

Oil & Natural Gas Technology

DOE Award No.: DE-FE0010175

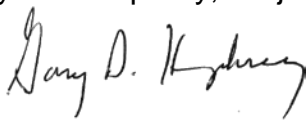
Quarterly Research Performance Progress Report (Period ending 03/31/2013)

PLANNING OF A MARINE METHANE HYDRATE PRESSURE CORING PROGRAM FOR THE WALKER RIDGE AND GREEN CANYON AREAS OF THE GULF OF MEXICO

Project Period (10/1/2012 – 9/30/2013)

Submitted by:

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Signature

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Prepared for:

United States Department of Energy
National Energy Technology Laboratory

Submission Date: July 30, 2013



Office of Fossil Energy

Executive Summary

This research effort will focus on developing a site characterization program for naturally occurring gas hydrate deposits. It will be based on a number of previous expeditions that Fugro has conducted for industry and for National Hydrate Programs. We will draw upon our experience from previous work and combine the objectives and site specific aspects of the planning into a comprehensive document that summarizes the best practices and best approaches.

Key issues identified for future research include:

- Develop a better understanding of the structure and properties of methane hydrate reservoirs
- Develop improved methodologies to select exploration targets (Topic 3 work)
- Develop improved ability to sample and test the hydrates in their natural state
- Develop improved technology and methodologies to extract and deliver the gas from hydrates to downstream facilities.

We have proposed the following approach; 1) Desktop Study to Prepare Detailed Plans and Recommendations for all Aspects of the Proposed Offshore Campaign (proposed advances in knowledge/technology), and 2) Prepare detailed plans of execution and make budgetary estimates for a future fieldwork program to collect the pressure cores including a recommended Scope of Work.

Accomplishments

- Reviewed related scientific/industry research efforts.
- Continued working on the development of a project execution plan (PEP) for the planning phase through the field work execution and reporting.
- Conducted additional phone planning sessions with Geotek (Peter Schultheiss) and J.A. Aumann & Associates, (Jim Aumann).
- Attended planning meetings with Geotek and other Fugro Data Acquisition Groups
- Discussed plan and implementation of the upcoming 2013 pressure coring campaign onboard M/V Rem Etive for GMGS (China Hydrate Program's second expedition)
- Commissioned the building of a new pressure corer system to advance the core length and quality issues working with Jim Aumann and Geotek. Note this was under separate budget internally funded by Fugro.

Progress, Results, and Discussion Summary of technical progress

We were awarded the project with an October start, but we there were several issues that took time to be negotiated. Time was spent to discuss and document Intellectual Property (IP) issues that delayed our progress. The development of the team members progressed with indicated roles and responsibilities of the various components identified and sent out as requirements. Again for this quarter, not a great deal of progress was made over this reporting period other than those listed above in the Accomplishments section.

Review previous research projects

Research programs have been undertaken in numerous countries to investigate the occurrences and characteristics of natural methane hydrates. The ultimate objective in most cases is a long-term goal to exploit methane hydrate reservoirs as a source of alternative energy in the future. The complexities of finding and economically exploiting these reserves demand substantial investment in research efforts devoted to understanding the science and developing technologies that may ultimately prove successful in achieving the long-term objective.

Much of the research effort has focused on offshore drilling campaigns whose goals included direct sampling and testing of methane hydrates. Several such campaigns have been undertaken in the United

States, including the Ocean Drilling Program (ODP) Leg 164 (South Carolina, 1995), ODP Leg 204 (Oregon, 2002), the Integrated Ocean Drilling Program (IODP) Expedition 311 (Cascadia Margin, Canadian northwest, 2005), the Joint Industry Project (JIP) Leg I (Gulf of Mexico, 2005) and most recently the JIP Leg II campaign in the Gulf of Mexico that was completed in 2009.

The JIP Leg II campaign was specifically conceived to investigate the nature of hydrate occurrences in sand-dominated systems, (Petroleum Systems Approach) principally by means of Logging While Drilling (LWD) operations. The campaign confirmed the presence of gas hydrate reservoirs at two boreholes and two boreholes in Walker Ridge Block 313 (WR313) of the Gulf of Mexico. The locations for the four wells had been selected utilizing prospectivity analysis based primarily using a petroleum systems approach for gas hydrate using 3D exploration seismic data and derivative analyses that produced predicted gas hydrate saturation volumes. The success of the four wells was a significant achievement and legitimized the conceptual approach taken to prospecting for potential producible methane hydrate reservoirs in deep water that could be exploited with modifications to present-day technology.

One of the objectives of the JIP Leg II campaign was to prioritize the best sites for subsequent geotechnical pressure coring and conventional coring during a proposed JIP Leg III campaign which was tentatively planned to occur as early as 2010. To date the JIP Leg III campaign has not materialized, however the research merit for a campaign of this nature has not changed.

Additionally, numerous other offshore expeditions to characterize hydrate occurrences including: DGH India 2006, Shell Gumusut (Malaysia 2006), China (GMGS 2007), South Korea (KNOC 2007) and South Korea (KNOC 2010) will be used to influence our recommendations in this project. At the time of this writing, a second expedition to investigate hydrate reservoir potential is underway in the South China Sea for GMGS (China 2013) involving LWD, in situ testing, coring and pressurized coring and analysis.

An excellent summary of all these expeditions (in addition to the Arctic Expeditions) is provided in the recent report released at the DOE/NETL/COL Methane Hydrates Workshop in Washington D.C, early June 2013.

Identify technical research concepts

The various research topics include:

- Development of safe drilling procedures for riserless drilling in known hydrate formations.
- Development of core quality measures for rotary pressure coring systems.
- Development of pressure core handling procedures and protocols to ensure best quality results.

Future work in next reporting period

- We will continue to work on finalization of the PEP and liaison with our collaborators in the next reporting period.
- We will continue our work on the pressure core acquisition and quality issues
- We will continue our work on the pressure core analysis handling, timing and quality issues
- We will continue to work on safe drilling practices for hydrate bearing sediments using open-hole techniques.

Key References

Collett, T.S, et. al., USDOE/NETL Report Prepared by Consortium for Ocean Leadership, Project No. DE-FE0010195, Development of a Scientific Plan for a Hydrate-Focused Marine Drilling, Logging and Coring Program – **Historical Methane Hydrate Project Review**, June 2013

Campbell, K.J., Humphrey, G.D. and Little, R.L., "Modern Deepwater Site Investigation: Getting It Right the First Time" for the 2008 **Offshore Technology Conference** 06-May-08 in Houston, Texas. Paper No. 19535.

Humphrey, G.D., Schultheiss, P.J., Holland, M., "Borehole Pressure Coring and Laboratory Pressure Core Analysis for Gas Hydrate Investigations" for the 2008 **Offshore Technology Conference** held May 2008 in Houston, Texas. Paper No. 19601.

Scientific Drilling Magazine, "Wireline Coring and Analysis Under Pressure: Recent Use and Future Developments of the HYACINTH System", Article by Peter Schultheiss, Melanie Holland and Gary Humphrey, published in March 2009.

P.J. Schultheiss, Geotek Ltd.; J.T. Aumann, Aumann & Associates, Inc.; and G.D. Humphrey, Fugro GeoConsulting, Inc., " Pressure Coring and Pressure Core Analysis for the Upcoming Gulf of Mexico Joint Industry Project Coring Expedition " for the 2010 **Offshore Technology Conference** held May 2010 in Houston, Texas. Paper No. 20827.

E. Tervoort, J. Peuchen & G. Humphrey, Gas Hydrate Quantification By Combining Pressure Coring And In-Situ Pore Water Sampling Tools, **Proceedings of the 7th International Conference on Gas Hydrates (ICGH 2011)**, Edinburgh, Scotland, United Kingdom, July 17-21, 2011.

Changes or Problems

Discussions with NETL on Intellectual Property (IP) issues delayed the start of the project after the initial kick-off meeting in November 2012.

Delays in the work timeline were caused by time spent in post-award negotiations. The shift in the timeline has been communicated to the NETL project manager.

There are no significant changes or problems with the direction of the project as originally proposed. However, we plan to request a "No-Cost Extension" for the project of six months which will extend the completion date until end of March 2014.

Participants and Other Collaborating Organizations

	Gary D. Humphrey, Principal Investigator / Project Director, Fugro Employee Houston, Texas	Jim Aumann, Technical Advisor, J.A. Aumann & Associates Employee Salt Lake City, Utah	Dr. Peter Schultheiss, Technical Advisor, Geotek, Ltd. Employee United Kingdom
Nearest month worked	0	0	0
Collaboration outside USA	Discussion with offices in UK and The Netherlands	Not this reporting period	Discussion with offices in USA and The Netherlands
Travel outside USA	None this reporting period	None this reporting period	None this reporting period

Other Collaborating Organizations:

Oklahoma State University and Fugro GeoConsulting have agreed to share progress and results from their respective DOE research projects (DE-FE0009904 and Fugro project DE-FE0010160).

Fugro, Jim Aumann & Associates and Geotek are all collaborating on the GMGS China Gas Hydrate field expedition for LWD, coring and pressure coring and in situ testing at several locations in the South China Sea.

Impact

The research findings from this project may potentially contribute to the US gas hydrate resource assessment but also international science and governmental organizations that are measuring gas hydrate exploration potential in Japan, Korea, China, India, Colombia, Brazil and New Zealand.

Additionally the findings from this project can also have the potential to aid imaging of sequestered CO₂ gas hydrate for greenhouse gas reduction if that technology advances.

Special Reporting Requirements

None identified this quarter.

Budgetary Information

A cumulative total of \$7,714 has been spent of an allocation of \$578,850. The federal share of the costs incurred to date is \$6,171 and the cost sharing is \$1,543. We do count several meeting, contacts, and other efforts as being consistent with advancing the research project but these are not reflected in the budget spend to date.

Exhibit I Milestone Status

Milestone 1, Task 1 was completed November 14, 2012.

Milestone 2 has been delayed to August 2013.

Completion Milestone will be adjusted to end March 2014 provided DOE agrees with a no-cost extension.

Exhibit 2 Cost Plan

Baseline Reporting Quarter	Budget Period 1							
	Q1		Q2		Q3		Q4	
	Q1	Comulative Total	Q2	Comulative Total	Q3	Comulative Total	Q4	Comulative Total
Baseline Cost Plan								
Federal Share	115000	115000	115000	230000	115000	345000	118080	463080
Non-Federal Share	28750	28750	28750	57500	28750	86250	29520	115770
Total Planned	143750	143750	143750	287500	143750	431250	147600	578850
Actual Income Cost								
Federal Share	2456	2456	3715	6171				
Non-Federal Share	614	614	929	1543				
Total Incurred Costs	3070	3070	4644	7714				
Variance								
Federal Share	(112544)	(112544)	(111285)	(223829)				
Non-Federal Share	(28136)	(28136)	(27821)	(55957)				
Total Variance	(140680)	(140680)	(139106)	(279786)				

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