Oil & Natural Gas Technology

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Quarterly Research Performance Progress Report

(Period ending 3/31/2016)

Advanced Hydrate Reservoir Modeling Using Rock Physics Techniques

10/1/2012 – 3/31/2016

Submitted by:
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Disclaimer

Executive Summary

This research effort focuses on developing and refining techniques that integrate rock physics modeling, amplitude analysis, and spectral decomposition to characterize complex gas hydrate reservoirs. The expected outcome of the research efforts will be an enhanced ability to quantitatively evaluate and prioritize potential gas hydrate accumulations that may be selected as exploration drilling targets based on 3-D seismic data.

On March 19th, Fugro Multi-Client Services agreed to in principle to provide a research license for these 3D seismic data in the Lloyd Ridge and The Elbow protraction areas, offshore Florida, for this consulting project. The dataset cover a large area of the United States' Lloyd Ridge (mistakenly referred to as "Lund" in prior reports) and The Elbow protraction areas in the Eastern Gulf of Mexico. The data were received and loaded for interpretation on April 22nd. Interpretation and screening for potential gas hydrate deposits was the principal effort in this quarter. On June 1, Fugro Multi-Client Services sold the seismic data to Spectrum ASA. On June 29th, we were informed that Spectrum ASA would honor an effective research license of the seismic data for this project.

Accomplishments to date

- Reviewed related scientific/industry research efforts.
- Identified relevant research concepts.
- Investigated well logs data in WR 313 and GC955
- Selection of initial rock physics model.
- Progress on selection of possible statistical classification techniques.
- Contact with communities of interest after the award announcement. USGS, Colombian Petroleum Institute, KIGAM, Guanzhou Marine Geological Survey, Shell, BP, Chevron, Petronas, National University of Singapore, and Texas A&M University
- Continued professional development for Dr. Zhang, building on recent past work.
- Received in-kind contribution Jason Workbench Suite of petrophysical and inversion software to develop analytical routines. License expired Jan 2014.
- Purchased Hampson Russell AVO and inversion software that can be used in this project
- Modeling mixtures of methane and thermogenic gas hydrate signatures against flux and geothermal gradients and depositional architecture.
- Presentation of Poster showing research progress at Gordon Research Conference in March, 2014.
- Researched attenuation concepts
- Preparation of oral talk for International Conference on Gas Hydrates.
- Negotiated donation of seismic lines in WR 313 and GC955 by CGG for use in this project.
- Presented oral talk at International Conference on Gas Hydrates in Beijing
- Agreement in principle for the use of approximately 12900 sq km of 3D seismic data in the Lloyd Ridge and The Elbow protraction areas, offshore Florida.(Exhibit 1).
- Agreement reached for the use of 3D seismic data in the Lloyd Ridge and The Elbow protraction areas.
- Screening of 3D data for potential gas hydrate targets.
- Use of the data for this project was secured from Spectrum ASA after they became the new owners of the data.
- Entered into discussions with specialty software developer Lumina Geophysical to support the project with advanced spectral decomposition software. However no working agreement could be reached that would maintain our data chain of custody obligations to data owner Spectrum.
- Determined to use the spectral decomposition modules in IHS Kingdom Suite.
- Determined the zone of interest for gas hydrate deposits
- Created spectral decomposition volumes from sub-cube of interest
- Integrated nearby DSDP data for rock property baseline

- Review of workflow for test run
- Outlining report and figure lists
- Preparation of final report
- Permission requests for seismic data examples

Progress, Results, and Discussion Summary of technical progress

The project was postponed for the period January 1, 2013 to September 30, 2013. Task Groups 1 (Project Management and Planning) and 2 (Project Initiation) were completed prior to this reporting period. Work was also done on Task Group 3 (Development of Project Research Concepts) prior to the work hiatus. The project restarted with continuation of work within Task Group 3 and Task Group 4. Because of difficulties getting permission to use 3D seismic data in the area of interest, a second no-cost extension was granted that extends the research project until March 31, 2016.

Approximately 12,900 sq km of 3D seismic data in the United States' Lloyd Ridge and The Elbow protraction areas in the Eastern Gulf of Mexico was secured for this project. The large seismic dataset was screened for potential gas hydrate deposits. Several potential targets were identified Thick sequences of buried channels extend through the inferred gas hydrate stability zone.

Current work includes evaluating sensitivity of lithologic and hydrocarbon pore fill at different frequency sub-bands.

Changes or Problems

Because of delays in securing a suitable data set for the research, a second no-cost extension was granted until March 31 2016.

Although there are interpretation questions outstanding, we believe that we have identified potential gas hydrate deposits in the Eastern Gulf of Mexico seismic data set. As long as interpretation suggests the absence of potential gas hydrate deposits data set, there should be no problems to complete the research as envisioned. It would have, however, been far preferable to have received permission to use the 3D data that had been licensed to the Gulf of Mexico Gas Hydrate JIP Leg II project.

Software and work commitments from CGG from earlier in the project are still outstanding issues. We do not see any support forthcoming and will not pursue their work commitment.

The other problem was that at the time of data transfer, Fugro owned the Florida 3D seismic data but did not have possession of the data. In addition Fugro had licensed CGG to market and sell the data. A dispute arose when CGG charged Fugro over $13,000 to copy transfer the Fugro-owned digital data to a Fugro-provided hard-drive for this project. The invoice was unjust. The P.I. for this project pushed for non-payment of an unjust invoice. In the end, however, Fugro paid the invoice which will be expensed to this project.

Participants and Other Collaborating Organizations

	Zijian Zhang, Geophysicist, Fugro Employee	Dan McConnell, Principal Investigator, Fugro Employee	William Haneberg, Consultant Geoscientist, Fugro Employee
Nearest month worked this reporting period	0	1	0
Collaboration outside USA	Not this reporting period	Not this reporting period	None this reporting period
Travel outside USA to communities of interest	Guanzhou, China Feb-Mar 2016	Guanzhou, China March 2016	None this reporting period

Special Reporting Requirements
None this quarter.

Budgetary Information
$203,575 has been spent from a budget allocation of $213,444 to date. The federal share of the costs to date is $161,716 and the cost sharing is $40429. The federal share of the costs per this reporting period is $56,283 and the cost sharing is $14,071.

Exhibit 3 Cost Plan

Baseline Reporting Quarter	Budget Period 1															
	Q1 2012		Q2 2013		Q3 2013		Q4 2013		Q1 2013		Q2 2014		Q3 2014		Q4 2014	
	Sept- Dec 2012		Jan-Mar 2013		April-June 2013		June-Sept 2013		Sept-Dec 2013		Jan-Mar 2014		April - June 2014		June-Sept 2014	
	Q1	Cumulative Total	Q2	Cumulative Total	Q3	Cumulative Total	Q4	Cumulative Total	Q1	Comulative Total	Q2	Comulative Total	Q3	Comulative Total	Q4	Comulative Total
Baseline Cost Plan																
Federal Share	2948	2948	13278	16226	703	16930	0	16930	0	16930	18587	35517	6030	41546	0	41546
Non-Federal Share	737	737	3320	4057	176	4232	0	4232	0	4232	4647	8879	1507	10387	0	10387
Total Planned	3685	3685	16598	20283	879	21162	0	21162	0	21162	23234	44396	7537	51933	0	51933
Actual Income Cost																
Federal Share	2948	2948	13278	16226	703	16930	0	16930	0	16930	18587	35517	6030	41546	0	41546
Non-Federal Share	737	737	3320	4057	176	4232	0	4232	0	4232	4647	8879	1507	10387	0	10387
Total Incurred Costs	3685	3685	16598	20283	879	21162	0	21162	0	21162	23234	44396	7537	51933	0	51933
Variance																
Federal Share	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non-Federal Share	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Variance	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Baseline Reporting Quarter	Budget Period 2											
	Q1 2014		Q2 2015		Q3 2015		Q4 2015		Q1 2016		Q2 2016	
	Sept-Dec 2014		Jan-Mar 2015		April-June 2015		July-Sept 2015		Oct-Dec 2015		Jan-Mar 2016	
	Q1	Comulative Total	Q2	Comulative Total	Q3	Comulative Total			Q3	Comulative Total	Q4	Comulative Total
Baseline Cost Plan												
Federal Share	3233	44779	6952	51731	25686	77417	10374	87791	17642	105433	64178	170755
Non-Federal Share	808	11195	1738	12933	6421	19354	2594	21948	4410	26358	16045	42689
Total Planned	4041	55974	7881	63855	32107	95962	15207	111169	22052	133221	80223	213444
Actual Income Cost												
Federal Share	3233	44779	6952	51731	25686	77417	10374	87791	17642	105433	56283	161716
Non-Federal Share	808	11195	1738	12933	6421	19354	2594	21948	4410	26358	14071	40429
Total Incurred Costs	4041	55974	7881	63855	32107	95962	15207	111169	22052	133221	70354	203575
Variance												
Federal Share	(0)	(0)	0	(0)	0	(0)	0	(0)	0	(0)	(7895)	(9039)
Non-Federal Share	0	0	0	0	0	0	0	0	0	0	(1974)	(2260)
Total Variance	0	0	0	0	0	0	0	0	0	0	(9869)	(9869)

Exhibit 2 Milestone Status

Milestone 1, Task 1 was completed November 14, 2012
Milestone 2 was completed March 31, 2016.

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