Oil & Natural Gas Technology

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Characterizing Natural Gas Hydrates in the Deep Water Gulf of Mexico: Applications for Safe Exploration and Production Activities

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ABSTRACT

In 2000, Chevron began a project to learn how to characterize the natural gas hydrate deposits in the deepwater portions of the Gulf of Mexico. A Joint Industry Participation (JIP) group formed in 2001, and a project partially funded by the U.S. Department of Energy (DOE) began in October 2001. The **primary objective** of this project is to develop technology and data to assist in the characterization of naturally occurring gas hydrates in the deep water Gulf of Mexico (GOM). These naturally occurring gas hydrates can cause problems relating to drilling and production of oil and gas, as well as building and operating pipelines. Other objectives of this project are to better understand how natural gas hydrates can affect seafloor stability, to gather data that can be used to study climate change, and to determine how the results of this project can be used to assess if, and how gas hydrates act as a trapping mechanism for shallow oil, or gas reservoirs.

During April 2010 – September 2010 JIP activities included:

- **Completing turnover of the JIP Program Manager position**
- **Continuing to analyze data from the Leg II (2009 LWD) cruise**
- **Completing formation of the Leg III (Coring) science team organization and holding a two-day science planning workshop by the full team on June 15-16 to develop the initial science plan**
- **Continuing Leg III engineering and operations planning including soliciting interest from potential drilling rigs and conducting initial rig inspections. Continuing contracting for equipment needed for Leg III**
- **In the second half of this period JIP activities were significantly impacted by the Gulf of Mexico Drilling Moratorium. JIP Leg III preparations have been put on hold, pending lifting of the moratorium and clarification of subsequent regulatory, legislative and commercial implications for operation in the Gulf of Mexico. Work under existing JIP contracts has continued.**

More information is available on the JIP website: http://gomhydratejip.ucsd.edu/

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1.0 Introduction

In 2000, Chevron Petroleum Technology Company began a project to learn how to characterize the natural gas hydrate deposits in the deepwater portion of the Gulf of Mexico. Chevron is an active explorer and operator in the Gulf of Mexico, and is aware that natural gas hydrates need to be understood to operate safely in deep water. In August 2000, Chevron working closely with the National Energy Technology Laboratory (NETL) of the United States Department of Energy (DOE) held a workshop in Houston, Texas, to define issues concerning the characterization of natural gas hydrate deposits. Specifically, the workshop was meant to clearly show where research, the development of new technologies, and new information sources would be of benefit to the DOE and to the oil and gas industry in defining issues and solving gas hydrate problems in deep water.

Based on the workshop held in August 2000, Chevron formed a Joint Industry Project (JIP) to write a proposal and conduct research concerning natural gas hydrate deposits in the deepwater portion of the Gulf of Mexico. The proposal was submitted to NETL on April 24, 2001, and Chevron was awarded a contract based on the proposal.

The title of the project is **"Characterizing Natural Gas Hydrates in the Deep Water Gulf of Mexico: Applications for Safe Exploration and Production Activities".**

1.2 Objectives

The **primary objective** of this project is to develop technology and data to assist in the characterization of naturally occurring gas hydrates in the deep water Gulf of Mexico (GOM). These naturally occurring gas hydrates can cause problems relating to drilling and production of oil and gas, as well as building and operating pipelines. Other objectives of this project are to better understand how natural gas hydrates can affect seafloor stability, to gather data that can be used to study climate change, and to determine how the results of this project can be used to assess if and how gas hydrates act as a trapping mechanism for shallow oil or gas reservoirs.

1.3 Project Phases

The project is divided into phases. **Phase I** of the project is devoted to gathering existing data, generating new data, and writing protocols that will help the research team determine the location of existing gas hydrate deposits. During **Phase II** of the project, Chevron will drill at least three data collection wells to improve the technologies required to characterize gas hydrate deposits in the deepwater GOM using seismic, core and logging data. **Phase III** of the project began in September of 2007 and will focus on obtaining logs and cores of hydrate bearing sands in the GOM.

1.4 Research Participants

In 2001, Chevron organized a Joint Industry Participation (JIP) group to plan and conduct the tasks necessary for accomplishing the objectives of this research project. As of March 2010, the members of the JIP were Chevron, Schlumberger, ConocoPhillips, Halliburton, the Minerals Management Service (MMS), Total, JOGMEC, Reliance Industries Limited, The Korean National Oil Company (KNOC), and Statoil.

1.5 Research Activities

The research activities began officially on October 1, 2001. However, very little activity occurred during 2001 because of the paperwork involved in getting the JIP formed and the contract between DOE and Chevron in place. Several Semi-Annual and Topical Reports have been written that cover the activity of the JIP through March 2010.

1.6 Purpose of This Report

The purpose of this report is to document the activities of the JIP during April 2010 – September 2010. It is not possible to put everything into this Semi-Annual report, however, many of the important results are included and references to the JIP website, http://gomhydratejip.ucsd.edu/, are used to point the reader to more detailed information concerning various aspects of the project. The discussion of the work performed during this report period is organized by task and subtask for easy reference to the technical proposal and the DOE contract documents.

2.0 Executive Summary

Chevron formed a Joint Industry Participation (JIP) group to write a proposal and conduct research concerning natural gas hydrate deposits in the deepwater portion of the Gulf of Mexico. The proposal was submitted to NETL on April 24, 2001, and Chevron was awarded a contract based on the proposal.

The title of the project is **"Characterizing Natural Gas Hydrates in the Deep Water Gulf of Mexico: Applications for Safe Exploration and Production Activities".**

The **primary objective** of this project is to develop technology and data to assist in the characterization of naturally occurring gas hydrates in the deep water Gulf of Mexico (GOM). **Other objectives** of this project are to better understand how natural gas hydrates can affect seafloor stability, to gather data that can be used to study climate change, and to determine how the results of this project can be used to assess if and how gas hydrates act as a trapping mechanism for shallow oil or gas reservoirs.

The project is divided into phases. **Phase I** of the project is devoted to gathering existing data, generating new data, and writing protocols that will help the research team determine the location of existing gas hydrate deposits. During **Phase II** of the project, Chevron drilled wells to obtain data for improving technologies required to characterize gas hydrate deposits in the deepwater GOM using seismic, core and logging data. **Phase III** of the project (the current phase) has an objective of collecting and analyzing data on hydrate bearing sands. Both logging and coring operations are planned in Phase III.

Phase III is roughly divided into two parts. Phase IIIA centered on a LWD drilling expedition (completed in 2009) to test methodologies to predict the locations and hydrate saturations of large, coarse-grained deepwater geobodies located in the hydrate stability zone. Phase IIIB will focus on retrieval and analysis of pressure cores from such geobodies, as well as wireline logging and (if possible) wireline formation testing. The

end of Phase IIIB will also include preparation and release of Final Integrated Reporting for the entire project.

3.0 Phase III A (Leg II) Activities

During the 2009 LWD leg, ongoing third party operations at one of the target drilling locations required that the Leg II expedition shift to an alternative site at a nearby block (AC21). LWD data at AC21 was successfully retrieved, and subsequent to completion of Leg II the JIP science team recommended that (for the sake of completeness) a pre-drill estimate should be made of this location. The estimate would be done the same way as the pre-drill estimates at GC 955 and WR 313. Seismic inversion work in support of this objective continued during this reporting period. As noted in the previous report, reading in the pre-stack seismic data took more time than anticipated because the tapes containing the seismic gathers are fairly old and problematic. Approximately 95% of the data had been retrieved by February. By March this was increased to 99.5% coverage. The largest gap was about 160ft (or 4 in-lines) which fortunately did not cross any of the well locations. The science team decided that the best option was to interpolate through these zones and proceed with the inversion analysis, keeping track of where the gaps were on all subsequent products, so as not to misinterpret them. The affect on our timeline is such that the pre-drill inversion and Sgh quantification continue to proceed. Post-drill updates are expected by year's end.

The original and fully processed GOM JIP Leg II well log database was loaded onto the Lamont-Doherty Earth Observatory web site: http://brg.ldeo.columbia.edu/ghp/. The web site includes original and processed data, in the same formats as GOM JIP Leg I. LDEO will add the processed MP3 shear-wave and PeriScope data when it is received from Schlumberger.

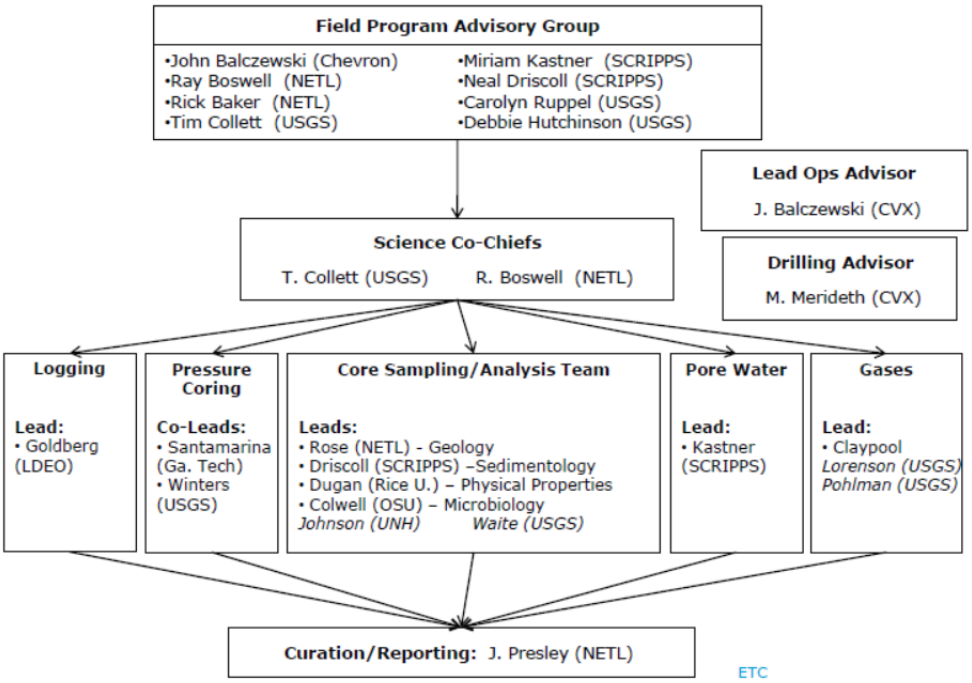
Meetings were held on May 7th and May 17th to review scope and status of outstanding Leg II LWD data processing and studies.

4.0 PHASE III B (LEG III) ACTIVITIES

Phase III B work was significantly impacted by the Gulf of Mexico drilling moratorium that was announced in late May. Prior to the moratorium the project team had been ramping up preparations for the planned 2011 coring expedition. Shortly after the moratorium was announced JIP Leg III preparations were put on hold, in order to await lifting of the moratorium and to get subsequent post-moratorium clarification and assessment of regulatory, legislative, permitting, operational and commercial changes in the Gulf of Mexico. Work under existing JIP contracts continued, but no new contracts were issued.

Details:

- The Leg III Science Field Organization was finalized (refer to the diagram below).



- Letters of Interest were received by drilling rig companies and several rig inspections were conducted.

- Letters of Interest were received from potential onshore drilling sites to test the prototype pressure corer prior to offshore deployment. Several inspections were conducted.
- Work by Aumann & Associates continued on the final design of the high pressure coring device (HPTC).
- The Bottom Hole Assembly (BHA) design and integration effort commenced.
- Initial discussions were held to draft letters of request for clearance by Gulf of Mexico lease block operators at and/or around proposed Leg III locations.
- A meeting was held on April 12th to kick off discussions of Leg III wireline logging requirements and integration with Bottom Hole Assembly design.
- A meeting was held on April 13th to kick off discussions of the Bottom Hole Assembly including drilling and coring bits, drill collars, stabilizers, subs, pressure core inner barrels and conventional core inner barrels.
- The first meeting of the full science team was held on April 15th. Objectives were to communicate overall Leg III goals and constraints and to set expectations and deliverables for a June Science Planning workshop. An initial straw man draft of the Leg III core flow – sample handling diagram was prepared and discussed.
- On May 4th a bench test was conducted to confirm that the wireline logging CMR device would fit within the proposed 5 7/8" drilling core head ID. A junk bit was bored out to the requisite ID and a CMR was passed through the opening with adequate clearance on all sides.

- A meeting was held on May 7th to progress details of the Bottom Hole Assembly design and advance integration of design between BHA component suppliers.

- A meeting was held on June 14th to advance the Leg III wireline logging and wireline formation testing program design.
- A two-day Science Planning workshop with the full science team was held on 15-16 June to present and discuss proposals for the Leg III science plan including core flow and sample handling, pressurized core analysis devices, etc.
- By mid- to late June the project put a temporary hold on Leg III activities due to the impact of and uncertainties related to the Drilling Moratorium. Activities on existing contracts were continued, but no new contracts were issued.
- The project team redirected activities toward assessment of impacts of the Drilling Moratorium and potential regulatory, legislative, permitting, operational and commercial changes in the Gulf of Mexico as they might relate to all aspects of the Leg III expedition.
- In August and September the project team began developing proposals for additional Gulf of Mexico hydrate science programs (outside of the Leg III program) that might be undertaken in 2011. Potential proposals would be in the areas of: geophysical data acquisition, expansion of existing seismic data to a wider range of researchers, geomechanical studies and additional Leg III log analyses. It is anticipated that development of proposals and selection (if any) will be completed by the end of 2010.

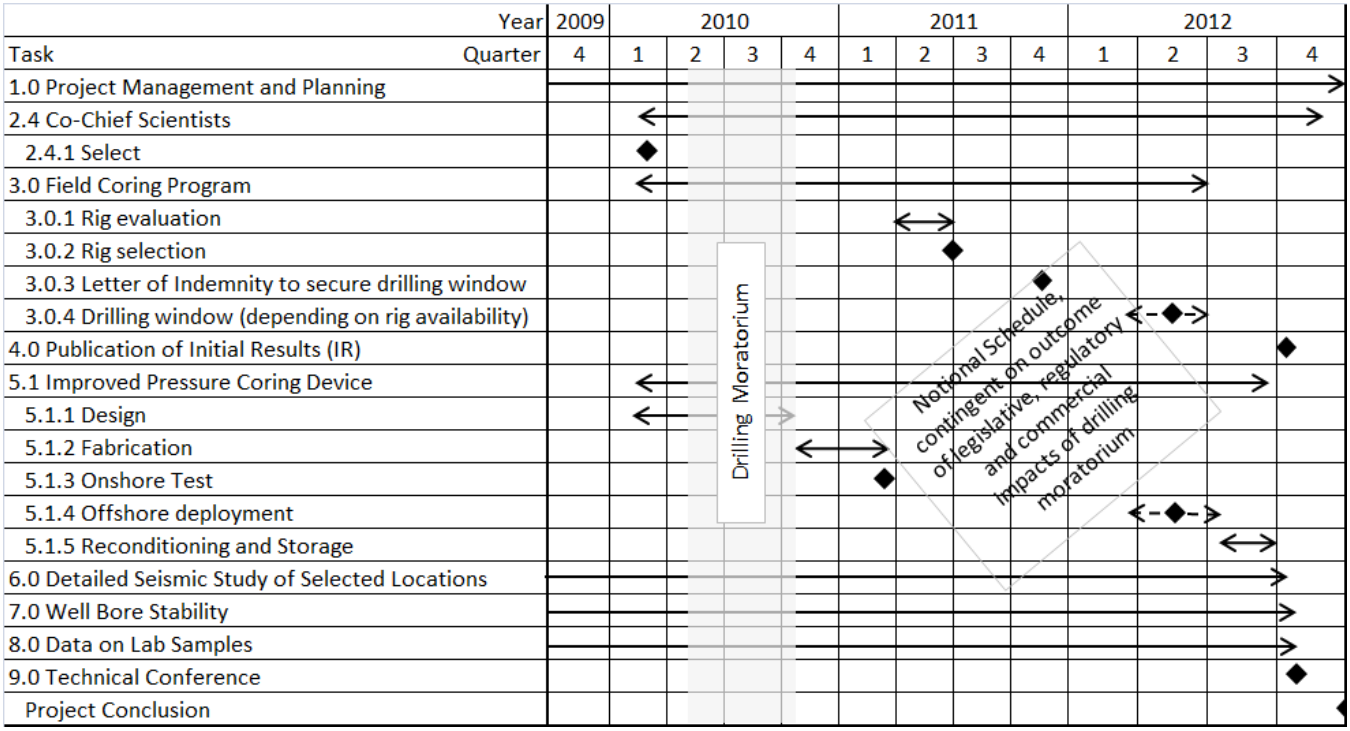
7.0 Conclusions

At the start of the reporting period preparations for the Leg III field expedition were well underway. However, by mid-June the Gulf of Mexico Drilling Moratorium and related developments had a significant adverse impact on the Phase III B work plan, adding elements of uncertainty that are currently impossible to quantify. As a consequence, activities related to preparation for the Leg III field expedition have been temporarily placed on hold. Project resources have been redirected toward assessment of impacts and development of alternative science proposals to utilize time that may now be available in 2011.

8.0 References

No external references were used for this report.

9.0 Appendix A – Project Timeline



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