Oil & Natural Gas Technology

DOE Award No.: DE-FE0023919

Quarterly Research Performance Progress Report (Period Ending 06/30/2016)

Deepwater Methane Hydrate Characterization and Scientific Assessment

Project Period 10/01/2014 – 09/30/2020

Submitted by:
Peter B. Flemings

Peter B Flemings

Signature

The University of Texas at Austin
DUNS #:170230239
101 East 27th Street, Suite 4.300
Austin, TX 78712-1500
e-mail: pflemings@jsg.utexas.edu

Office of Fossil Energy

1. ACCOMPLISHMENTS:

A. What are the major goals of the project?

The goals of this project are to plan and execute a state of the art field program in the Gulf of Mexico to characterize methane hydrates. The project team will acquire conventional core, pressure core, and downhole logs, and perform in situ testing and measure physical properties in methane hydrate reservoirs in the Gulf of Mexico (GOM) to meet this goal.

Previous Phase Milestones

Milestone Description	Status
M1A: Project Management Plan	Complete: 03/18/2015
M1B: Project Kick-off Meeting	Complete: 12/11/2014
M1C: Site Location and Ranking Report	Complete: 9/30/2015
M1D: Preliminary Field Program Operational Plan Report	Complete: 9/30/2015
M1E: Updated CPP Proposal Submitted	Complete: 10/1/2015
M1F: Demonstration of a viable PCS Tool	Complete: 9/30/2015

Table 1: Milestones BP1

Current Phase Milestones

Milestone Description	Status	Verification Method	Comments
M1G: Document results of BP1/Phase 1 Activities	Submitted	Phase 1 Report	
M2A: Complete Updated CPP Proposal Submitted	Complete: Nov 2015 (BP3, Q1)	Quarterly Report	Update given in Y2Q1 report
M2B: Scheduling of Hydrate Drilling Leg by IODP	Expected date: May 2017 (BP2, Q7)	report status immediately to DOE PM	
M2C: Demonstration of a viable PCS tool for hydrate drilling through completion of land-based testing	Complete: Dec 2015 (BP2, Q5)	PCTB Land Test Report, in Quarterly Report	Update given in Y2Q1 report
M2D: Demonstration of a viable PCS tool for hydrate drilling through completion of a deepwater marine field test	Expected date: May 2017 (BP2, Q7)	Marine Field Test Report, in Quarterly Report	Date to be set in next quarter
M2E: Complete Refined Field Program Operation Plan	Expected date: Sept 2017 (BP2, Q8)	Quarterly Report	

Table 2: Milestones BP2

Future Phase Milestones

Milestone Description	Planned Completion	Verification Method
M2F: Document results of BP2/Phase 2 Activities	12/29/2017 (BP3A, Q1)	Phase 2 Report
M3A: Field Program Operational Plan report	12/18/2018 (BP3A, Q5)	Quarterly Report
M3B: Completion of Field Program Permit	12/9/2018 (BP3A, Q5)	Quarterly Report
M3C: Completion of Hazards Analysis	10/9/2018 (BP3A, Q5)	Field Program Hazards Report, in Quarterly Report
M3D: Demonstration of a viable PCS tool for hydrate drilling through completion of field operations	4/4/2019 (BP3A, Q7)	Quarterly Report
M3E: Complete IODP Preliminary Expedition Report	6/27/2019 (BP3A, Q7)	Send directly to DOE PM
M3F: Complete Project Sample and Data Distribution Plan	8/8/2019 (BP3A, Q8)	Send directly to DOE PM
M3G: Initiate Expedition Scientific Results Volume	4/3/2020 (BP3B, Q3)	Send directly to DOE PM
M3H:Complete IODP Proceedings Expedition Volume	8/24/2020 (BP3B, Q4)	Send directly to DOE PM

Table 3: Milestones BP3A, and BP3B

B. What was accomplished under these goals?

PREVIOUS – BUDGET PERIOD 1:

Task	Status	Quarterly Report with Task Information
Task 2.0 Site Analysis and Selection	Complete	Y1Q1, Y1Q2, Y1Q3, Y1Q4
Task 3.0 Develop Pre-Expedition Drilling/Logging/Coring/Sampling Operational Plan	Complete	Y1Q3, Y1Q4
Task 4.0 Complete and Update IODP CPP Proposal	Complete	Y1Q2, Y1Q3, Y1Q4
Task 5.0 Pressure Coring and Core Analysis System Modification and Testing	Complete	Y1Q2, Y1Q3, Y1Q4

CURRENT - BUDGET PERIOD 2:

Task 1.0 Project Management and Planning (*Status: On Schedule)*

Activity this period:

Objectives and Achievements
Objective 1: Assemble teams according to project needs.

- No new hires this period

Objective 2: Coordinate the overall scientific progress, administration and finances of the project
- Managed current tasks see details in document below
- Monitored costs

Objective 3: Communicate with project team and sponsors
- Organized regular team meetings
- Managed SharePoint sites, email list, and archive/website

Objective 4: Coordinate and supervise all subcontractors and service agreements to realize deliverables and milestones according to the work plan
- Actively managed subcontractors and service agreements.
- Negotiated SOW and budget for University of New Hampshire subcontract.

Objective 5: Compare identified risks with project risks to ensure all risks are identified and monitored. Communicate risks and possible outcomes to project team and stakeholders.
- Actively monitored project risks and as needed reported to project team and stakeholders.

Task 6.0: Technical and Operational Support of Complimentary Project Proposal (CPP) (*Status: On Schedule)*

Apr 1, 2015:	First Submittal of CPP
May 1, 2015:	Upload data to IODP SSDB
Oct 1, 2015:	Revised Submittal of CPP
Jan 8, 2016:	Upload data to IODP SSDB
Jan 12-14, 2016:	SEP Review Meeting
Apr 1, 2016:	CPP Addendum Submittal
May 2, 2016:	Upload data to IODP SSDB
May 15, 2016:	Proponent Response Letter Submitted
Jun 21-23, 2016:	SEP Review Meeting
June 2016	Safety Review Report Submitted
July 2016	Safety Presentation PowerPoint
July 11 – 13, 2016	Environmental Protection and Safety Panel (EPSP) Meeting
May 2017:	Scheduling of Hydrate Drilling Leg by IODP (JR Facility Board Meeting)
Spring 2019:	IODP Expedition

Table 4: Timing of Complimentary Project Proposal submission

Activity this period:

1. Received review of CPP
    a. We received the review of our proposal 887-CPP2 'Genesis of Methane Hydrate in Coarse-Grained Systems: Northern Gulf of Mexico Slope.' The reviews were generally positive and our proposal was advanced to 'External Review'. Requirements of this review were to submit an Addendum (due April 1, 2016) and a Proponent Response Letter (due sometime before June 2016). This is a synthesis of the reviews:
        i. **LWD:** The SEP review found no scientific reason to conduct LWD at Mad Dog and Orca and recommended focusing on coring at Terrebonne.
        ii. **Coring and Sampling Plan:** There are 4 issues related to core contamination, microbiology techniques, hypothesis testing and sampling strategy.
        iii. **Petrophysics:** The reviewers request a more detailed discussion about how the work will advance the petrophysics of hydrate formation.
        iv. **Site Survey: Sigsbee:** The reviewers could see no scientific merit to drilling this location because it does not test the dipping sand problem.
        v. **Site Survey: Mad Dog:** The discussion of Mad Dog is confusing. The reviewers appear to assume that there was JIP drilling at Mad Dog, but there was not. There is a discussion about the large gas leg and safety considerations.
        vi. **Site Survey: Terrebone:** The SEP appears to have spent some time doing our job including relocating drilling locations. The also seem to think we can drill into the sand below the BSR.
        vii. **Site Survey: Orca:** There is a lot of criticism about the Orca sites.
2. CPP Addendum Submitted and Data uploaded (April 2016)
    a. This document is a formal response to the reviews of the proposal.
    b. Key decisions from addendum
        i. Orca kept as primary
        ii. Terrebone kept as primary
        iii. Mad Dog preserved as alternate
    c. Required data was uploaded and submitted to the IODP SSDB. In addition, laptop from Ohio State was loaded with all data in IHS Kingdom and ArcGIS projects. One was shipped to Angela Slagle at LDEO. Angela carried that laptop the SEP mtg in time for the pre-meeting on June 20th.
3. Received External Reviews
    a. We received the external reviews for our proposal CPP_887. At the January (2016) SEPS Meeting, our proposal was advanced to outside review. This is intended to be an external review, independent of the IODP system. The reviews were very positive. 3 of the 4 are laudatory; one of the 4 has some modest criticism that I think can be addressed with ease. Required response to these reviews was a Proponent Response Letter (PRL).

4. Proponent Response Letter Submitted (May 2016)
    a. This document is a formal response to the reviews of the proposal.
5. Addendum reviewed at IODP Science Evaluation Panel (SEP) Review Meeting
    a. The IODP Science Evaluation Panel (SEP) is an advisory body of the *JOIDES Resolution* Facility Board (JRFB) composed of volunteer domain experts from IODP member countries. SEP primarily reviews proposals to use the IODP drilling platforms.
6. Presented at IODP Environmental Protection and Safety Panel (EPSP) Meeting
    a. The IODP Environmental Protection and Safety Panel (EPSP) is an advisory body of the JOIDES Resolution Facility Board (JRFB) composed of volunteer domain experts from IODP member countries. The EPSP primarily carries out a site-by-site review of proposed or scheduled IODP expeditions from the point of view of safety and environmental protection.
    b. For the meeting we prepared a Safety Review Report. The Safety Review Report is a document written by the proponent(s), and its contents in distilled form, are presented by a proponent during an EPSP review (or preview) of proposed sites
    c. The Environmental Protection and Safety Panel (EPSP) Presentation
        i. We answered the following with this document
            1. proposed depths of penetration (including the required "rat-hole" for logging tools)
            2. nature of the section to be penetrated (including the identification of any potential hydrocarbon reservoirs and seals)
            3. an expression of your degree of confidence in the velocity control for depthing and your proposed lithologic column
            4. possibilities of thermally mature hydrocarbon source rocks in the vicinity of proposed drilling targets and effective migration pathways
            5. results of any industry and/or previous scientific drilling
            6. likelihood of either abnormal pressure or subsurface fluid flow
            7. environmental and safety issues that may be specific to your leg (including how sites will be located, availability of crossing seismic lines, order of drilling, etc.).
    d. The Safety Presentation is a PowerPoint presentation given by a proponent to the EPSP, summarizing the information in the Safety Review Report

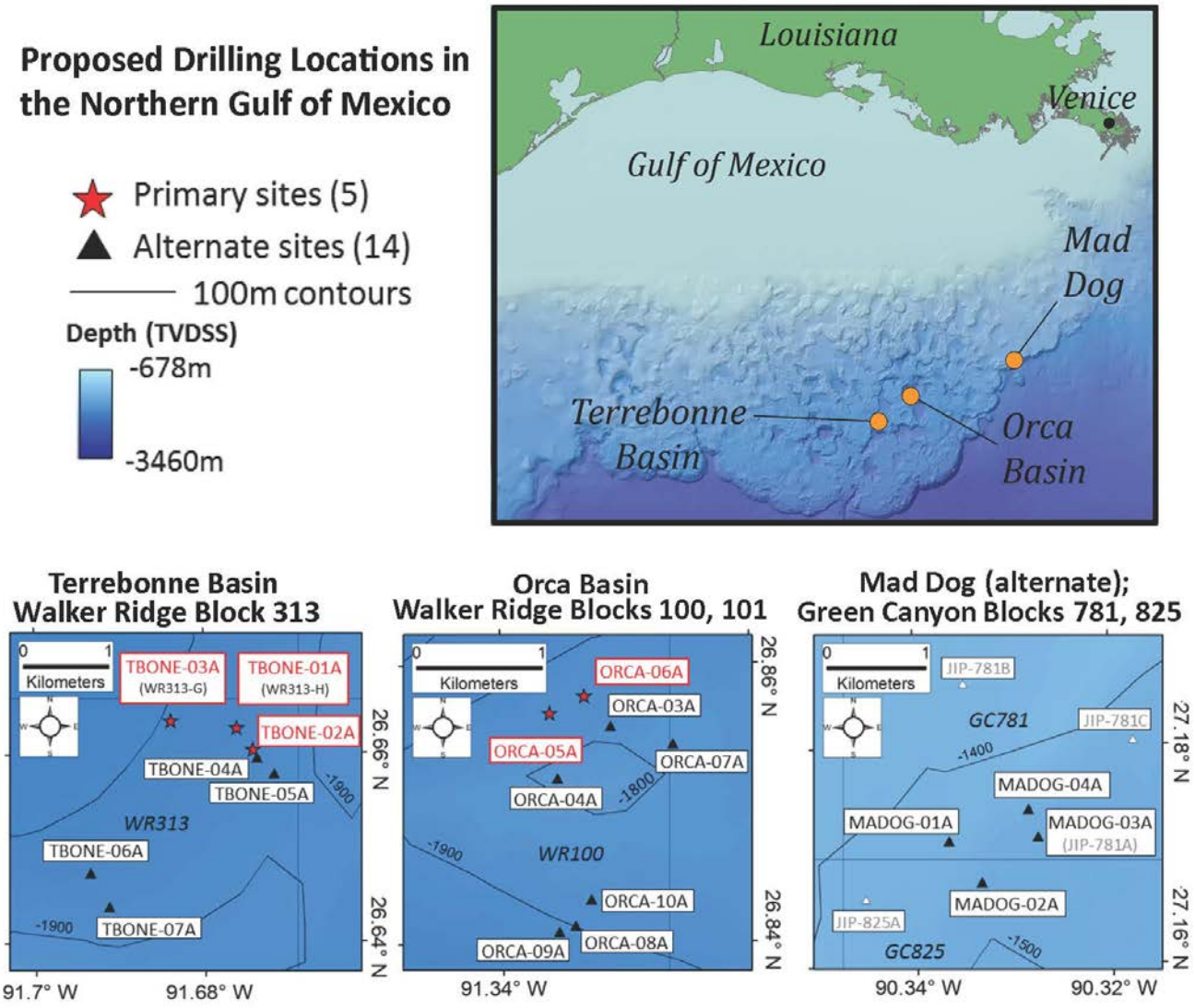

Figure 1: Proposed drilling location in the Northern Gulf of Mexico included in the IODP Complimentary Project Proposal.

Site Name	Well Name	Water Depth (tvdss,m)	Total Penetration (tvdss,m)	Latitude	Longitude	Coordinate System	Site type (Primary / Alternate)
Terrebonne	TBONE-01A	1966	2984	26.6627° N	91.6761° W	WGS 84	Primary
	TBONE-02A	1935	2785	26.6604° N	91.6742° W	WGS 84	Primary
	TBONE-03A	2000	3107	26.6635° N	91.6839° W	WGS 84	Primary
	TBONE-04A	1931	2932	26.6595° N	91.6737° W	WGS 84	Alternate
	TBONE-05A	1919	2842	26.6578° N	91.6717° W	WGS 84	Alternate
	TBONE-06A	1959	3221	26.6474° N	91.6935° W	WGS 84	Alternate
	TBONE-07A	1930	2807	26.6438° N	91.6913° W	WGS 84	Alternate
Orca Basin	ORCAB-03A	1856	2425	26.8555° N	91.3312° W	WGS 84	Alternate
	ORCAB-04A	1772	2523	26.8518° N	91.3355° W	WGS 84	Alternate
	ORCAB-05A	1889	2498	26.8565° N	91.3361° W	WGS 84	Primary
	ORCAB-06A	1894	2440	26.8577° N	91.3333° W	WGS 84	Primary
	ORCAB-07A	1770	2354	26.8542° N	91.3262° W	WGS 84	Alternate
	ORCAB-08A	1886	2583	26.8412° N	91.3342° W	WGS 84	Alternate
	ORCAB-09A	1904	2620	26.8408° N	91.3355° W	WGS 84	Alternate
	ORCAB-10A	1865	2504	26.8431° N	91.3329° W	WGS 84	Alternate
Mad Dog	MADOG-01A	1400	2076	27.1714° N	90.3366° W	WGS 84	Alternate
	MADOG-02A	1472	1961	27.1676° N	90.3333° W	WGS 84	Alternate
	MADOG-03A	1479	1959	27.1717° N	90.3275° W	WGS 84	Alternate
	MADOG-04A	1437	2031	27.1742° N	90.3284° W	WGS 84	Alternate

Table 5: Proposed drilling location in the Northern Gulf of Mexico included in the IODP Complimentary Project Proposal.

Task 7.0: Continued Pressure Coring and Core Analysis System Modifications and Testing (*Status: On Schedule)*

Completed Tasks:

- **Subtask 7.1: Review and Complete NEPA Requirements (PCTB Land Test):** Submitted and received approval for PCTB Land Test NEPA Requirements Y2Q1
- **Subtask 7.2: Pressure Coring Tool with Ball (PCTB) Land Test:** *Y2Q1 report (Flemings, 2016a)*
- **Subtask 7.3: PCTB Land Test Report:** GOM^2 PRESSURE CORING TOOL WITH BALL VALVE (PCTB) LAND TEST INITIAL REPORT in Y2 Q1 report (Flemings, 2016a)
  Appendix A: GEOTEK CORING, HYBRID PRESSURE CORING TOOL WITH BALL VALVE (PCTB) 2015 LAND TEST PROGRAM in Y2 Q2 report (Flemings, 2016b)

Activity this period:

Subtask 7.4: PCTB Tool Modification, *Status: On Schedule*

The PCTB Tool Modification team continued to refine modification goals and reviewed proposed modifications to the PCTB. The following outlines the team study outcomes and path forward in

preparation for the marine test. Major outcome was to move forward with modifications and perform land tests to validate these modifications.

Modifications

1. Flow rate v. pressure drop
    a. Calculations performed indicate the overriding pressure drop occurs at or near to top of the PCTB and not at the bit.
    b. Calculations performed indicate the bit Total Flow Area (TFA) needs to be reduced, by reducing the nozzle size, so as to increase the jetting velocity and thus reduce nozzle plugging and improve bit cleaning.
    c. Modification of existing bits to add interchangeable nozzles has been explored and is under review.
    d. A new bit design that includes interchangeable nozzles has been completed and is under review.
2. Core Liner Collapse/Pressure Calculations
    a. Calculations performed indicate that the pressure differential causing core liner collapse is created above the core liner and not below.
    b. Modifications were made to eliminate flow between core tube and core liner thus eliminating core liner collapse.
    c. An Instrumented Core Liner (ICL), for monitoring the pressure differential inside the PCTB core tube has been design and fabricated.
    d. An ICL has been fabricated and shipped to China for use in a possible field flow test.
3. PCTB internal closure stroke space out issue resulting in observed late boost
    a. New and modified parts have been designed which will eliminate late boost.
    b. Two sets of new and modified parts have been fabricated and are ready for testing.
    c. One set of new and modified parts has been shipped to China for use in the field flow test.
    d. One set of the new and modified parts are at Geotek Salt Lake City for use in bench and vertical full function testing.
    e. Procedures for a bench to determine the autoclave upper seal friction force have been developed.

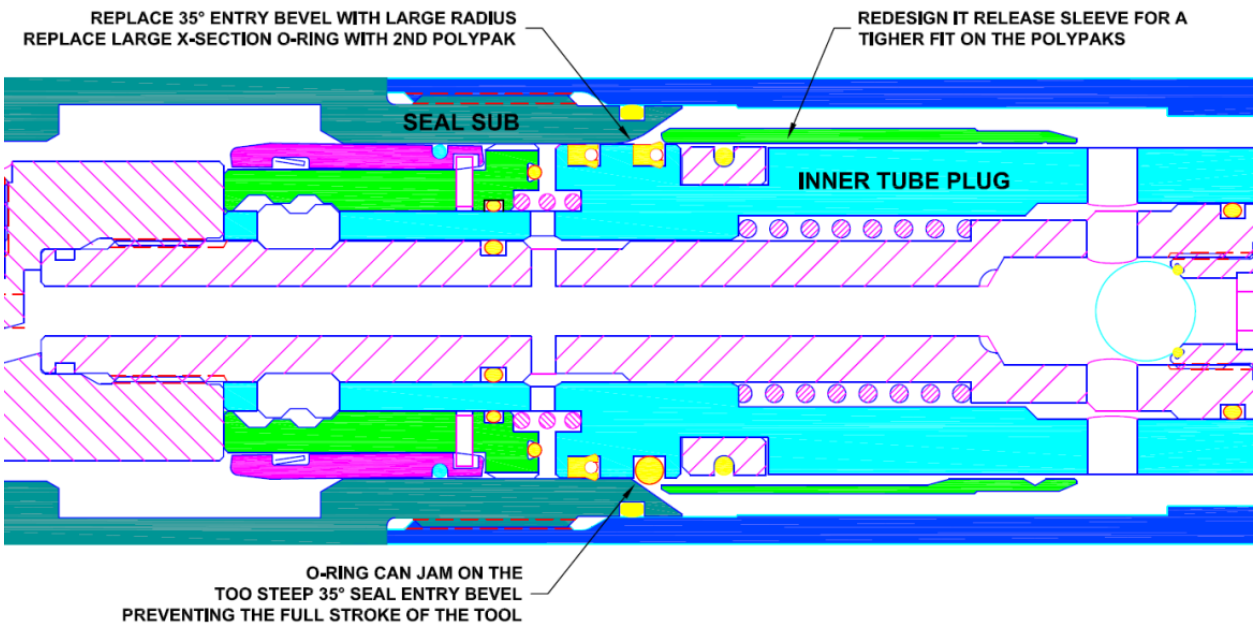

Figure 2: Modifications to address incomplete stroke.

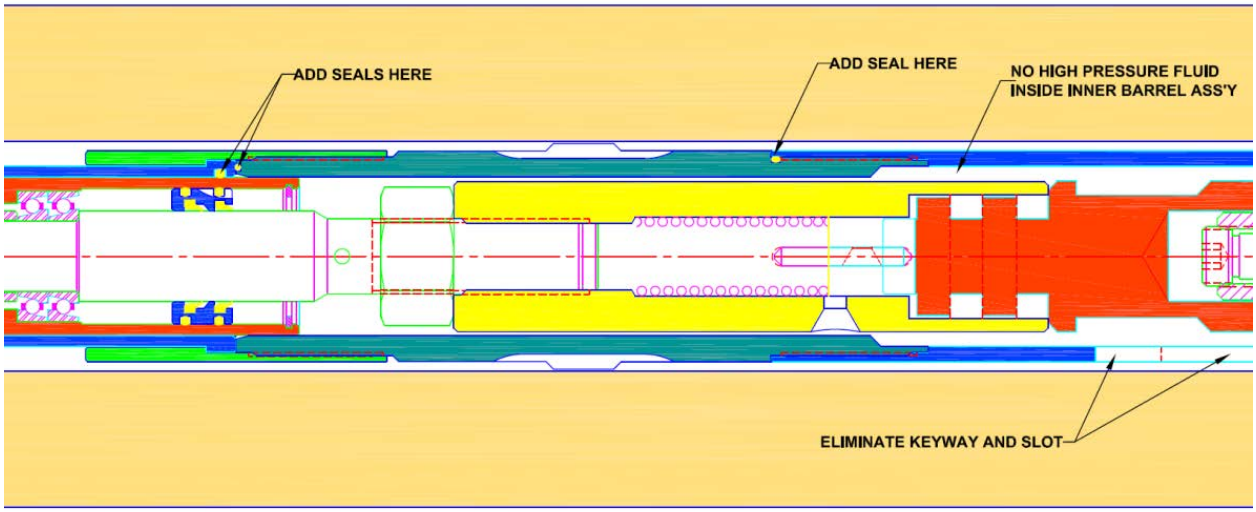

Figure 3: Modifications to address inner tube and core liner collapse.

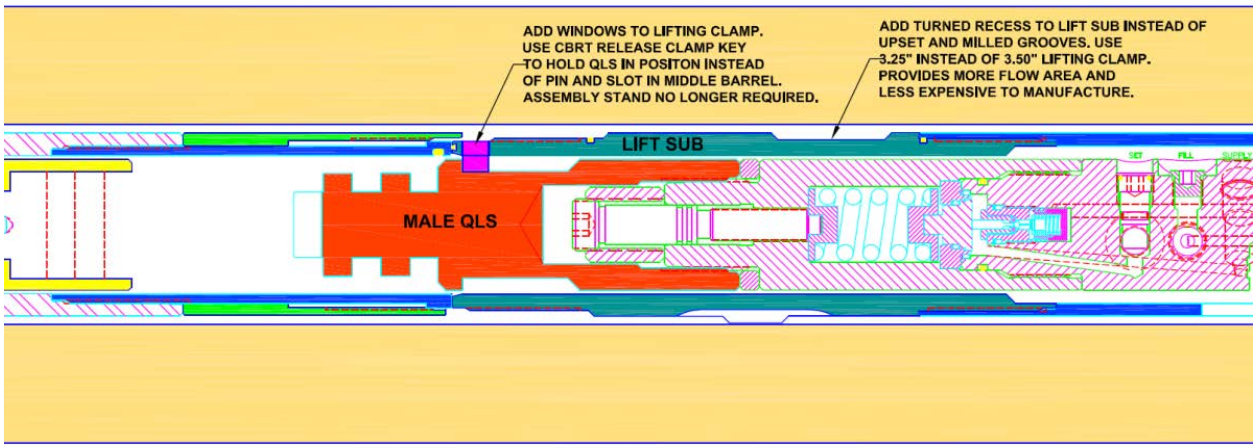

Figure 4: Modifications to address inner tube and core liner collapse.

Testing

Pre-Sea Trial Bench Test

1. Objective: To determine the minimum force required to pull the Lower Inner Tube Plug into the Seal Sub, thus completing the autoclave top seal. The ultimate goal is to eliminate hanging up of the plug seals on the seal sub entry surface causing an incomplete internal stroke resulting in loss of retained pressure and/or late boost.
2. Test setup: Assemble test apparatus such that the plug can be driven into the seal sub in a controlled manor while monitoring and recording the force required, no lubrication is to be used, Optional: If possible, the plug and seal sub should be submerged in water. Procedures for a vertical full function test to determine if the proposed modifications eliminate incomplete tool stroke have been developed.
3. Modified parts to be tested:
    a. Seal Sub
        i. Existing seal sub, CES7602
        ii. Modified seal sub AES7602, reconfigured with reduced seal entry angle
        iii. Modified seal sub, AES7603, reconfigured with radiused seal entry
    b. Lower Inner Tube Plug
        i. Existing plug (one PolyPak and one o-ring)
        ii. Plug reconfigured with different seals (two PolyPaks)

Pre-Sea Trial Vertical Full Function Pressure Test

1. Objective: To fully vet all modified parts, prior to the sea trial, by exercising the PCTB in a full function manor such that the PCTB is activated under pressure. Pressure recording devices will be use and analyzed to insure proper timing of the boost and retention of pressure is achieved.
2. Test setup: Assemble test apparatus similar to that of the previous horizontal full function pressure test except for orientating it in the vertical. Procedures for a horizontal latch in test,

using a complete OCB and PCTB configured with all the new and modified parts, to verify proper mechanical function during latch in and release.

3. Modified parts to be tested
    a. Sealed Inner Barrel Assembly
        i. Inner Tube Sub: New shorter tube required for conversion
        ii. Latch Extension: Add ports for better circulation around the spring housing.
        iii. Lift Sub: Lengthen and add lock pin hole; add Polypak groove and o-ring seal grooves and seal surfaces; eliminate fins and add undercut for higher flow and for use with new smaller lifting clamp.
    b. IT Plug/BV Housing
    c. Latch Springs
    d. Cutting Shoe Sleeve

Pre-Sea Trial Horizontal Spaceout Test

1. Objective: To fully vet all modified parts prior to the sea trial by latching in the fully assembled PCTB in an Outer Core Barrel Assembly (OCBA) and exercising the latching and unlatching function. PCTB modifications to eliminate core liner collapse and late boost.
2. Test setup: Assemble a complete OCBA, laid out horizontally, and a complete PCTB with all modified parts installed.
3. Modified parts to be tested:
    a. Sealed Inner Barrel Assembly
        i. Inner Tube Sub: New shorter tube required for conversion
        ii. Latch Extension: Add ports for better circulation around the spring housing.
        iii. Lift Sub: Lengthen and add lock pin hole; add Polypak groove and o-ring seal grooves and seal surfaces; eliminate fins and add undercut for higher flow and for use with new smaller lifting clamp.
        iv. Additional mods not listed
    b. IT Plug/BV Housing
    c. Latch Springs
    d. Cutting Shoe Sleeve

Task 8.0: Pressure Coring Tool with Ball (PCTB) Marine Field Test (*Status: On Schedule)*

Target Marine Test Dates: March – May 2017

Completed Tasks

- **Decision Point 2: Marine Field Test Stage Gate:** Submitted necessary documents to meet requirements of stage gate. This authorization was granted based on documentation received to support the Marine Field Test to be conducted under Task 8.4.

Activity this period:

Subtask 8.1: Review and Complete NEPA Requirements (*Status: On Schedule)*
Continued process of collecting and reviewing information for DOE Environmental Questionnaire.

Subtask 8.2: Marine Field Test Detailed Drilling/Logging/Coring/Sampling Operational Plan *(Status: On schedule)*

- Selected vessel contractor for Marine Test.
- Commenced contract negotiations.
- Commenced determination if UT Board of Regents' approval will be required for the vessel contract.
- Prepared draft Preliminary Operations Plan.
- Completed review of past mud programs used with the PCTB tool and during gas-hydrate LWD work at Green Canyon GoM.

Subtask 8.3: Marine Field Test Documentation and Permitting (*Status: On schedule)*
Continue preparation of BOEM-0327 Application for Permit to Conduct Scientific Research on the OCS.

Subtask 8.4: Marine Field Test of Pressure Coring System (*Status: Future Task)*
Nothing to report this period.

Subtask 8.5: Marine Field Test Report (*Status: Future Task)*
Nothing to report this period.

Task 9.0: Pressure Core Transport, Storage, and Manipulation (*Status: On Schedule)*

Completed Tasks:

- **Subtask 9.1: Review and Complete NEPA Requirements (Core Storage and Manipulation):** Submitted and received approval for NEPA Requirements Y2Q2.

Activity this period:

Subtask 9.2: Hydrate Core Transport (*Status: On schedule)*
A contract is in place for the transport of ten 1.2 m long cores, acquired during the Marine Field Test, using overpacks and a reefer truck that meet required U.S. regulations to allow for transport. The cores will be brought to U.T. for subsequent analysis.

Subtask 9.3: Storage of Hydrate Pressure Cores (*Status: Future Task)*
Nothing to report this period

Subtask 9.4: Refrigerated Container for Storage of Hydrate Pressure Cores (*Status: On Schedule)*

Design of the container is 100% complete. Bids have been received for construction and delivery. The walk-in container will be capable of storing, moving, and monitoring the pressure cores. Storage capability includes the ability to maintain conditions necessary to keep twenty 1.2 m pressure cores for the duration of the project.

Subtask 9.5 – 9.7: Hydrate Core Manipulator and Cutter Tool, Hydrate Core Effective Stress Chamber, Hydrate Core Depressurization Chamber (*Status: On Schedule)*

Design work continues on the Pressure Core Manipulator and Cutting Tool, Hydrate Core Effective Stress Chamber, and Depressurization Chamber.

1. Pressure Core Manipulator and Cutting Tool
    a. A smaller version (length-wise) of the Geotek PCATS.
2. Hydrate Core Effective Stress Chamber
    a. Chamber will couple with the Manipulator and Cutting Tool to receive samples.
    b. The chamber will be capable of measuring effective stress, permeability, and extracting liquids for pore fluid analysis.
3. Depressurization Chamber
    a. The chamber includes a high pressure gas manifold and gas sampling equipment

Task 10.0 Pressure Core Analysis (*Status: On Schedule)*

Continued planning for acquisition of pressure cores. Details include the Marine Test Timeline, expected number of cores, prioritization of core experiments, process for assigning cores to specific assignments, and process by with other parties can gain access to core. We envision the establishment of a technical advisory council to provide guidance on the analysis and distribution of routine and pressure cores.

Subtask 10.1: Routine Core Analysis (*Status: Future Task)*

Nothing to report this period.

Subtask 10.2: Pressure Core Analysis (*Status: Future Task)*

Nothing to report this period.

Subtask 10.3: Hydrate Core-Log-Seismic Synthesis (*Status: Future Task)*

Nothing to report this period.

Task 11.0: Update Pre-Expedition Drilling / Logging / Coring / Sampling Operational Plan (Field Program / Research Expedition) (*Status: On Schedule)*

Revised Operational Plan for the IODP---CPP drilling campaign, which includes drill site sequence, coring and pressure coring, LWD and wireline measurements, and rig time estimates in response to the SEP review.

Task 12.0: Field Program / Research Expedition Vessel Access (*Status: Future Task)*

Nothing to report this period.

Decision Point 3: Budget Period Continuation

Nothing to report this period.

FUTURE – BUDGET PERIOD 3, & 3A: Not Started

C. What do you plan to do during the next reporting period to accomplish the goals?

Task 1.0: Project Management and Planning (continued from prior phase)

Will continue to execute the project in accordance with the approved PMP, manage and control project activities in accordance with their established processes and procedures to ensure subtasks and tasks are completed within schedule and budget constraints defined by the PMP. A key goal of the next quarter is to finalize contracts for the Marine Test.

Task 6.0: Technical and Operational Support of Complimentary Project Proposal (CPP)

During the next reporting period we will focus on the geological analysis of our proposed drilling locations within the CPP proposal. The analysis will be used to either modify proposed drilling locations or strengthen the justification for drilling in the locations currently proposed.

Task 7.0: Continued Pressure Coring and Core Analysis System Modifications and Testing

In the next reporting period we will test tool modifications on land in Salt Lake City, UT. We will gather data from these test to validate modifications and prepare tool for Marine Test.

Task 8.0: Pressure Coring Tool with Ball (PCTB) Marine Field Test

Continue to refine drilling plan in preparation for marine test, finalize contracts, and begin permitting.

Task 9.0: Pressure Core Transport, Storage, and Manipulation

Continue with purchase and installation of equipment and storage area at UT Austin.

Task 10.0 Pressure Core Analysis

Continue planning for acquisition of pressure cores and petrophysical and seismic data integration efforts for the PCTB Marine Field Test.

Task 11.0: Update Pre-Expedition Drilling / Logging / Coring / Sampling Operational Plan (Field Program / Research Expedition) (*Status: On Schedule)*

Continue to develop the Operational Plan for the IODP---CPP drilling campaign.

Task 12.0: Field Program / Research Expedition Vessel Access (*Status: Future Task)*

No work planned for the next reporting period.

2. PRODUCTS:

A. Publications, conference papers, and presentations

Cook, A.E., & Sawyer, D., 2015, Methane migration in the Terrebonne Basin gas hydrate system, Gulf of Mexico, presented at 2015, Fall Meeting, AGU, San Francisco, CA, 14-18 Dec.

Cook, A.E., & Sawyer, D., 2015, The mud-sand crossover on marine seismic data: Geophysics, v. 80, no. 6, p. A109-A114, 10.1190/geo2015-0291.1.

Cook, A.E., and Waite, 2016, Archie's saturation exponent for natural gas hydrate in coarse-grained reservoir, presented at 2016 Gordon Research Conference from Feb28 to Mar04 in Galveston, TX, United States.

Cook, A.E., Hillman, J., & Sawyer, D., 2015, Gas migration in the Terrebonne Basin gas hydrate system, Abstract OS23D-05 presented at 2015, Fall Meeting, AGU, San Francisco, CA, 14-18 Dec.

Fortin, W., D. S. Goldberg, W.S. Holbrook, and H.M. Küçük, 2016. Velocity analysis of gas hydrate systems using prestack waveform inversion, Gordon Research Conference on Natural Gas Hydrate Systems, Galveston, TX, Feb 28 - March 4, 2016.

Goldberg, D., H.M. Küçük, S. Haines, G. Guerin, 2016. Reprocessing of high resolution multichannel seismic data in the Gulf of Mexico: implications for BSR character in the Walker Ridge and

Green Canyon areas, Gordon Research Conference on Natural Gas Hydrate Systems, Galveston, TX, Feb 28 - March 4, 2016.

Hillman, J., Cook, A. & Sawyer, D., 2016, Mapping and characterizing bottom-simulating reflectors in 2D and 3D seismic data to investigate connections to lithology and frequency dependence, presented at 2016 Gordon Research Conference from Feb28 to Mar04 in Galveston, TX, United States.

Hillman, J, Cook, A.E., Sawyer, D., Küçük, H.M., and Goldberg, D.S., 2016. The character and amplitude of bottom-simulating reflectors in marine seismic data, Earth & Plan Sci Lett., in review.

Küçük, H.M., Goldberg, D.S, Haines, S., Dondurur, D., Guerin, G., and Çifçi, G., 2016. Acoustic investigation of shallow gas and gas hydrates: comparison between the Black Sea and Gulf of Mexico, Gordon Research Conference on Natural Gas Hydrate Systems, Galveston, TX, Feb 28 - March 4, 2016.

Majumdar, U., Cook, A. E., Shedd, W., and Frye, M., 2016, The connection between natural gas hydrate and bottom-simulating reflectors: Geophysical Research Letters, DOI: 10.1002/2016GL069443

Malinverno, A., 2015. Monte Carlo inversion applied to reaction-transport modeling of methane hydrate in continental margin sediments, Fall AGU Meeting, San Francisco, Calif., Abstract OS23B-2003.

Malinverno, A., 2016. Modeling gas hydrate formation from microbial methane in the Terrebonne basin, Walker Ridge, Gulf of Mexico, Gordon Research Conference on Natural Gas Hydrate Systems, Galveston, TX, Feb 28 - March 4, 2016.

Meazell, K., & Flemings, P.B., 2016, New insights into hydrate-bearing clastic sediments in the Terrebonne basin, northern Gulf of Mexico. Gordon Research Conference on Natural Gas Hydrate Systems.

Meazell, K., & Flemings, P.B., 2016, The depositional evolution of the Terrebonne basin, northern Gulf of Mexico. 5th Annual Jackson School Research Symposium.

Meazell, K., 2015, Methane hydrate-bearing sediments in the Terrebonne basin, northern Gulf of Mexico, Abstract OS23B-2012 presented at 2015 Fall Meeting, AGU, San Francisco, CA. 14-18 Dec.

Phillips, S.C., Borgfedlt, T., You, K., Meyer, D., and Flemings, P., 2016, Dissociation of laboratory-synthesized methane hydrate by depressurization. Poster presented at 2016 Gordon Research Conference and Gordon Research Seminar on Natural Gas Hydrates. Poster presented at 2016 Gordon Research Conference from Feb28 to Mar04 in Galveston, TX, United States.

Treiber, K, Sawyer, D., & Cook, A., 2016, Geophysical interpretation of gas hydrates in Green Canyon Block 955, northern Gulf of Mexico, USA. Poster presented, poster presented at 2016 Gordon Research Conference from Feb28 to Mar04 in Galveston, TX, United States.

Worman, S. and, Flemings, P.B., 2016, Genesis of Methane Hydrate in Coarse-Grained Systems: Northern Gulf of Mexico Slope (GOM^2). Poster presented at UT GeoFluids Consortia Meeting from March 2nd- March 4th in Austin, TX, United States.

Yang, C., Cook, A., & Sawyer, D., 2016, Geophysical interpretation of the gas hydrate reservoir system at the Perdido Site, northern Gulf of Mexico, presented at 2016 Gordon Research Conference from Feb28 to Mar04 in Galveston, TX, United States

B. Website(s) or other Internet site(s)

Project Website: http://www.ig.utexas.edu/gom2/

Project SharePoint: https://sps.austin.utexas.edu/sites/GEOMech/doehd/teams/

C. Technologies or techniques

Nothing to Report.

D. Inventions, patent applications, and/or licenses

Nothing to Report.

E. Other products

Flemings, P. B., 2014, Y1Q1 Quarterly Research Performance Progress Report (Period ending 12/31/2014), Deepwater Methane Hydrate Characterization and Scientific Assessment, DOE Award No.: DE-FE0023919.

Flemings, P. B., 2015, Y1Q2 Quarterly Research Performance Progress Report (Period ending 3/31/2015), Deepwater Methane Hydrate Characterization and Scientific Assessment, DOE Award No.: DE-FE0023919.

Flemings, P. B., 2015, Y1Q3 Quarterly Research Performance Progress Report (Period ending 6/30/2015), Deepwater Methane Hydrate Characterization and Scientific Assessment, DOE Award No.: DE-FE0023919.

Flemings, P. B., 2015, Y1Q4 Quarterly Research Performance Progress Report (Period ending 9/30/2015), Deepwater Methane Hydrate Characterization and Scientific Assessment, DOE Award No.: DE-FE0023919.

Flemings, P. B., 2015, Phase 1 Report (Period ending 9/30/2015), Deepwater Methane Hydrate Characterization and Scientific Assessment, DOE Award No.: DE-FE0023919.

Flemings, P. B., 2016, Y2Q1 Quarterly Research Performance Progress Report (Period ending 12/31/2015), Deepwater Methane Hydrate Characterization and Scientific Assessment, DOE Award No.: DE-FE0023919.

Flemings, P. B., 2016, Y2Q2 Quarterly Research Performance Progress Report (Period ending 3/31/2015), Deepwater Methane Hydrate Characterization and Scientific Assessment, DOE Award No.: DE-FE0023919.

3. CHANGES/PROBLEMS:

A. Changes in approach and reasons for change

Nothing to report.

B. Actual or anticipated problems or delays and actions or plans to resolve them

There is a chance that the Helix contract will need to be reviewed by the UT Board of Regents and there is a chance that these budget negotiations may take several months. If Board of Regents approval is required or negotiations drag on, the signing of the contract would be delayed until late this year. To ensure that this possible delay doesn't prevent work from starting at Helix, we envision signing a Letter of Intent (LOI). This letter will outline a set dollar amount for necessary project management work on Helix's part in preparation for the Marine Test. If the contract is approved, these funds will be rolled into the cost under the contract scope of work. In the event that the contract is not approved by the BoR, these funds would be paid to Helix and we would release our commitment to the rig. The risk to DOE is that there is a small chance that funds will be spent toward the planning of the Marine Test without the actual execution of the test.

C. Changes that have a significant impact on expenditures

Nothing to report

D. Change of primary performance site location from that originally proposed

Nothing to Report.

4. SPECIAL REPORTING REQUIREMENTS:

A. CURRENT - BP2 / Phase 2

Task 1 – Revised Project Management Plan (Complete)

Subtask 7.03 – PCTB Land Test Report (Complete)

Subtask 8.05 – Pressure Core Marine Field Test Report

Task 11 – Refined Field Program Operational Plan Report

B. FUTURE - BP 3 / Phase 3

Phase 3A

A Phase 3A Report encompassing the refined Operational Plan, pressure coring team report, and permitting report

Task 14 - Field Program Operational Plan report
Task 15 – Field Program Hazards Report

Phase 3B
Task 16 – IODP Preliminary Expedition Report
Task 18 – Project Sample and Data Distribution Plan
Task 18 – IODP Proceedings Expedition Volume
Task 18 – Expedition Scientific Results Volume

5. BUDGETARY INFORMATION:

Budget Period 2 cost summary is outlined below.

Baseline Reporting Quarter	Budget Period 2							
	Y1Q1		Y1Q2		Y1Q3		Y1Q4	
	10/01/15-12/31/15		01/01/16-03/31/16		04/01/16-06/30/16		07/01/16-09/30/16	
	Y1Q1	Cumulative Total	Y1Q2	Cumulative Total	Y1Q3	Cumulative Total	Y1Q4	Cumulative Total
Baseline Cost Plan								
Federal Share	$ 1,805,358	$ 1,805,358	$ 1,327,931	$ 3,133,289	$ 492,932	$ 3,626,221	$ 492,932	$ 4,119,153
Non-Federal Share	$ 471,771	$ 471,771	$ 471,771	$ 943,542	$ 471,771	$ 1,415,313	$ 471,771	$ 1,887,084
Total Planned	$ 2,277,129	$ 2,277,129	$ 1,799,702	$ 4,076,831	$ 964,703	$ 5,041,534	$ 964,703	$ 6,006,237
Actual Incurred Cost								
Federal Share	$ 788,040	$ 788,040	$ 802,088	$ 1,590,128	$ 862,023	$ 2,452,151		
Non-Federal Share	$ 267,114	$ 267,114	$ 258,648	$ 525,762	$ 308,579	$ 834,341		
Total Incurred Cost	$ 1,055,154	$ 1,055,154	$ 1,060,736	$ 2,115,890	$ 1,170,602	$ 3,286,492		
Variance								
Federal Share	$ (1,017,318)	$ (1,017,318)	$ (525,843)	$ (1,543,161)	$ 369,091	$ (1,174,070)		
Non-Federal Share	$ (204,657)	$ (204,657)	$ (213,123)	$ (417,780)	$ (163,192)	$ (580,972)		
Total Variance	$ (1,221,975)	$ (1,221,975)	$ (738,966)	$ (1,960,941)	$ 205,899	$ (1,755,042)		
Baseline Reporting Quarter	Budget Period 2							
	Y2Q1		Y2Q2		Y2Q3		Y2Q4	
	10/01/16-12/31/16		01/01/17-03/31/17		04/01/17-06/30/17		07/01/17-09/30/17	
	Y2Q1	Cumulative Total	Y2Q2	Cumulative Total	Y2Q3	Cumulative Total	Y2Q4	Cumulative Total
Baseline Cost Plan								
Federal Share	$ 1,096,922	$ 5,216,075	$ 10,209,921	$ 15,425,996	$ 1,001,922	$ 16,427,918	$ 1,001,922	$ 17,429,840
Non-Federal Share	$ 848,570	$ 2,735,654	$ 848,569	$ 3,584,223	$ 848,569	$ 4,432,792	$ 848,569	$ 5,281,361
Total Planned	$ 1,945,492	$ 7,951,729	$ 11,058,490	$ 19,010,219	$ 1,850,491	$ 20,860,710	$ 1,850,491	$ 22,711,201
Actual Incurred Cost								
Federal Share								
Non-Federal Share								
Total Incurred Cost								
Variance								
Federal Share								
Non-Federal Share								
Total Variance								

Table 6

6. REFERENCES

Flemings, P. B., 2016a, Y2Q1 Quarterly Research Performance Progress Report (Period ending 12/31/2015), Deepwater Methane Hydrate Characterization and Scientific Assessment, DOE Award No.: DE-FE0023919.

Flemings, P. B., 2016b, Y2Q2 Quarterly Research Performance Progress Report (Period ending 3/31/2015), Deepwater Methane Hydrate Characterization and Scientific Assessment, DOE Award No.: DE-FE0023919.

7. ACRONYMS

CPP	Complimentary Project Proposal
DOE	Department of Energy
EPSP	Environmental Protection and Safety Panel
gpm	Gallons per minute
ICL	Instrumented Core Liner
ID	Inner diameter
IODP	International Ocean Discovery Program
LDEO	Lamont–Doherty Earth Observatory
LWD	Logging While Drilling
m	meter
MADOG	Mad Dog
NEPA	National Environmental Policy Act
OCB	Outer Core Barrel
OCBA	Outer Core Barrel Assembly
OSU	Ohio State University
PCATS	Pressure Core Analysis and Transfer System
PCTB	Pressure Coring Tool with Ball Valve
PRL	Proponent Response Letter
SEP	Science Evaluation Panel
SSDB	Site Survey Data Bank
TBONE	Terrebonne
TFA	Total Flow Area
UNH	University of New Hampshire
UT	The University of Texas