



DOE Award No.: DE-FE0023919

# Quarterly Research Performance Progress

## Report (Period Ending 12/31/2017)

# Deepwater Methane Hydrate Characterization and Scientific Assessment

Project Period (10/1/2016-9/30/2020)

Submitted by:

Peter B. Flemings

A handwritten signature in black ink that reads 'Peter B. Flemings'. The signature is written in a cursive style and is positioned above a horizontal line.

Signature

The University of Texas at Austin

DUNS #: 170230239

101 East 27<sup>th</sup> Street, Suite 4.300

Austin, TX 78712-1500

Email: [pflemings@jsg.utexas.edu](mailto:pflemings@jsg.utexas.edu)

Phone number: (512) 475-8738

Prepared for:

United States Department of Energy

National Energy Technology Laboratory

February 09, 2018



U.S. DEPARTMENT OF  
**ENERGY**

**NATIONAL ENERGY  
TECHNOLOGY LABORATORY**

Office of Fossil Energy

## **DISCLAIMER**

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

# 1 ACCOMPLISHMENTS

## 1.1 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.

Project Milestones are listed in the tables below.

**Table 1: Previous Project Phase Milestones (Phase 1)**

Milestone Description	Planned Completion	Actual Completion	Verification Method	Comments
M1A: Project Management Plan	3/2/2015 (BP1)	03/18/2015	Project Mgmt. Plan	--
M1B: Project Kick-off Meeting	1/14/2015 (BP1, Q2)	12/11/2014	Presentation	--
M1C: Site Location and Ranking Report	9/30/2015 (BP1, Q3)	09/30/2015	Phase 1 Report	--
M1D: Preliminary Field Program Operational Plan Report	9/30/2015 (BP1, Q3)	09/30/2015	Phase 1 Report	--
M1E: Updated CPP Proposal Submitted	5/1/2015 (BP1, Q3)	10/1/2015	Phase 1 Report	--
M1F: Demonstration of a viable PCS Tool	9/30/2015 (BP1, Q4)	09/30/2015	Phase 1 Report	--
M1G: Document results of BP1/Phase 1 Activities	12/29/2015 (BP2, Q1)	1/12/2016	Phase 1 Report	--

**Table 2: Current Project Phase Milestones (Phase 2)**

Milestone Description	Planned Completion	Actual Completion	Verification Method	Comments
M2A: Complete Updated CPP Proposal Submitted	11/2/2015 (BP2, Q1)	Nov 2015 (BP2, Q1)	Quarterly Report	Presented in Y2Q1 report
M2B: Scheduling of Hydrate Drilling Leg by IODP	5/18/2016 (BP2, Q3)	May 2017 (BP2, Q7)	Report status immediately to DOE PM	Expedition 386 scheduled for 2020
M2C: Demonstration of a viable PCS tool for hydrate drilling through completion of land-based testing	12/21/2015 (BP2, Q5)	Dec 2015 (BP2, Q5)	PCTB Land Test Report, in Quarterly Report	Presented in Y2Q1 report
M2D: Demonstration of a viable PCS tool for hydrate drilling through completion of a deep water marine field test	1/2/2017 (BP2, Q6)	May 2017 (BP2, Q7)	UT-GOM2-1 Expedition Summary, in Quarterly Report	Presented in Y3Q7 report
M2E: Complete Refined Field Program Operation Plan	9/26/2017 (BP2, Q8)	--	Phase 2 Report	In progress
M2F: Document results of BP2/Phase 2 Activities	12/29/2017 (BP3, Q1)	--	Phase 2 Report	In progress

**Table 3: Future Project Phase Milestones (Phases 3, 4)**

Milestone Description	Planned Completion	Actual Completion	Verification Method	Comments
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 Haz. 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	--

We are currently revising the milestones for future project phases in concert with the Budget Period 2/Budget Period 3 transition (January 15, 2018). The Project Phase Milestones will be adjusted and revised accordingly in the next QRPPR (period ending March 31, 2018) based on the revised Project Management Plan (PMP).

## 1.2 WHAT WAS ACCOMPLISHED UNDER THESE GOALS?

### Previous - Phase 1 / Budget Period 1

**Table 4: Tasks completed under Phase1/BP1**

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 - Phase 2 / Budget Period 2

### **TASK 1.0 - Project Management and Planning**

Status: Ongoing

#### *Activity this Period*

Objective 1: Assemble teams according to project needs.

- On-boarded new postdoctoral researcher, hired in previous quarter.

Objective 2: Coordinate the overall scientific progress, administration and finances of the project.

- Managed current project phase tasks (see details in document below).
- Monitored costs.
- Held meetings with DOE to finalize details of Phase 2 / Budget Period 2 transition.
- Submitted draft budget period transition proposal to DOE on November 21, 2017 (including revised budgets, budget description, budget justification, SF424, and revised Scope of Project Objectives).
- Submitted final budget period transition proposal to DOE on December 8, 2017.

Objective 3: Communicate with project team and sponsors.

- Organized regular team meetings:
  - Monthly sponsor meetings,
  - PCTB development team meetings, and
  - Operations team meetings.
- Organized in-person and webex conference with IODP (Texas A&M) and DOE on October 11, 2017 to discuss UT-GOM<sup>2</sup>-2 operational plan and permitting strategy.
- Coordinated and prepared for DOE visit to University of Texas at Austin, scheduled for January 30, 2018.
- Managed SharePoint sites, email lists, 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.
- Worked with subcontractors to finalize revised final statements of work and estimated costs for budget period transition.

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: Ongoing

**Table 5: Timing of Complimentary Project Proposal submission**

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
March 2, 2017	Submit CPP Addendum2
March 10, 2017	Upload Revised Site Survey Data
April 2017	Submit EPSP Safety Review Report V2
May 3, 2017	EPSP Safety Review Presentation V2
May 24, 2017	Scheduling of CPP-887 Hydrate Drilling Leg by JR Facility Board
Jan-March 2020	CPP-887 / IODP Expedition 386

### **Activity this Period**

- Continued to refine the operational project plan for UT-GOM<sup>2</sup>-2 expedition.
- Initiated G&G component of Exploration Plan for UT-GOM<sup>2</sup>-2.
- Prepared permitting procedure based on UT-GOM<sup>2</sup>-1 and provided to IODP and DOE.
- Held web-conference meetings with IODP (Texas A&M) and DOE to discuss regulatory compliance, expedition permitting, and upgrades required for drillship to operate in the Gulf of Mexico.

## **TASK 7.0 – Cont'd Pressure Coring and Core Analysis System Modifications & Testing**

Status: Complete

### **Completed Subtasks**

- Subtask 7.1: Review and Complete NEPA Requirements (PCTB Land Test)
- Subtask 7.2: Pressure Coring Tool with Ball (PCTB) Land Test
- Subtask 7.3: PCTB Land Test Report
- Subtask 7.4: PCTB Tool Modification

## **TASK 8.0 - Pressure Coring Tool with Ball (PCTB) Marine Field Test**

Status: In Progress (The Marine Field Test offshore expedition was completed in May 2017; Marine Test dockside core processing and gas analytics were completed May-June, 2017)

### **Completed Subtasks**

- Decision Point 2: Marine Field Test Stage Gate
- Subtask 8.1: Review and Complete NEPA Requirements
- Subtask 8.2: Marine Field Test Detailed Drilling/Logging/Coring/Sampling Operational Plan
- Subtask 8.3: Marine Field Test Documentation and Permitting
- Subtask 8.4: Marine Field Test of Pressure Coring System

### **Activity this Period**

- Subtask 8.5: Marine Field Test Report (*Status: On Schedule*)
  - The UT-GOM2-1 Science Party continues to refine the Marine Test Report.

## **TASK 9.0 - Pressure Core Transport, Storage, and Manipulation**

Status: Complete

### **Completed Subtasks**

- Subtask 9.1: Review and Complete NEPA Requirements (Core Storage and Manipulation)
- Subtask 9.2: Hydrate Core Transport
- Subtask 9.3: Storage of Hydrate Pressure Cores
- Subtask 9.4: Refrigerated Container for Storage of Hydrate Pressure Cores
- Subtask 9.5: Hydrate Core Manipulator and Cutter Tool
- Subtask 9.6 Hydrate Core Effective Stress Chamber
- Subtask 9.7 Hydrate Core Depressurization Chamber

## **TASK 10.0 - Pressure Core Analysis**

Status: On Schedule

- Subtask 10.1: Routine Core Analysis (Status: On Schedule)  
Depressurized core from the Marine Test was divided, stored, and shipped according to sample handling protocols established for mud lab operations on the rig and at the dock. Initial results from the analysis are included in the Expedition Report. Additional work is still on-going as proposed into BP3.
- Subtask 10.2: Pressure Core Analysis (Status: On Schedule)  
The third and final round of pressure core sample and data requests was reviewed and approved by the council. Samples are expected to be distributed to the University of Texas, USGS Woods Hole, Georgia Tech, NETL, and AIST.

Protocols for Pressure Core cutting and analysis were tested at UT using synthetic cores made from concrete and one of the compromised core, UT-GOM2-1-H005-06FB.

Analysis will continue into BP3.

Gas analysis, hydrate saturation studies, continued and gas samples were sent for clumped isotope analysis at Caltech.

- Subtask 10.3: Hydrate Core-Log-Seismic Synthesis (*Status: Future Task*)  
We were unable to capture well logging data from the hydrate-bearing reservoir in H002 as planned.



**TASK 11.0 - Update Pre-Expedition Drilling / Logging / Coring / Sampling Operational Plan (Research Expedition)**

Status: On Schedule

**Activity this period**

- Held Operations Team meetings as needed to inform operational project plan development.
- Held PCTB Development team meetings as needed to refine PCTB development plan and scope of work for Geotek during BP3.

**TASK 12.0 - Field Program / Research Expedition Vessel Access**

Status: Complete

In Y3, Q7 UT and the Hydrates Project Advisory Team presented for the IODP EPSP final review. This meeting was attended by members of UT, Columbia University, Ohio State University, BOEM, and USGS. The IODP review panel recommended CPP-887 for scheduling to the JOIDES Resolution Facilities Board. JOIDES Resolution Facilities Board approved CPP-887 and scheduled Expedition 386 for January – March 15, 2020. Having acquired access to the Research Expedition vessel, this task is now completed. Ongoing tasks associated with planning the Research Expedition fall under Task 6.0 (Technical and Operational Support of Complimentary Project Proposal) or Task 11.0 (Update Pre-Expedition Drilling/Logging/Coring/Sampling Operational Plan).

**Decision Point 3: Budget Period Continuation**

**Activity this period**

- A no-cost budget period extension was granted extending Phase 2/Budget Period 2 from September 30, 2017 to January 15, 2017.
- As noted in activities reported in Tasks 1, 6, and 11 above, UT prepared and submitted draft and final Budget Period transition/continuation proposal documents. This included:
  - Holding Operational Planning Team meetings to refine the operational project plan;
  - Holding PCTB Development Team meetings to refine PCTB development scope;
  - Engaging subcontractors and vendors with requests for refined scopes work and costs;
  - Discussing proposed revisions to project plan and associated costs with DOE on a weekly basis; and
  - Preparing the required documentation for the Budget Period transition/continuation, including revised SOPO, budget, budget description, and budget justification.
- UT held a webex presentation with DOE on October 26, 2017 to present the initial draft budget.
- UT submitted the draft budget period transition application to DOE on November 21, 2017.
- UT submitted a final budget period transition application to DOE December 08, 2017.

### **1.3 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)**

UT 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.

Key project management and planning goals for the next quarter include:

- Complete Phase 2 Report and associated documents.
- Finalize service agreements and business contracts for PCTB performance assessment, modifications, and testing tasks.
- Coordinate DOE visit to UT Austin.

#### **TASK 6.0: Technical and Operational Support of Complimentary Project Proposal (CPP)**

UT will continue to engage IODP/Texas A&M on critical decision point of who (UT or Texas A&M) will function as the “licensed operator” during the Research Expedition, and move forward with permitting preparations based on this decision. UT will also engage subcontractors on initiation of project tasks to be started in Q1 of the next project phase, beginning January 16, 2018.

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

UT has assembled a PCTB Development Team and has held meetings to assess the performance of the pressure coring system during the Marine Test. The PCTB Development Team has determined that additional tool testing and modifications are required prior to the Research Expedition, and has developed a plan for testing, analysis, and modifications, which will be proposed as a future project task.

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

UT will complete the Marine Test Report also known as the UT-GOM2-1 Expedition Summary.

#### **Task 10.0 Pressure Core Analysis**

UT will work with other institutions on plans for transferring pressure core per the final distribution plan. Pressure core distribution will start in late spring / summer 2018.

Gas analysis will continue and K0 permeability studies on pressure cores will start.

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

UT will continue to hold planning meetings with Texas A&M University and the project advisory board to plan and refined the Field Program / Research Expedition.

**Task 12.0: Field Program / Research Expedition Vessel Access**

Research Expedition vessel access has been acquired. IODP has scheduled CPP-887 (Expedition 386) to occur between January and March 2020.

## 2 PRODUCTS

### 2.1 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.
- Cook, A.E., Hillman, J., Sawyer, D., Treiber, K., Yang, C., Frye, M., Shedd, W., Palmes, 2016, Prospecting for Natural Gas Hydrate in the Orca & Choctaw Basins in the Northern Gulf of Mexico, poster at 2016 Fall Meeting, AGU, San Francisco, CA, 12-16 Dec.
- Fortin, W., 2016, Properties from Seismic Data, IODP planning workshop, Southern Methodist University, Dallas, Texas, April 11, 2017.
- Fortin, W., Goldberg, D.S., Holbrook, W.S., and Küçük, H.M., 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.
- Fortin, W., Goldberg, D.S., Küçük, H.M., 2016, Methane Hydrate Concentrations at GC955 and WR313 Drilling Sites in the Gulf of Mexico Determined from Seismic Prestack Waveform Inversion, *EOS Trans. AGU*, Fall Meeting, Session 13837: Experiments, Modeling and Field Studies on Gas Hydrate Formation, San Francisco, CA Dec 12-16, 2016.
- Fortin, W., D. S. Goldberg, H. M. Küçük, 2017. Prestack Waveform Inversion and Well Log Examination at GC955 and WR313 in the Gulf of Mexico for Estimation of Methane Hydrate Concentrations, *EOS Trans. AGU*, Fall Meeting, New Orleans, LA Dec 12-16, 2017.
- Darnell, K., Flemings, P.B., DiCarlo, D.A., 2016, Nitrogen-assisted Three-phase Equilibrium in Hydrate Systems Composed of Water, Methane, Carbon Dioxide, and Nitrogen, Fall Meeting, AGU, San Francisco, Calif., 12-16 Dec. (scheduled)
- 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.
- Heber, R., Kinash, N., Cook, A., Sawyer, D., Sheets, J., and Johnson, J.E., 2017. Mineralogy of Gas Hydrate Bearing Sediment in Green Canyon Block 955 Northern Gulf of Mexico. Abstract OS53B-1206 presented at AGU Fall Meeting, New Orleans, LA Dec 12-16, 2017.
- 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.*, doi:<http://dx.doi.org/10.1016/j.epsl.2016.10.058>
- Hillman, J.I.T., Cook, A.E., Daigle, H., Nole, M., Malinverno, A., Meazell, K. and Flemings, P.B, 2017. Gas hydrate reservoirs and gas migration mechanisms in the Terrebonne Basin, Gulf of Mexico. *Marine and Petroleum Geology*. doi:10.1016/j.marpetgeo.2017.07.029
- Kinash, N. Cook, A., Sawyer, D. and Heber, R., 2017. Recovery and Lithologic Analysis of Sediment from Hole UT-GOM2-1-H002, Green Canyon 955, Northern Gulf of Mexico. Abstract OS53B-1207 presented at AGU Fall Meeting, New Orleans, LA Dec 12-16, 2017.
- 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.
- Malinverno, A., A. E. Cook, H. Daigle, B. Oryan, 2017. Methane Hydrate Formation from Enhanced Organic Carbon Burial During Glacial Lowstands: Examples from the Gulf of Mexico, *EOS Trans. AGU*, Fall Meeting, New Orleans, LA, Dec 12-16, 2017.
- Meazell, K., Flemings, P.B., 2016, Heat Flux and Fluid Flow in the Terrebonne Basin, Northern Gulf of Mexico, Fall Meeting, AGU, San Francisco, Calif., 12-16 Dec. (scheduled)
- 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.
- Moore, M., Darrah, T., Cook, A., Sawyer, D., Phillips, S., Whyte, C., Lary, B., and UT-GOM2-01 Scientists, 2017. The genetic source and timing of hydrocarbon formation in gas hydrate reservoirs in Green Canyon, Block GC955. Abstract OS44A-03 presented at AGU Fall Meeting, New Orleans, LA Dec 12-16, 2017.
- Oryan, B., A. Malinverno, D. Goldberg, W. Fortin, 2017. Do Pleistocene glacial-interglacial cycles control methane hydrate formation? An example from Green Canyon, Gulf of Mexico, *EOS Trans. AGU*, Fall Meeting, New Orleans, LA Dec 12-16, 2017.

- Oti, E., Cook, A., Buchwalter, E., and Crandall, D., 2017. Non-Destructive X-ray Computed Tomography (XCT) of Gas Hydrate Bearing Fractures in Marine Sediment. Abstract OS44A-05 presented at AGU Fall Meeting, New Orleans, LA Dec 12-16, 2017.
- Phillips, S.C., Borgfeldt, 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.
- Phillips, S.C., \*You, K., Borgfeldt, T., \*Meyer, D.W., \*Dong, T., Flemings, P.B., 2016, Dissociation of Laboratory-Synthesized Methane Hydrate in Coarse-Grained Sediments by Slow Depressurization, Fall Meeting, AGU, San Francisco, Calif., 12-16 Dec. (scheduled)
- Phillips, S.C., You, K., Flemings, P.B., Meyer, D.W., and Dong, T., under review. Dissociation of Laboratory-Synthesized Methane Hydrate in Coarse-Grained Sediments By Slow Depressurization. *Marine And Petroleum Geology*
- 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<sup>2</sup>). 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 Feb 28 to Mar 04 in Galveston, TX, United States.
- You, K.Y., DiCarlo, D. & Flemings, P.B., 2015, Quantifying methane hydrate formation in gas-rich environments using the method of characteristics. Abstract OS23B-2005 presented at 2015, Fall Meeting, AGU, San Francisco, CA, 14-18 Dec.
- You, K., Flemings, P.B., 2016, Methane Hydrate Formation in Thick Sand Reservoirs: Long-range Gas Transport or Short-range Methane Diffusion?, Fall Meeting, AGU, San Francisco, Calif., 12-16 Dec.
- You, K., and Flemings, P. B., 2017, Methane Hydrate Formation In Thick Sand Reservoirs: 1. Short-Range Methane Diffusion, *Marine and Petroleum Geology*.
- You, K.Y., Flemings, P.B., & DiCarlo, D., 2015, Quantifying methane hydrate formation in gas-rich environments using the method of characteristics. 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.

## 2.2 WEBSITE(S) OR OTHER INTERNET SITE(S)

- UT-GOM<sup>2</sup> Project Website: <https://ig.utexas.edu/energy/genesis-of-methane-hydrate-in-coarse-grained-systems/>
- UT-GOM<sup>2</sup>-1 Expedition Website: <https://ig.utexas.edu/energy/genesis-of-methane-hydrate-in-coarse-grained-systems/expedition-ut-gom2-1/>

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

### **2.3 TECHNOLOGIES OR TECHNIQUES**

Nothing to report.

### **2.4 INVENTIONS, PATENT APPLICATIONS, AND/OR LICENSES**

Nothing to report.

### **3 CHANGES/PROBLEMS**

#### **3.1 CHANGES IN APPROACH AND REASONS FOR CHANGE**

Nothing to report.

#### **3.2 ACTUAL OR ANTICIPATED PROBLEMS OR DELAYS AND ACTIONS OR PLANS TO RESOLVE THEM**

This is a challenging and complex project with many moving pieces. Our largest current challenges are:

- Planning the science and operational program with Texas A&M University, the operator of the JOIDES Resolution drillship.
- Determining the path forward in concert with Texas A&M University to permit the JOIDES Resolution drillship, and ensure that it meets the regulatory requirements to operate in the Gulf of Mexico.

#### **3.3 CHANGES THAT HAVE A SIGNIFICANT IMPACT ON EXPENDITURES**

As part of the budget period transition, UT developed a revised budget for BP3 and BP4 based on experiences during BP2 that led to a more robust understanding of the remaining tasks, actual negotiations with subcontractors, careful operational planning, and recent developments with the complimentary project proposal no. 887 (CPP-887).

This revised budget reflects an overall increase in the project cost, driven by 1) additional costs required to complete PCTB testing and modification tasks were not originally scoped, 2) additional costs required to complete the UT-GOM2-2 research expedition based on UT's recent experiences during the UT-GOM2-1 marine test which resulted in a clearer understanding of offshore drilling costs, and 3) additional direct costs required for personnel, equipment, supplies, and travel that are required to meet the refined program objectives.

#### **3.4 CHANGE OF PRIMARY PERFORMANCE SITE LOCATION FROM THAT ORIGINALLY PROPOSED**

Nothing to report.



## 4 SPECIAL REPORTING REQUIREMENTS

### 4.1 CURRENT: PHASE 2 / Budget Period 2

- Task 1: Revised Project Management Plan (Status: Complete)
- Subtask 7.3 – PCTB Land Test Report (Status: Complete)
- Subtask 8.5 – Pressure Core Marine Field Test Report (Status: On Schedule)
- Task 11 – Refined Field Program Operational Plan Report (Status: On schedule)

### 4.2 FUTURE – Phase 3 / Budget Period 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

We are currently revising the schedule for future project phases in concert with the Budget Period 2/Budget Period 3 transition, which will occur January 15, 2018. The Project Phase tasks will be adjusted accordingly in the next Quarterly Report (BP2 Q9).

# 5 BUDGETARY INFORMATION

Budget Period 2 cost summary is outlined below. Note: Y2 in the table is Y3 of the overall project including BP1.

**Table 6: BP2 Cost Summary**

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
<b>Baseline Cost Plan</b>								
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
<b>Actual Incurred Cost</b>								
Federal Share	\$ 788,040	\$ 788,040	\$ 802,088	\$ 1,590,128	\$ 862,023	\$ 2,452,151	\$ 920,499	\$ 3,372,650
Non-Federal Share	\$ 267,114	\$ 267,114	\$ 258,648	\$ 525,762	\$ 308,579	\$ 834,341	\$ 246,863	\$ 1,081,204
Total Incurred Cost	\$ 1,055,154	\$ 1,055,154	\$ 1,060,736	\$ 2,115,890	\$ 1,170,602	\$ 3,286,492	\$ 1,167,362	\$ 4,453,854
<b>Variance</b>								
Federal Share	\$ (1,017,318)	\$ (1,017,318)	\$ (525,843)	\$ (1,543,161)	\$ 369,091	\$ (1,174,070)	\$ 427,567	\$ (746,503)
Non-Federal Share	\$ (204,657)	\$ (204,657)	\$ (213,123)	\$ (417,780)	\$ (163,192)	\$ (580,972)	\$ (224,908)	\$ (805,880)
Total Variance	\$ (1,221,975)	\$ (1,221,975)	\$ (738,966)	\$ (1,960,941)	\$ 205,899	\$ (1,755,042)	\$ 202,659	\$ (1,552,383)
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
<b>Baseline Cost Plan</b>								
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
<b>Actual Incurred Cost</b>								
Federal Share	\$ 1,726,789	\$ 5,099,439	\$ 1,806,352	\$ 6,905,791	\$ 5,995,336	\$ 12,901,127	\$ 2,788,502	\$ 15,689,629
Non-Federal Share	\$ 525,849	\$ 1,607,053	\$ 576,503	\$ 2,183,556	\$ 1,456,361	\$ 3,639,917	\$ 1,070,171	\$ 4,710,088
Total Incurred Cost	\$ 2,252,638	\$ 6,706,492	\$ 2,382,855	\$ 9,089,347	\$ 7,451,697	\$ 16,541,044	\$ 3,858,672	\$ 20,399,717
<b>Variance</b>								
Federal Share	\$ 629,867	\$ (116,636)	\$ (8,403,569)	\$ (8,520,205)	\$ 4,993,414	\$ (3,526,791)	\$ 1,786,580	\$ (1,740,211)
Non-Federal Share	\$ (322,721)	\$ (1,128,600)	\$ (272,066)	\$ (1,400,666)	\$ 607,792	\$ (792,874)	\$ 221,602	\$ (571,273)
Total Variance	\$ 307,147	\$ (1,245,236)	\$ (8,675,635)	\$ (9,920,871)	\$ 5,601,206	\$ (4,319,665)	\$ 2,008,181	\$ (2,311,484)
Baseline Reporting Quarter	Budget Period 2							
	Y3Q1							
	10/01/17-12/31/17							
	Y3Q1	Cumulative Total						
<b>Baseline Cost Plan</b>								
Federal Share	\$ 4,079,930	\$ 21,509,770						
Non-Federal Share	\$ 14,975,092	\$ 20,256,452						
Total Planned	\$ 19,055,022	\$ 41,766,222						
<b>Actual Incurred Cost</b>								
Federal Share	\$ 5,883,313	\$ 21,572,942						
Non-Federal Share	\$ 16,077,089	\$ 20,787,176						
Total Incurred Cost	\$ 21,960,402	\$ 42,360,118						
<b>Variance</b>								
Federal Share	\$ 1,803,383	\$ 63,172						
Non-Federal Share	\$ 1,101,997	\$ 530,724						
Total Variance	\$ 2,905,380	\$ 593,896						

## 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
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

*Table 7: Acronyms*

## National Energy Technology Laboratory

626 Cochran's Mill Road  
P.O. Box 10940  
Pittsburgh, PA 15236-0940

3610 Collins Ferry Road  
P.O. Box 880  
Morgantown, WV 26507-0880

13131 Dairy Ashford Road, Suite 225  
Sugar Land, TX 77478

1450 Queen Avenue SW  
Albany, OR 97321-2198

Arctic Energy Office  
420 L Street, Suite 305  
Anchorage, AK 99501

Visit the NETL website at:  
[www.netl.doe.gov](http://www.netl.doe.gov)

Customer Service Line:  
1-800-553-7681



U.S. DEPARTMENT OF  
**ENERGY**

**NATIONAL ENERGY  
TECHNOLOGY LABORATORY**