CENTER FOR MARINE RESOURCES AND ENVIRONMENTAL TECHNOLOGY and SEABED TECHNOLOGY REASERCH CENTER UNIVERSITY OF MISSISSIPPI

Activities Report for Cruise GOM2-08-MC118 aboard the *R/V Pelican*
Integrated Data/Power Unit and Data Recovery System Deployment Cruise
Mississippi Canyon Federal Lease Block 118,
Northern Gulf of Mexico
May 31 to June 10, 2008
by
Ken Sleeper[1]

CRUISE OBJECTIVES

1) Installation of Seafloor Observatory Data Recovery System and Integrated Data/Power Unit.
2) Utilize the Station Service Device ROV to conduct a resistivity survey, collect geochemical and microbial instruments from the seafloor, and deploy two SeaSnap 360^0 cameras in active vent areas with exposed hydrates and microbial mat growths.

PARTICIPANTS

University of Mississippi: Center for Marine Resources and Environmental Technology (CMRET) and Seabed Technology Research Center (STRC):
Bob Woolsey, Ken Sleeper, Matt Lowe, Brian Noakes and Andy Gosset, science and technical staff
Baylor University
John Dunbar, scientific staff
Specialty Devices Inc.
Paul Higley, Scott Sharpe, Rob Higley, and David Galligan, technical and scientific staff
Texas A&M University, Corpus Christi
Ian Macdonald, scientific staff
Advanced Geosciences Inc.
Markus Lagmanson, technical staff
Florida State University
Laura Lapham and Jeff Chanton scientific staff
Mississippi State University
Rudy Rogers, scientific staff
Columbia University
Hannah Lee, student researcher
R/V Pelican Crew:
Craig LeBoeuf, Captain; Joe Thomas, First Mate; Jack Pennington, Chief Engineer; Sam LeBouef, Vessel Technician; Jordan Westmoreland, Marine Technician; Mike Borelon, Deck Hand; and Steve Joltki, Cook; and Max Wike as First Mate for second half of the cruise.

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INTRODUCTION

A scientific research cruise was undertaken to Mississippi Canyon Federal Lease Block 118 (Fig. 1) from May 31 to June 10, 2008 aboard the *R/V Pelican*. The primary objective of the cruise was to deploy key components of the seafloor observatory. These components include the central hub of the observatory (the Integrated Data/Power Unit) and the data recovery system. Secondary, but equally important, objectives of the cruise were to conduct an electrical resistivity survey, deploy time lapse cameras, and recover a hydrate collector and pore fluid samplers. These operations were all planned around the diverse capabilities of Station Service Device ROV. The activities of the cruise are summarized in this report along with sub-reports by each of the primary participants as appendices.

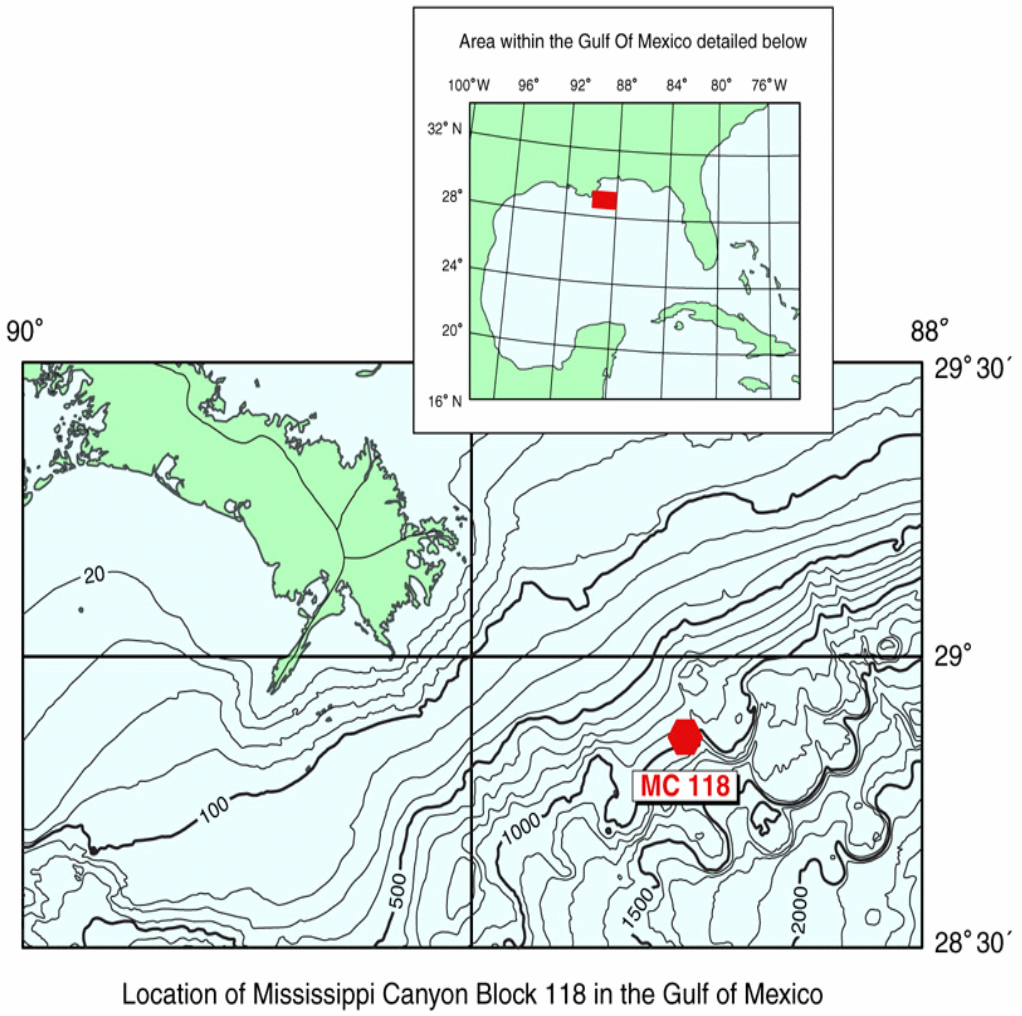

Figure 1. Location map of Mississippi Canyon Federal Lease Block 118.

SEAFLOOR OBSERVATORY INSTALLAION

The Integrated Data/Power Unit (IDP) and the Data Recovery System (DRS) are two key components of the seafloor observatory that were scheduled for deployment and installation on the cruise. The IDP functions as the central command and control unit of the observatory and is responsible for powering on and off arrays, issuing data collection parameters to systems connected to the IDP and for controlling data flow between sea floor systems and the Surface telemetry buoy via the DRS. The IDP (Fig 2) houses a micro-processor for controlling data loggers and power flow to external devices and is equipped with ten underwater, wet mateable, make-and-break connections for attaching multiple arrays or other experiments and battery systems to the unit. A fiber optic cable connects the IDP to the DRS for a high speed, high band width connection to the surface.

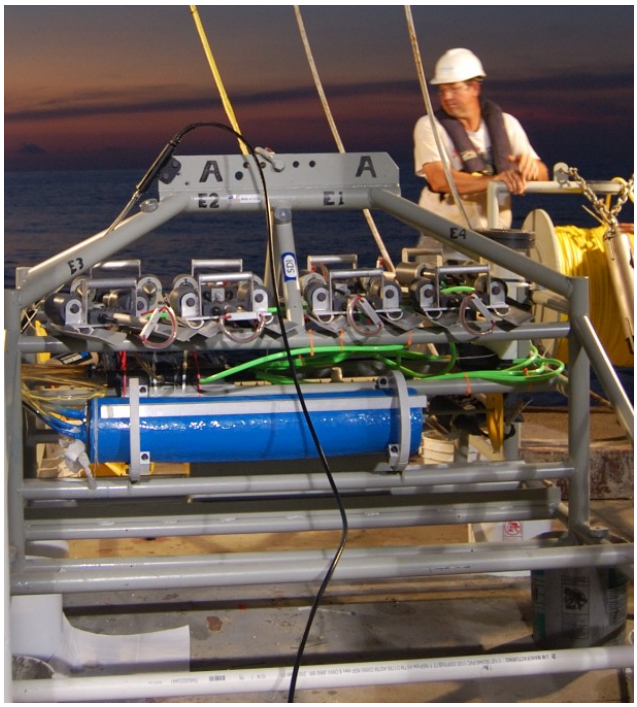

Figure 2. The Integrated Data/Power unit on the deck of the *Pelican* prior to deployment. The ROV latch-on bar is in the foreground and the central electronics package (blue) is mounted below a bank of underwater, ROV make-and-break connectors.

The DRS was originally planned to have a “Big M” type mooring with a recoverable buoy system suspended at mid-water depths (200 to 300m). The presence of long-liners in the area forced a redesign of this system. A new configuration in the shape of a “Big I” using a popup buoy was developed. Figure 3 is a cartoon of the observatory site that shows the DRS in sleep mode (dotted line) with the pop-up buoy on the seafloor and in active (Big I) mode where the popup buoy has been retrieved and a telemetry buoy has been connected to the fiber optic cable. As the popup buoy is a new, untested design, preliminary tests were conducted on this system prior to installation.

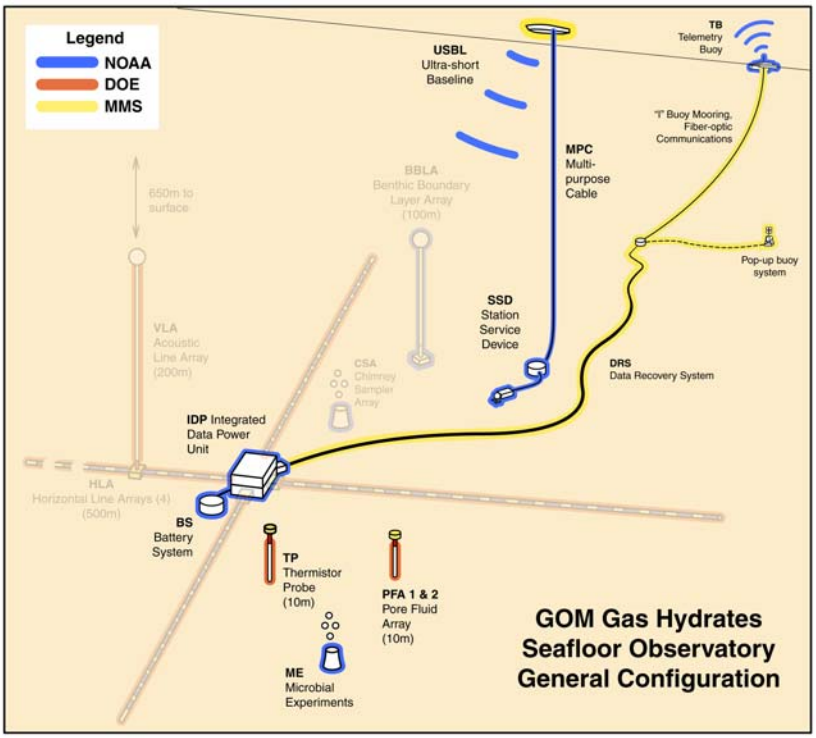

Figure 3. Cartoon of current configuration of the observatory. The IDP, DRS and Popup Buoy were deployed during this cruise. Color coded legend indicates contributions by major sponsors.

The cruise was delayed for two days while numerous dock side activities took place. These activities included spooling under tension cables onto the Institutes winch and the popup buoy and the bottom founded DRS, making final preparations on the IDP including completing connectors and corrosion protection, and conducting a dock-side flotation test of the Station Service Device ROV. LUMCON personnel took advantage of this time to complete the construction of an electric powered, retractable stiff-arm to facilitate installation and operations of the Ultra Short Base Line system (USBL). LUMCON personnel had mounted the Rochester multi-purpose cable on the trawl winch prior to our arrival.

On the morning of June 1st we arrived on site at MC118 and conducted the popup buoy test (Fig 4). For this test, only the buoy was sent to the seafloor and, once there, the acoustic releases were triggered to allow the floats to draw the Ultrex fiber rope to the surface. When the floats surfaced, the line was connected to the Institute's hydraulic winch and the buoy was retrieved from the seafloor. The test was a success, the line un-spooled as designed and the floats had more than enough buoyancy to keep the line from tangling. A mooring was subsequently deployed for calibrating the USBL system and recovered upon completion. One final floatation test was also made on a recoverable USBL transponder unit. This unit was designed to mount on or near the IDP to help guide the IDP during installation. After placement, the transponder would be recovered via a special release mechanism and float jacket developed to help prevent entanglement in the cables. The test was successful and activities turned toward the actual deployment of the components.

Figure 4. The Popup Buoy ready for deployment off the stern of the *Pelican*. At the base of the buoy is a cement weight to hold the assembly on the seafloor. Above the weight is a spool of ultrex rope (yellow drum) connected to an acoustic release. The release is anchored to the buoy below and a series of floats above (yellow hard hats). To retrieve the fiber optic cable from the IDP the acoustic release is triggered allowing the floats to rise while pulling the length of ultrex behind. Once surfaced, the floats can be retrieved and the ultrex rewound on board which brings the buoy and the attached fiber optic cable to the surface.

The IDP and DRS were to be deployed in one, long, continuous operation and on the evening of June 2nd, installation began. The computer on the IDP was put into sleep mode with instruction to wake up and begin listening for commands in late August 2008. The IDP was then lowered over the aft of the boat with the trawl winch while the ROC fiber optic cable and the Ultrex strength member were also fed out. These cables were zip tied together approximately every 1.5m (5ft) and a small amount of slack was provided, where possible, in the ROC cable between each zip tie. Once the IDP was lowered to about 10m from the seafloor, the boat positioned it for final installation. Placement of the IDP was within 10m of the pre-selected spot. Once the IDP was on the bottom, the boat continued to maneuver northward at a slow speed of 2 knots or less while the ROC and Ultrex cables were fed out and zip tied together. Once the first spool of ROC cable was deployed (approximately 1500m (4800 ft)), the ship held station while a fiber optic splice was made at a pre-fabricated junction mounted to a mid-weight. After the splice was made the second spool was deployed in a similar fashion as the boat slowly made its way northward until all the cable was paid out (approximately 1350m (4300ft)). The end of the ROC cable and the Ultrex line were then attached to the popup buoy and the popup buoy was lowered to the bottom on the trawl winch as the boat continued a slow northward tack or, if needed, held station. Once the popup buoy

was on the bottom the releases were triggered and trawl winch cable was rewound. The system was now installed. The process took about seven hours from start to finish and it was early morning hours before activities were completed and everything was collected and stowed away for the night. The entire scientific and technical staff assisted in the deployment and helped to keep the maze of cables and equipment aligned and untangled.

The IDP and DRS installation was successful and the placement was such that future arrays can easily be deployed and connected without fouling the system. Figure 5 shows the layout and location of the IDP, bottom-founded cable, mid-weight and popup buoy. The mid-weight provided a convenient place to make cable splice but also serves to isolate the IDP from any tug or pull on the cables when the popup buoy is in use.

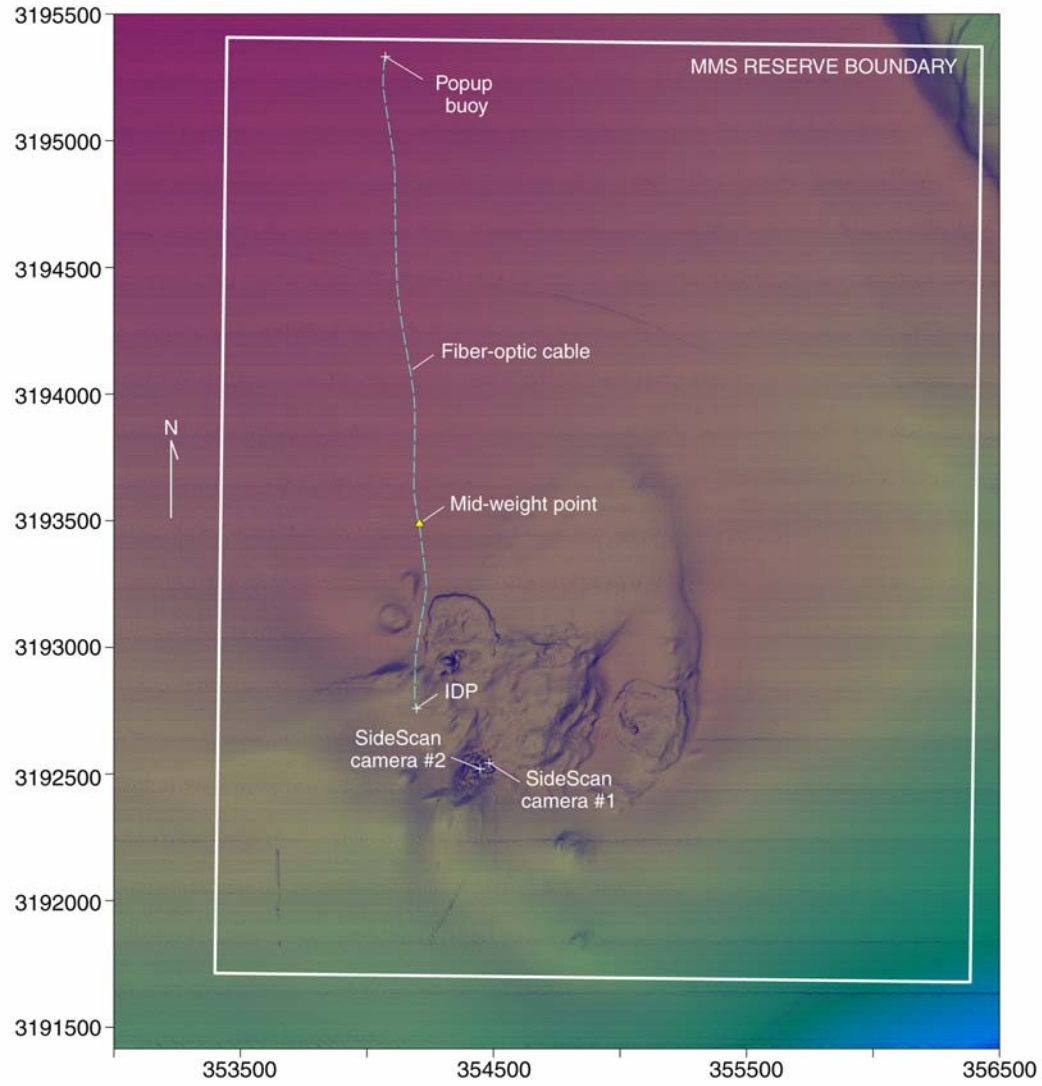

Figure 5. Site map of MC118 reserve area with locations of the IDP, DRS and Cameras deployed on this cruise.

STATION SERVICE DEVICE ROV ACTIVITIES

With the installation of the backbone of the observatory completed, attention turned toward activities using the Station Service Device (SSD). The first objective was to conduct a resistivity survey. An issue with transmission through the fiber optic caused a delay the following day and that night the boat made its way to South Pass to meet the *R/V Acadian* for a crew and staff change over. Of the scientific staff, J. Robert Woolsey, Jeff Chanton, Rudy Rogers, and Ian MacDonald boarded while Hannah Lee, Laura Lapham, David Galligan, Rob Higley, and Ken Sleeper disembarked. Jack Pennington, chief engineer also debarked and Max Wike boarded. The crew roster shifted a bit with Sam LeBouef taking the chief engineers position and the captain, Craig LeBoeuf stepping down to assist the engineer. Joe Thomas was acting captain and Max Wike filled in as first mate.

As the author of this report was one of the staff to get off at this time the rest of this report represent a brief summary of verbal and written reports made by Bob Woolsey, John Dunbar and Ian MacDonald. PI reports, are attached as appendixes.

Resistivity Survey

To conduct the survey an electronics package was mounted on the front of the SSD and an electrode array was attached to the aft of the landing cage (Fig. 6 and 7). The SSD provides a smart tow-body with a high-speed communications link to the system, obstacles avoidance sonar, pressure transducer for array altitude and cameras with lighting for visual inspection of bottom conditions. The array itself consists of a 570m cable with 28 electrodes that trails the SSD making contact with the sea floor while the system is pulled slowly along by the ship. The array was designed with an expected penetration of 180m with 10m resolution.

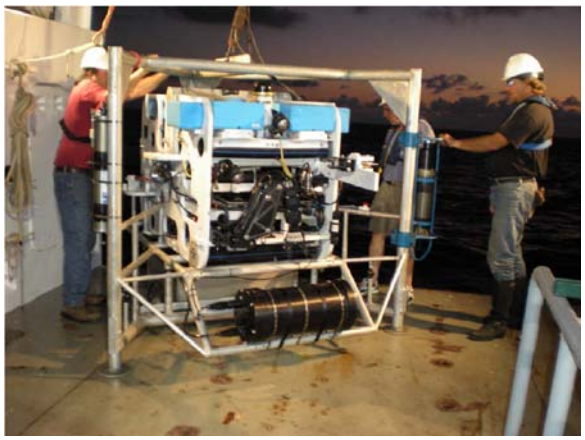

Figure 6. The electronics' package for the Resistivity Survey mounted to the front of the SSD lander cage.

Figure 7. Array cable coiled on the deck of the *Pelican.*

Once the transmission issue with the SSD, as discussed above, was corrected the array was paid out behind the boat and then the SSD was lowered into the sea. The SSD and the mid-water weight were brought back on board to replace a cable between the SSD and the mid-water weight. This cable was shorter than the intended cable and had been intended as a

backup cable for another application. During replacement of this cable the resistivity array streamed behind the vessel at near surface depths. When the SSD was re-deployed to the seafloor and the resistivity system powered up a fault was immediately detected in the resistivity electronics package. Upon retrieval it was discovered that the last 200 meters of the array with 10 electrodes were missing. The end of the array was mauled and showed bite marks consistent with those of a shark (Fig. 8). Additional details on the operations of the resistivity survey are presented in Appendix 1.

Figure 8. A damaged section of the resistivity array cable with bite marks, damaged jacket, and frayed wires.

SSD recovery and deployment activities

Additional activities for the SSD included recovering geochemical and microbial samplers from the seafloor, reconnoitering for an appropriate location for two new time lapse-cameras and aid in the deployment of these cameras. As the ROV was deployed to commence these operations a communications issue arose at a depth of about 800m. During retrieval operations, however, communications were re-established at about a depth of 150m. Efforts to isolate this apparent pressure sensitive fault proved difficult. Replacement cables were installed but to problem remained repeatable. Repeated efforts to identify the fault could not resolve the problem and the SSD was not available for the rest of the cruise.

The two cameras were deployed using the wire line winch off the starboard side of the vessel. A USBL transponder aided in locating and placing cameras (see figure 5). Further details of the deployment are provided in Appendix 2.

CONCLUSIONS

Deployment of key observatory components, the Integrated Data/Power unit and the Data Recovery System, was successful. The electrical resistivity survey was not successful because of an apparent shark attack. Success of the survey may have been limited anyhow because of subsequent problems with the operations of the SSD and the discovery of a leak in the resistivity instrument package's pressure vessel. Furthermore, the apparent pressure related, optical fault on the SSD eliminated it from use in deployment and recovery

operations. Standby operations using an acoustic transponder on the wire line allowed the successful deployed of two time-lapse cameras.

An additional concern for the SSD, which may be related to the pressure fault, is the new oil used in the pressure compensated tubing. The oil was specifically recommended for use with fiber optic cables but as the cruise progressed it looked like the oil might have started to react with the fiber's protective lining. Previous oil used with the fiber optics eventually caused problems after 1 to 2 years of use. This new oil was used as it was represented as a solution to the long term degradation which was found in use of the previous oil. Unfortunately the new oil, rather than curing the aging problem, exacerbated the problem causing loss of longer wave length light transmission in the fiber optic cable. Tests are being conducted by SDI after the cruise. This issue has implications for the long term operations of the IDP as the new oil was also used in this unit.

APPENDICES

Appendix 1. Electrical Resistivity Survey
Appendix 2. Rotary Time-Lapse Cameras
Appendix 3. Cruise Log

Appendix 1. Electrical Resistivity Survey

Cruise, RV Pelican Cruise to MC118, May 31 to June 10, 2008

Activities of John Dunbar Baylor University, Department of Geology and Markus Lagmanson of Advanced Geosciences, Inc., Austin, TX

The first week of the cruise was spent by the crew from Specialty Devices, Inc. and the University of Mississippi deploying and testing the seafloor observatory IDP (Integrated Data and Power Unit). This work was completed in the early morning hours of June 3.

Work on the planned resistivity survey began the morning of June 3. The day of June 3 was spent preparing the resistivity system and attaching it to the SSD ROV for the resistivity survey. The initial deployment of the resistivity system began at 5:45 PM, June 3, with the lowering of the 570 m long electrode array over the stern. Once the electrode array was in the water, the SSD was lowered over the stern. During deployment of the SSD it was discovered that the fiber optic link from the mid-water weight to the SSD was shorter than the load-supporting cable. To work around this problem, the mid-water weight and SSD were brought back onboard. The tow cable connection to the mid-water weight was removed and the tow cable was attached directly to the SSD, removing the mid-water weight. During the 2 hours required to make the transfer, the electrode array was left in the water. At 8:15 PM the SSD was re-deployed, directly connected to the tow cable.

The instrument was slowly lowered to the bottom at a depth of approximately 900 m over the next hour. When the instrument reached the bottom, the resistivity instrument was successfully powered up through the remote control link and initialization of the system to collect the first line was begun. About one minute into the initialization procedure, communication with the resistivity system was lost. The real-time video and altitude data were still coming from the SSD, but the resistivity system would no longer respond to commands.

At 9:30 PM the process of retrieving the SSD was begun and at 10:30 the SSD and resistivity system were back on the deck. At this point, the damage assessment began. First, the electrode array had been severed. The active part of the electrode array that had been 540 m long with 28 electrodes, ended at 360 m, at the 18th electrode. Ten electrodes and 200 m of cable were missing. The severed end of the cable showed bite marks and areas where the cable jacket had been torn and chewed. Apparently, the cable was bitten off by sharks, perhaps during the 2 hr period in which it was trailing the ship in near the surface, while the mid-water weight was removed.

A second problem was found it the connector between the electrode array and the resistivity system housing. It was found to be full of water. Apparently, once the electrode array was severed and its interior exposed to the high-pressure water, seawater wicked up the Kevlar strength member core and into the connector. The instrument housing also contained about a half a cup of water. This water caused the electronics to short out, which caused the loss in communication. The resistivity instrument was immediately taken apart, and the components washed in fresh water and dried with a heat gun. Although, this initial washing did not restore

the circuitry to operational condition, a more thorough washing and drying at the Advanced Geosciences facilities in Austin were able to restore the instrument to working condition.

Initially it was not clear whether the water in the housing had come from the flooded connector or if the housing itself had leaked. During the cruise the empty housing was lowered to the bottom twice to test the source of the leak. Both times the housing leaked, but the water was not coming from the connector penetrations. Post-cruise testing of the housing turned up a pin-hole sized leak in one of the welds, which was apparently the source of the water in the housing. Dunbar and Lagmanson are currently in the process of building a new electrode array and having the housing re-welded.

Appendix 2. Rotary Time-Lapse Cameras

Cruise report: 4-10 June 2008

Program component: Visual observations of microbial mats

PIs: Ian MacDonald (at sea), Samantha Joye, Andreas Teske

This component of the program is studying the microbial community associated with near-surface gas hydrate deposits. In previous efforts, sediment samples have been collected using push cores. The present effort is concerned with studying the turnover time for surface mats using time-lapse photography.

Ian MacDonald and his student Doug Weaver traveled to Cocodrie on 4 June 2008 and rode offshore on the RV ACADIANA. They were accompanied by Bob Woolsey and Rudy Rogers. ACADIANA met RV PELICAN and transferred personnel and equipment.

The plan was to deploy, using the SSD, two rotary time-lapse cameras at sites where they could monitor bacterial mats and exposed hydrate. These devices are equipped with a Benthos TR6001 acoustic release that can drop an anchor after receiving a command from the surface. A mechanism was devised and fabricated that attached the camera system to the deployment cage of the SSD. The deployment mechanism was tested during several deployments of the SSD. It successfully held the cameras in place during launch and recovery of the SSD. However, due to continued malfunctions of the SSD, the mechanism was not fully tested by having the SSD remove and position the camera.

On 9 June, it was determined that the SSD would not be functional. A backup deployment plan was executed and both cameras were deployed. The procedure was to lower the camera near the bottom using a depth sensor and acoustic release attached to the CTD cable of PELICAN. There was no image feedback available to show where the cameras were actually positioned on the seafloor. Positioning was accomplished based on previous knowledge of the features of the site. Both cameras were set to take pictures every 48 minutes—this will produce 20 pictures per day and a total of 2 complete revolutions of the camera per day. The image storage and battery power are expected to last through September. Details of the two deployments are as follows:

System D:
Receive code 14.0 kHz, Transmit code 11.0 kHz, Enable code: D Release code: E
Deployed at N28°51’08.53 ”W88°29’30.51” 886m depth (Sleeping Dragon)

System H:
Receive code 11.0 kHz, Transmit code 12.0 kHz, Enable code: F Release code: C
Deployed at N28°51’07.74” W88°29’31.79” 888m depth (Mandyville)

Recovery will be accomplished in September 2008 cruise. One berth on the Pelican is required for project personnel.

Appendix 3. Cruise Log

Cruise Log
Cruise GOM2-08-MC118 aboard the *R/V Pelican*
Ken Sleeper,
STRC Project Coordinator

Wednesday, 05/28/2008
1300: Andy calls and says we are going to go now, will meet me at home to get my bag
1800: I-55 weigh station near MS/LA state line; Andy Calls Paul; they are still loading the trailer
1930: Arrive in NOLA and pickup Hannah Lee at her Hotel
2130: Arrive at LUMCON. Matt and Brian already at the boat with the flat bed trailer

Thursday 05/29/2008
0730: Hear from Paul. They left about an hour ago at 0630. Begin to unload the van and the truck. Laura will come tomorrow and we hope to head out tomorrow evening
1100: retire to cabin and work on previous cruise report
1800: Paul, Scott and David have arrived and Captain Craig treats us all to crawdad boil! 120 pound of crawfish with corn, sausage, onions and garlic
2000: John Dunbar and Markus Lagmanson have arrived.

Friday 05/30/2008
0700: begin loading Paul's stuff. Still a lot of dock side work to be done. Spooling ultrex on to the popup buoy, David working on assembling the IDP (constructing and adjusting of the connection matting boxes, connecting cables etc) Paul working on getting light through a straw, Scott and Andy setting up control center and getting the rental truck returned
2230: Calling it quits for the day. Much was loaded today. Matt, Brian and Ken worked on spooling and re-spooling Ultrex rope on to various drums and getting things loaded and set up on the boat. Everything is now loaded on except the SSD which is still in the trailer.

Saturday 05/31/2008
0700: Load the SSD on the Boat. Paul has several hours of work to do on the vehicle including dunking it over the side for a ballast test.
1000: Paul hopes to be done by lunch or right after. Will need to have a pow wow first to go over the plan and see if Laura Lapham should come or not
1400: Dock side test completed, the SSD functioned as asked to: cameras, motors, thrusters, floats etc. Ballast test showed that the SSD is a little heavy. The new front arm! Paul has the data to calculate the floats needed.
1500: DEPORT. Finally away. Everything is ready to work. Equipment is being tied down for the cruise. Will arrive on site in the early AM. First do the popup test and then do the USBL calibration

Sunday 06/01/2008
0600: breakfast on site at MC118
0700: Prep for popup buoy test

Appendix 3. Cruise Log

0830: nearly ready to deploy buoy; burn wire broke. Will do the test without the wire
0905: Popup buoy over the stern in the N central part of 118
0930: buoy on the bottom
0936: buoy floats back on top of water
1130: buoy recovered and rewound and reassembled for final deployment. Test worked great!
0230: USBL calibration completed, ready to recover mooring
~0330: mooring recovered. Work on the USBL release setup for the IDP

Monday 06/02/2008
0600: crew is up for breakfast
0700: looking over things. Get transponder and modems connected. **Rob working on a computer bug in the IDP system.** Has to do with the new configuration of it being command and control from the seafloor. Must fix before the pressure housing can be closed and mounted.
1200: Bug fixed and electronics boards loaded into pressure housing. Paul will need to pot the connections; once completed they will need two hours to cure.
1900: Dinner is over. Paul is filling the last few tubes with oil and making the last fiber connections on the IDP. Weather is great; smooth water and clear skies.
~2100: IDP over the back

Tuesday 06/03/2008
0130: IDP in, begin lowering the popup buoy with the trawl winch. Everyone took part in the deployment. John, Markus, Laura, Hannah everyone.
0230: bring on board the releases from the buoy. Installation is complete
0330: finish straightening up after the deployment. Time for bed!
0720: get up, start prep for resistivity survey.
1300: pop the USBL transponder off of the IDP frame. Paul having difficulty getting full light through to the SSD
~2000: depart site to meet the *R/V Acadian* around South Pass of the Mississippi. Will make the transfer there and the Pelican should be back on site first thing in the morning to continue working with little loss of time.

Wednesday 06/04/2008
~0200: Make the transfer. Depart the Pelican and journey toward home with Laura, Hannah, Rob, David and Jack Pennington. Jack has a stress test he must be back for. Bob, Jeff Chanton, Rudy, Ian get on the boat to do second half of cruise: resistivity survey, recover items from the sea floor and set out Ian's cameras. Mad Max gets on to replace Jack (actually Sam will take over as engineer and the cpt will assist Sam so Max will be first Mate to Joe.

Location points from HyPac after the cruise

Name	Date	Time	Lat	Long
SeaSnap Camera 1	6/9/2008	11:37:51	28.8523695	-88.49180821
SeaSnap Camera 2	6/9/2008	15:16:31	28.8521503	-88.49216494
Integrated Data Power Unit	6/2/2008	23:36:42	28.8542736	-88.49477612
Popup Buoy	6/3/2008	3:05:45	28.8774801	-88.49636969