HYDRATE RESEARCH ACTIVITIES THAT BOTH SUPPORT AND DERIVE FROM THE MONITORING STATION/SEA-FLOOR OBSERVATORY, MISSISSIPPI CANYON 118, NORTHERN GULF OF MEXICO

SEMIANNUAL PROGRESS REPORT
1 JULY, 2007 THROUGH 31 DECEMBER, 2007

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ABSTRACT

The Gulf of Mexico Hydrates Research Consortium (GOM-HRC) was established in 1999 to assemble leaders in gas hydrates research. The Consortium is administered by the Center for Marine Resources and Environmental Technology, CMRET, the marine arm of the Mississippi Mineral Resources Institute (MMRI) at the University of Mississippi. The primary objective of the group is to design and emplace a remote monitoring station or sea floor observatory (MS/SFO) on the sea floor in the northern Gulf of Mexico in an area where gas hydrates are known to be present at, or just below, the sea floor. This mission, although unavoidably delayed by hurricanes and other disturbances, necessitates assembling a station that will monitor physical and chemical parameters of the marine environment, including sea water and sea-floor sediments, on a more-or-less continuous basis over an extended period of time. In 2005, biological monitoring was added to the mission of the MS/SFO as a means of assessing input and impact of microbial communities in the establishment and longevity of hydrates and in assessing environmental health.

Establishment of the Consortium has succeeded in fulfilling the critical need to coordinate activities, avoid redundancies and communicate effectively among researchers in the arena of gas hydrates research. Complementary expertise, both scientific and technical, has been assembled to promote innovative research methods and construct necessary instrumentation.

Following much scientific research, consideration and discussion, the Consortium selected Mississippi Canyon 118 (MC118) as the site of the MS/SFO. Initial components of the observatory, a probe that collects pore-fluid samples and another that records sea floor temperatures, were deployed at MC118 in May of 2005. Follow-up deployments, planned for fall 2005, had to be postponed due to the catastrophic effects of Hurricane Katrina (and later, Rita) on the Gulf Coast. Station/observatory completion, anticipated for 2007, was unavoidably delayed.

The CMRET regularly conducts research cruises to the site of the MS/SFO. During this reporting period, the Consortium arranged and conducted two cruises. The primary objectives of a July cruise were to conduct a second round of sea trial tests of the Station Service Device (SSD) including testing modifications implemented following initial (March) sea trials and to provide further training for vehicle operators. Secondary objectives were to attempt recovery of several microbial experiments at the southwest (SW) Crater, MC118, to deploy a second Storm/Sperm Whale song Monitor and to provide opportunity for University of South Florida (USF) to test their Fluorescents/Mass Spectrometer system at SW Crater, MC118. A follow-up cruise to MC118 in November had as primary objectives the calibration of the Ultra-Short Baseline (USBL) navigation system with the newly acquired TSS (dynamic motion sensor), deployment of a sonar reflector at MC118, additional tests of the SSD with additional video cameras and to provide pinpoint accuracy of sea-floor features and sensor positions *via* an additional USBL locator attached to the SSD lander frame. Secondary objectives were to recover sensors from the seafloor, to provide another opportunity for the USF to test their Fluorescents/Mass Spectrometer system at SW Crater, MC118, and for the University of Georgia to test their microbial filtering system. In addition, it was anticipated that the Storm/Sperm Whale song Monitor deployed successfully in July could be recovered, the

data downloaded onboard ship, and the monitoring device redeployed.

The seafloor monitoring station/observatory is funded approximately equally by three federal Agencies: Minerals Management Services (MMS) of the Department of the Interior (DOI), National Energy Technology Laboratory (NETL) of the Department of Energy (DOE), and the Seabed Technology Research Center (STRC), a division of the National Institute for Undersea Science and Technology (NIUST), an agency of the National Oceanographic and Atmospheric Administration (NOAA), Department of Commerce (DOC).

Noteworthy accomplishments of Consortium researchers funded with DOE's contributions to this multiagency effort during this six-month cycle include:

- Design and construction of the Horizontal Line Arrays (HLAs):
  - The Horizontal Line Array (HLA) design evolved through the second half of 2007 with a change from 2 to 4 arrays,
  - The length of each "arm" of the arrays was increased from 400 to 500 meters,
  - 4C sensor packages have been replaced with all hydrophone arrays,
  - New cable designs were developed to meet these program needs and
  - A new deployment concept was developed.
- Seismic Data Processing at the Gas Hydrate Sea-floor Observatory: MC118:
  - The seismic data-acquisition system that will be deployed on the seafloor at the sea-floor observatory in Block MC118 was field tested in the shallow waters of Biloxi Bay.
  - Impulses from a seafloor-positioned impact sled were recorded by the sensor package, a 3-component accelerometer and a hydrophone.
  - Shallow-water test data are now available for analysis.

- Coupling of Continuous Geochemical and Sea-floor Acoustic Measurements:
  - Manuscripts have been submitted to twp peer-reviewed journals,
  - Florida State University (FSU) has built 12 new osmosamplers; deployment is scheduled for May-June, 2008.
  - Temperature probes were purchased for integration into future Pore-Fluid Array (PFA) sampler boxes in order to determine the exact temperature at which the OsmoSamplers are deployed (osmopumping rates are solely dependent upon temperature) and to have a temporal record of bottom seawater temperatures.
  - University of North Carolina – Chapel Hill (UNC-CH) and Georgia Tech researchers collaborated to determine the relative contribution of coccolith calcite and authigenic carbonate in MC118 sediment cores using a technique designed to determine relative contribution of carbonates produced by overlying water column carbonates (i.e. coccoliths) or carbonates produced *in situ* by chemical precipitation (i.e., authigenic carbonates). They found that cores demonstrating high microbial activity were relatively more enriched with authigenic carbonates than coccolith carbonate.

- Noise-Based Gas Hydrates Monitoring:
    - In the second half of 2007, noise-based monitoring efforts were focused on analyzing array data from the SW06 site where tropical storm Ernesto passed nearby.
    - Two papers on this analysis have been submitted to the Journal of Society of America Express Letters.

- Administration of the Monitoring Station/Sea-floor Observatory project this reporting period has consisted of:
    - Organizing and hosting an October meeting of the Consortium held in Oxford, MS and attended by 35 Consortium members.
    - Organizing and carrying out a July cruise aboard the R/V *Pelican* to test the capabilities of the Consortium-designed and built robotic Station Service Device (SSD) and to provide additional operator experience for the SSD crew. Additional objectives included deploying the microbial filter/collector and mass spectrometer as well as a storm monitor
    - Organizing and carrying out a November cruise aboard the R/V *Pelican* to pursue some of the same missions of the July cruise and to collect instruments and sediment samples from MC118.
    - Reporting to and interacting with sponsoring agencies and their officers as well as with Consortium members. The semiannual progress report, 42877R04 was completed and submitted in August and the semiannual progress report, 41628R20 was completed and submitted to DOE in December, 2007. Monthly reports have been made to DOE each month of the reporting period. Documents deriving from the Fall Meeting were generated and compiled to create a CD which has been distributed to meeting attendees.

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LIST OF GRAPHICAL MATERIALS

Graphical materials used to illustrate reports can be found in the individual reports submitted by the subcontractors.

INTRODUCTION / PROJECT SUMMARY

The Gulf of Mexico-Hydrate Research Consortium (GOM-HRC) is in its eighth year of developing a sea-floor station to monitor a mound where hydrates outcrop on the sea floor. The plan for the Monitoring Station/Sea Floor Observatory (MS/SFO) is that it be a multi-sensor station that provides more-or-less continuous monitoring of the near-seabed hydrocarbon system, within the hydrate stability zone (HSZ) of the northern Gulf of Mexico (GOM). The goal of the GOM-HRC is to oversee the development and emplacement of such a facility to provide a better understanding of this complex hydrocarbon system, particularly hydrate formation and dissociation, fluid venting to the water column, and associated microbial and/or chemosynthetic communities. Models developed from these studies should provide a better understanding of gas hydrates and associated free gas as: 1) a geo-hazard to conventional deep oil and gas activities; 2) a future energy resource of considerable significance; and 3) a source of hydrocarbon gases, venting to the water column and eventually the atmosphere, with global climate implications.

Initial funding for the MS/SFO was received from the Department of Interior (DOI) Minerals Management Service (MMS) in FY1998. Funding from the Department of Energy (DOE) National Energy Technology Laboratory (NETL) began in FY2000 and from the Department of Commerce (DOC) National Oceanographic and Atmospheric Administration's National Undersea Research Program (NOAA-NURP) in 2002. Some ten industries and fifteen universities, the United States Geological Survey (USGS), the US Navy, Naval Meteorology and Oceanography Command, Naval Research Laboratory and NOAA's National Data Buoy Center are involved at various levels of participation. Funded investigations include a range of physical, chemical, and, more recently, microbiological studies.

EXECUTIVE SUMMARY

A consortium has been assembled for the purpose of consolidating both the laboratory and field efforts of leaders in gas hydrates research. The Consortium, established at and administered by the University of Mississippi's Center for Marine Resources and Environmental Technology (CMRET), has, as its primary objective, the design and emplacement of a remote monitoring station on the sea-floor in the northern Gulf of Mexico. The primary purpose of the station is to monitor activity in an area where gas hydrates are known to be present at, or just below, the sea-floor. In order to meet this goal, the Consortium has developed and assembled components for a station that will monitor physical and chemical parameters of the sea water, sea-floor sediments, and shallow subsea-floor sediments on a more-or-less continuous basis over an extended period of time.

Central to the establishment of the Consortium is the need to coordinate activities, avoid redundancies and promote effective and efficient communication among researchers in this growing area of research. Complementary expertise, both scientific and technical, has been assembled; collaborative research and coordinated research

methods have grown out of the Consortium and design and construction of most instrumentation for the sea-floor station is essentially complete.

The MS/SFO was designed to accommodate the possibility of expanding its capabilities to include biological monitoring. A portion of FY04 funding from the MMS was directed toward this effort to support the study of chemosynthetic communities and their interactions with geologic processes. In addition, results will provide an assessment of environmental health in the area of the station. NOAA-NURP has, as a focal point, investigations of the effects of deep sea activities on world atmosphere and therefore, weather. In July of 2005, the Director of the National Institute for Undersea Science and Technology (NIUST) of NOAA-NURP made a portion of that agency's budget available, *via* competitive grants, to researchers with proven expertise in microbial research. A sea-floor microbial observatory is an objective of that agency and these sponsored projects sited at the MS/SFO are designed to fulfill that directive.

The centerpiece of the observatory, is a series of vertical and horizontal line arrays of sensors (VLA, HLAs) designed to detect shifts in the hydrate stability zone (HSZ). The VLA is to be moored to the sea floor and extend approximately 200 meters from the sea-floor into the water column. Sensors in the VLA include hydrophones to record water-borne acoustic energy (and measure sound speed in the lower water column), thermistors to measure water temperature, tilt meters to sense deviations from the vertical induced by water currents, and compasses to indicate the directions in which the deviations occur. The prospective horizontal water-bottom arrays, will consist of hydrophones and will be laid upon, and pressed into, the soft sediment of the sea-floor. They will be arranged into a cross with four 500m-long arms so that they simulate two perpendicular arrays, with each of the two directions approximating the water depth at the observatory site. Their deployment will be accomplished by means of a sea-floor sled designed to lay cable and deploy probes into shallow, unconsolidated sediments. This sled will also be used as a seismic source of compressional and shear waves for calibrating the subsurface seismo-acoustic array commissioned by the Joint Industries Program (JIP). It is anticipated that accelerometers will be implanted in the vicinity of the HLAs in the future, thus making it possible to image the HSZ to greater depths and to see interstitial space occupied by gas (as shown by hydrophone data, which do not travel through gas).

The prototype DOE-funded VLA has been completed and tested together with the associated data-logging and processing systems. The NOAA/NURP/NIUST-funded Bubble Counter, Oceanographic Benthic Boundary Layer Array (BBLA), Chimney Sampler Array (CSA), - equipped with a variety of sensors: thermistors, fluorometers, oxygen sensors, transmissometers, mass spectrometers, conductivity and current flow meters – have been deployed at the observatory site, and recovered at MC118 *via* the Johnson SeaLink. Processing techniques continue to be developed for vertical array data by Consortium participants who are currently funded by the MMS.

A Remotely Operated Vehicle (ROV) mateable connector system was designed and installed in the VLA Data Acquisition and Telemetry System (DATS) deployed in 2005. This improved design has been incorporated into the VLA and the Oceanographic Line Array (OLA) components of the observatory. Positioning sensors – including compass and tilt sensors – have been completed and tested. Pressure housings rated twice that of any anticipated deployment have been built and pressure tested.

In May, 2005, the Sea-Floor Probe (SFP) was used to retrieve core samples from MC118 as part of the effort to select sites appropriate for deployment of the thermistor and geochemical probes. The northwestern portion of the mound area defined on images recovered during a C&C autonomous underwater vehicle (AUV) survey April 30-May 2, 2005, was selected for probe deployments based on information from these cores. Both the pore-fluid array and the thermistor array were deployed *via* SFP at MC118 in May, 2005.

A complete surface-source/deep-receiver (SS/DR) survey of the mound at MC118 has been made and a drift camera designed, deployed and used successfully to survey the sea-floor, visually. The SS/DR survey consists of north-south lines spaced 50m apart and east-west lines at 100m spacing over the mound at MC118. The resultant 109 profiles of very high resolution seismic data have undergone preliminary processing to create a 3-D model of the mound. Normal-incidence reflection seismic traces recorded over the mound were obtained using an $80in^3$ watergun source at the water surface and a single hydrophone deep-towed (350-400m) vertically below the source. The data set describes the interior of the mound to a depth of more than 300m below the sea floor with vertical resolution on the order of a meter. Results are expected to be sufficient to describe the entire hydrate stability zone in the vicinity of the mound. The 30,000-trace data set has been processed using source-signature phase conjugation, spherical-divergence corrections and a high-cut filter to attenuate the noise in the shallow section. The amount of attenuation achieved was less than desired, however, and the filter produced undesired phase shifts. It was decided to redo the processing using the method of Empirical Mode Decomposition described by Battista et al. (2007).

Following several “false starts” in the wake of Hurricane Katrina, anticipating the use of other vessels which never did become available, the CMRET eventually secured seven days of ship time aboard the R/V *Seward Johnson* with use of its manned-submersible, the Johnson SeaLink. This vessel combination was used to retrieve the osmopump packages and data-loggers deployed in 2005, to conduct visual surveys of the observatory site at MC118 and to deploy sensors and experiments. Experiments designed to assess water-column geochemistry, microbial communities and activities, hydrate host materials, and composition of pore-fluids were left on the sea-floor for several months’ data collection.

The Pore Fluid Array, which had been installed in May, 2005, was located on the first dive of the September *Seward Johnson*/Johnson SeaLink cruise, upright and protruding from the sediments by about 2 meters. The osmo-pumps and sampling

loops were recovered and a replacement box and pumps were interfaced to the PFA device on a subsequent dive.

A second PFA osmosampler was placed on the sea-floor near the southwestern crater at the site designated “Rudyville”. Pore water equilibrators or “peepers” were installed at three sites at MC118. In addition to samples and data collected from these instruments, methane concentration and isotope samples were collected from 8 cores that were collected using the SeaLink at a variety of sites along transects across microbial mats.

Acoustic wipe-out zones may be indicative of active methane venting from sediments containing gas hydrate. Analysis of data recovered from the Pore-Fluid Array and the Geophysical Line Array (GLA) indicate that the pore-fluids at 8.5m depth are many times brinier than “normal” pore-fluids and are likely inhibiting the formation of hydrates and diminishing the extent of the hydrate stability zone in the area of the northwest vent on the mound at MC118.

Analyses of cores from MC118 have been made and reveal that these cores are isotopically lighter than the vent gas, suggesting microbial methane production in the surface sediments. The dissolved methane in the porewaters is a mixture of biogenic and thermogenic sources, with more biogenic methane near the surface. Three cores are depleted in sulfate within 10 cm of the sediment-seawater interface. Although the average sea-water chloride concentration varies, brine was not present within the surface sediments.

Sediments collected from Mississippi Canyon have been studied for effects of parameters possibly involved in hydrate formation. The sediments vary in mineral composition as well as in grain size. They also vary in the extent and variety of microbial activities that occur in them, suggesting diverse bioproducts.

Smectite clays promote hydrate formation when basic platelets slough off the clay mass. These small platelets act as nuclei for hydrate formation. Anionic bioproducts may collect in the interlayers of the platelets and become involved in the mechanism of hydrate promotion.

It remains unclear exactly how particle size/size distributions affect hydrate formation. It is thought that the variety of bioproducts existing with depth in the sediments may mask particle size effects—that is, some bioproducts may promote hydrate formation and others may coat particles and retard hydrate formation.

The Consortium’s geophysical team conducted a test of the 4-C prototype horizontal line array in June, 2007, offshore Biloxi, MS. The test featured an advanced accelerometer design, for incorporation in a 4-component, hydrophone and accelerometer (for p- and s-wave reception, respectively) passive seismic array net work. Accelerometer shear data were collected, generated from the MMRI-developed seismic gun shear-sled. Multiple accelerometer sensors coupled with multiple

hydrophone sensors were used to simulate down-hole arrays or deep-sea HLAs. Shear phones were installed in 3 different ways and multiple data lines shot varying shot-point offsets and spacings and recovering data with excellent signal–to-noise ratios. This seismic array design will enable the use of natural surface noise (*via* hydrophone) and microseism noise from salt movement (*via* accelerometer). The goal is to use these passive seismic sources for long-term monitoring of structural and hydrocarbon fluid dynamics in a way analogous to conventional reservoir monitoring. The system will be incorporated into the SFO at the hydrate mound/salt dome complex at MC118, providing the capability of long-term, continuous seismic monitoring that is marine mammal friendly through the elimination of the traditional seismic energy source.

Seismic data-processing software has been developed at Exploration Geophysics Laboratory (EGL) of the Texas Bureau of Economic Geology (BEG) that is structured to optimize P-P and P-SV image resolution in the immediate vicinity of 4C seafloor-based seismic sensors. This data-processing strategy can now be applied to data acquired with the actual sensor system that will be deployed across Block MC118.

Specialty Devices, Inc. (SDI) has redesigned the HLAs to accommodate the Consortium's deployment schedule. Rather than the 2 HLAs each 400m in length and containing 4C nodes, the redesign is for hydrophones only in 500m length arrays arranged in a cross that provides 1000m arrays orthogonal to each other but with data-loggers and power centrally located. The redesign effort included changes to the cable and hydrophone electronics to accommodate increased cable length and weight. The redesign also includes nested hydrophones that will provide both high resolution (closely spaced) and depth of resolution (greater spacing). Additional hardware, required to handle cable during deployment, is being built and a new deployment scheme established. Power issues are being addressed as the longer cabling poses additional challenges to transmission of power to array extremes.

Efforts to collect high resolution pressurized pore-water samples to investigate the control of gas hydrate dissolution at MC-118 included the deployment of 6 peepers and one osmolander at MC 118 in September 2006. One peeper is located about 50cm from outcropping hydrate and about 50cm from a bacterial mat, in about 15cm of sediment. This peeper was collected in March, 2007, using the station service device (SSD). It has been analyzed for methane concentrations; 100uM closest to the hydrate, increasing to 325uM 10cm distant. Although these preliminary results counter the original hypothesis, that methane concentrations will be higher closest to the hydrate, they suggest that there is a methane sink closest to the hydrate, possibly attributable to microbial oxidation. Manuscripts discussing these original findings have been submitted to peer-reviewed journals,

FSU has built 12 new osmosamplers; deployment is scheduled for May-June, 2008. Temperature probes were purchased in order to integrate them onto future PFA sampler boxes in order to determine the exact temperature at which the OsmoSamplers are deployed (osmopumping rates are solely dependent upon temperature) and to have

a temporal record of bottom seawater temperatures. Consortium researchers have coordinated efforts to characterize sediments from MC118; Geochemists at the University of North Carolina and Georgia Institute of Technology are working together to determine the relative contribution of coccolith calcite and authigenic carbonate in cores using a technique designed to determine relative contribution of carbonates produced by overlying water column carbonates (i.e., coccoliths) or carbonates produced *in situ* by chemical precipitation (i.e., authigenic carbonates). They found that high microbial activity appears in cores relatively more enriched with authigenic carbonates as opposed to coccolith carbonate.

Reporting to and interacting with sponsoring agencies and their officers as well as with Consortium members is a primary administrative function of CMRET. Technical semiannual progress reports 42168R20 and 42877R04 were completed and submitted to DOE during this reporting period as were regular monthly reports documenting progress of subcontractors and the Consortium in general. In October, the Consortium held its fall meeting in Oxford, Mississippi. This gathering was attended by 35 members, 11 of whom made presentations (see attached Appendix), and a meeting CD including presentations by participants (both funded and not-funded), complete Consortium member contact information, an agenda, and summary documents, was distributed to meeting attendees as well as to interested parties who requested copies. Consortium administrators traveled to Golden, Colorado at the invitation of the DOE Methane Hydrate Research and Development Division to participate in the merit-review process of DOE-sponsored hydrate research projects.

The CMRET planned and executed two cruises during the reporting period to perform additional tests of the SSD and to use it for retrieval of instruments, if possible, at the Observatory site. The R/V *Pelican,* departed Cocodrie July 2 with representatives from four projects aboard, including the DOE-funded Pore-fluid collector. The primary objective of the cruise was to conduct further tests of the custom-built SSD following modifications made since the March 2007 test cruise to the trim flotation, ballast system and tether cable. Of equal importance to the success of the SSD, this cruise provided additional training for the SSD operators. Also of interest was the collection of several microbial and pore fluid experiments from the SW crater at MC118. A tertiary objective was to test the USF, X-Ray Fluorescents/Mass Spec system for high resolution analysis of hydrocarbon fluids in solution in the lower water column at an active gas hydrate/vent site. UNC-CH went prepared to deploy a replacement “box” (osmopumps and ~6 months worth of sample-collecting capillary tubing) on the 10m probe already located on the sea-floor at MC118.

While successes of the cruise included several successful deployments and recoveries of the SSD and its lander cage, ballast problems continued to plague the efforts of the operators, and the ship’s directional input was apparently damaged by the combination of a lightning strike to the ship and damage to the stiff-arm supporting the USBL transducers which shorted to the frame. Positioning was complicated by a 1.5-2.0kt loop current normal to direction of 18kt winds. The newly acquired heave

compensator worked well, relieving surge loading in seas up to 2m. A storm monitor was deployed successfully at MC118 during this cruise. A Biolec experiment was located and recovered only to be lost when power to the SSD was lost temporarily when the tether snagged on the crater in which the experiment had been located. Video was lost when the fiber-optic element in the tether cable was broken while freeing the SSD from stiff sea-floor mud. The tether winch motor gear box was found to be stripped; this was remedied by swapping the sister motor used to drive the ballast trim float with the failed motor on the winch. Meanwhile, the Mass Spectrometer fusing element appeared to be incompatible with the ship's electrical systems and the team was unable to deploy the instrument for the test. It was later determined that the mass spec could not be adapted onboard. Many of the challenges of this cruise were overcome at sea but as no instrument recoveries were actually completed, a follow-up cruise was scheduled for November, to afford scientists and engineers adequate time to repair/re-engineer the sources of failure.

November 5-13, Consortium scientists again chartered LUMCON's R/V *Pelican*, and returned to MC118. This cruise was crowded with objectives. The TSS (dynamic motion sensor) acquired by the Consortium *via* Vernon Asper, University of Southern Mississippi, was installed. The ultra-short baseline (USBL) transducers were installed and the system calibrated. It appeared to work flawlessly. The University of Georgia's microbial filter and USF's X-Ray Fluorescents/Mass Spec system (for high resolution analysis of hydrocarbon fluids in solution in the lower water column at an active gas hydrate/vent site.) were deployed and operated separately and in concert with excellent results. The former had been deployed successfully on previous cruises but the latter had never undergone a successful deployment to depth until this cruise. The storm monitor deployed in July was recovered successfully, in good condition, and with good data. A third storm monitor was deployed. Two dives of the SSD were made and all markers and instruments left on the sea-floor on previous site-visits were located with pin-point accuracy by virtue of the fact that the SSD frame now carries its own USBL. Many hours of video of the sea-floor at MC118 were recovered *via* multiple cameras on the SSD. Sediment samples were recovered from the vicinities of both the Northwest and Southwest crater complexes using push-cores in box-core samples. Precise locations of these cores were made possible by attaching the USBL to the cable immediately above the corer. Specifics of sample collection were followed as per instructions from Mandy Joye (University of Georgia) and Charlotte Brunner (University of Southern Mississippi). Additional samples were collected for geochemical and geotechnical analyses by Roger Sassen (Texas A&M University) and Rudy Rogers (Mississippi State University). Due to electrical failures/difficulties, the SSD was not able to exit the lander cage (and maintain power). As a result, no instruments could be recovered from the sea-floor and no samples recovered *via* the SSD. Video from the SSD dives is murky due to the amazing amount of particulate matter in the water column. The source of this suspended material and debris covering the instruments is possibly related to the changes observed in the hydrate outcrops – diminished and exhibiting slump features.

EXPERIMENTAL

Experiments are described in the individual reports submitted by the subcontractors.

RESULTS AND DISCUSSION

Results and discussion of those results are described in the individual reports submitted by the subcontractors. Reports from the subcontractors follow.

CONCLUSIONS

This report covers the accomplishments of the third six-month period of funding of Cooperative agreement Project #DE-FC26-06NT42877, between the Department of Energy and the Center for Marine Resources and Environmental Technology, University of Mississippi. The efforts of the Hydrates Research Consortium are reviewed: cruises to test and/or deploy instruments have been made, innovative data processing techniques developed, HLA configuration and electronics challenges resolved, additional dives of the SSD made with resulting improvements to that system, additional samples collected from MC118, collaborations made and continued among Consortium members, additional pore-fluid collecting devices completed. Several manuscripts have been submitted to peer-reviewed journals and several additional papers and presentations have resulted from Consortium research efforts. Additional cruises are scheduled for retrieval of instrumentation that remains on the sea-floor. Every effort has been – and will continue to be – made to maximize Consortium members' access to and benefit from the cruises scheduled for 2008.

Project summaries of the subcontractors' efforts appear in their reports contained within this document. Appendices include documents relating to the fall Meeting of the Consortium.

REFERENCES

Battista, B., Knapp, C., McGee, T.M., Goebel, V., 2007, Applications of the Empirical Mode Decomposition and Hilbert-Hoang Transform to Seismic Reflector Data, Geophysics, V.72, pp H29-H37.

Additional relevant references appear following contributions by the individual subcontractors.

HYDRATE RESEARCH AT THE UNIVERSITY OF MISSISSIPPI

SEMIANNUAL TECHNICAL PROGRESS REPORT
1 JULY, 2007 THROUGH 31 DECEMBER, 2007

Principal Investigator: Paul Higley

Date Issued: February 28, 2008

DOE Cooperative Agreement No. DE-FC26-06NT42877

Task 1: Design and Construction of Four Horizontal Line Arrays

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Design and Construction of four Horizontal Line Arrays: Development of a set of Horizontal Line Arrays for Installation in the Gas Hydrates Research Consortium Sea Floor Observatory

Introduction
The Horizontal Line Array (HLA) design evolved through the second half of 2007 with a change from 2 to 4 arrays, an increase in individual array length from 400 to 500 meters and replacing the 4C sensor packages with all hydrophone arrays. New cable designs were developed to meet these program needs and a deployment concept was developed.

Background
The Horizontal Line Array (HLA) design was contracted in April 2007 with the plan to build two horizontal 4C arrays utilizing technology developed for these 4C sensors during the Borehole Line Array (BLA) development project. The project plan for the Horizontal Line Arrays included building 2 arrays of 4C sensors, each 400 meters long. Cable designs were developed and quotes obtained for various possible configurations during the last period

Activities during this period
The program emphasis was changed in the summer of 2007 to build four longer arrays of hydrophones only. These four Horizontal Line Arrays were to have 16 hydrophones each and the length of each array was to be extended from 400 meters to 500 meters. The additional length required an effort to accommodate longer distances between the HLA DATS and the Integrated Data Power Unit (IDP) if the original “L” shaped deployment configuration was to be maintained. While a prototype design was developed to allow the Ethernet to communicate over greater distances, the plan for two arrays arranged in an “L” shaped deployment configuration was changed to having the four arrays deployed in an “X” shaped configuration. This allowed the HLA array DATS to be placed at the center of the “X” pattern. This change was effected by September of 2007 and a design phase begun for the new array configurations. The restriction to this approach is that the center of the “X” pattern needs to be within 25 to possibly 50 meters from the IDP. This is limited by the viable operational distance for Ethernet and the distance that the system power can be sent to the HLA DATS from the IDP power provider.

The design for the cable to be used with the 4C sensors packages was modified and a new cable design developed which would allow the total line length to increase while maintaining the same performance and cost levels. The design effort included changes to the cable and hydrophone electronics to accommodate the increased cable length and cable weight.

During the August to October time-frame the spacing of the hydrophones on the four HLAs was resolved with the consortium members and a new cable design was drawn and cable production quotes were obtained. Significant concerns including cable weight

and length and a method to deploy these cables and a concern over the water block material that is compatible with the molding technique were also addressed during this period.

The expenses for building a total of 800 meters of cable versus the now 2,000 meters of cable meant considerably greater cost for purchasing the cable and thus created a higher risk should the design of the cable have a flaw. A greater effort was therefore expended on reviewing this cable design. Also the added length of cable to be handled during the cut and molding of connectors to this cable necessitated a change to the way the connector shop was to handle these long cables. A plan to accomplish this has been developed and the hardware to handle the cables during installation of the connectors is being built.

Additionally a method for deploying these long cables from the “X” pattern needed to be resolved. Discussions with MMRI and SDI resulted in a promising approach using five cable spools mounted on a central HLA frame. Four cable spools each contain an HLA and the fifth spool contains the extension cable to the IDP. Following deployment of this HLA frame in the vicinity of the IDP, each HLA array spool would be picked up by the SSD and towed to un-spool and deploy the HLA. Following all four HLA deployments the fifth spool would be picked up and towed to the IDP and one connection would be made to attach the HLA arrays to the IDP. Several cabling and electronics ramifications need to be addressed to accomplish this but the resulting simplification of the HLA deployment is beneficial. The power transmission may require a heavier conductor in the extension cable, the battery voltage for the pressure compensated battery has been increased to allow more HLA DATS to run from a single extension cable and a method for distributing Ethernet communications to all 4 HLA DATS through the one cable will need to be developed to make this deployment plan viable.

Summary

The modification of the HLA s from 2 arrays with 4C sensors to 4 longer arrays with hydrophone sensors has progressed well with costs retained at the same levels and an improvement to the deployment method. Remaining issues include getting the long cable lengths manufactured, adapting HLA DATS and IDP electronics to handle the longer lengths, more sensors and deployment method without increasing costs.

References

None.

Support of Gulf of Mexico Hydrate Research Consortium: Activities to Support Establishment of Seafloor Monitoring Station

SIX-MONTHS PROGRESS REPORT

Reporting Period Start Date: July 1, 2007

Reporting Period End Date: December 31, 2007

Principal Investigator (Author): Bob A. Hardage

Date Issued: January 28, 2008

DOE Cooperative Agreement No. DE-FC26-02NT41628

Task 2: Seismic Data Processing at the Gas Hydrate Sea-Floor Observatory: MC118

Submitting Organization:
Bureau of Economic Geology
John A. and Katherine G. Jackson School of Geosciences
The University of Texas at Austin
University Station, Box X
Austin, TX 78713-8924

Abstract

The seismic data-acquisition system that will be deployed on the seafloor at the hydrate observation in Block MC118 was field tested in the shallow waters of Biloxi Bay. Several impulses from a seafloor-positioned impact sled were recorded by the sensor package, consisting of a 3-component accelerometer and a hydrophone, that will be installed on the seafloor at Block MC118. Our analysis of these 4-component data will be reported at the next consortium meeting in Oxford, MS in February 2008.

Introduction

One objective of the research work that will be done at the seafloor observatory is to deploy 4-component (4C) seismic sensors on the seafloor that can be used to monitor calendar-time variations in the P-P and P-SV reflectivities of interfaces that extend from the seafloor to the base of the hydrate stability zone. Analysis of these alterations in the seismic response will be useful for determining if and how the hydrate system beneath the observatory site varies as a function of calendar-time events such as thermal cycles in the water column and local microseisms.

Executive Summary

Seismic data-processing software has been developed at EGL that is structured to optimize P-P and P-SV image resolution in the immediate vicinity of 4C seafloor-based seismic sensors. This data-processing strategy can now be applied to data acquired with the actual sensor system that will be deployed across Block MC118. The first field test of this sensor system was done in Biloxi Bay during this reporting period and was provided to the Bureau research team in November. Our analysis of the data will be presented at the 2008 meeting of the consortium members in Oxford, MS, which is scheduled for late February 2008.

Experimental

Experimental activity during this period focused on deploying the 4C seafloor seismic sensor package in Biloxi Bay and acquiring test data with a seafloor-positioned impact source. Each sensor package consisted of a 3-component solid-state accelerometer unit that measured seafloor movement in 3-dimensional space and a hydrophone, which provided pressure variations at the seafloor as the fourth data component. These test data will allow us to analyze sensor performance and also much of the seismic data-acquisition system.

Results and Discussion

Our analysis of the seismic test data began late in the report period. Our objective is to have a complete and thorough data analysis prepared for the consortium meeting that will convene in February 2008.

Conclusions

The seismic measurement portion of the seafloor monitoring project has progressed to the point that the actual seismic sensor package that will be deployed at Block MC118 can now be used to acquire test data. Initial tests have been done in

shallow water. The data acquired in these tests are being analyzed to determine if there are any deficiencies in the sensor performance or in the data-acquisition system.

References

None

Abbreviations and Acronyms

3-C: three-component
4-C: four-component
MC: Mississippi Canyon
P-P: compressional wave mode
P-SV: converted shear mode

HYDRATE RESEARCH AT THE UNIVERSITY OF MISSISSIPPI

SEMIANNUAL TECHNICAL PROGRESS REPORT
1 JULY, 2007 THROUGH 31 DECEMBER, 2007

Principal Investigators:
Jeff Chanton and Laura Lapham, Florida State University

Associated Collaborator:
Paul Higley, Specialty Devices Inc.

Date Issued: February 5, 2008

DOE Cooperative Agreement No. DE-FC26-06NT42877

Task 3: Coupling of Continuous Geochemical and Sea-floor Acoustic Measurements

Coupling of Continuous Geochemical and Sea-floor Acoustic Measurements

Activities up to date:

1. Manuscripts

a. "Microbial activity in surficial sediments overlying acoustic wipe-out zones at a Gulf of Mexico cold seep" by Lapham, Chanton, Martens, Sleeper, and Woolsey to Geochemistry, Geophysics, Geosystems, submitted. (copy attached)

b. "Applying a diagenetic model to estimate upward advection rates at two Gulf of Mexico brine seeps" by Lapham, Alperin, Chanton, and Martens to Marine Chemistry, submitted.

2. Meetings

a. DOE Merit Review Board Meeting - September 2007

-Jeff Chanton presented: "Geochemical studies at MC 118 Seafloor Station" by Chanton, Lapham, Martens, Higley, Woolsey, Rogers, Whelan, Camilli, and Sassen.

b. Consortium Semi-Annual Meeting – October 2007

-Laura Lapham presented the following paper: "What is the role dissolved methane plays in hydrate stability?" by Lapham, Chanton, Mendlovitz, Albert, Martens, Higley, Noakes, Lowe, Gossett, and Woolsey

c. American Geophysical Union Meeting - Dec 2007

-Laura Lapham presented the following paper: "Methane and biogeochemical gradients within acoustic wipe-out zones at a Gulf of Mexico cold seep" by Lapham, Chanton, Martens, Sleeper, and Woolsey.

3. Cruises

a. June 2007 Consortium cruise

-objectives: to pick up seafloor instruments emplaced at MC 118, including the Pore-Fluid Array (PFA)

-results: No seafloor instruments were retrieved.

b. Nov 2007 Consortium cruise

-objectives: to pick up seafloor instruments emplaced at MC 118, including the Pore-Fluid Array (PFA)

-results: No seafloor instruments were retrieved however, samples for other consortium members were collected. Sediment box cores were collected, processed, and preserved for Drs. Mandy Joye and Charlotte Brunner.

4. Laboratory work

a. Laura Lapham visited Dr. Boris Mizaikoff's laboratory at Georgia Tech and worked with Yulia Luzinova and Dr. Gary Dobbs to determine the relative contribution of coccolith calcite and authigenic carbonate in 4 cores (one background, one moderate microbial activity, and two with high microbial activity). This is important

because it tells you relative presence of carbonates produced by overlying water column carbonates (i.e., coccoliths) or carbonates produced *in situ* by chemical precipitation (i.e., authigenic carbonates). We used a novel technique called Infrared-Attenuated Total Reflection Spectroscopy (Dobbs, 2007, Georgia Tech PhD dissertation. This technique can determine the relative contribution of carbonate pool from coccoliths and authigenic carbonates. Since a byproduct of microbial activity is bicarbonate, the precursor to authigenic carbonates, we hypothesized that there would be more authigenic carbonate in the high microbial activity cores than the moderate or the background cores. We found that where there was high microbial activity, the cores were relatively more enriched with authigenic carbonates than coccolith carbonate (Table 1). These results therefore support the idea that microbial activity is both spatially and temporally variable at MC 118. They are also significant in that they provide a quick and easy method of determining where high microbial activity is found.

Table 1: Summary of the presence of strong coccolith or authigenic carbonates absorption features.

Core #	Microbial activity	Strong Coccolith features	Strong Authigenic Carbonate features
1	Low (background)	0-18 cmbsf	>18 cmbsf
29	Moderate	0-40 cmbsf	>40 cmbsf
26	High (SW crater)	0-3 cmbsf	>3 cmbsf
9	High (NW crater)	none	>0 cmbsf

b. Twelve OsmoSamplers were built and assembled at the Florida State University Machine Shop. Instrument quality control testing will begin in Feb 2008. Deployment of these instruments as integrated into the Pore Fluid Array is planned for the May/June 2008 cruise.

c. Temperature probes were also purchased in order to integrate them onto future PFA sampler boxes. This will serve two purposes. The first is to know the exact temperature at which the OsmoSamplers are deployed in. This is important since the sampler pumping rates are solely dependent upon temperature. The second purpose of the thermisters is to have a temporal record of bottom seawater temperatures. Preliminary evidence with a 50-day temperature record shows that the temperature shifts between 4.2 and 5.0ºC (Figure 1, Paul Higley unpublished data).

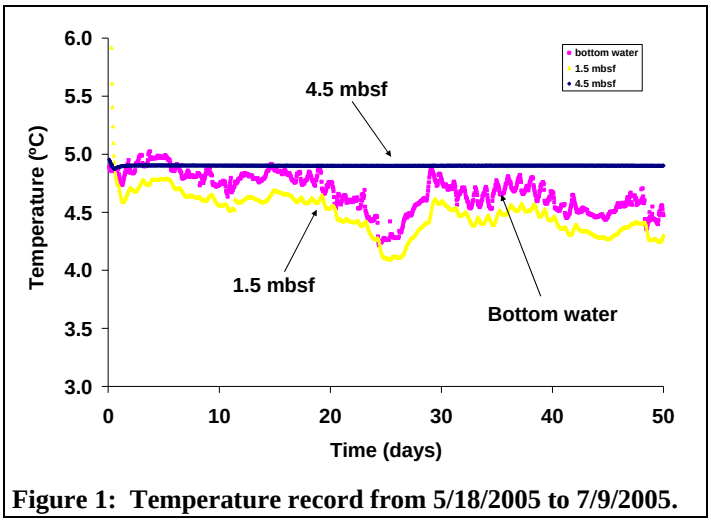

Figure 1: Temperature record from 5/18/2005 to 7/9/2005.

HYDRATE RESEARCH AT THE UNIVERSITY OF MISSISSIPPI

SEMIANNUAL TECHNICAL PROGRESS REPORT
1 JUNE, 2007 THROUGH 31 DECEMBER, 2007

Principal Investigator: Peter Gerstoft

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Date Issued: February 4, 2008

DOE Cooperative Agreement No. DE-FC26-06NT42877

Task 4: Noise-Based Gas Hydrates Monitoring:
Monitoring gas hydrates by extracting Green's functions from noise

Abstract
Monitoring of gas hydrates at Mississippi Canyon 118 is possible using ambient noise as a sound source. The goal is to attempt to apply passive methods to supply information similar to that supplied by active sources, but on a continuous basis as passive sources, such as wave-noise, are everpresent at MC118.

Introduction
By using ambient noise-based methods with dense networks, passive monitoring of gas hydrates is possible. Making use of ambient-noise cross correlation function of diffuse fields between two receivers, information can be recovered that is similar to that recovered using an active source.

Executive summary
In the second half of 2007, we have focused on analyzing array data from the SW06 site where tropical storm Ernesto passed nearby. We have submitted two papers on this analysis to the Journal of Society of America Express Letters.

Hurricane monitoring
In the first paper, we focused on characterizing the acoustic environment due to Hurricane Ernesto. Variations in ambient noise levels at the SW06 shallow water site due to Tropical Storm Ernesto were observed with the SWAMI32 and SWAMI52 hydrophone arrays, separated by 15 km. Microseisms were observed at 0.02--0.18 Hz and between 0.2—2 Hz. Temporal variations in the spectra recorded by the two arrays below 2 Hz were similar and the microseism spectra were consistent with measurements of local wave spectra below 0.2 Hz. Beamforming at 5—75 Hz showed a sound field dominated by local surface-noise punctuated by brief surges of noise from distant sources. Changes in the acoustic environment on the time-scale of hours were measured by beamforming and time-domain cross-correlations with good correlation in time and directionality.

The environment is shown in Figure 1. An example of observed spectrograms is shown in Figure 2. Figure 3 shows an example of the noise cross correlation function over a one-day period.

Noise cross correlation
In the second paper we focused on using noise cross correlation to determine channel switching in an array. This involves length scales similar to those that we will be working with in the Gulf of Mexico. A practical application of noise correlation for the analysis of channel switching on an ocean hydrophone array is presented. Acoustic data was recorded on a horizontal line array on the New Jersey Shelf while Tropical Storm Ernesto passed through on 2nd September 2006. Results obtained from active source measurements prior and after the storm revealed that several channels switched during the storm. Noise correlation of data recorded during the storm was performed. Changes in the cross-correlation clearly showed when, and in what manner, the channel switching took place.

Submitted papers:
- Traer, J., P Gerstoft, WS Hodgkiss, LA Brooks, PD Bromirski, Acoustic signature of tropical storm Ernesto, JASA-EL, submitted 2008.
- Brooks, LA, P Gerstoft, DP Knobles, Using noise correlation to determine channel switching in an array, JASA-EL, submitted 2008.

Conclusions
Two papers demonstrate the utility of passive monitoring. The analysis shows promise of providing a true monitoring capability at MC118.

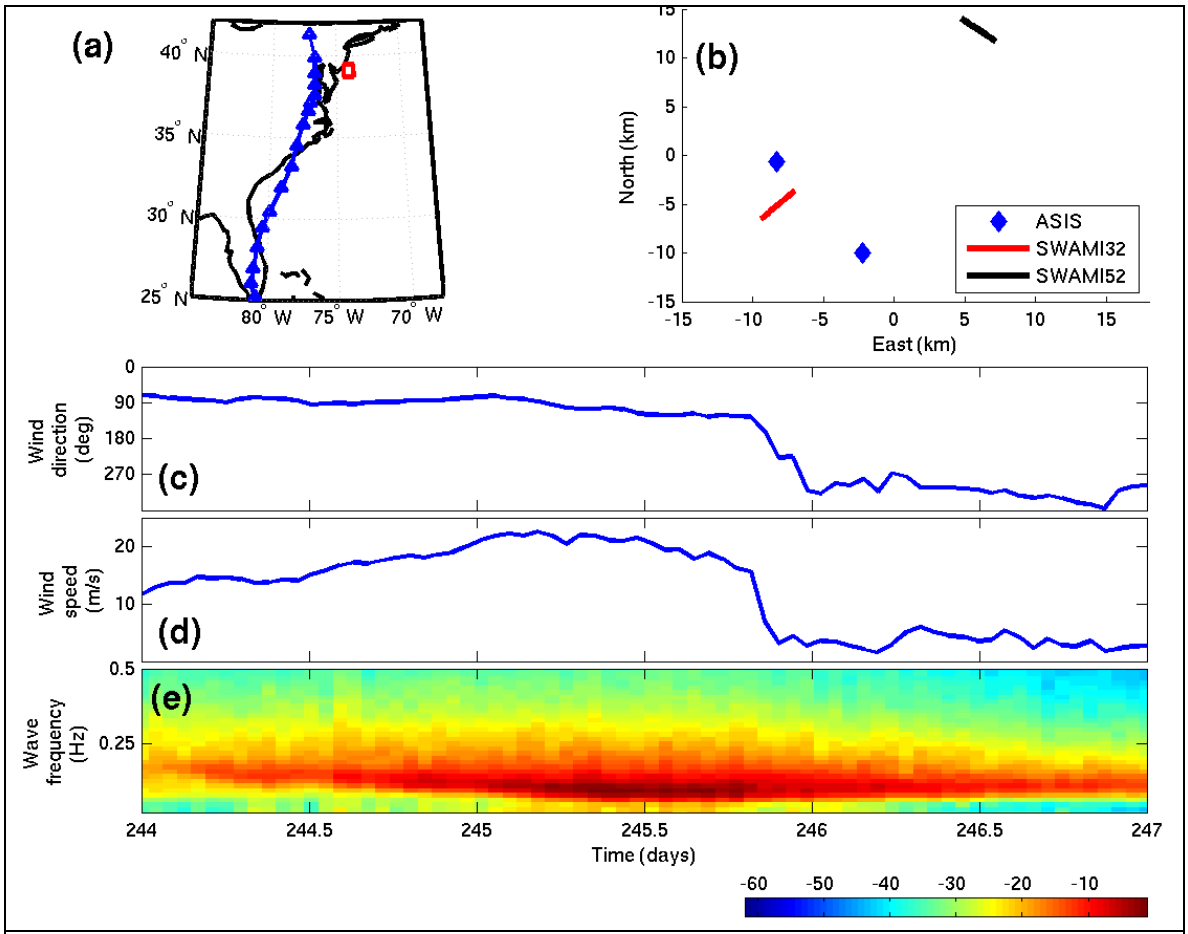

Figure 2: The experiment environment. (a) Experiment location (rectangle) and the recorded path of the storm center. The triangles mark the location of the storm center every 6 hours starting JD242. The single contour line marks a depth of 100\,m. {(b)} Relative positions and axial orientations of the SWAMI32 and SWAMI52 hydrophone arrays and the UMiami ASIS buoys. Note the array lengths are not shown to scale. The axes origin is located at 39.094N, 73.049W. The lower plots show the (c) regional wind direction, (d) regional wind speed, and (e) the surface wave spectra (dB) from 0.02—1 Hz from JD244--JD246. The wave spectral energy is normalized with respect to the highest observed energy per unit frequency per unit time in this band. Wind and wave data from the ASIS buoys are averaged over half-hour periods.

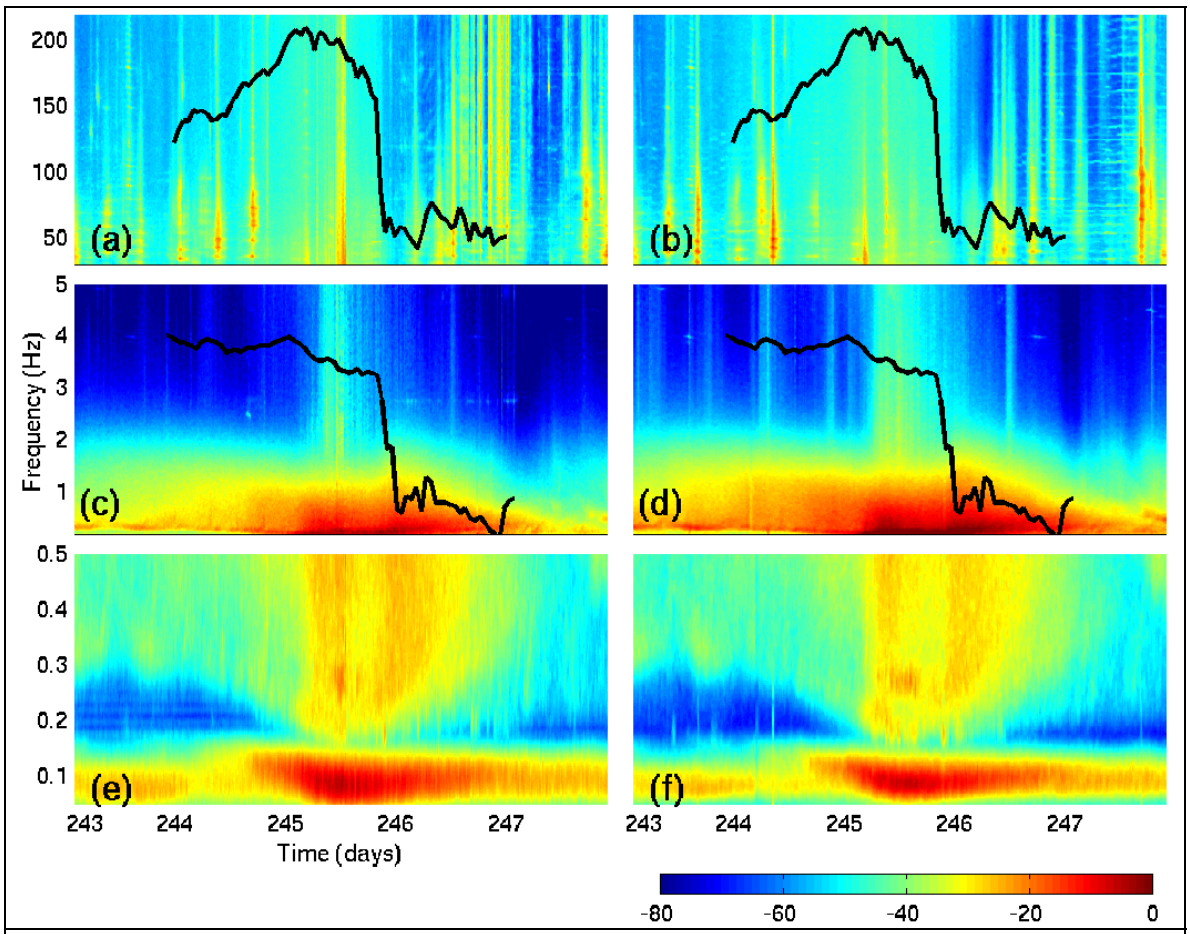

Figure 3: Normalized spectrograms (dB) of the acoustic data at three frequency scales [30—220 Hz (a) and (b), 0.2—5 Hz (c) and (d), 0.02--0.5 Hz (e) and (f)] obtained over a five day period (JD243--247) from the SWAMI32 array [(a), (c) and (e)] and the SWAMI52 [(b), (d) and (f)]. The wind velocity trace from Fig. 1(d) is superimposed in (a) and (b). The spectrograms are averaged over five hydrophones and normalized with respect to the highest observed energy per unit frequency per unit time in the observed range.

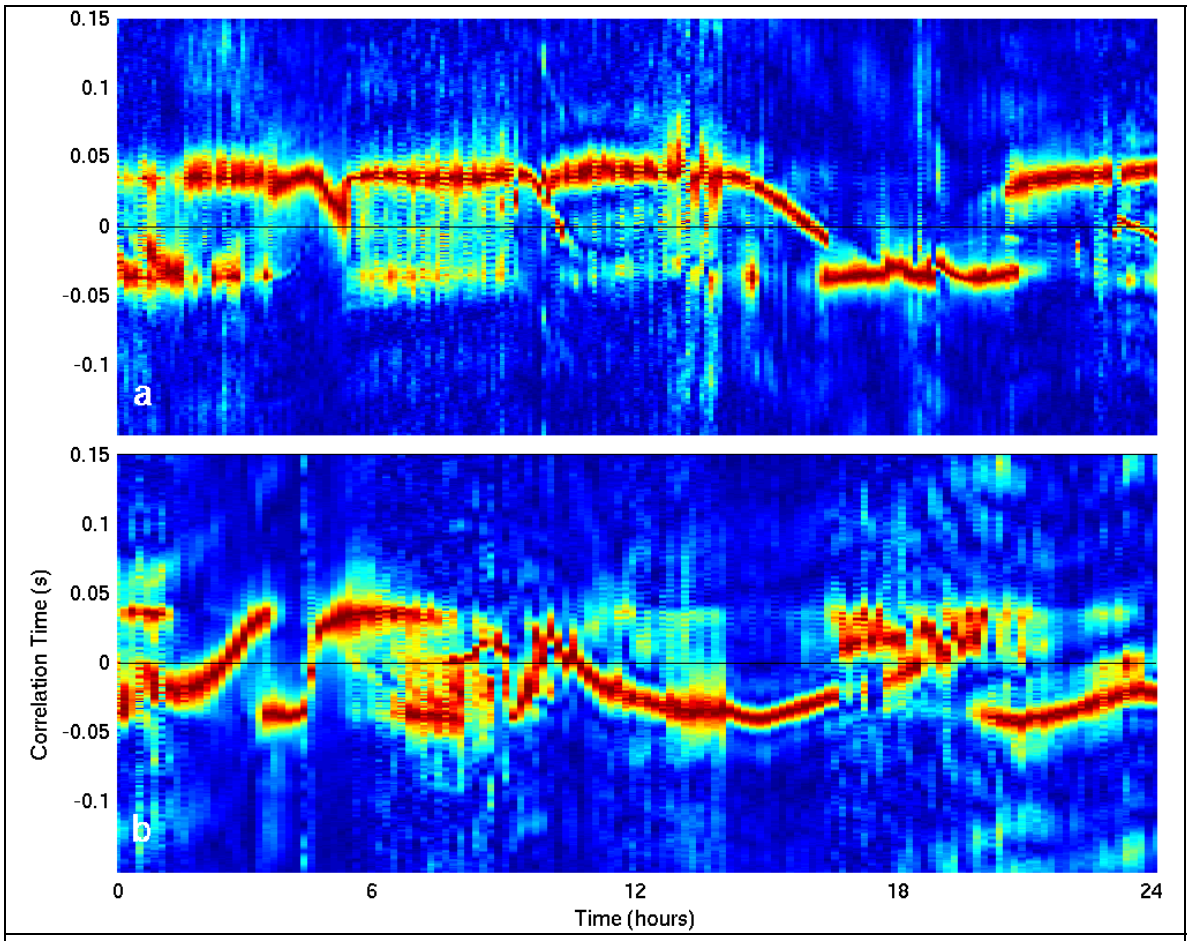

Figure 4: Envelope of the time-derivative of the time-domain cross-correlations (linear scale) from two hydrophones from the (a) SWAMI32, and the (b) SWAMI52 on JD245. The hydrophones were separated by (a) 58.1 m and (b) 60.0 m with positive correlation times indicating sound coming from (a) the north-east, and (b) the south-east. The cross-correlations are normalized with respect to the highest output observed over JD245.

ACRONYMS AND ABBREVIATIONS

3-D	three-dimensional
4-C	four component
AUV	autonomous underwater vehicle
BBLA	Benthic Boundary Layer Array
BEG	Bureau of Economic Geology (University of Texas)
C&C	Chance and Chance
CD	compact disk
CSA	Chimney Sampler Array
CMRET	Center for Marine Resources and Environmental Technology
DATS	Data Acquisition and Telemetry System
DOC	Department of Commerce
DOE	Department of Energy
DOI	Department of the Interior
DRS	Data Recovery System
EGL	Exploration Geophysics Laboratory
FSU	Florida State University
FY	Fiscal Year
GLA	geophysical line array
GOM	Gulf of Mexico
GOM-HRC	Gulf of Mexico-Hydrates Research Consortium
HLA	horizontal line array
HRC	Hydrates Research Consortium
HSZ	Hydrate Stability Zone
IDP	Integrated Data Power Unit
JIP	Joint Industries Program
MC	Mississippi Canyon
MMRI	Mississippi Mineral Resources Institute
MMS	Minerals Management Service
uM	micromolar
MS	monitoring station
MS/SFO	monitoring station/sea-floor observatory
NETL	National Energy Technology Laboratory
NIUST	National Institute for Undersea Science and Technology
NOAA	National Oceanographic and Atmospheric Administration
OLA	Oceanographic Line Array
PFA (=PCA)	pore-fluid array
P-P	compressional wave mode
P-SV	converted-shear mode (P-wave to SV-shear wave conversion)
P-wave	compressional wave
ROV	remotely operated vehicle
R/V	Research Vessel
SDI	Specialty Devices, Inc.
SFO	Sea Floor Observatory
SFP	Sea Floor Probe

SSD	Station Service Device
SS/DR	Surface-Source Deep Receiver
STRC	Seabed Technology Research Center
S-wave	shear wave
TSS	dynamic motion sensor
UNC-CH	University of North Carolina at Chapel Hill
US	United States
USBL	ultra-short baseline navigation system
USF	University of South Florida
USGS	United States Geological Survey
VLA	vertical line array

APPENDIX A: FALL MEETING OF THE CONSORTIUM

GULF OF MEXICO HYDRATES RESEARCH CONSORTIUM
SEMIANNUAL MEETING
The University of Mississippi E.F. Yerby Center
Oxford, Mississippi
October 10-11, 2007

Hosted by:
The Center for Marine Resources and Environmental Technology and
The National Institute for Undersea Science and Technology's
Seabed Technology Research Center at
The University of Mississippi

AGENDA

Wednesday, October 10, 2007

8:00 am - Gather at the Yerby Center
Speakers, please load and save your presentations onto the computer.

8:30 am – Welcoming Remarks Bob Woolsey, Director, The Seabed Technology Center and Center for Marine Resources and Environmental Technology, University of Mississippi

8:35 am – Opening of the Consortium Meeting Dr. Alice Clark
Vice Chancellor for Research and Sponsored Programs, University of Mississippi

8:45 am – Program Update Bob Woolsey and Tom McGee, CMRET, STRC

9:15 am – Comments from federal agency representatives Roger Amato, MMS
Traci Rodosta, DOE
Gene Smith, NURP

9:30 am – *Peeper results* Laura Lapham and Jeff Chanton, Florida State University

10:00 am – *Update on NR-1 March cruise and data* Ken Sleeper
Seabed Technology Research Center (NIUST)

10:15 am – BREAK (Coffee and Pastries provided by Bottletree Bakery)

10:45 am - *Stratigraphy and paleoenvironment of shallow sediments at Block MC118.*
Charlotte Brunner
University of Southern Mississippi, Dept of Marine Science

11:05 pm - *Molecular microbial community analyses at MC118: an update* Andreas Teske
University of North Carolina – Chapel Hill

11:35 pm - *Water column microbial community structure potentially impacted by hydrocarbon venting in the Gulf of Mexico* Chuanlun Zhang and John Noakes
University of Georgia
Tim Short: SRI-St. Petersburg & University of South Florida

12:00 noon – LUNCH (on-site, provided by Bottletree Bakery)

1:00 am – *IR Spectroscopic Detection of Authigenic Carbonate in Coccolith Loaded Sediments and an Update on Hydrate Monitoring* Gary Dobbs
Georgia Institute of Technology

1:20 am - *Insonnified Quantification of Temporo-Spatio Seep Emission Variability in the Coal Oil Point Seep Field, offshore Santa Barbara, California*
Ira Leifer and Bruce Luyendyk
University of California, Santa Barbara

1:45 am – *Electromagnetic sediment property inversion* and
Symbiotic use of underwater cables for monitoring volume transports
Tim Fristedt
Deptartment of Underwater Research, FOI, Sweden

2:15 pm – BREAK

2:45 pm - *Underwater Work Vehicles for the Sea Floor Observatory* Paul Higley
Specialty Devices, Inc.

GENERAL DISCUSSION – CRUISE NEEDS – Paul Higley, moderator

Site Characterization – MC118 – gaps?
Geophysical Systems Deployments – what and when?
Geochemistry at MC118 – needs?
Microbial Activity at MC118 – needs?

Thursday, October 11, 2007

8:30 am - Reconvene at the Yerby Center. .
8:40 pm – *In situ water column data from MC118* Rich Camilli
Woods Hole Oceanographic Institution

Break-out sessions - sessions will break out according to Wednesday's accomplishments and remaining tasks. Groups will prepare to make brief reports to the larger group before the close of the meeting.

11:00 am - Meeting participants reassemble to discuss status of station and cruise plans.

Lunch provided by H_2O, Oxford Oriental Café.

MEETING SUMMARY
GULF OF MEXICO HYDRATES RESEARCH CONSORTIUM
SEMIANNUAL MEETING, OCTOBER 10-11, 2007

The Gulf of Mexico Hydrates Research Consortium held its fall meeting in Oxford, Mississippi, October 10-11, 2007. Consortium Director, Dr. J. R. Woolsey opened the meeting and Dr. Alice Clark, Vice Chancellor for Research and Sponsored Programs, University of Mississippi, greeted the attendees in the E. F. Yerby Center on campus at the University of Mississippi. Thirty-five hydrates workers attended, to establish priorities for the next year and to assess where research for the Observatory at Mississippi Canyon 118 (MC118) now stands. Eleven presentations of research were made, including an update of geophysical systems, results of analyses of pore-fluid samples collected at MC118 using peepers, analyses of near sea-floor water geochemistry using mass spectroscopy, analyses of shallow sediments using mid-infrared scectroscopy, lithologic and paleontologic history of MC118, possible applications of bubble studies to the Sea-floor Observatory and the monitoring of gas hydrates, the status of the Station Service Device (SSD), microbe studies at MC118, the future of resistivity study at MC118 and of the possible applications of storm monitoring at the Observatory site. Productive small group sessions established immediate- and intermediate-term needs for the station to become a complete and functioning monitoring station. A cruise plan for the November cruise to MC118 was established as were tentative plans for the spring, 2008 cruises to the Observatory.

Prioritized objectives for the next three cruises are as follows:

November 5-13, 2007 *R/V Pelican* Cruise

1^{o} – calibrate USBL w/Vernon's TSS (dynamic motion sensor)
deploy sonar reflector to improve navigation
test additions to SSD
additional video cameras (2)
additional USBL locator attached to lander frame for improved positioning

2^{o} - recover sensors from the seafloor:
FSU – mini-osmo sampler
Peepers (5)
Osmo-sampler probe box
UGa - microbial collector
Droycon – Bio-Lec (locate and check functioning)
storm/Sperm Whale song Monitor – recover, download data and redeploy

3^{o} – Deployments:
USM – buoy (?)
UGa - water-column microbial collector (deploy and recover)

USF - Mass spectrometer (deploy and recover)
storm/Sperm Whale song monitor

Coring:
push cores (w/SSD)
box cores
back-up for SSD
foram samples

April 22-30, 2008 *R/V Pelican* Cruise

1^{o} – Deploy the major array components of the station
DRS (data recovery system)
big "M"
IDP (integrated data power unit)
VLA
2^{o} - Record ship noise with VLA to test system; download data from data-logger

May 24 to June 6, 2008 *R/V Pelican* Cruise

1^{o} – Repeat the SSDR survey and shoot on the VLA

2^{o} – recover instruments from sea-floor
hydrate collector (MSU)
storm/whale song monitor (download data and redeploy)
any remaining instruments

deployments using trawl winch, USBL and maybe a camera
BBLA
PFA (new deployment)

3^{o} – deployments with SSD
Sea Snap camera (Texas A&M)
New osmo-box on first PFA
John Dunbar's resistivity survey (?)
HLAs (?)

NOAA PHOTOGRAPH (TAKEN AT CLOSE OF MEETING): Participant (left to right) and their affiliation

Ken Sleeper – STRC/NIUST, University of Mississippi; Gary Dobbs – Georgia Institute of Technology; Carol Lutken – MMRI/CMRET, University of Mississippi; Laura Lapham – Florida State University; Norm Farr – Wood's Hole Oceanographic Institution; Charlotte Brunner – University of Southern Mississippi, Dept of Marine Science; Bob Woolsey - STRC/NIUST, MMRI/CMRET, University of Mississippi; Jesse Hunt – Minerals Management Services, New Orleans; Ross Chapman – University of Victoria, British Columbia; Yulia Luzinova – Georgia Institute of Technology, Brad Crafton – MMRI, University of Mississippi, Tim Fristedt - Defence & Security Systems and Technology Underwater Research, Stockholm, Sweeden; Ray Highsmith – NIUST; Rich Camilli - Wood's Hole Oceanographic Institution; Roger Amato - Minerals Management Services, Herndon, Va.; Tom McGee - MMRI/CMRET, University of Mississippi; Ira Leifer – University of California, Santa Barbara; Leigh Brewer – Sempra Pipelines and Storage; George Ioup – University of New Orleans at Stennis Space Center; Andreas Teske – University of North Carolina – Chapel Hill; Arslan Tashmukhambetov - University of New Orleans at Stennis Space Center; Paul Higley – Specialty Devices, Inc., Wiley, Tx; Bin Liu – University of Georgia; Brad Battista – University of South Carolina; Gene Smith – NOAA/NURP; Chuanlun Zhang - University of Georgia; Traci Rodosta – Department of Energy, National Energy Technology Laboratory.