBT11_110826	28 14.22511N	86 54.23535W	
8/26/2011	10:52:32	EX1105_XBT12_110826	28 36.21533N	87 59.96582W	
8/26/2011	18:25:49	EX1105_XBT13_110826	28 47.55591N	88 33.90981W	
8/26/2011	22:47:02	EX1105_XBT14_110826	28 39.2146N	88 27.63867W	
8/27/2011	04:36:08	EX1105_XBT15_110827	28 42.80249N	88 29.13379W	
8/27/2011	10:48:10	EX1105_XBT16_110827	28 38.49634N	88 27.23242W	
8/27/2011	18:13:00	EX1105_XBT17_110827	28 39.42847N	88 27.79102W	
8/27/2011	23:32:13	EX1105_XBT18_110827	28 40.47046N	88 28.07617W	
8/28/2011	06:06:25	EX1105_XBT19_110828	28 6.99658N	88 11.61914W	
8/28/2011	10:45:16	EX1105_XBT20_110828	28 11.69531N	88 7.863280W	
8/28/2011	16:33:02	EX1105_XBT21_110828	28 20.08618N	88 1.416990W	
8/28/2011	23:07:00	EX1105_XBT22_110828	28 26.67749N	87 59.40527W	
8/29/2011	04:42:27	EX1105_XBT23_110829	28 23.02734N	88 5.496100W	
8/29/2011	10:50:57	EX1105_XBT24_110829	28 9.13159N	88 25.77246W	
8/29/2011	12:42:20	EX1105_CTD02_110829	28 15.3700 N	088 12.7800 W	

8/29/2011	23:41:50	EX1105_XBT25_110829	28 37.22778N	87 55.70508W	
8/30/2011	05:10:34	EX1105_XBT26_110830	28 18.29102N	88 16.40039W	
8/30/2011	10:48:31	EX1105_XBT27_110830	28 35.51709N	88 1.734380W	
8/30/2011	16:36:56	EX1105_XBT28_110830	28 50.15210N	88 25.31641W	
8/30/2011	22:45:37	EX1105_XBT29_110830	28 56.27832N	88 10.72461W	
8/31/2011	4:27:50	EX1105_XBT30_110831	28 43.76929N	88 26.44336W	
8/31/2011	10:50:22	EX1105_XBT31_110831	28 46.87549N	88 23.91113W	
8/31/2011	16:40:33	EX1105_XBT32_110831	28 47.75146N	88 21.46582W	
8/31/2011	17:03:01	EX1105_XSV33_110831	28 44.02173N	88 21.41016W	
8/31/2011	23:48:30	EX1105_XBT34_110831	28 47.22290N	88 19.00680W	
9/1/2011	05:10:27	EX1105_XBT35_110901	28 33.39722 N	88 9.928710W	
9/1/2011	14:42:30	EX1105_XBT36_110901	28 39.56665N	88 2.298830W	
9/2/2011	04:26:33	EX1105_XBT37_110902	28 14.54175N	86 58.99902W	
9/2/2011	10:44:55	EX1105_XBT38_110902	27 55.83936N	86 2.003910W	
9/2/2011	23:35:54	EX1105_XBT39_110902	26 28.62012N	84 59.26562W	
9/2/2011	23:35:54	EX1105_XBT40_110902	26 28.62012N	84 59.26562W	
9/3/2011	02:34:39	EX1105_XSV41_110903	26 4.94116N	84 55.65137W	
9/3/2011	05:14:54	EX1105_XBT42_110903	25 47.28076N	85 1.371090W	
9/3/2011	10:57:12	EX1105_XBT43_110903	25 15.44604N	84 47.26953W	
9/3/2011	07:37:00	EX1105_CTD03_110903	25 11.66367N	84 41.67480W	
9/3/2011	23:33:10	EX1105_XBT44_110903	25 11.66367N	84 41.67480W	
9/4/2011	10:48:14	EX1105_XBT45_110904	25 14.34302N	84 36.78418W	
9/4/2011	10:48:14	EX1105_XBT46_110904	25 14.34302N	84 36.78418W	
9/4/2011	16:41:15	EX1105_XBT47_110904	25 53.41357N	84 49.11621W	
9/4/2011	22:45:45	EX1105_XBT48_110904	25 24.79224N	84 36.83984W	
9/5/2011	05:32:05	EX1105_XBT49_110905	25 36.04102N	84 39.66895W	bad cast, wire broke
9/5/2011	05:35:13	EX1105_XBT50_110905	25 35.58301N	84 39.50586W	
9/5/2011	10:52:05	EX1105_XBT51_110906	25 38.10742N	84 39.16406W	
9/5/2011	16:37:21	EX1105_XBT52_110905	26 17.80347N	85 12.63477W	
9/6/2011	23:39:36	EX1105_XBT53_110905	26 47.44873N	85 35.87660W	
9/6/2011	06:06:44	EX1105_XBT54_110906	26 48.18335N	86 16.69336W	
9/6/2011	10:50:01	EX1105_XBT55_110906	27 13.97876N	86 46.24505W	
9/6/2011	16:41:09	EX1105_XBT56_110906	27 54.27197N	87 28.41699W	
9/6/2011	11:09:19	EX1105_XBT57_110906	28 33.36182N	88 04.47754W	
9/7/2011	5:00:19	EX1105_XBT58_110907	28 33.40234N	88 9.488280W	
9/7/2011	10:36:35	EX1105_XBT59_110907	28 44.82104N	88 02.00977W	
9/8/2011	5:05:26	EX1105_XBT60_110908	28 46.03390N	88 05.06640W	
9/8/2011	10:33:57	EX1105_XBT61_110908	28 36.91064N	88 21.03223W	
9/8/2011	16:34:46	EX1105_XBT61_110908	28 45.67163N	88 16.20898W	

9/8/2011	23:02:45	EX1105_XBT63_110908	28 54.46265N	88 08.42090W	
9/9/2011	5:04:32	EX1105_XBT64_110909	29 00.42829N	88 03.67871W	
9/9/2011	10:50:30	EX1105_XBT65_110909	29 01.16211N	88 07.44629W	
9/9/2011	16:35:25	EX1105_XBT66_110909	28 42.60962N	88 30.47754W	
9/9/2011	19:07:42	EX1105_XBT67_110909	29 3.48169N	88 23.43945W	T6 XBT
9/10/2011	22:42:48	EX1105_XBT68_110910	29 7.05200N	88 23.53516W	

Table 7b: Multibeam files collected during the cruise:

Date (GMT)	MB Line Filename	Location	Remarks
8/23/2011	0000_20110823_003743_EX1105_MB.all	Key West, FL	PreUpgrade
8/23/2011	0001_20110823_011516_EX1105_MB.all	Key West, FL	PreUpgrade
8/23/2011	0000_20110823_062314_EX1105_MB.all	Key West, FL	Post Upgrade
8/23/2011	0001_20110823_064004_EX1105_MB.all	Key West, FL	Post Upgrade
8/23/2011	0002_20110823_093647_EX1105_MB.all	Key West, FL	Post Upgrade
8/23/2011	0003_20110823_153422_EX1105_MB.all	Key West, FL	Post Upgrade
8/23/2011	0000_20110823_175500_EX1105_MB.all	Transit	EX1105_Survey
8/23/2011	0001_20110823_182821_EX1105_MB.all	Transit to Working Ground (WG)	EX1105_Survey
8/23/2011	0002_20110823_185807_EX1105_MB.all	Transit to WG	EX1105_Survey
8/24/2011	0003_20110824_005807_EX1105_MB.all	Transit to WG	EX1105_Survey
8/24/2011	0004_20110824_015105_EX1105_MB.all	Transit to WG	EX1105_Survey
8/24/2011	0005_20110824_075106_EX1105_MB.all	Transit to WG	EX1105_Survey
8/24/2011	0006_20110824_154752_EX1105_MB.all	Transit to WG	EX1105_Survey
8/24/2011	0007_20110824_164128_EX1105_MB.all	Transit to WG	EX1105_Survey
8/24/2011	0000_20110824_205708_EX1105_MB.all	Transit to WG	EX1105_Survey 1
8/24/2011	0002_20110824_225936_EX1105_MB.all	Transit to WG	EX1105_Survey 1
8/24/2011	0003_20110824_235421_EX1105_MB.all	Transit to WG	EX1105_Survey 1
8/25/2011	0004_20110825_055420_EX1105_MB.all	Transit to WG	EX1105_Survey 1
8/25/2011	0005_20110825_115419_EX1105_MB.all	Transit to WG	EX1105_Survey 1
8/25/2011	0006_20110825_135501_EX1105_MB.all	Transit to WG	EX1105_Survey 1
8/25/2011	0007_20110825_172156_EX1105_MB.all	Transit to WG	EX1105_Survey 1
8/25/2011	0000_20110825_213114_EX1105_MB.all	Transit to WG	EX1105_Survey 2
8/25/2011	0000_20110825_235407_EX1105_MB.all	Transit to WG	EX1105_Survey 3
8/26/2011	0001_20110826_003851_EX1105_MB.all	Transit to WG	
8/26/2011	0002_20110826_010051_EX1105_MB.all	Transit to WG	

8/26/2011	0003_20110826_013131_EX1105_MB.all	Transit to WG	
8/26/2011	0004_20110826_020053_EX1105_MB.all	Transit to WG	
8/26/2011	0005_20110826_030052_EX1105_MB.all	Transit to WG	
8/26/2011	0006_20110826_040053_EX1105_MB.all	Transit to WG	
8/26/2011	0007_20110826_043844_EX1105_MB.all	Transit to WG	
8/26/2011	0008_20110826_050038_EX1105_MB.all	Transit to WG	
8/26/2011	0009_20110826_060041_EX1105_MB.all	Transit to WG	
8/26/2011	0010_20110826_070041_EX1105_MB.all	Transit to WG	
8/26/2011	0011_20110826_080039_EX1105_MB.all	Transit to WG	
8/26/2011	0012_20110826_090040_EX1105_MB.all	Transit to WG	
8/26/2011	0013_20110826_100041_EX1105_MB.all	WG	
8/26/2011	0014_20110826_110044_EX1105_MB.all	WG	
8/26/2011	0015_20110826_120041_EX1105_MB.all	WG	
8/26/2011	0016_20110826_125439_EX1105_MB.all	WG	
8/26/2011	0017_20110826_131534_EX1105_MB.all	WG	
8/26/2011	0018_20110826_140222_EX1105_MB.all	WG	
8/26/2011	0019_20110826_144810_EX1105_MB.all	WG	
8/26/2011	0020_20110826_145604_EX1105_MB.all	WG	
8/26/2011	0021_20110826_155126_EX1105_MB.all	WG	
8/26/2011	0022_20110826_160206_EX1105_MB.all	WG	
8/26/2011	0023_20110826_170207_EX1105_MB.all	WG	
8/26/2011	0024_20110826_170323_EX1105_MB.all	WG	
8/26/2011	0025_20110826_180326_EX1105_MB.all	WG	
8/26/2011	0026_20110826_181934_EX1105_MB.all	WG	
8/26/2011	0027_20110826_182904_EX1105_MB.all	WG	
8/26/2011	0028_20110826_190544_EX1105_MB.all	WG	
8/26/2011	0029_20110826_195532_EX1105_MB.all	WG	
8/26/2011	0030_20110826_200657_EX1105_MB.all	WG	
8/26/2011	0031_20110826_210052_EX1105_MB.all	WG	
8/26/2011	0032_20110826_212229_EX1105_MB.all	WG	
8/26/2011	0033_20110826_213054_EX1105_MB.all	WG	
8/26/2011	0034_20110826_220618_EX1105_MB.all	WG	
8/26/2011	0035_20110826_222649_EX1105_MB.all	WG	
8/26/2011	0036_20110826_223755_EX1105_MB.all	WG	
8/26/2011	0037_20110826_230259_EX1105_MB.all	WG	
8/26/2011	0038_20110826_232043_EX1105_MB.all	WG	
8/26/2011	0039_20110826_232504_EX1105_MB.all	WG	
8/26/2011	0040_20110826_234556_EX1105_MB.all	WG	
8/26/2011	0041_20110826_235801_EX1105_MB.all	WG	
8/27/2011	0054_20110827_050134_EX1105_MB.all	WG	
8/27/2011	0055_20110827_051454_EX1105_MB.all	WG	

8/27/2011	0056_20110827_052105_EX1105_MB.all	WG	
8/27/2011	0057_20110827_060851_EX1105_MB.all	WG	
8/27/2011	0058_20110827_061722_EX1105_MB.all	WG	
8/27/2011	0059_20110827_071134_EX1105_MB.all	WG	
8/27/2011	0060_20110827_075356_EX1105_MB.all	WG	
8/27/2011	0061_20110827_080201_EX1105_MB.all	WG	
8/27/2011	0062_20110827_083907_EX1105_MB.all	WG	
8/27/2011	0063_20110827_084829_EX1105_MB.all	WG	
8/27/2011	0064_20110827_093802_EX1105_MB.all	WG	
8/27/2011	0065_20110827_094722_EX1105_MB.all	WG	
8/27/2011	0066_20110827_103855_EX1105_MB.all	WG	
8/27/2011	0067_20110827_110023_EX1105_MB.all	WG	
8/27/2011	0068_20110827_113025_EX1105_MB.all	WG	
8/27/2011	0069_20110827_113858_EX1105_MB.all	WG	
8/27/2011	0070_20110827_120005_EX1105_MB.all	WG	
8/27/2011	0071_20110827_122356_EX1105_MB.all	WG	
8/27/2011	0072_20110827_122915_EX1105_MB.all	WG	
8/27/2011	0073_20110827_130014_EX1105_MB.all	WG	
8/27/2011	0074_20110827_133205_EX1105_MB.all	WG	
8/27/2011	0075_20110827_140141_EX1105_MB.all	WG	
8/27/2011	0076_20110827_150120_EX1105_MB.all	WG	
8/27/2011	0077_20110827_160120_EX1105_MB.all	WG	
8/27/2011	0078_20110827_202800_EX1105_MB.all	WG	
8/27/2011	0079_20110827_211022_EX1105_MB.all	WG	
8/27/2011	0080_20110827_212020_EX1105_MB.all	WG	
8/27/2011	0081_20110827_221938_EX1105_MB.all	WG	
8/27/2011	0082_20110827_222149_EX1105_MB.all	WG	
8/27/2011	0083_20110827_230434_EX1105_MB.all	WG	
8/27/2011	0084_20110827_231058_EX1105_MB.all	WG	
8/27/2011	0085_20110827_235705_EX1105_MB.all	WG	
8/28/2011	0086_20110828_000558_EX1105_MB.all	WG	
8/28/2011	0087_20110828_005500_EX1105_MB.all	WG	
8/28/2011	0088_20110828_015458_EX1105_MB.all	WG	
8/28/2011	0089_20110828_020950_EX1105_MB.all	WG	
8/28/2011	0090_20110828_030001_EX1105_MB.all	WG	
8/28/2011	0091_20110828_040004_EX1105_MB.all	WG	
8/28/2011	0092_20110828_050002_EX1105_MB.all	WG	
8/28/2011	0093_20110828_051641_EX1105_MB.all	WG	
8/28/2011	0094_20110828_060003_EX1105_MB.all	WG	
8/28/2011	0095_20110828_070001_EX1105_MB.all	WG	
8/28/2011	0096_20110828_080005_EX1105_MB.all	WG	

8/28/2011	0097_20110828_083824_EX1105_MB.all	WG	
8/28/2011	0098_20110828_084609_EX1105_MB.all	WG	
8/28/2011	0099_20110828_090005_EX1105_MB.all	WG	
8/28/2011	0100_20110828_100004_EX1105_MB.all	WG	
8/28/2011	0101_20110828_110002_EX1105_MB.all	WG	
8/28/2011	0102_20110828_120002_EX1105_MB.all	WG	
8/28/2011	0103_20110828_121045_EX1105_MB.all	WG	
8/28/2011	0104_20110828_121728_EX1105_MB.all	WG	
8/28/2011	0105_20110828_131231_EX1105_MB.all	WG	
8/28/2011	0106_20110828_140002_EX1105_MB.all	WG	
8/28/2011	0107_20110828_150003_EX1105_MB.all	WG	
8/28/2011	0108_20110828_150009_EX1105_MB.all	WG	
8/28/2011	0109_20110828_152358_EX1105_MB.all	WG	
8/28/2011	0110_20110828_153618_EX1105_MB.all	WG	
8/28/2011	0111_20110828_160103_EX1105_MB.all	WG	
8/28/2011	0112_20110828_170103_EX1105_MB.all	WG	
8/28/2011	0113_20110828_180047_EX1105_MB.all	WG	
8/28/2011	0114_20110828_190043_EX1105_MB.all	WG	
8/28/2011	0115_20110828_190100_EX1105_MB.all	WG	
8/28/2011	0116_20110828_191929_EX1105_MB.all	WG	
8/28/2011	0117_20110828_200320_EX1105_MB.all	WG	
8/28/2011	0118_20110828_210323_EX1105_MB.all	WG	
8/28/2011	0119_20110828_220000_EX1105_MB.all	WG	
8/28/2011	0120_20110828_223226_EX1105_MB.all	WG	
8/28/2011	0121_20110828_224928_EX1105_MB.all	WG	
8/28/2011	0122_20110828_234930_EX1105_MB.all	WG	
8/29/2011	0123_20110829_000001_EX1105_MB.all	WG	
8/29/2011	0124_20110829_010005_EX1105_MB.all	WG	
8/29/2011	0125_20110829_020003_EX1105_MB.all	WG	
8/29/2011	0126_20110829_021145_EX1105_MB.all	WG	
8/29/2011	0127_20110829_022901_EX1105_MB.all	WG	
8/29/2011	0128_20110829_032901_EX1105_MB.all	WG	
8/29/2011	0129_20110829_042900_EX1105_MB.all	WG	
8/29/2011	0130_20110829_052902_EX1105_MB.all	WG	
8/29/2011	0131_20110829_061952_EX1105_MB.all	WG	
8/29/2011	0132_20110829_063334_EX1105_MB.all	WG	
8/29/2011	0133_20110829_073332_EX1105_MB.all	WG	
8/29/2011	0134_20110829_083333_EX1105_MB.all	WG	
8/29/2011	0135_20110829_093335_EX1105_MB.all	WG	
8/29/2011	0136_20110829_103141_EX1105_MB.all	WG	
8/29/2011	0137_20110829_104354_EX1105_MB.all	WG	

8/29/2011	0138_20110829_110031_EX1105_MB.all	WG	
8/29/2011	0139_20110829_120031_EX1105_MB.all	WG	
8/29/2011	0140_20110829_201944_EX1105_MB.all	WG	
8/29/2011	0141_20110829_210239_EX1105_MB.all	WG	
8/29/2011	0142_20110829_220237_EX1105_MB.all	WG	
8/29/2011	0143_20110829_230238_EX1105_MB.all	WG	
8/29/2011	0144_20110829_230858_EX1105_MB.all	WG	
8/30/2011	0145_20110830_000859_EX1105_MB.all	WG	
8/30/2011	0146_20110830_000956_EX1105_MB.all	WG	
8/30/2011	0147_20110830_005416_EX1105_MB.all	WG	
8/30/2011	0148_20110830_010821_EX1105_MB.all	WG	
8/30/2011	0149_20110830_020822_EX1105_MB.all	WG	
8/30/2011	0150_20110830_030817_EX1105_MB.all	WG	
8/30/2011	0151_20110830_032600_EX1105_MB.all	WG	
8/30/2011	0152_20110830_042559_EX1105_MB.all	WG	
8/30/2011	0153_20110830_052600_EX1105_MB.all	WG	
8/30/2011	0154_20110830_062558_EX1105_MB.all	WG	
8/30/2011	0155_20110830_064330_EX1105_MB.all	WG	
8/30/2011	0156_20110830_065135_EX1105_MB.all	WG	
8/30/2011	0157_20110830_070119_EX1105_MB.all	WG	
8/30/2011	0158_20110830_080050_EX1105_MB.all	WG	
8/30/2011	0159_20110830_090050_EX1105_MB.all	WG	
8/30/2011	0160_20110830_100047_EX1105_MB.all	WG	
8/30/2011	0161_20110830_105219_EX1105_MB.all	WG	
8/30/2011	0162_20110830_110148_EX1105_MB.all	WG	
8/30/2011	0163_20110830_120151_EX1105_MB.all	WG	
8/30/2011	0164_20110830_130153_EX1105_MB.all	WG	Repeat line with Pisces
8/30/2011	0165_20110830_140148_EX1105_MB.all	WG	Repeat line with Pisces
8/30/2011	0166_20110830_150148_EX1105_MB.all	WG	Repeat line with Pisces
8/30/2011	0168_20110830_153927_EX1105_MB.all	WG	Repeat line with Pisces
8/30/2011	0169_20110830_160106_EX1105_MB.all	WG	Repeat line with Pisces
8/30/2011	0170_20110830_164219_EX1105_MB.all	WG	Repeat line with Pisces
8/30/2011	0171_20110830_174223_EX1105_MB.all	WG	Repeat line with Pisces
8/30/2011	0172_20110830_184219_EX1105_MB.all	WG	Repeat line with Pisces
8/30/2011	0173_20110830_185117_EX1105_MB.all	WG	Repeat line with Pisces
8/30/2011	0174_20110830_195119_EX1105_MB.all	WG	
8/30/2011	0175_20110830_205119_EX1105_MB.all	WG	

8/30/2011	0176_20110830_210420_EX1105_MB.all	WG	
8/30/2011	0177_20110830_213831_EX1105_MB.all	WG	
8/30/2011	0178_20110830_215736_EX1105_MB.all	WG	
8/30/2011	0179_20110830_220517_EX1105_MB.all	WG	
8/30/2011	0180_20110830_220912_EX1105_MB.all	WG	
8/30/2011	0181_20110830_222656_EX1105_MB.all	WG	
8/30/2011	0182_20110830_223647_EX1105_MB.all	WG	
8/30/2011	0183_20110830_224009_EX1105_MB.all	WG	
8/30/2011	0184_20110830_231828_EX1105_MB.all	WG	
8/30/2011	0185_20110830_233955_EX1105_MB.all	WG	
8/31/2011	0186_20110831_002630_EX1105_MB.all	WG	
8/31/2011	0187_20110831_012631_EX1105_MB.all	WG	
8/31/2011	0188_20110831_013352_EX1105_MB.all	WG	
8/31/2011	0189_20110831_020118_EX1105_MB.all	WG	
8/31/2011	0190_20110831_020718_EX1105_MB.all	WG	
8/31/2011	0191_20110831_021952_EX1105_MB.all	WG	
8/31/2011	0192_20110831_025336_EX1105_MB.all	WG	
8/31/2011	0193_20110831_030540_EX1105_MB.all	WG	
8/31/2011	0194_20110831_033448_EX1105_MB.all	WG	
8/31/2011	0195_20110831_034347_EX1105_MB.all	WG	
8/31/2011	0197_20110831_041702_EX1105_MB.all	WG	
8/31/2011	0198_20110831_042550_EX1105_MB.all	WG	
8/31/2011	0199_20110831_045809_EX1105_MB.all	WG	
8/31/2011	0200_20110831_053722_EX1105_MB.all	WG	
8/31/2011	0201_20110831_061416_EX1105_MB.all	WG	
8/31/2011	0202_20110831_061923_EX1105_MB.all	WG	
8/31/2011	0203_20110831_070651_EX1105_MB.all	WG	
8/31/2011	0204_20110831_071238_EX1105_MB.all	WG	
8/31/2011	0205_20110831_080033_EX1105_MB.all	WG	
8/31/2011	0206_20110831_080708_EX1105_MB.all	WG	
8/31/2011	0207_20110831_090003_EX1105_MB.all	WG	
8/31/2011	0208_20110831_090713_EX1105_MB.all	WG	
8/31/2011	0209_20110831_091539_EX1105_MB.all	WG	
8/31/2011	0210_20110831_101540_EX1105_MB.all	WG	
8/31/2011	0211_20110831_101903_EX1105_MB.all	WG	
8/31/2011	0212_20110831_102736_EX1105_MB.all	WG	
8/31/2011	0213_20110831_110004_EX1105_MB.all	WG	
8/31/2011	0214_20110831_113734_EX1105_MB.all	WG	
8/31/2011	0215_20110831_114647_EX1105_MB.all	WG	
8/31/2011	0216_20110831_124647_EX1105_MB.all	WG	
8/31/2011	0217_20110831_125743_EX1105_MB.all	WG	

8/31/2011	0218_20110831_131802_EX1105_MB.all	WG	
8/31/2011	0219_20110831_140122_EX1105_MB.all	WG	
8/31/2011	0220_20110831_144209_EX1105_MB.all	WG	
8/31/2011	0221_20110831_145024_EX1105_MB.all	WG	
8/31/2011	0222_20110831_155027_EX1105_MB.all	WG	
8/31/2011	0223_20110831_161458_EX1105_MB.all	WG	
8/31/2011	0224_20110831_162215_EX1105_MB.all	WG	
8/31/2011	0225_20110831_172216_EX1105_MB.all	WG	
8/31/2011	0226_20110831_174629_EX1105_MB.all	WG	
8/31/2011	0227_20110831_175403_EX1105_MB.all	WG	
8/31/2011	0228_20110831_185404_EX1105_MB.all	WG	
8/31/2011	0229_20110831_191611_EX1105_MB.all	WG	
8/31/2011	0230_20110831_201612_EX1105_MB.all	WG	
8/31/2011	0231_20110831_210131_EX1105_MB.all	WG	
8/31/2011	0232_20110831_214501_EX1105_MB.all	WG	
8/31/2011	0233_20110831_224502_EX1105_MB.all	WG	
8/31/2011	0234_20110831_230044_EX1105_MB.all	WG	
8/31/2011	0235_20110831_231922_EX1105_MB.all	WG	
8/31/2011	0236_20110831_232628_EX1105_MB.all	WG	
8/31/2011	0237_20110831_233410_EX1105_MB.all	WG	
9/01/2011	0238_20110901_003411_EX1105_MB.all	WG	
9/01/2011	0239_20110901_005338_EX1105_MB.all	WG	
9/01/2011	0240_20110901_010104_EX1105_MB.all	WG	
9/01/2011	0241_20110901_015031_EX1105_MB.all	WG	
9/01/2011	0242_20110901_020749_EX1105_MB.all	WG	
9/01/2011	0243_20110901_022334_EX1105_MB.all	WG	
9/01/2011	0244_20110901_022908_EX1105_MB.all	WG	
9/01/2011	0245_20110901_023615_EX1105_MB.all	WG	
9/01/2011	0246_20110901_030002_EX1105_MB.all	WG	
9/01/2011	0247_20110901_040005_EX1105_MB.all	WG	
9/01/2011	0248_20110901_042722_EX1105_MB.all	WG	
9/01/2011	0249_20110901_042955_EX1105_MB.all	WG	
9/01/2011	0250_20110901_045005_EX1105_MB.all	WG	
9/01/2011	0251_20110901_054310_EX1105_MB.all	WG	
9/01/2011	0252_20110901_060517_EX1105_MB.all	WG	
9/01/2011	0253_20110901_061514_EX1105_MB.all	WG	
9/01/2011	0254_20110901_064412_EX1105_MB.all	WG	
9/01/2011	0255_20110901_072623_EX1105_MB.all	WG	
9/01/2011	0256_20110901_082625_EX1105_MB.all	WG	
9/01/2011	0257_20110901_092632_EX1105_MB.all	WG	
9/01/2011	0258_20110901_094506_EX1105_MB.all	WG	

9/01/2011	0259_20110901_100252_EX1105_MB.all	WG	
9/01/2011	0260_20110901_104529_EX1105_MB.all	WG	
9/01/2011	0261_20110901_114531_EX1105_MB.all	WG	
9/01/2011	0262_20110901_124527_EX1105_MB.all	WG	
9/01/2011	0263_20110901_134528_EX1105_MB.all	WG	
9/01/2011	0264_20110901_143441_EX1105_MB.all	WG	
9/01/2011	0265_20110901_153440_EX1105_MB.all	WG	
9/01/2011	0266_20110901_163438_EX1105_MB.all	WG	
9/01/2011	0267_20110901_165955_EX1105_MB.all	WG	
9/01/2011	0268_20110901_175956_EX1105_MB.all	WG	
9/01/2011	0269_20110901_185955_EX1105_MB.all	WG	
9/01/2011	0270_20110901_195954_EX1105_MB.all	WG	
9/01/2011	0271_20110901_200016_EX1105_MB.all	WG	
9/01/2011	0272_20110901_210017_EX1105_MB.all	WG	
9/01/2011	0273_20110901_220016_EX1105_MB.all	WG	
9/01/2011	0274_20110901_230017_EX1105_MB.all	Transit to Florida Escarpment (FE)	
9/02/2011	0275_20110902_000017_EX1105_MB.all	Transit to FE	
9/02/2011	0276_20110902_010019_EX1105_MB.all	Transit to FE	
9/02/2011	0277_20110902_014535_EX1105_MB.all	Transit to FE	
9/02/2011	0278_20110902_020001_EX1105_MB.all	Transit to FE	
9/02/2011	0279_20110902_030001_EX1105_MB.all	Transit to FE	
9/02/2011	0280_20110902_040001_EX1105_MB.all	Transit to FE	
9/02/2011	0281_20110902_050003_EX1105_MB.all	Transit to FE	
9/02/2011	0282_20110902_060004_EX1105_MB.all	Transit to FE	
9/02/2011	0283_20110902_070002_EX1105_MB.all	Transit to FE	
9/02/2011	0284_20110902_080003_EX1105_MB.all	Transit to FE	
9/02/2011	0285_20110902_090002_EX1105_MB.all	Transit to FE	
9/02/2011	0286_20110902_100001_EX1105_MB.all	Transit to FE	
9/02/2011	0287_20110902_110003_EX1105_MB.all	Transit to FE	
9/02/2011	0288_20110902_120007_EX1105_MB.all	Transit to FE	
9/02/2011	0289_20110902_130002_EX1105_MB.all	Transit to FE	
9/02/2011	0290_20110902_140001_EX1105_MB.all	Transit to FE	
9/02/2011	0291_20110902_150001_EX1105_MB.all	Transit to FE	
9/02/2011	0292_20110902_160004_EX1105_MB.all	Transit to FE	
9/02/2011	0293_20110902_165959_EX1105_MB.all	Transit to FE	
9/02/2011	0294_20110902_180001_EX1105_MB.all	Transit to FE	
9/02/2011	0295_20110902_190002_EX1105_MB.all	Transit to FE	
9/02/2011	0296_20110902_200000_EX1105_MB.all	Transit to FE	
9/02/2011	0297_20110902_210000_EX1105_MB.all	Transit to FE	
9/02/2011	0298_20110902_212102_EX1105_MB.all	Transit to FE	
9/02/2011	0299_20110902_212453_EX1105_MB.all	Transit to FE	

9/02/2011	0300_20110902_220000_EX1105_MB.all	Transit to FE	
9/02/2011	0301_20110902_221606_EX1105_MB.all	Transit to FE	
9/02/2011	0302_20110902_231242_EX1105_MB.all	Transit to FE	
9/02/2011	0303_20110902_231728_EX1105_MB.all	Transit to FE	
9/03/2011	0304_20110903_001153_EX1105_MB.all	Transit to FE	
9/03/2011	0305_20110903_005901_EX1105_MB.all	Transit to FE	
9/03/2011	0306_20110903_015901_EX1105_MB.all	Transit to FE	
9/03/2011	0307_20110903_025313_EX1105_MB.all	Transit to FE	
9/03/2011	0308_20110903_031829_EX1105_MB.all	FE	
9/03/2011	0309_20110903_032505_EX1105_MB.all	FE	
9/03/2011	0310_20110903_034250_EX1105_MB.all	FE	
9/03/2011	0311_20110903_043432_EX1105_MB.all	FE	
9/03/2011	0312_20110903_050001_EX1105_MB.all	FE	
9/03/2011	0313_20110903_060003_EX1105_MB.all	FE	
9/03/2011	0314_20110903_070001_EX1105_MB.all	FE	
9/03/2011	0315_20110903_080003_EX1105_MB.all	FE	
9/03/2011	0316_20110903_090004_EX1105_MB.all	FE	
9/03/2011	0317_20110903_100006_EX1105_MB.all	FE	
9/03/2011	0318_20110903_100344_EX1105_MB.all	FE	
9/03/2011	0319_20110903_101823_EX1105_MB.all	FE	
9/03/2011	0320_20110903_102326_EX1105_MB.all	FE	
9/03/2011	0321_20110903_110409_EX1105_MB.all	FE	
9/03/2011	0322_20110903_120404_EX1105_MB.all	FE	
9/03/2011	0323_20110903_130409_EX1105_MB.all	FE	
9/03/2011	0324_20110903_140408_EX1105_MB.all	FE	
9/03/2011	0325_20110903_150403_EX1105_MB.all	FE	
9/03/2011	0326_20110903_155146_EX1105_MB.all	FE	
9/03/2011	0327_20110903_183951_EX1105_MB.all	FE	
9/03/2011	0328_20110903_193949_EX1105_MB.all	FE	
9/03/2011	0329_20110903_203950_EX1105_MB.all	FE	
9/03/2011	0330_20110903_213950_EX1105_MB.all	FE	
9/03/2011	0331_20110903_220535_EX1105_MB.all	FE	
9/03/2011	0332_20110903_230417_EX1105_MB.all	FE	
9/03/2011	0333_20110903_232616_EX1105_MB.all	FE	
9/03/2011	0334_20110903_234150_EX1105_MB.all	FE	
9/04/2011	0335_20110904_000358_EX1105_MB.all	FE	
9/04/2011	0336_20110904_010353_EX1105_MB.all	FE	
9/04/2011	0337_20110904_020351_EX1105_MB.all	FE	
9/04/2011	0338_20110904_030357_EX1105_MB.all	FE	
9/04/2011	0339_20110904_040354_EX1105_MB.all	FE	
9/04/2011	0340_20110904_050355_EX1105_MB.all	FE	

9/04/2011	0341_20110904_052924_EX1105_MB.all	FE	
9/04/2011	0342_20110904_054645_EX1105_MB.all	FE	
9/04/2011	0343_20110904_060008_EX1105_MB.all	FE	
9/04/2011	0344_20110904_070004_EX1105_MB.all	FE	
9/04/2011	0345_20110904_080004_EX1105_MB.all	FE	
9/04/2011	0346_20110904_090003_EX1105_MB.all	FE	
9/04/2011	0347_20110904_100001_EX1105_MB.all	FE	
9/04/2011	0348_20110904_102627_EX1105_MB.all	FE	
9/04/2011	0349_20110904_104230_EX1105_MB.all	FE	
9/04/2011	0350_20110904_110003_EX1105_MB.all	FE	
9/04/2011	0351_20110904_120004_EX1105_MB.all	FE	
9/04/2011	0352_20110904_130001_EX1105_MB.all	FE	
9/04/2011	0353_20110904_140001_EX1105_MB.all	FE	
9/04/2011	0354_20110904_150003_EX1105_MB.all	FE	
9/04/2011	0355_20110904_160007_EX1105_MB.all	FE	
9/04/2011	0356_20110904_161618_EX1105_MB.all	FE	
9/04/2011	0357_20110904_171612_EX1105_MB.all	FE	
9/04/2011	0358_20110904_181613_EX1105_MB.all	FE	
9/04/2011	0359_20110904_191613_EX1105_MB.all	FE	
9/04/2011	0360_20110904_201610_EX1105_MB.all	FE	
9/04/2011	0361_20110904_210708_EX1105_MB.all	FE	
9/04/2011	0362_20110904_212032_EX1105_MB.all	FE	
9/04/2011	0363_20110904_220843_EX1105_MB.all	FE	
9/04/2011	0364_20110904_230839_EX1105_MB.all	FE	
9/05/2011	0365_20110905_000840_EX1105_MB.all	FE	
9/05/2011	0366_20110905_010231_EX1105_MB.all	FE	
9/05/2011	0367_20110905_020230_EX1105_MB.all	FE	
9/05/2011	0368_20110905_025708_EX1105_MB.all	FE	
9/05/2011	0369_20110905_030810_EX1105_MB.all	FE	
9/05/2011	0370_20110905_040809_EX1105_MB.all	FE	
9/05/2011	0371_20110905_050004_EX1105_MB.all	FE	
9/05/2011	0372_20110905_060002_EX1105_MB.all	FE	
9/05/2011	0373_20110905_070004_EX1105_MB.all	FE	
9/05/2011	0374_20110905_075138_EX1105_MB.all	FE	
9/05/2011	0375_20110905_080455_EX1105_MB.all	FE	
9/05/2011	0376_20110905_090243_EX1105_MB.all	FE	
9/05/2011	0377_20110905_100021_EX1105_MB.all	FE	
9/05/2011	0378_20110905_110018_EX1105_MB.all	FE	
9/05/2011	0379_20110905_120021_EX1105_MB.all	FE	
9/05/2011	0380_20110905_130020_EX1105_MB.all	FE	
9/05/2011	0381_20110905_131443_EX1105_MB.all	Transit to WG	

9/05/2011	0382_20110905_140147_EX1105_MB.all	Transit to WG	
9/05/2011	0383_20110905_150147_EX1105_MB.all	Transit to WG	
9/05/2011	0384_20110905_160149_EX1105_MB.all	Transit to WG	
9/05/2011	0385_20110905_170148_EX1105_MB.all	Transit to WG	
9/05/2011	0386_20110905_180147_EX1105_MB.all	Transit to WG	
9/05/2011	0387_20110905_190147_EX1105_MB.all	Transit to WG	
9/05/2011	0388_20110905_193307_EX1105_MB.all	Transit to WG	
9/05/2011	0389_20110905_203306_EX1105_MB.all	Transit to WG	
9/05/2011	0390_20110905_213307_EX1105_MB.all	Transit to WG	
9/05/2011	0391_20110905_221341_EX1105_MB.all	Transit to WG	
9/05/2011	0392_20110905_221647_EX1105_MB.all	Transit to WG	
9/05/2011	0393_20110905_231648_EX1105_MB.all	Transit to WG	
9/06/2011	0394_20110906_001646_EX1105_MB.all	Transit to WG	
9/06/2011	0395_20110906_011647_EX1105_MB.all	Transit to WG	
9/06/2011	0396_20110906_021646_EX1105_MB.all	Transit to WG	
9/06/2011	0397_20110906_031648_EX1105_MB.all	Transit to WG	
9/06/2011	0398_20110906_041650_EX1105_MB.all	Transit to WG	
9/06/2011	0399_20110906_051651_EX1105_MB.all	Transit to WG	
9/06/2011	0401_20110906_061651_EX1105_MB.all	Transit to WG	
9/06/2011	0402_20110906_071652_EX1105_MB.all	Transit to WG	
9/06/2011	0403_20110906_081651_EX1105_MB.all	Transit to WG	
9/06/2011	0404_20110906_091648_EX1105_MB.all	Transit to WG	
9/06/2011	0405_20110906_101650_EX1105_MB.all	Transit to WG	
9/06/2011	0406_20110906_110213_EX1105_MB.all	Transit to WG	
9/06/2011	0407_20110906_120212_EX1105_MB.all	Transit to WG	
9/06/2011	0408_20110906_130214_EX1105_MB.all	Transit to WG	
9/06/2011	0409_20110906_140213_EX1105_MB.all	Transit to WG	
9/06/2011	0410_20110906_150209_EX1105_MB.all	Transit to WG	
9/06/2011	0411_20110906_160212_EX1105_MB.all	Transit to WG	
9/06/2011	0412_20110906_170212_EX1105_MB.all	Transit to WG	
9/06/2011	0413_20110906_180210_EX1105_MB.all	Transit to WG	
9/06/2011	0414_20110906_184006_EX1105_MB.all	Transit to WG	
9/06/2011	0415_20110906_194006_EX1105_MB.all	Transit to WG	
9/06/2011	0416_20110906_204005_EX1105_MB.all	WG	
9/06/2011	0417_20110906_214006_EX1105_MB.all	WG	
9/06/2011	0418_20110906_220013_EX1105_MB.all	WG	
9/06/2011	0419_20110906_223858_EX1105_MB.all	WG	
9/06/2011	0420_20110906_224406_EX1105_MB.all	WG	
9/06/2011	0421_20110906_233751_EX1105_MB.all	WG	
9/06/2011	0422_20110906_234033_EX1105_MB.all	WG	
9/06/2011	0423_20110906_235423_EX1105_MB.all	WG	

9/07/2011	0424_20110907_005423_EX1105_MB.all	WG	
9/07/2011	0425_20110907_010608_EX1105_MB.all	WG	
9/07/2011	0426_20110907_020604_EX1105_MB.all	WG	
9/07/2011	0427_20110907_023438_EX1105_MB.all	WG	
9/07/2011	0428_20110907_025117_EX1105_MB.all	WG	
9/07/2011	0429_20110907_035117_EX1105_MB.all	WG	
9/07/2011	0430_20110907_045120_EX1105_MB.all	WG	
9/07/2011	0431_20110907_053214_EX1105_MB.all	WG	
9/07/2011	0432_20110907_063210_EX1105_MB.all	WG	
9/07/2011	0433_20110907_063757_EX1105_MB.all	WG	
9/07/2011	0434_20110907_065807_EX1105_MB.all	WG	
9/07/2011	0435_20110907_075807_EX1105_MB.all	WG	
9/07/2011	0436_20110907_083700_EX1105_MB.all	WG	
9/07/2011	0437_20110907_085057_EX1105_MB.all	WG	
9/07/2011	0438_20110907_095052_EX1105_MB.all	WG	
9/07/2011	0439_20110907_104855_EX1105_MB.all	WG	
9/07/2011	0440_20110907_105503_EX1105_MB.all	WG	
9/07/2011	0441_20110907_112346_EX1105_MB.all	WG	
9/07/2011	0442_20110907_122348_EX1105_MB.all	WG	
9/07/2011	0443_20110907_123430_EX1105_MB.all	WG	
9/07/2011	0444_20110907_124917_EX1105_MB.all	WG	
9/07/2011	0445_20110907_125810_EX1105_MB.all	WG	
9/07/2011	0446_20110907_130633_EX1105_MB.all	WG	
9/07/2011	0447_20110907_134046_EX1105_MB.all	WG	
9/07/2011	0448_20110907_144050_EX1105_MB.all	WG	
9/07/2011	0449_20110907_154046_EX1105_MB.all	WG	
9/07/2011	0450_20110907_154846_EX1105_MB.all	WG	
9/07/2011	0451_20110907_155404_EX1105_MB.all	WG	
9/07/2011	0452_20110907_165402_EX1105_MB.all	WG	
9/07/2011	0453_20110907_175406_EX1105_MB.all	WG	
9/07/2011	0454_20110907_180858_EX1105_MB.all	WG	
9/07/2011	0456_20110907_183118_EX1105_MB.all	WG	
9/07/2011	0457_20110907_193117_EX1105_MB.all	WG	
9/07/2011	0458_20110907_203117_EX1105_MB.all	WG	
9/07/2011	0459_20110907_210616_EX1105_MB.all	WG	
9/07/2011	0460_20110907_211933_EX1105_MB.all	WG	
9/07/2011	0461_20110907_221931_EX1105_MB.all	WG	
9/07/2011	0462_20110907_230124_EX1105_MB.all	WG	
9/08/2011	0463_20110908_000119_EX1105_MB.all	WG	
9/08/2011	0464_20110908_002054_EX1105_MB.all	WG	
9/08/2011	0465_20110908_005007_EX1105_MB.all	WG	

9/08/2011	0466_20110908_012855_EX1105_MB.all	WG	
9/08/2011	0467_20110908_013205_EX1105_MB.all	WG	
9/08/2011	0468_20110908_013855_EX1105_MB.all	WG	
9/08/2011	0469_20110908_014124_EX1105_MB.all	WG	
9/08/2011	0470_20110908_014130_EX1105_MB.all	WG	
9/08/2011	0471_20110908_020453_EX1105_MB.all	WG	
9/08/2011	0472_20110908_020947_EX1105_MB.all	WG	
9/08/2011	0473_20110908_022003_EX1105_MB.all	WG	
9/08/2011	0474_20110908_032001_EX1105_MB.all	WG	
9/08/2011	0475_20110908_040259_EX1105_MB.all	WG	
9/08/2011	0476_20110908_050300_EX1105_MB.all	WG	
9/08/2011	0477_20110908_055447_EX1105_MB.all	WG	
9/08/2011	0478_20110908_062347_EX1105_MB.all	WG	
9/08/2011	0479_20110908_070036_EX1105_MB.all	WG	
9/08/2011	0480_20110908_080036_EX1105_MB.all	WG	
9/08/2011	0481_20110908_090039_EX1105_MB.all	WG	
9/08/2011	0482_20110908_092923_EX1105_MB.all	WG	
9/08/2011	0483_20110908_094345_EX1105_MB.all	WG	
9/08/2011	0484_20110908_100235_EX1105_MB.all	WG	
9/08/2011	0485_20110908_110001_EX1105_MB.all	WG	
9/08/2011	0486_20110908_120002_EX1105_MB.all	WG	
9/08/2011	0487_20110908_130001_EX1105_MB.all	WG	
9/08/2011	0488_20110908_132741_EX1105_MB.all	WG	
9/08/2011	0489_20110908_134712_EX1105_MB.all	WG	
9/08/2011	0490_20110908_144710_EX1105_MB.all	WG	
9/08/2011	0491_20110908_154712_EX1105_MB.all	WG	
9/08/2011	0492_20110908_160633_EX1105_MB.all	WG	
9/08/2011	0493_20110908_162233_EX1105_MB.all	WG	
9/08/2011	0494_20110908_165133_EX1105_MB.all	WG	
9/08/2011	0495_20110908_172727_EX1105_MB.all	WG	
9/08/2011	0496_20110908_181250_EX1105_MB.all	WG	
9/08/2011	0497_20110908_182247_EX1105_MB.all	WG	
9/08/2011	0498_20110908_192245_EX1105_MB.all	WG	
9/08/2011	0499_20110908_193259_EX1105_MB.all	WG	
9/08/2011	0500_20110908_200111_EX1105_MB.all	WG	
9/08/2011	0501_20110908_201233_EX1105_MB.all	WG	
9/08/2011	0502_20110908_210155_EX1105_MB.all	WG	
9/08/2011	0503_20110908_214221_EX1105_MB.all	WG	
9/08/2011	0504_20110908_215707_EX1105_MB.all	WG	
9/08/2011	0505_20110908_225709_EX1105_MB.all	WG	
9/08/2011	0506_20110908_234822_EX1105_MB.all	WG	

9/09/2011	0507_20110909_000317_EX1105_MB.all	WG	
9/09/2011	0508_20110909_000822_EX1105_MB.all	WG	
9/09/2011	0509_20110909_010819_EX1105_MB.all	WG	
9/09/2011	0510_20110909_020819_EX1105_MB.all	WG	
9/09/2011	0511_20110909_021049_EX1105_MB.all	WG	
9/09/2011	0512_20110909_022300_EX1105_MB.all	WG	
9/09/2011	0513_20110909_032301_EX1105_MB.all	WG	
9/09/2011	0514_20110909_040004_EX1105_MB.all	WG	
9/09/2011	0515_20110909_043229_EX1105_MB.all	WG	
9/09/2011	0516_20110909_044141_EX1105_MB.all	WG	
9/09/2011	0517_20110909_050001_EX1105_MB.all	WG	
9/09/2011	0518_20110909_060002_EX1105_MB.all	WG	
9/09/2011	0519_20110909_070002_EX1105_MB.all	WG	
9/09/2011	0520_20110909_071130_EX1105_MB.all	WG	
9/09/2011	0521_20110909_072100_EX1105_MB.all	WG	
9/09/2011	0522_20110909_080004_EX1105_MB.all	WG	
9/09/2011	0523_20110909_090001_EX1105_MB.all	WG	
9/09/2011	0524_20110909_095237_EX1105_MB.all	WG	
9/09/2011	0525_20110909_100248_EX1105_MB.all	WG	
9/09/2011	0526_20110909_110249_EX1105_MB.all	WG	
9/09/2011	0527_20110909_120246_EX1105_MB.all	WG	
9/09/2011	0528_20110909_125520_EX1105_MB.all	WG	
9/09/2011	0529_20110909_132158_EX1105_MB.all	WG	
9/09/2011	0530_20110909_132544_EX1105_MB.all	WG	
9/09/2011	0531_20110909_134853_EX1105_MB.all	WG	
9/09/2011	0532_20110909_141313_EX1105_MB.all	WG	
9/09/2011	0533_20110909_142534_EX1105_MB.all	WG	
9/09/2011	0534_20110909_145646_EX1105_MB.all	WG	
9/09/2011	0535_20110909_145818_EX1105_MB.all	WG	
9/09/2011	0536_20110909_152512_EX1105_MB.all	WG	
9/09/2011	0537_20110909_153142_EX1105_MB.all	WG	
9/09/2011	0538_20110909_163142_EX1105_MB.all	Transit to shallow survey	
9/09/2011	0539_20110909_173141_EX1105_MB.all	Transit to shallow survey 1	
9/09/2011	0540_20110909_174425_EX1105_MB.all	Transit to shallow survey 1	
9/09/2011	0541_20110909_180202_EX1105_MB.all	Transit to shallow survey 1	
9/09/2011	0542_20110909_190203_EX1105_MB.all	Shallow survey 1	
9/09/2011	0543_20110909_190522_EX1105_MB.all	Shallow survey 1	
9/09/2011	0544_20110909_192917_EX1105_MB.all	Shallow survey 1	
9/09/2011	0545_20110909_193700_EX1105_MB.all	Shallow survey 1	

9/09/2011	0546_20110909_200053_EX1105_MB.all	Shallow survey 1	
9/09/2011	0547_20110909_200829_EX1105_MB.all	Shallow survey 1	
9/09/2011	0548_20110909_202858_EX1105_MB.all	Shallow survey 1	
9/09/2011	0549_20110909_203650_EX1105_MB.all	Shallow survey 1	
9/09/2011	0550_20110909_210017_EX1105_MB.all	Shallow survey 1	
9/09/2011	0551_20110909_210806_EX1105_MB.all	Shallow survey 1	
9/09/2011	0552_20110909_212851_EX1105_MB.all	Shallow survey 1	
9/09/2011	0553_20110909_215711_EX1105_MB.all	Shallow survey 1	
9/09/2011	0554_20110909_220459_EX1105_MB.all	Shallow survey 1	
9/09/2011	0555_20110909_222621_EX1105_MB.all	Shallow survey 1	
9/09/2011	0556_20110909_223508_EX1105_MB.all	Shallow survey 1	
9/09/2011	0557_20110909_225530_EX1105_MB.all	Transit to shallow survey 2	
9/09/2011	0558_20110909_235529_EX1105_MB.all	Transit to shallow survey 2	
9/10/2011	0559_20110910_000159_EX1105_MB.all	Shallow survey 2	
9/10/2011	0560_20110910_001207_EX1105_MB.all	Shallow survey 2	
9/10/2011	0561_20110910_001509_EX1105_MB.all	Shallow survey 2	
9/10/2011	0562_20110910_002622_EX1105_MB.all	Transit to Pascagoula	
9/10/2011	0563_20110910_012622_EX1105_MB.all	Transit to Pascagoula	
9/10/2011	0564_20110910_022622_EX1105_MB.all	Transit to Pascagoula	
9/10/2011	0565_20110910_032623_EX1105_MB.all	Transit to Pascagoula	
9/10/2011	0566_20110910_040652_EX1105_MB.all	Transit to Pascagoula	
9/10/2011	0567_20110910_043635_EX1105_MB.all	Transit to Pascagoula	
9/10/2011	0568_20110910_044346_EX1105_MB.all	Transit to Pascagoula	
9/10/2011	0569_20110910_054346_EX1105_MB.all	Transit to Pascagoula	
9/10/2011	0570_20110910_064346_EX1105_MB.all	Transit to Pascagoula	
9/10/2011	0571_20110910_074346_EX1105_MB.all	Transit to Pascagoula	
9/10/2011	0572_20110910_084346_EX1105_MB.all	Transit to Pascagoula	
9/10/2011	0573_20110910_094346_EX1105_MB.all	Transit to Pascagoula	

Table 7c: Single beam EK 60 files collected during the cruise:

Date (GMT)	**EK 60 Line Filename**	**Location**	**Remarks**
8/22/2011	EX1105_EK60_-D20110822-T212703.raw		

8/22/2011	EX1105_EK60_-D20110822-T214156.raw		
8/22/2011	EX1105_EK60_-D20110822-T214525.raw		
8/22/2011	EX1105_EK60_-D20110822-T214803.raw		
8/22/2011	EX1105_EK60_-D20110822-T221346.raw		
8/22/2011	EX1105_EK60_-D20110822-T223254.raw		
8/22/2011	EX1105_EK60_-D20110822-T225444.raw		
8/22/2011	EX1105_EK60_-D20110823-T001157.raw		
8/22/2011	EX1105_EK60_-D20110823-T031639.raw		
8/22/2011	EX1105_EK60_-D20110823-T032202.raw		
8/23/2011	EX1105_EK60_-D20110823-T032213.raw		
8/23/2011	EX1105_EK60_-D20110823-T065653.raw		
8/23/2011	EX1105_EK60_-D20110823-T093741.raw		
8/23/2011	EX1105_EK60_-D20110823-T093953.raw		
8/24/2011	EX1105_EK60_-D20110823-T205654.raw		
8/24/2011	EX1105_EK60_-D20110824-T051035.raw		
8/24/2011	EX1105_EK60_-D20110824-T155306.raw		
8/25/2011	EX1105_EK60_-D20110825-T002416.raw		
8/25/2011	EX1105_EK60_-D20110825-T094844.raw		
8/25/2011	EX1105_EK60_-D20110825-T152338.raw		
8/25/2011	EX1105_EK60_-D20110825-T191336.raw		
8/25/2011	EX1105_EK60_-D20110825-T193455.raw		
8/25/2011	EX1105_EK60_-D20110825-T194352.raw		
8/25/2011	EX1105_EK60_-D20110826-T012623.raw		
8/25/2011	EX1105_EK60_-D20110826-T025436.raw		
8/26/2011	EX1105_EK60_-D20110826-T030135.raw		
8/26/2011	EX1105_EK60_-D20110826-T072447.raw		
8/26/2011	EX1105_EK60_-D20110826-T101219.raw		
8/26/2011	EX1105_EK60_-D20110826-T144005.raw		
8/26/2011	EX1105_EK60_-D20110826-T185703.raw		
8/26/2011	EX1105_EK60_-D20110826-T230847.raw		
8/27/2011	EX1105_EK60_-D20110827-T031053.raw		
8/27/2011	EX1105_EK60_-D20110827-T070018.raw		
8/27/2011	EX1105_EK60_-D20110827-T121112.raw		
8/27/2011	EX1105_EK60_-D20110827-T165812.raw		
8/27/2011	EX1105_EK60_-D20110827-T203116.raw		
8/27/2011	EX1105_EK60_-D20110827-T203201.raw		

8/28/2011	EX1105_EK60_-D20110828-T014452.raw		
8/28/2011	EX1105_EK60_-D20110828-T061319.raw		
8/28/2011	EX1105_EK60_-D20110828-T105302.raw		
8/28/2011	EX1105_EK60_-D20110828-T152743.raw		
8/28/2011	EX1105_EK60_-D20110828-T200405.raw		
8/29/2011	EX1105_EK60_-D20110829-T003847.raw		
8/29/2011	EX1105_EK60_-D20110829-T050610.raw		
8/29/2011	EX1105_EK60_-D20110829-T094235.raw		
8/29/2011	EX1105_EK60_-D20110829-T141033.raw		
8/29/2011	EX1105_EK60_-D20110829-T175714.raw		
8/29/2011	EX1105_EK60_-D20110829-T183309.raw		
8/29/2011	EX1105_EK60_-D20110829-T185458.raw		
8/29/2011	EX1105_EK60_-D20110829-T230127.raw		
8/30/2011	EX1105_EK60_-D20110830-T033357.raw		
8/30/2011	EX1105_EK60_-D20110830-T075856.raw		
8/30/2011	EX1105_EK60_-D20110830-T110717.raw		
8/30/2011	EX1105_EK60_-D20110830-T110854.raw		
8/30/2011	EX1105_EK60_-D20110830-T135240.raw		
8/30/2011	EX1105_EK60_-D20110830-T170611.raw		
8/30/2011	EX1105_EK60_-D20110830-T195030.raw		
8/30/2011	EX1105_EK60_-D20110830-T230051.raw		
8/31/2011	EX1105_EK60_-D20110831-T015744.raw		
8/31/2011	EX1105_EK60_-D20110831-T044452.raw		
8/31/2011	EX1105_EK60_-D20110831-T074859.raw		
8/31/2011	EX1105_EK60_-D20110831-T105112.raw		
8/31/2011	EX1105_EK60_-D20110831-T134623.raw		
8/31/2011	EX1105_EK60_-D20110831-T162851.raw		
8/31/2011	EX1105_EK60_-D20110831-T192119.raw		
8/31/2011	EX1105_EK60_-D20110831-T221806.raw		
9/1/2011	EX1105_EK60_-D20110901-T011351.raw		
9/1/2011	EX1105_EK60_-D20110901-T040908.raw		
9/1/2011	EX1105_EK60_-D20110901-T065740.raw		
9/1/2011	EX1105_EK60_-D20110901-T093733.raw		
9/1/2011	EX1105_EK60_-D20110901-T124349.raw		
9/1/2011	EX1105_EK60_-D20110901-T153802.raw		
9/1/2011	EX1105_EK60_-D20110901-T183923.raw		

9/1/2011	EX1105_EK60_-D20110901-T212820.raw		
9/1/2011	EX1105_EK60_-D20110902-T002415.raw		
9/2/2011	EX1105_EK60_-D20110902-T030941.raw		
9/2/2011	EX1105_EK60_-D20110902-T060730.raw		
9/2/2011	EX1105_EK60_-D20110902-T092838.raw		
9/2/2011	EX1105_EK60_-D20110902-T122033.raw		
9/2/2011	EX1105_EK60_-D20110902-T151034.raw		
9/2/2011	EX1105_EK60_-D20110902-T180631.raw		
9/2/2011	EX1105_EK60_-D20110902-T205124.raw		
9/2/2011	EX1105_EK60_-D20110902-T233331.raw		
9/2/2011	EX1105_EK60_-D20110903-T021521.raw		
9/3/2011	EX1105_EK60_-D20110903-T035224.raw		
9/3/2011	EX1105_EK60_-D20110903-T071222.raw		
9/3/2011	EX1105_EK60_-D20110903-T101804.raw		
9/3/2011	EX1105_EK60_-D20110903-T125909.raw		
9/3/2011	EX1105_EK60_-D20110903-T153315.raw		
9/3/2011	EX1105_EK60_-D20110903-T183551.raw		
9/3/2011	EX1105_EK60_-D20110903-T211021.raw		
9/3/2011	EX1105_EK60_-D20110904-T000335.raw		
9/4/2011	EX1105_EK60_-D20110904-T025827.raw		
9/4/2011	EX1105_EK60_-D20110904-T054837.raw		
9/4/2011	EX1105_EK60_-D20110904-T084722.raw		
9/4/2011	EX1105_EK60_-D20110904-T115935.raw		
9/4/2011	EX1105_EK60_-D20110904-T150027.raw		
9/4/2011	EX1105_EK60_-D20110904-T180127.raw		
9/4/2011	EX1105_EK60_-D20110904-T210246.raw		
9/4/2011	EX1105_EK60_-D20110904-T235108.raw		
9/5/2011	EX1105_EK60_-D20110905-T025208.raw		
9/5/2011	EX1105_EK60_-D20110905-T060942.raw		
9/5/2011	EX1105_EK60_-D20110905-T092903.raw		
9/5/2011	EX1105_EK60_-D20110905-T124246.raw		
9/5/2011	EX1105_EK60_-D20110905-T155242.raw		
9/5/2011	EX1105_EK60_-D20110905-T191357.raw		
9/5/2011	EX1105_EK60_-D20110905-T222900.raw		
9/6/2011	EX1105_EK60_-D20110906-T012838.raw		
9/6/2011	EX1105_EK60_-D20110906-T041628.raw		

9/6/2011	EX1105_EK60_-D20110906-T065415.raw		
9/6/2011	EX1105_EK60_-D20110906-T093046.raw		
9/6/2011	EX1105_EK60_-D20110906-T120530.raw		
9/6/2011	EX1105_EK60_-D20110906-T144232.raw		
9/6/2011	EX1105_EK60_-D20110906-T172256.raw		
9/6/2011	EX1105_EK60_-D20110906-T202350.raw		
9/6/2011	EX1105_EK60_-D20110906-T232556.raw		
9/7/2011	EX1105_EK60_-D20110907-T021742.raw		
9/7/2011	EX1105_EK60_-D20110907-T050823.raw		
9/7/2011	EX1105_EK60_-D20110907-T080154.raw		
9/7/2011	EX1105_EK60_-D20110907-T100209.raw		
9/7/2011	EX1105_EK60_-D20110907-T124721.raw		
9/7/2011	EX1105_EK60_-D20110907-T154025.raw		
9/7/2011	EX1105_EK60_-D20110907-T181004.raw		
9/7/2011	EX1105_EK60_-D20110907-T185349.raw		
9/7/2011	EX1105_EK60_-D20110907-T214129.raw		
9/7/2011	EX1105_EK60_-D20110908-T002610.raw		
9/8/2011	EX1105_EK60_-D20110908-T030727.raw		
9/8/2011	EX1105_EK60_-D20110908-T055140.raw		
9/8/2011	EX1105_EK60_-D20110908-T083223.raw		
9/8/2011	EX1105_EK60_-D20110908-T111152.raw		
9/8/2011	EX1105_EK60_-D20110908-T135809.raw		
9/8/2011	EX1105_EK60_-D20110908-T165820.raw		
9/8/2011	EX1105_EK60_-D20110908-T201130.raw		
9/8/2011	EX1105_EK60_-D20110908-T232909.raw		
9/9/2011	EX1105_EK60_-D20110909-T024029.raw		
9/9/2011	EX1105_EK60_-D20110909-T055457.raw		
9/9/2011	EX1105_EK60_-D20110909-T085556.raw		
9/9/2011	EX1105_EK60_-D20110909-T120429.raw		
9/9/2011	EX1105_EK60_-D20110909-T150415.raw		
9/9/2011	EX1105_EK60_-D20110909-T175620.raw		
9/9/2011	EX1105_EK60_-D20110909-T204607.raw		
9/9/2011	EX1105_EK60_-D20110909-T232556.raw		
9/10/2011	EX1105_EK60_-D20110910-T021239.raw		
9/10/2011	EX1105_EK60_-D20110910-T045926.raw		
9/10/2011	EX1105_EK60_-D20110910-T073535.raw		

Table 7d: Knudsen subbottom profiler files (SGY format) collected during the cruise:

Date (GMT)	Knudsen SEGY files	Location	Remarks
08/23/2011	0001_2011_235_1410_70870_3.5kHz_000.sgy		
08/23/2011	0001_2011_235_1412_70870_5.0kHz_001.sgy		
08/23/2011	0001_2011_235_1412_70870_5.0kHz_002.sgy		
08/23/2011	0002_2011_235_1437_70870_5.0kHz_003.sgy		
08/23/2011	0002_2011_235_1439_70870_11.0kHz_004.sgy		
08/23/2011	0002_2011_235_1440_70870_11.0kHz_005.sgy		
08/23/2011	0003_2011_235_1532_70870_11.0kHz_006.sgy		
08/23/2011	0003_2011_235_1542_70870_5.0kHz_007.sgy		
08/23/2011	0003_2011_235_1543_70870_5.0kHz_008.sgy		
08/25/2011	0001_2011_237_1631_70870_5.0kHz_000.sgy		
08/25/2011	0001_2011_237_1634_70870_5.0kHz_001.sgy		
08/25/2011	0001_2011_237_1634_70870_5.0kHz_002.sgy		
08/25/2011	0001_2011_237_1637_70870_5.0kHz_003.sgy		
08/25/2011	0001_2011_237_1638_70870_5.0kHz_004.sgy		
08/25/2011	0001_2011_237_1647_70870_5.0kHz_005.sgy		
08/25/2011	0001_2011_237_1649_70870_5.0kHz_006.sgy		
08/25/2011	0001_2011_237_1701_70870_5.0kHz_007.sgy		
08/25/2011	0001_2011_237_1704_70870_5.0kHz_008.sgy		
08/25/2011	0002_2011_237_1723_70870_5.0kHz_009.sgy		
08/25/2011	0002_2011_237_1725_70870_5.0kHz_010.sgy		
08/25/2011	0002_2011_237_1726_70870_5.0kHz_011.sgy		
08/25/2011	0002_2011_237_1727_70870_5.0kHz_012.sgy		
08/25/2011	0002_2011_237_1822_70870_6.0kHz_013.sgy		
08/25/2011	0002_2011_237_1824_70870_7.0kHz_014.sgy		
08/25/2011	0002_2011_237_1827_70870_5.0kHz_015.sgy		
08/27/2011	0003_2011_239_1609_70870_5.0kHz_016.sgy		
08/27/2011	0004_2011_239_1647_70870_5.0kHz_017.sgy		
08/27/2011	0004_2011_239_1657_70870_5.0kHz_018.sgy		
08/27/2011	0004_2011_239_1731_70870_5.0kHz_019.sgy		
08/27/2011	0005_2011_239_1735_70870_5.0kHz_020.sgy		
08/27/2011	0005_2011_239_1843_70870_5.0kHz_021.sgy		

08/27/2011	0006_2011_239_1907_70870_5.0kHz_002.sgy		
08/27/2011	0007_2011_239_1929_70870_5.0kHz_003.sgy		
08/29/2011	0007_2011_241_1933_70870_5.0kHz_004.sgy		
08/29/2011	0007_2011_241_1933_70870_5.0kHz_005.sgy		
08/29/2011	0008_2011_241_1941_70870_5.0kHz_006.sgy		
08/29/2011	0009_2011_241_2005_70870_5.0kHz_007.sgy		
08/29/2011	0010_2011_241_2018_70870_5.0kHz_008.sgy		
08/29/2011	0011_2011_241_2035_70870_5.0kHz_009.sgy		

Table 7e: Knudsen subbottom profiler files (KEB/KEAB format) collected during the cruise:

Date (GMT)	Knudsen KEB files	Knudsen KEA files	Remarks
08/23/2011	0001_2011_235_1410_000.keb	0001_2011_235_1410_000.kea	
08/23/2011	0002_2011_235_1437_000.keb	0002_2011_235_1437_000.kea	
08/23/2011	0003_2011_235_1532_001.keb	0003_2011_235_1532_001.kea	
08/25/2011	0001_2011_237_1631_000.keb	0001_2011_237_1631_000.kea	
08/25/2011	0002_2011_237_1723_001.keb	0002_2011_237_1723_001.kea	
08/27/2011	0003_2011_239_1609_000.keb	0003_2011_239_1609_000.kea	
08/27/2011	0004_2011_239_1647_001.keb	0004_2011_239_1647_001.kea	
08/27/2011	0005_2011_239_1735_002.keb	0005_2011_239_1735_002.kea	
08/27/2011	0006_2011_239_1907_000.keb	0006_2011_239_1907_000.kea	
08/27/2011	0007_2011_239_1929_001.keb	0007_2011_239_1929_001.kea	
08/29/2011	0008_2011_241_1941_002.keb	0008_2011_241_1941_002.kea	
08/29/2011	0009_2011_241_2005_003.keb	0009_2011_241_2005_003.kea	
08/29/2011	0010_2011_241_2018_004.keb	0010_2011_241_2018_004.kea	
08/29/2011	0011_2011_241_2035_005.keb	0011_2011_241_2035_005.kea	

Table 7f: CTD vertical casts and water samples collected during the cruise:

CTD station	Date	Position	Sensors	Water Samples Collected (Depth/m)

8. References:

1. Project Instructions, EX 11-05, NOAA Ship *Okeanos Explorer*, July 2011.

Appendices

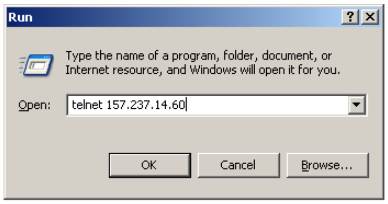
Appendix A: Optimizing EM302 Settings for Water Column Imaging

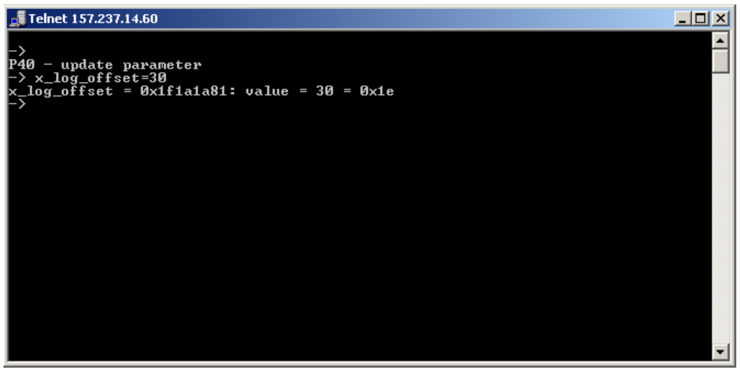
Jonathan Beaudoin
Center for Coastal and Ocean Mapping/Joint Hydrographic Center
University of New Hampshire
Sept. 7, 2011
NOAA Ship Okeanos Explorer

TVG offset

The water column data has its own unique time-varying gain (TVG) function applied that is independent of the TVG applied for bottom detection and seabed imagery data. The nominal range of the water column data, as stored on disk, is -64 dB to 63 dB. Signals below or above this range are clipped. It is possible to avoid clipping the weak scatters that we are seeking to image by modifying the TVG parameters for the water column data. This is done by starting a telnet session to the TRU cabinet from the SIS machine:

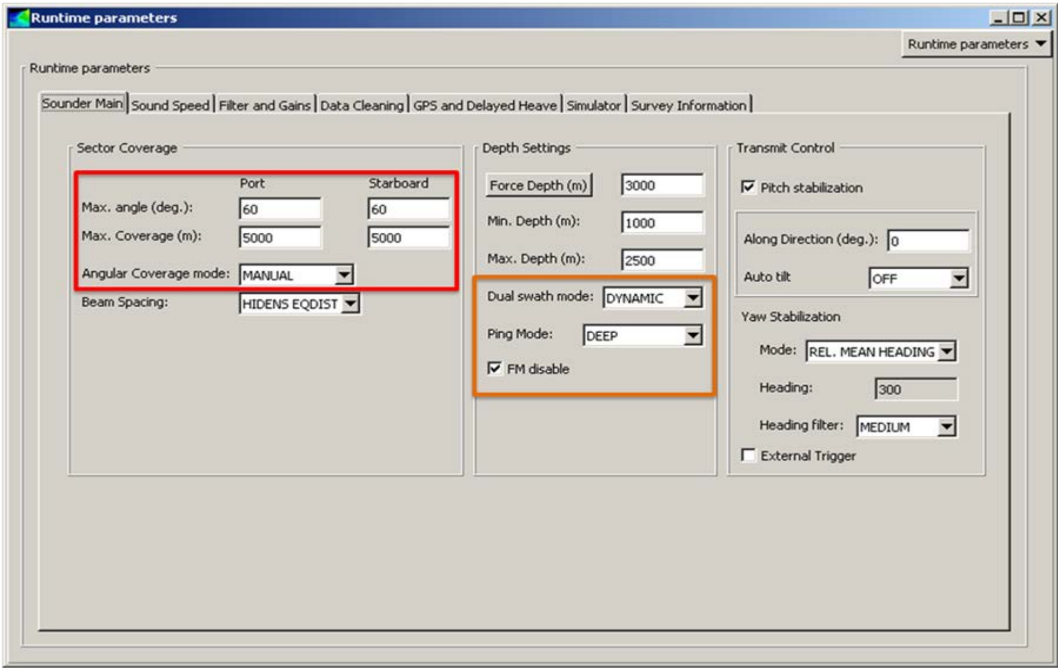
1. Click the Windows button on the taskbar and choose "Run".
2. Type "telnet 157.237.14.60", this will open a DOS command window with a telnet session actively connected to the TRU.
3. Type the following: x_log_offset=30 This will update the TVG to use an additional 30 dB gain (the default is 0 dB). The TRU should report back the typed command the value being used for the TVG offset
4. Type "exit".





The above procedure must be repeated whenever the power is cycled on the TRU. If this procedure is not completed, then data whose level falls below -64dB will be lost.

Runtime Parameters



Sector Coverage

Setting the Angular Coverage Mode to "Automatic" will displace, grow or shrink the receiver beam fan to optimize the bottom detection quality across the swath. Though this is desirable from a bathymetric mapping point of view, it can be make further water column signal processing difficult as one can no longer assume that a given receive beam is at a fixed angle with respect to the vertical or within the same transmitter sector. For water column data acquisition, it is helpful to set the angular coverage mode to "Manual" with "Max. angle" values appropriate to the water depth. It is noteworthy that when the system runs in "Automatic" angular coverage mode that it will shrink the receiver coverage sector when faced with weak bottom returns at the outer edges of the swath. If water column mapping is the primary focus of the mission, then it may instead be desirable to allow for increased angular coverage despite the fact that the system cannot track the seabed at these angles. For example, in automatic mode you may find that the system selects +/-55° based on seabed return signal quality, however, water column imaging may still be possible over a much wider sector, e.g. +/-65°. Increasing the angular coverage must be balanced against a decrease in along-track density that comes with the reduced ping rate associated with large angular coverage.

Depth Settings

Dual swath sounding allows for increased along-track data density and/or faster survey speeds by essentially firing a second ping shortly after the first. The swaths are adjusted in the fore-aft direction such that one ensonifies an area slightly aft of the vessel and the other ensonifies an area slightly forward. The FIXED mode will set the fore and aft swaths at a fixed angle whereas the DYNAMIC mode will adjust the angular spacing to ensure a fixed along track sampling density to account for changes in vessel speed and water depth. The DYNAMIC mode is likely the better of the two as it attempts to maintain a constant along-track sampling density on the seafloor, however, it should be noted that this is not necessarily the case for water column targets, especially those in the upper part of the water column.

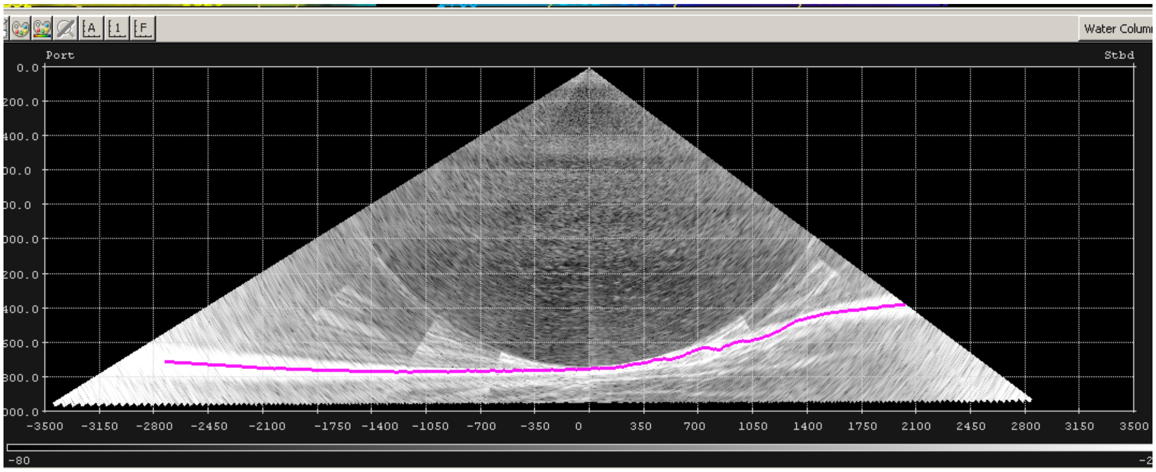
With the Ping Mode set to automatic, the system will choose an appropriate mode of operation depending on the water depth and return signal quality. In our experience, water column imaging artifacts can vary slightly or even dramatically between the various modes and some experimentation should be done to find a mode of operation that produces data of sufficient quality for the purpose of the mission. For our particular mission (mapping natural gas seeps), we desired a long pulse length to increase our chances of detecting weak scatterers in the water column so we chose to run in DEEP mode regardless of the water depth. Other water column mapping missions may have other priorities though and the table of mode characteristics should be consulted since the pulse length, number of transmit sectors and their operating frequencies all vary with Ping Mode. Furthermore, test data should be acquired using FM mode enabled and disabled (for the modes of operation that support both pulse waveforms) to determine if water column imagery quality varies with waveform type. Given the variety of data quality from one mode to the next, it is important to set aside time early in the cruise to assess the different Ping Modes and determine which is best suited for the mission at hand.

Transmit Control

Pitch and yaw stabilization is desirable as these both lessen the uncertainty in positioning with water column imagery that is not corrected for motion of the vessel. Currently, there is no commercially available software to fully geo-register water column imagery and it is thus advantageous to have the data compensated for motion in real-time such that the ensonified volume closely approximates a plane orthogonal to the vessel track.

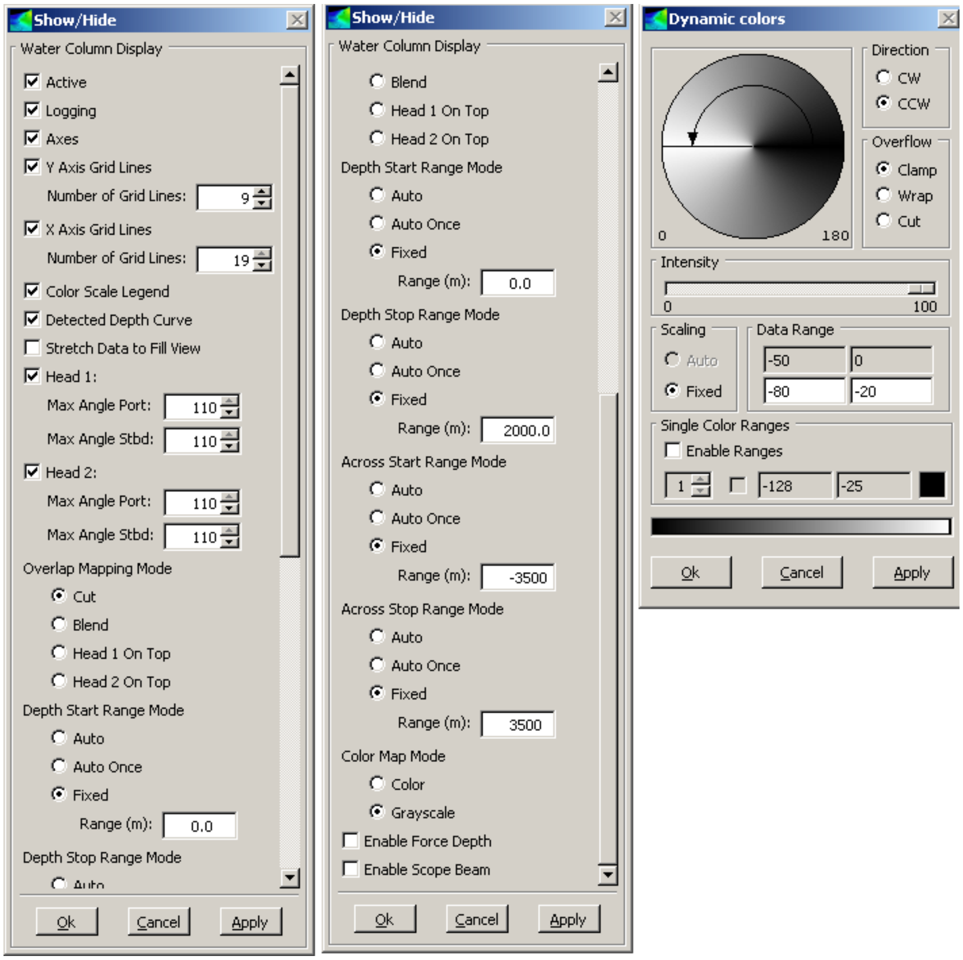
Real-Time Visualization

Real-time visualization parameters can be optimized to increase the utility of the water column data display for quality control such that watch standers can monitor data quality for problems such as ship noise, interference from other sounders or weather related signal degradation. Suggested settings are a fixed depth and across track scale with integer tickmarks such that the operator can quickly ascertain the vessel relative coordinates of any water column targets. When attempting to find water column targets, it is paticularly inconvenient if the reference frame in the image changes from swath to swath. Fixing the image scale may be of particular importance for operations where the water column display imagery is used to help coordinate other operations such as CTD or ROV.



Fixing the image scale can be done through the “Show/Hide” interface which is accessed via the top left button in the water column imagery display. The “Depth Start Range Mode” and “Depth Stop Range Mode” should be set to fixed with reasonable scale values entered (e.g. image should stretch vertically from X meters to Y meters). The same is done for the “Across Start Range Mode” and “Across Stop Range Mode”. The number of grid lines are then set for both the X and Y Axes. This particular procedure is non-intuitive and some experimentation will be required to get a particular combination of Start/Stop range and number of grid lines to give reasonable (and usable) scales on the image. A more intuitive procedure would be to set the grid interval, however, this is not currently possible in SIS.

The color scaling for the image should be set to “Fixed” as well to maintain consistent imagery coloring from ping to ping that is visually easier to maintain watch over. The Data Range should be adjusted to avoid visually clipping the weaker targets, such as plumes, from the display (-80dB in the case below). Bringing the upper end of the scale down below or near the level of the bottom returns allows for an increase in contrast for water column scatterers at the expense of visually clipping the seabed returns. Note that these settings affect the display only and do not affect the data.



Once the settings are optimized, it is suggested that the current frame layout and settings are saved as a new set of settings for water column mapping operations.

System Tuning

As mentioned earlier, there may be a particular set of system settings that provide optimal data quality for the task at hand. It is suggested that the following parameters be considered:

1) Ping Mode: dictates pulse lengths, transmit sector geometry and angular coverage (deeper modes may restrict the angular coverage even when used in water depths where the system is not attenuation limited at the outer edges of the swath)
2) Pulse wave form: CW and/or FM, some modes allow for both waveforms with the “FM disable” setting in the runtime parameters tab forcing the use of CW.
3) Dual swath versus single swath: water column artifacts, interference and noise levels may vary with the two modes of operation. Single swath may afford cleaner imagery however dual swath allows for increased along-track resolution at the expense of potential degradation of imagery quality due to imperfect normalization between the swath pairs (e.g. strobing effect).

4) Transmitter beamwidth. Though not mentioned in the configuration documentation above, it is possible to modify the beamwidth of the transmitter array. Depending on the nature of the mission, it may be desirable to increase the beamwidth to improve probability of detection. Though dual swath technology can virtually guarantee 100% along-track coverage on the seafloor, the same cannot be said of targets in the water column, especially if the system is actively optimizing transmitter steering to maintain coverage on the seafloor.

Though we can optimize the water column imagery display for real-time Q/A, this display is of limited use, particularly for system tuning, for several reasons:

1) The only mechanism to compare data quality is through screen grabs. This does not permit quantitative analysis of the data itself, only of the real-time display imagery.
2) Only one swath of the dual swath is displayed. Noise levels, artifacts and interference patterns cannot be assessed in the second swath.
3) The low ping rate in deep water can make this a particularly tedious and subjective exercise.

For these reasons, it is critical to assess data quality using post-processing software tools such as FM Midwater or SonarScope.

Appendix B: Kongsberg trip Report, submitted by: Tony Dahlheim

NOAA Vessel: Okeanos Explorer
EM302 update / EK60 18kHz calibration - Training

August 21st 2011 – August 23rd 2011

Coast Guard Station, Key West, Florida

Kongsberg Personnel on Vessel:

- Tony Dahlheim
- Jeff Condiotty

August 21st 2011

Met with Mashkoor Malik and other NOAA personnel aboard the vessel Okeanus Explorer. We discussed the EM302 update and the calibration proceedure of the EK60 18 kHz.

The decission was made that I perform a backup on the EM302 TRU and SIS while transisting to the EK60 calibration area. Once there we will log a line using the Exsisting EM302 SIS software version 3.6.4. Then we will update the EM302 TRU and SIS to current version 3.8.3 and log the same line. Comparrisions will be done by NOAA personnel to validate the data.

Once at the EK60 Calibration area the downriggers will be installed on vessel and the sphere attached and dropped overboard to begin the calibration of the EK60 18 Khz.

August 22nd 2011

Started back up of EM302 TRU and SIS during transist. First created an image of the HWS in which SIS runs on. Next I pulled the PU parameters and stored them on local drive under C:/em302/em302_bkup. I also took screen grabs of Installation settings, external sensors, and Set Parameters within SIS. Finally I exported the appropreate TRU files from the TRU and saved them to this directory.

The decission was made to start the EK60 18kHz calibration after back up was done. Installed outriggers to the appropreate locations on vessel decks and attached the 18kHz calibration sphere. Once the sphere was in the water, riggers were adjusted for line length and sphere was observed in the EK60 software window. Calibration was started and after some time about 50% of the calibration was performed before line broke off swivel on Straboard side. The decission was made by NOAA that they had enough information on how to perform the calibration, that they would perform one at later date before there testing at a specified location in the gulf.

August 23rd 2011

During the evening EM302 logged a two and half hour line at varring depths with the old version of software. After the line was run I performed the update to the TRU and the HWS which runs SIS. SIS was updated to reflect current version 3.8.3, PU parameters were imported and external sensors as well as Set Parameters were adjusted for Okeanus Explorer settings. The RX boards and TX boards firmware on the TRU were updated to current versions and all is operational.

Run time settings were adjusted in SIS to be the same settings as how the pervious line was run with the older version of software. After line was run NOAA validated the data and found that the system is running within specifications and there are no significant difference between these two data sets. The EM302 is running at full performance at this time.

Summary:

EM302 updated to 3.8.3 and fully operational. EK60 18kHz training provided to ship personnel and calibration will be performed by ship personnel again at later date.

Concerns:

- Found that stave 126 on receive array has a low db signal. Possible issue could be growth on receive array. Vessel should monitor this to see if it worst over time. Data being collected is still good.
- Recommend upgrading HWS in the future. As technology increases year by year the PC hardware platforms should be updated to accept new software that needs more processing power to run at peek performance.