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

ACTIVITIES REPORT FOR THE CRUISE GOM2-10-MC118 ABOARD THE *R/V PELICAN*

MISSISSIPPI CANYON FEDERAL LEASE BLOCK 118
NORTHERN GULF OF MEXICO

April 21-29, 2010

OPERATIONS REPORT AND EVENT LOG OF AT-SEA ENGINEERING TESTS OF THE STATION SERVICE DEVICE, SURVEYING EFFORTS ATTHE SEAFLOOR OBSERVATORY SITE AT MC118, DEPLOYMENT OF THE INTEGRATED DATA POWER UNIT, AND PUSH-CORE SAMPLE COLLECTION

By

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INTRODUCTION

A scientific research cruise was undertaken to Mississippi Canyon Federal Lease Block 118 (Fig. 1) April 21 – 29, 2010 aboard the *R/V Pelican*. A portion of the block has been reserved by the Minerals Management Services for use by the Gulf of Mexico Hydrates Research Consortium to investigate gas hydrates. The Consortium has chosen the site for the installation of a seafloor observatory to monitor and evaluate the forcing factors involved with the formation and dissociation of gas hydrates. The objectives of this cruise were to perform engineering tests with the Station Service Device (SSD) including a proposed new deployment method, the use of the SSD as a deployment platform for seafloor arrays and sediment core collection.

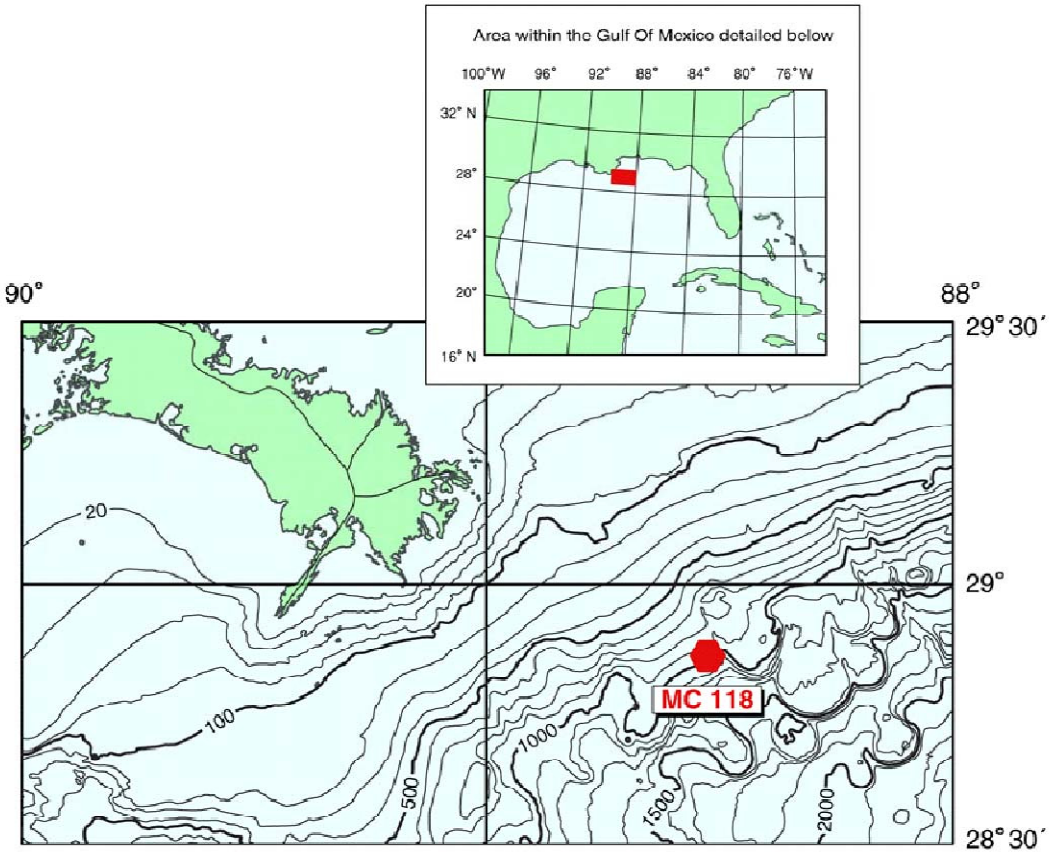


Figure 1. Location of Mississippi Canyon Federal Lease Block 118.

Previous cruises to Mississippi Canyon 118 to test the capabilities of the SSD and to use it to recover sensors and data/sample-collecting devices from the sea-floor had not succeeded in completing those missions. In March of 2010 a cruise scheduled to perform engineering tests of the SSD was aborted when the cable purchased for the purpose of eliminating the mid-water weight thereby greatly streamlining SSD deployment, failed on final testing. During the early part of April, the MMRI shop investigated alternatives to using the Cortland cable for its intended purpose. Although we could not trust this cable with the SSD, having both strength and optic members, it

could be used to deploy the IDP (master data-logger for the observatory) and serve as the main line of the data recovery system. We also determined to return to using the Rochester cable as our SSD deployment cable as acquiring a replacement cable would require not only significant additional – and unbudgeted – funds but another 6 months.

A major challenge of this cruise was to test a method to deploy an HLA array from the SSD cage. Installing an HLA array with its deployment spool on the SSD not only adds significantly to the size and weight of the SSD during deployment but also nearly doubles the virtual mass of the vehicle during the dive to operating depth. This large increase in virtual mass makes the SSD significantly more susceptible to ship heave and the resulting snap loading on the vehicle, cage and deployment lines. A new cable, intended to allow the SSD to be deployed with the heave compensator in use during the entire deployment, was found to be defective during the previous cruise. In order to proceed with an SSD deployment of the HLA arrays, a method was devised to allow the steel heavy lift cable to be used in the new deployment plan. Evaluation of the ability to dive the SSD with the HLA array using the previous lift cable would determine whether we would be able to deploy the HLA arrays from the SSD.

If this test was successful, a series of other tests was planned for the SSD. These ranged from the simple reliability testing of new power distribution circuits and new LED lighting to critical and far more complex testing of components of the planned HLA deployment method. These included testing the HLA DATS transporter and the SSD's ability to swim free of its cage and carry the transporter to an HLA pod, testing installation of the transporter to the HLA pod, pulling free the IDP wet mateable ROV connector from the transporter, pulling free the HLA pod to IDP cable, removing the IDP dummy plug and storing it on the spare hand and a first at-sea test of the IDP connector function with an ROV. Another planned test was the deployment of the HLA array spool from the SSD cage and pick-up of the array spool for cable deployment. Also to be evaluated was the new 8 push core carousel and SSD vehicle ballasting with new equipment payloads.

OBJECTIVES

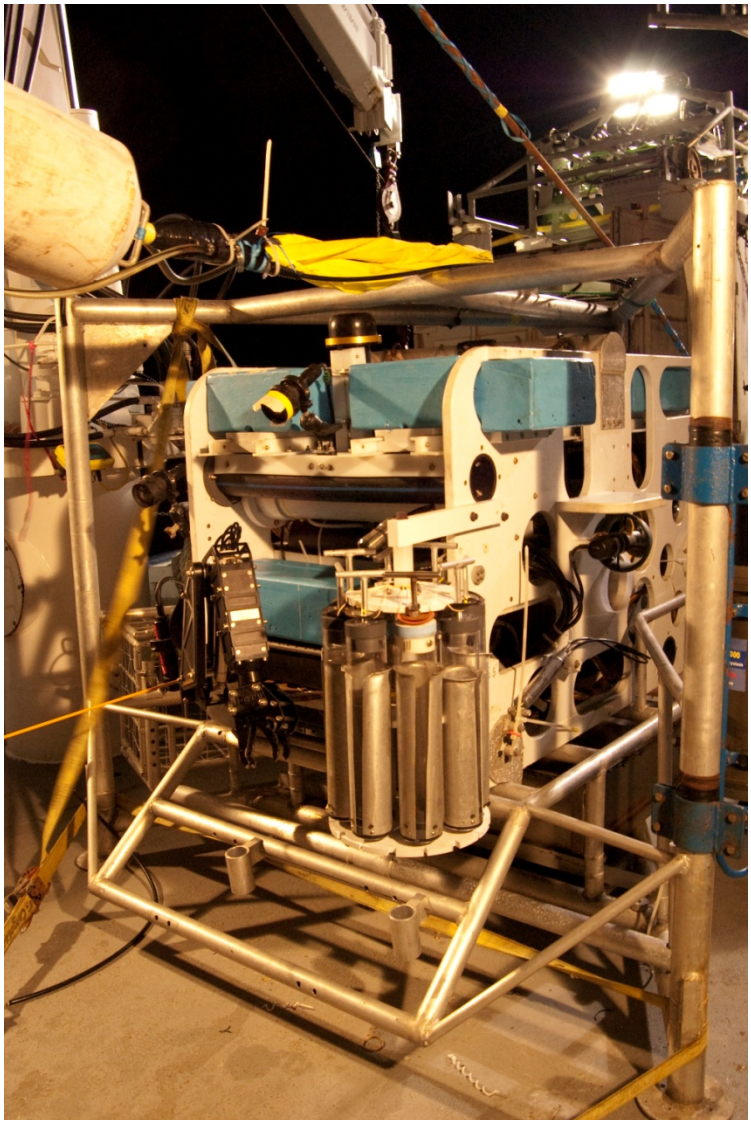
1) Test the new deployment method for the SSD, i.e. elimination of the mid-water weight, replacing it as a means of isolating the ship's movement from the SSD by placing floats on the cable above the SSD to keep the cable off the instruments and stabilizing the cable with lead weights above the floats,
2) employ the station service device (SSD) to conduct video surveys of some lesser-known portions of the MC118 mound and vicinity,
3) afford opportunities for additional personnel to operate the SSD,
4) deploy a mock-horizontal line array to test the proposed technique (including deploying the seafloor pod, attaching a data-logger to it, unspooling the array and attaching it to the IDP),
5) redeploy the IDP,
6) recover push-cores for geochemical and microbial studies, using the new carousel,
7) recover the osmobox from the pore-fluid array deployed at the NW crater complex,
8) recover one or both of the bio-batteries deployed in 2006.

CRUISE ACTIVITIES

Before we left Cocodrie, we were made aware of the explosion at the Deepwater Horizon rig at MC252 (late April 20). Contact with the MMS, the US Coast Guard and local officials produced no regulations that forbade our accessing our site so we proceeded to MC118 late on April 21. Onsight, the burning rig was clearly visible and we were working when it sank on April 22. Following the calibration of the USBL and recovery of the mooring, we sent the SSD down for the exploratory dive, successfully employing the newly modified deployment strategy. With a good location for the BEG (biobattery) at the SW crater, we headed there to make that recovery. After spending over an hour on/near the bottom searching, we concluded that it must have been covered by sediments or possibly moved by deepwater currents. We proceeded to push-coring, learning much about the carousel (8 core-tubes with quivers, mounted on a carousel on the SSD) and how it works. We collected 3 good intact cores (see Table A) from Mandy Joye's requested coring site south of the exposed crater complexes. We also tried to find the weight from the BBLA deployment (1 year ago) to get a good location on it and to relocate the Sleeping Dragon but neither was visible. It appears sedimentation in this area has been considerable over the last 30 months since we have had a very clear SSD dive.

The burning Deepwater Horizon rig, Mississippi Canyon 252, April 22, 2010.

Horrible weather (8-12' seas and 25-30kt winds) forced us to Pensacola Bay and calmer waters to continue testing the deployment system for the arrays. Three dives there gave us opportunity to allow other operators time at the SSD controls. We deployed the pod, swam the SSD with the data-logger aboard, placed the Transporter (single-array data-logger) on the pod and deployed and partially unspooled a mock-up array. Visibility deteriorated so much that by Monday evening we headed back to MC118. When we arrived, there was no sign of anyone working the area; as we returned to work, recovery vessels began to reappear and planes spraying chemical dispersants were active during all daylight hours. Back on site we were able to work in fairly rough seas – well enough to deploy the IDP with new cabling. When the seas calmed, we were surrounded by slick. We had a 100% functional SSD and had hoped to complete another dive to recover instruments and collect additional push-cores as well as to document additional locations but were not willing to risk the SSD by putting it through the oil/chemical-dispersant that was getting thicker by the minute. In the early afternoon of April 28, the mission was called and we headed to Cocodrie.



The SSD, ready to dive, with the new 8-core carousel in the foreground. Note the float on the cable (upper left in the photo), part of the rigging that will keep the cable above the SSD during seafloor operations.

After the SSD is off the back deck, a USBL transducer is attached to the cable for precise location of the vehicle during deployment and operations. Floats are then attached to the cable to keep it clear of the vehicle during seafloor operations. Then, a series of lead weights is attached to the cable to give it stability, a form of mid-water "anchor" that isolates the vehicle from the ship's movement. In this photograph, the MMRI team has just attached one member of this series to the cable.

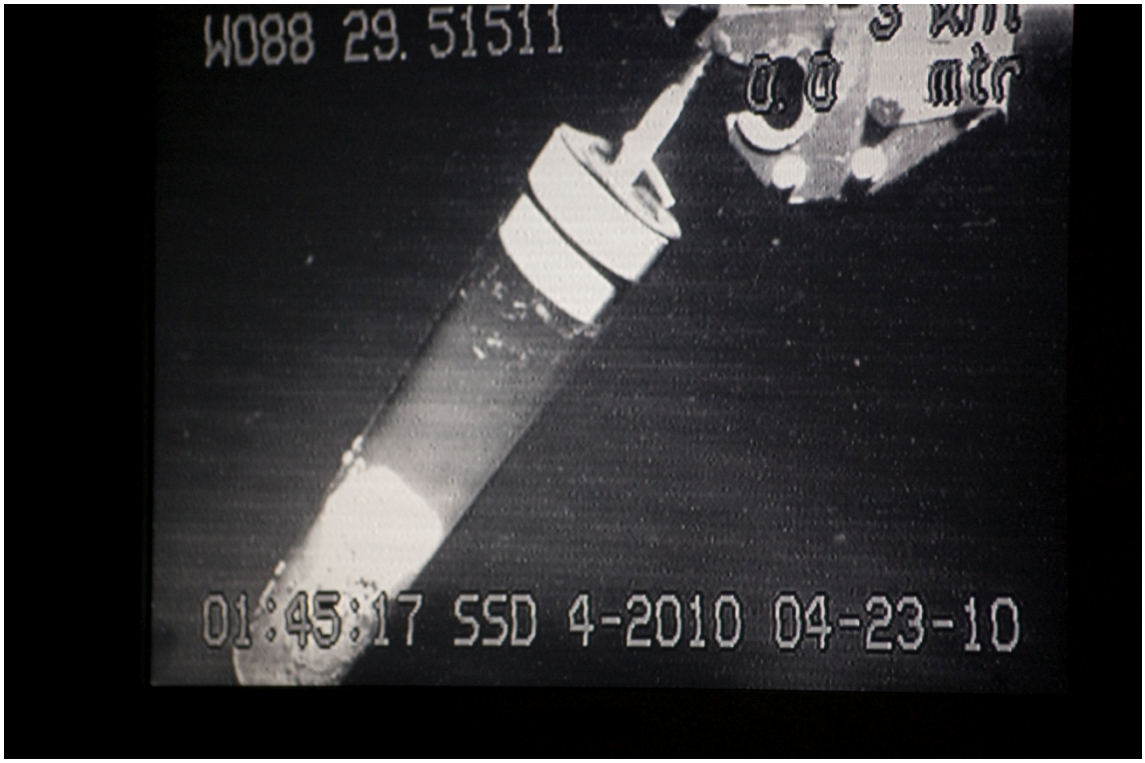
CONCLUSIONS

In spite of unforeseen difficulties associated with the BP Deepwater Horizon disaster at MC252, this cruise succeeded in accomplishing several major objectives. The new deployment method for the SSD, i.e. elimination of the mid-water weight, replacing it as a means of isolating the ship's movement from the SSD by placing floats on the cable above the SSD to keep the cable off the instruments and stabilizing the cable with lead weights above the floats, was an unqualified success. The added bulk of the HLA makes deployment much more challenging but in relatively calm seas it is possible. The SSD's utility in conducting video surveys is proven though there is a level of frustration at the limited depth of view. This is due in part to the volume of particulate matter in the water – especially in Pensacola Bay – but may also be a factor of the video and lights, in turn functions of available power. Increasing these capabilities should be a priority. Additional personnel did get to operate the SSD, with great success. One mock-horizontal line array was deployed, and its data-logger connected

to the already deployed seafloor pod. The array was released and unspooling begun; however, the IDP was not deployed during the test so the plug-in was not tested.

The IDP was redeployed successfully, the cabling deployed, and the pop-up buoy deployed in the northern part of the reserve. Three push-cores for geochemical and microbial studies were recovered, using the new carousel. However, no additional instruments were located or recovered.

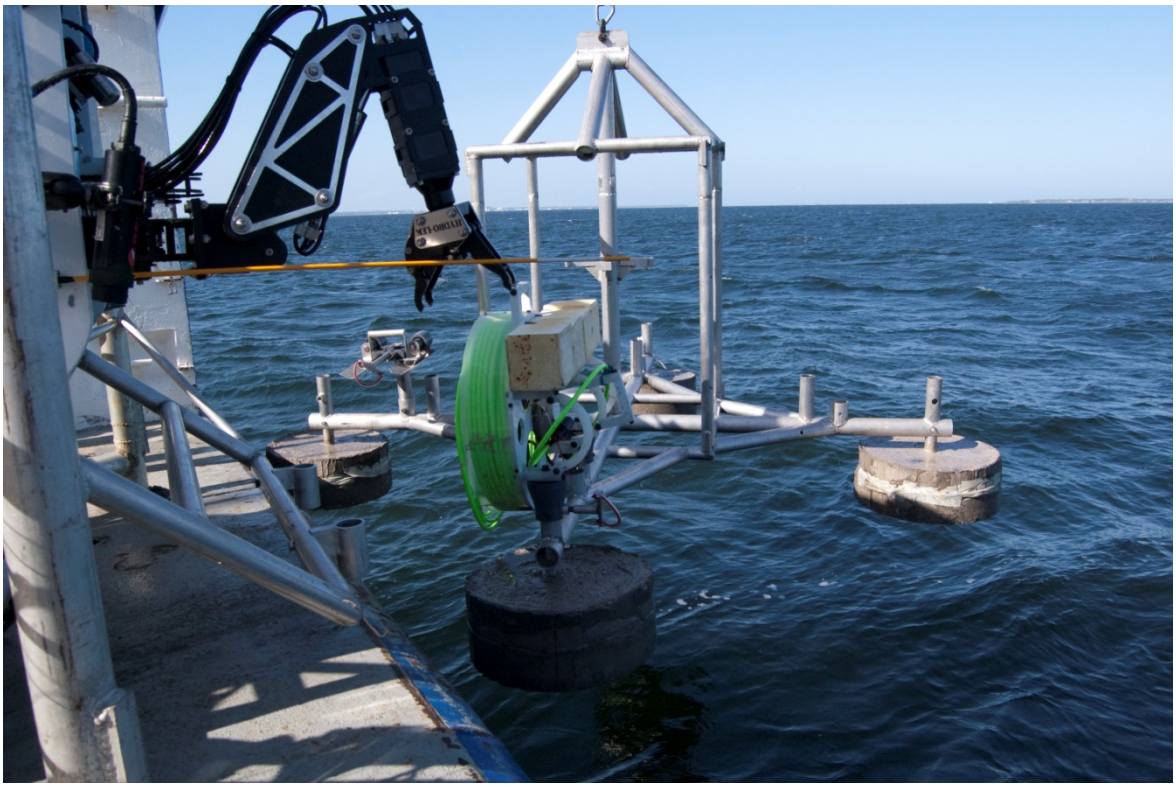
The orientation of the Transporter receivers was problematic and may need to be re-engineered. Also, the replacement of the push-cores into the quivers in the carousel was difficult, partly due to the tenacity of the rubber bands holding the cores in place. A redesign including a bit more space laterally and vertically should make recovery easier.



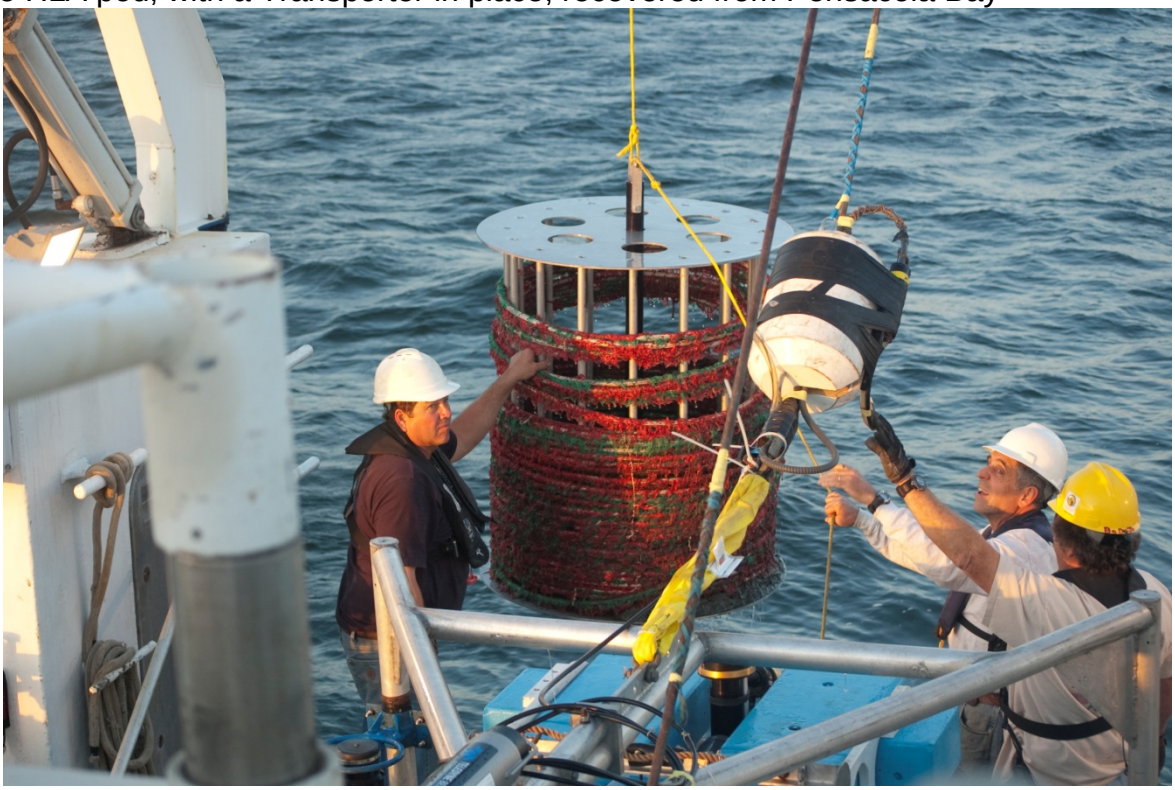
SSD recovering a push-core from the seafloor at MC118, ~870m water depth.

TABLE A. Push-cores collected from south of the Southeast Crater Complex

Push-core Positions	UTM (easting)	UTM (northing)	Latitude (north)	Longitude (west)	Date
1_4_23_10 1st core VIII	354467.20	3192505.99	28.853608	-88.4919602	04/23/2010
2_4_23_10 2nd core VII	354462.35	3192510.16	28.853645	-88.4920105	04/23/2010
3_4_23_10 3rd core VI	354473.94	3192508.45	28.853631	-88.4918915	04/23/2010



The HLA pod, with a Transporter in place, recovered from Pensacola Bay



The mock-up horizontal array, being recovered, following its shallow-water deployment.

The pop-up-buoy, part of the data recovery system for the observatory, rigged for deployment about 3km distant from the IDP. The arrangement allows a surface vessel to “pop” the connection to the data-logger and down-load data without risking entanglement in the observatory instruments.

When the seas calmed on Wednesday, we were surrounded by the oil-dispersant slick.

The pop-up buoy was deployed near the northern border of the Consortium's research reserve at MC118, the only one in the Gulf of Mexico.

Event Log
SSDR Cruise on RV *Pelican*
20-29 April, 2010

04/20/10
11:00 - Brian, Andy, Matt, Larry depart for Cocodrie with Kodiak and Van.
18:30 - Arrive in Cocodrie and begin mobilization.

04/21/10 – transit Cocodrie to MC118
04:30 – Ken and Carol depart Oxford in the MMRI van
06:00 – Shop team continues with mobilization.
12:00 – Ken and Carol pick up pvc pipe at Lowe's (Houma).
13:30 – Ken and Carol arrive at LUMCON boat loaded, except for the stiff arm. Before we left Cocodrie, we were made aware of the explosion at the Deepwater Horizon rig at MC252 (late April 20). The Macondo well is about 10 miles from the Seafloor Observatory, downslope to the SE. Contact with the MMS, the US Coast Guard and local officials produced no regulations that forbade our accessing our site, so we complete preparations to sail. BP is the leaseholder; the platform Deep Water Horizon is operated by Transocean Ltd. Transocean operates the rig too. MC252 is three blocks south and two blocks east of 118.
19:00 - We proceeded to MC118 late on April 21.
~20:00 – We held a brief science meeting to lay out dive plans. First dive goals: surveying, station-keeping, instrument documentation and recovery, push-coring. Second dive: HLA mock deployment, including deploying lander, diving with SSD, swimming out and setting "dats" on HLA central pod, swimming back into SSD cage, triggering spool-release, paying out cable and recovering SSD with reel. A third dive will be a mock connection from the pod to the mock-IDP.

04/22/10 – MC118
09:00 – Smoke from the burning rig to the SSE is clearly visible from MC118.
10:00 – On sight. Setting up for USBL calibration.
11:00 – Calibration mooring deployed.
11:45 – Calibration complete. Set to recover mooring.
12:15 – Calibration mooring back on deck.
12:45 – SDI potting cable, attaching basket and new core carousel to SSD for recovery and push-coring.
19:20 SSD powered up. Pre-dive checks completed without incident.
21:10 – Begin deploying the SSD.
22:10 –Seafloor visible. Proceed to first target, Droycon's Biolec (microbial fuel cell) at the SW crater complex, north of Rudyville.
22:36 – corals visible north of target. Moderate amounts of marine "snow."
22:48 – Touch down #1; Land SSD on seafloor. Disarticulated clam shells litter bottom. 21 degree tilt probably due to too slow a cable payout when we touched down. No apparent problem was detected from the lift cable or fiber optics. This was deemed a ***success of the new deployment method***. Now we want to do

several pick-ups and touch-downs and spend some time on the bottom to verify the repeatability of the method. Did not locate Biolec. Picked up SSD in cage and continued to search the area for the fuel cell.

23:18 – Touch-down #2; Bottom is rocky and covered with shells of dead clams. 887.3m of cable out (including slack needed to maintain station). Tilt now +10 roll and -6 pitch with the cable tension at the deck winch = 1250 lbs. (weight of cable only) pay out 30 meters (of calculated 54 m max.). Exited cage to look around and test the SSD. All functions good. Experiencing significant bottom current flow and medium to poor visibility. Re-entered the cage. Picked up to look for a new target area

23:25 – Touch-down #3, this time in the crater. 1.2 Pitch and 7.1 degree roll of the cage prior to exiting the cage. 40 meters of lift cable pay out after touchdown with 1300 to 1500 lbs tension and 887 meters total lift cable out on the ships trawl winch indicator. SSD out of cage. Clam shells are everywhere. Eels are visible. There is no twist on the strap atop the SSD cage.

23:52 – Re-enter the cage and latch down. We are about 5 lbs light with all the ballast blown. We should add about 10 lbs so we can hold bottom better. RSS is using vertical thrust to hold us down near the bottom to work; After failing to locate the BEG (for which we had a confirmed location), we pick up and proceed to a site on the south side of the SW crater complex where we had recovered bacterial mat in box cores in November, 2007.

24:00 – HyPac navigation system crashed. Andy is rebuilding it.

04/23/10 – MC118; transit to Pensacola Bay

00:29 –Touch down #4 -0.4 Pitch and 4.0 roll R/V Pelican about 150 meters off station and with 30 meters of lift cable deployed after touchdown we have a Pitch and roll change (tug on the cage) to R= 2.2 and P = 2.2. further drift-off of the Pelican and we get R=3.2 and Pitch=1.5 this matches the finite element model predicted response to ship drift off site. Pull up off the bottom.

00:58 - Land SSD between 2 target sites. Beggiatoa mats sighted. Touch-down #5 p= 2.3 and R = -3.5 Pick up to change SSD cage heading with SSD thrusters.

01:00 – Touch down # 6 facing south and waiting for the stirred up mud to leave. Attempting to grab “V” push-core tube by T-handle. The tube came out of the bottom cork (rubber) but with difficulty. The rubber bands proved quite tenacious and the robotic hand slipped while maneuvering.

01:28 – Rotated hand to grab core in a different orientation.

01:30 – Double-dipped into mat.

01:35 - Dropped core.

01:43 – Second core into mat, “VIII” at 88*29’31.0805W; 28*51’07.2926N. I (CBL) think hydrate formed in the head space of the core-tube while Paul maneuvered it to return it to the quiver and also, possibly on the outside of the core barrel where sediment adhered to the side.

02:18 – Core VIII was successfully returned to the carousel quiver.

02:31 – Core VII was pushed into mat.

02:34 – Core VII successfully returned to carousel quiver.

02:40 – Core VI pushed through mat, revealing very dark sediments underneath cored material.

02:52 – Core VI successfully returned to carousel quiver.
03:07 – Proceeding to next target, site of the 2009 BBLA deployment to verify its precise location.
03:34 – touch-down #7 navigation says 7 meters from the “Sleeping Dragon” p = -13.9 roll = 10.9 heading = 122 degrees. Surface currents and wind and wave conditions making the R/V Pelican position holding difficult. Sleeping Dragon was NOT sighted. Neither was the BBLA anchor location found after repeated drifts over the site. Monkey-fist marker on the ridge was sighted.
03:55 – SSD returned to cage and recovery begun. Cable jumped the shiv while taking off the line weights. Zip ties on the floats broke and the Chinese fingers bunged up. Used zip ties on the upper connection because it was too tight to get the upper carabiner hooked on.
05:00 - Recovery complete. Lift cable had jumped out of the recovery block and the recovery was done with about a 6 to 8” bend radius on the lift cable. No apparent damage.
05:00 - Weather is bad and worsening. Forecast is grim (9-11” seas through Monday). Strap things down, pull up the USBL transponder and head for Pensacola Bay to wait out the storm. Hope to work there.
05:30 - Vehicle washed down, blew and vented ballast, air off, shut down on new power switch and secured for transit.
14:00 Arrive in Pensacola Bay. Requesting permission to work. Need some time to rig for a mock HLA deployment here in the Bay.

04/24/10 – Pensacola Bay
07:00 - Working on the cable, adding new Chinese fingers. Perform maintenance checks on SSD including pull-down and check of new power switch and recharge of batteries.
10:30 - Weather buoy near MC118 getting gusts to 54 mph.
18:00 - SSD and Pod set up, ready for deployment. One last cable from the reel to the DATS needs to be added otherwise ready to go. 10:00 am tomorrow morning will be a low current and low high tide with better weather than this evening. Will wait till the morning to do the launch.

04/25/10 – Pensacola Bay
Dive in Pensacola Bay with plan to test the ability of the SSD to swim with the HLA DATS/ IDP Connector transporter. The transporter pin receivers were mounted on the lower rung of the SSD cage ramp. The core tube carousel was removed and the 2nd hand installed, the transporter was equipped with a full complement of syntactic foam and a 10 lb weight. No DATS. Increased deployment SSD ballast to 25 lbs.

08:20 SSD powered up. Pre-dive checks ok with adjustment of port side ballast trim clutch tension.
08:30 - start paying out anchor cable so we can pull forward during the mock deployment.
08:50 - deploy the pod (center of HLA “X”)
09:05 - deploy SSD w/reel and mock-DATS; weather is nice, sunny with light breeze. Boat still has a good swing on the anchor. Will launch units at center of swing.
09:30 - launch complete, visibility low; lander 13 degree pitch – pulled a little askew.

09:40 - dats pulled up with arm; swam vehicle out w/ low visibility but good sonar on pod and lander. We successfully lifted the transporter free of the SSD cage mounts and swam out of the cage about 20meters and re-entered the cage. Re-stowed the transporter on the port side SSD pin receiver and held the transporter securely with the arm, ompleting tasks for this dive. SSD has too much flotation; the bladder is hard to blow in shallow water (lift up 3m) about 36 ft water depth.
09:50 - floated up to near surface, lost bottom target and can see the boat on sonar
10:00 - reeling SSD back to lander. Will come back on board.
10:10 - back in lander which was pitched over 11 degrees.
10:18 - DATS partially back in its slot; boat at end of swing. Current is changing.
10:35 - SSD back on board; reel has a half foot of mud on its base. Added 10lbs for a total of 35lbs ballast.
10:40 - setting up to recover pod. Current has shifted so need to reorient. High tide was at 10:00. Tide charts show this as a low tidal cycle. From high tide at 10:00 to low tide at 18:00 is less than 1 foot.
11:15 - Pod up. Hanging on the fantail while we reset. Will need to re-coil cable from reel to DATS on front of lander.
13:00 - Deploy pod.
13:10 - Deploy SSD, making big arcs on the anchor. Good level landing, 1 deg pitch
13:30 - lifting the DATS.
13:35 - leave the lander.
13:55 - at the pod, visibility is very poor.
14:20 - got one pin into the pod; pull up to orient for both posts.
14:50 - cannot get both posts in; tough angle of approach and limited maneuverability between legs of the pod. ***Need a redesign***: need a single post or a "T" at the end of each leg so vehicle can come straight at it. The HLA pod should have the transporter receivers moved further out the pod legs to allow more room for the SSD to enter the pod and install the transporter. Pulling back and will try from other side where the locking pin is. If we can get the one post in and locked then we will call that good for this trip. Worried about tangling the mock-HLA rope. Call the mission.
15:00 - SSD back in the lander; raising lander.
15:15 - SSD back on board.

The plan was to install the HLA pod with the transporter in place. The SSD was then to swim to the HLA pod and attempt to remove the IDP connector from the transporter, pull out DATS to IDP cable from the Transporter and install it in the IDP simulator. To do so the SSD had to also remove the IDP dummy plug that protects the IDP connectors and store it on the SSD for recovery using the 2nd hand. If this could be completed the HLA array would be released from the back of the SSD cage and the simulated array deployment would be tested. The SSD dove with the 2nd hand, and the HLA array spool mounted to the back of the SSD cage.
16:55 - deploy the SSD.

17:05 - on the bottom venting the ballast chamber. Ballasts is about correct for this water depth.

Swam to the HLA Pod and found the Transporter on the opposite side of the HLA pod requiring maneuvering around the pod. Removed the IDP connector and pulled out the HLA DATS to IDP cable. Swam to the IDP connector, removed the IDP dummy plug connector and stored it on the SSD 2nd hand, inserted the DATS to IDP connector and screwed it into place.

The SSD returned to the cage and locked itself into the cage then actuated the HLA array spool release and the array was deployed.

19:10 the SSD was recovered with the deployed HLA array spool without incident. Complete success.

19:30 SSD powered down.

23:55 SSD battery charge stopped to be completed in the morning.

04/26/10 Monday Pensacola Bay

am – Scott working on interference problem in forward camera of the SSD. Paul and Larry terminating cabes for the Integrated Data Power Unit (IDP) in anticipation of a deployment when we return to MC118. Captains Craig and Joe work on gaining access to Pensacola's recreational dock.
12:15 – Docked at recreational dock. Ken deboarded leaving cruise on emergency family leave. We secured permission from the Port Captain to continue operations in Pensacola Bay.
14:00 – pre-dive procedures completed; SSD cleared to dive.
14:15 – SSD on bottom. Visibility is near zero.
14:45 – Visibility has not improved. Scrapped dive.

Discussed various options. Winds are in excess of 17knts all around. The risk to the vehicle is too great to consider a deployment from the crane or outside the protected area of the Bay.

15:40 – Deck operations begun to prepare for IDP deployment. We do not know if we will get access to our site (MC118) or not. Mitigation related to oil slick is widespread and may well extend the 8-10 miles to MC118.
19:30 – With predicted calming of seas on Wednesday, we overnight in the Bay.

04/27/10 Tuesday Transit Pensacola Bay to MC118

am – Discuss possible scenarios and decide that no further gain can come of remaining in the Bay. Visibility and winds prevent anything like a reasonable deployment scenario. With predicted calmer seas and winds on Wednesday, we decide to take our chances at MC118. We begin transiting in the afternoon and continue into the night.

04/28/10 Wednesday MC118

A.M. - We arrive onsight in the early morning. The oil slick has worsened considerably. However, there is no sign of the spill recovery effort.

06:00 – onsite and on “go” to deploy IDP. Seas are 2-4; winds less than 10knts.

06:55 – On the first attempt, a float slammed into the IDP; the IDP stuck on deck then slipped and swung to starboard and into Larry, knocking him down. Determined Larry is alright.

08:20 – Checked electronics on IDP (okay). Attached additional check cable. Holding station. Spooling cable out. IDP successfully deployed over stern.

08:36 – With 840m of cable out, we motor to target position.

08:45 – IDP on bottom with 889m cable out. Pay out additional cable.

09:00 – Motoring NE, though mostly North.

09:06 – Holding station to attach pig-weight. Port motor seems to be out.

09:15 – Motor fixed.

09:20 – Holding station, 1000m (horizontal) from IDP.

09:25 – Proceeding NE from holding station toward pop-up target. Set pop-up buoy for deployment.

10:15 – Pop-up over the stern, on its way to the seafloor.

10:37 – stop and drop the pop-up buoy over the target site with 855m of cable out.

Seas have calmed considerably during this morning’s deployment of the IDP. Paul, Matt, Scott, Carol discuss the pros and cons of an additional SSD dive. Most importantly, we need to verify the deployment and orientation of the IDP and verify additional instrument positions. However, while we have been working, the recovery effort has resumed with ships returning to the site and planes flying over spraying dispersant. By noon, we are surrounded by pinkish-orangish-brownish foam. We determine that the cruise has had many successes and that the operating capabilities of the SSD have, in large part, been proven. The risk to the vehicle posed by passing it through the chemically active dispersant of largely unknown (to us) composition outweigh the possible benefits of what would necessarily be a short dive. We determine to return to Cocodrie.

14:00 - headed for Cocodrie

04/29/10

~04:00 – arrive at LUMCON