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Deepwater Methane Hydrate Characterization and Scientific Assessment

Project Period 10/01/2014 to 09/30/2021

Submitted by:
Peter B. Flemings

Signature

The University of Texas at Austin
DUNS #:170230239
101 East 27th Street, Suite 4.300
Austin, TX 78712
Email: pflemings@jsg.utexas.edu
Phone number: (512) 475-8738

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ABSTRACT

The University of Texas at Austin (UT) leads a multi-disciplinary study of methane hydrates in the Gulf of Mexico supported by the U.S. Department of Energy (DOE) (Award No. DE-FE0023919). The objective of this project is to locate, drill, and sample methane hydrate deposits through multiple expeditions, and build the infrastructure to store, manipulate, and analyze pressurized hydrates samples. Phase 2 of this project occurred from October 1, 2015 to January 15, 2018. During this period, UT completed program management tasks required to meet project needs such as coordinating the operational and scientific processes, communicating with project team and sponsors, managing subcontractors, and managing risks. A complimentary project proposal (CPP) was submitted to the International Ocean Drilling Program (IODP) for acquiring access to the *JOIDES Resolution* (*JR*) research vessel. The CPP was approved in May 2017, and IODP Expedition 386 was subsequently scheduled for January-March 2020. Concurrently during Phase 2, UT continued the development of a DOE pressure coring system initiated in Phase 1, including completion of National Environmental Policy Act (NEPA) requirements, execution of a land-based test of the pressure coring system, submission of a land-based test report, and completion of additional modifications to the pressure coring system deemed necessary prior to further testing in a marine environment. In Phase 2, UT planned a marine-based test of the pressure coring system in the Gulf of Mexico. Preparation for the marine-based test involved completion of NEPA requirements, completion of drilling, logging, coring, and pressure core sampling operations plans, regulatory compliance and permitting. The marine-based test of the pressure core system was successfully executed in the Gulf of Mexico, Green Canyon Block 955 in May 2017, during which two holes were drilled and methane hydrate-bearing pressure core samples were acquired. A summary of the marine-based test of the pressure core system was completed and submitted to DOE. Methane hydrate-bearing pressure cores acquired during the marine-based test were returned to shore for preliminary analysis. Pressure cores were then transported to a NEPA-compliant refrigerated pressure core center (PCC) at UT, constructed for the purpose of storing, manipulating, and analyzing pressure core. The UT PCC was completed prior to the arrival of the pressure cores, and outfitted with a pressure core manipulator and cutter tool, effective stress chamber, and depressurization chamber. After pressure cores were secured within the UT PCC, UT initiated routine conventional core analysis and pressure core analysis. UT is currently comparing measurements at the core scale to the logging results from previous drilling at GC 955 and building models to relate core velocity measurements to actual velocity measurements. Following the completion of the marine-based field test and the scheduling of IODP Expedition 386 in May 2017, UT initiated and completed a pre-expedition operational plan for IODP Expedition 386. Numerous products were developed by UT and project Sub-Awards from the work conducted in Phase 2 of this project, including publications, conference papers, presentations, websites, and videos.

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1 EXECUTIVE SUMMARY

The *Deepwater Methane Hydrate Characterization and Scientific Assessment* or *Genesis of Methane Hydrates in the Gulf of Mexico* (GOM^2) research project is led by the University of Texas at Austin (UT) and funded by the US Department of Energy (DOE) (DOE Award No. DE-FE0023919). The objective of this project is to gain insight into the nature, formation, occurrence and physical properties of methane hydrate-bearing sediments for the purpose of methane hydrate resource appraisal through the planning and execution of drilling, coring, logging, testing and analytical activities that assess the geologic occurrence, regional context, and characteristics of marine methane hydrate deposits in the Gulf of Mexico Continental Shelf.

GOM^2 Phase 2 took place from Oct. 1, 2015 to Jan. 15, 2018. UT and the GOM^2 project team (including Lamont-Doherty Earth Observatory, Ohio State University, Oregon State University, University of New Hampshire, and University of Washington, and the U.S. Geological Survey) successfully achieved numerous operational and scientific objectives during this period, in particular as related to support of a Complementary Project Proposal (CPP) and research expedition vessel access, modification and testing of the DOE pressure coring system, a deep-water marine test of said system during which hydrate pressure cores were acquired, subsequent pressure core analysis, completion of the UT pressure core center, and operational planning of an extensive marine-hydrate coring expedition.

In Phase 2 of this project, UT and the GOM^2 project team completed the CPP that was submitted to the International Ocean Discovery Program (IODP) in GOM^2 Phase 1, as a means of accessing the *JOIDES Resolution* (*JR*) research vessel. The GOM^2 project team also provided technical presentations to the IODP Science Evaluation Panel (SEP) and Environmental Protection and Safety Panel (EPSP) during this period. The CPP was subsequently approved in May 2017, and *IODP Expedition 386 (UT-GOM^{2-}2)* was scheduled by the *JR* Facility Board (JRFB) for Jan.-Mar., 2020.

Concurrently during GOM^2 Phase 2, the UT Pressure Core Center (PCC) was completed in the Jackson School of Geosciences building at UT. The UT PCC has the ability to store, manipulate, subsample, and characterize hydrate pressure cores. Major components of the UT PCC include a refrigerated pressure core storage unit, a miniature pressure core analysis and transfer system (mPCATS), a stress chamber, and a depressurization chamber.

Modifications and testing of the DOE pressure coring system, initiated during GOM^2 Phase 1, continued during GOM^2 Phase 2. UT and the GOM^2 project team planned and executed a land-based field test of the Pressure Coring Tool with Ball (PCTB) at the Schlumberger *Cameron Test and Training Facility* in Cameron, TX in December 2015.

Following the PCTB Land Test, a deep-water marine-based field test (*UT-GOM^2-1*) of the pressure coring system was planned and executed in Green Canyon Block 955, Gulf of Mexico outer continental shelf. The PCTB was used to successfully acquire methane hydrate-bearing pressure cores during *UT-GOM^2-1*, which were subsequently transported to the UT PCC where they were then stored, subsampled, and characterization initiated.

A pre-expedition Operational Plan for drilling, logging, and sampling in the Gulf of Mexico Continental Shelf aboard the *JR* during UT-GOM^2-2 was refined and updated at the end of GOM^2 Phase 2.

2 INTRODUCTION

The objective of GOM[2] is to gain insight into the nature, formation, occurrence and physical properties of methane hydrate-bearing sediments for the purpose of methane hydrate resource appraisal through the planning and execution of drilling, coring, logging, testing and analytical activities that assess the geologic occurrence, regional context, and characteristics of marine methane hydrate deposits in the Gulf of Mexico Continental Shelf.

GOM[2] Phase 1 took place from Oct. 1, 2014 to Sep. 30, 2015. In Phase 1, the University of Texas at Austin (UT) accomplished the major tasks of 1) expedition site analysis and selection, 2) developing a draft pre-expedition operational plan, 3) submitting a complimentary project proposal (CPP) to the International Ocean Discovery Program (IODP), for use of the *JOIDES Resolution* (*JR*) research vessel, and 4) conducting bench-testing of the DOE pressure coring system (Pressure Coring Tool with Ball [PCTB]), and planning a land-based test of this system.

GOM[2] Phase 2 took place from Oct. 1, 2015 to Jan. 15, 2018. This document provides a summary of the objectives that were undertaken and accomplishments made during this project phase. Key deliverables are provided as appendices. Task-specific reports associated with key milestones are provided as appendices.

GOM[2] Phase 2 milestones are presented in Table 2-1.

Table 2-1: Phase 2 Milestones

Task	Milestone	Milestone Description	Planned Completion*	Actual Completion	Verification Method
6.0	M2A	Complete Updated CPP Proposal Submitted	Nov. 2015	Nov. 2015	Quarterly Report
6.0	M2B	Scheduling of Hydrate Drilling Leg by IODP	May 2016	May 2017	Report status immediately to DOE PM
7.0	M2C	Demonstration of a viable PCS tool for hydrate drilling through completion of land-based testing	Dec. 2015	Dec. 2015	PCTB Land Test Report, in Quarterly Report
8.0	M2D	Demonstration of a viable PCS tool for hydrate drilling through completion of a deep-water marine field test	Jan. 2017	May 2017	Quarterly Report
11.0	M2E	Update Field Program Operational Plan	Sep. 2017	Apr. 2018	Phase 2 Report
--	M2F	Document results of BP2/Phase 2 Activities	Dec. 2017	Apr. 2018	Phase 2 Report

* As projected at onset of Phase 2.

3 SUMMARY OF PHASE 2 TASKS

GOM^2 Phase 2 tasks are summarized in Table 3-1.

Table 3-1: Summary of Phase 2 tasks

TASK No.	***DESCRIPTION***
Tasks continued from Phase 1	
Task 1.0	**Project Management and Planning (cont'd)**
Tasks initiated during Phase 2	
Task 6.0	**Technical and Operational Support of CPP Proposal**
Task 7.0	**Continued Pressure Coring and Core Analysis System Modifications and Testing**
Subtask 7.1	*Review and Complete NEPA Requirements (PCTB Land Test)*
Subtask 7.2	*PCTB Land Test*
Subtask 7.3	*PCTB Land Test Report*
Subtask 7.4	*PCTB Tool Modification*
Task 8.0	**Pressure Coring Tool with Ball Marine Field Test**
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*
Subtask 8.5	*Marine Field Test Report*
Task 9.0	**Pressure Core Transport, Storage, and Manipulation**
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**
Subtask 10.1	*Routine Core Analysis*
Subtask 10.2	*Pressure Core Analysis*
Subtask 10.3	*Hydrate Core-Log-Seismic Synthesis*
Task 11.0	**Update Pre-Expedition Drilling / Logging / Coring / Sampling Operational Plan**
Task 12.0	**Field Program / Research Expedition Vessel Access**

3.1 Task 1.0: Project Management and Planning

Objectives:

The Recipient will execute the project in accordance with the approved PMP covering the entire project period. The Recipient will manage and control project activities in accordance with their established processes and procedures to ensure tasks and subtasks are completed within schedule and budget constraints defined by the PMP. This includes tracking and reporting progress and project risks to DOE and other stakeholders.

Accomplishments:

During GOM^2 Phase 2, UT accomplished the following:

1. Assembled team to meet project needs:
    a. Hired Consultant / Project Manager for marine field test, Jamie Morrison – Dec. 2015
    b. Hired Research Scientist Associate, Joshua O'Connell – Jan. 2016
    c. Hired Contract Mapping Technician for marine field test, Eric Scott – Nov. 2016
    d. Hired Postdoctoral Researcher, Manasij Santra – Nov. 2016
    e. Hired Project Manager, Jesse Houghton – Mar. 2017
    f. Hired Research Scientist Associate, Ethan Petrou – Apr. 2017
    g. Hired Postdoctoral Fellow, Yi Fang – Nov. 2017
2. Coordinated the overall scientific progress, administration and finances of the project
    a. Monitored costs and reported status and changes to DOE Project Manager.
    b. Managed the upload of CPP supporting data, revisions, and addenda.
    c. Coordinated logistics of PCTB Land Test at testing facility in Cameron, TX
    d. Negotiated a cost increase to cover the expense of the UT-GOM^2-1 marine field test
    e. Coordinated field logistics and regulatory permitting of UT-GOM^2-1 marine field test
    f. Negotiated a no-cost extension of Budget Period (BP) 2 through January 15, 2018, allowing UT to:
        i. Perform final review of costs from UT-GOM^2-1
        ii. Complete a review of the PCTB performance during UT-GOM^2-1
        iii. Assemble a PCTB development team and prepare a plan for further upgrades / testing
        iv. Assess experiences from UT-GOM^2-1 and incorporate into the Operational Plan
        v. Allow time for more complete evaluation of cost schedules for BP3 and BP4
    g. Engaged stakeholders and subcontractors to develop refined costs and detailed scopes of work
    h. Developed a revised scope of work and 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 CPP887
    i. Submitted draft budget period transition application to DOE on Nov. 21, 2017
    j. Submitted final budget period transition application to DOE on Dec. 08, 2017
3. Communicated with project team and sponsors
    a. Organized regular team meetings
        i. Monthly Sponsor Meetings
        ii. Mapping Team Meetings

        iii. PCTB Land Test Meetings
        iv. PCTB Development Team Meetings
        v. UT-GOM^2-1 Pre-Mobilization and Operational Planning Meetings
        vi. UT-GOM^2-2 Operational Planning and Permitting Meetings
    b. Managed SharePoint sites developed for project teams to facilitate collaboration
    c. Managed archive websites for project deliverables
    d. Hosted face-to-face meeting with Geotek at UT Austin on Apr. 19, 2016
    e. Organized UT-GOM^2-1 marine field test kickoff meetings in Houston, TX on Sep. 7-9, 2017
    f. Hosted face-to-face meetings with DOE, USGS, and Geotek at shore-based operations site Houma, LA immediately following UT-GOM^2-1 on Jul. 31, 2017
    g. Coordinated UT-GOM^2-2 Planning Team for development/refinement of Operational Plan
    h. Coordinated face-to-face meeting and webex conference between UT, DOE, and Texas A&M University (TAMU), the operator of the *JR*, in College Station, TX on Oct. 11, 2017 to discuss operational plan and permitting strategy for UT-GOM^2-2
4. Coordinated and supervised all subcontractors and service agreements to realize deliverables and milestones according to the work plan
    a. Actively managed subcontractors and service agreements
    b. Negotiated scope of work (SOW) and budget for University of New Hampshire, Oregon State University, and University of Washington subcontracts
    c. Held Hazard Identification Study (HAZID) and Drill Well on Paper (DWOP) Workshop at Helix Offices to prepare for marine-based field test (Mar. 6-7 2017).
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.
    a. Actively monitored project risks and reported as needed to project team and stakeholders.

3.2 Task 6.0: Technical and Operational Support of CPP Proposal

Objectives:

The Recipient will upload data associated with the CPP proposal to a designated site-survey databank. Presentations will be prepared, as required, for safety reviews. The Recipient will evaluate and respond to all reviews conducted of the CPP proposal in conjunction with the Project Advisory Team within the timeframes identified by IODP. The Recipient will continually refine the planned science within the CPP proposal, and the project in general, as the project develops.

Accomplishments:

A timeline of major Phase 2 accomplishments associated with the CPP are summarized in Table 3-2.

Table 3-2: Technical and Operational Support of CPP: Completed Tasks

Date	Action
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
Jun 2016	Safety Review Report Submitted
Jul 2016	Safety Presentation PowerPoint
Jul 11-13, 2016	EPSP Meeting
Mar 2, 2017	Submit CPP Addendum 2
Mar 10, 2017	Upload Revised Site Survey Data
Apr 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

A summary of the timeline of efforts and accomplishments related to the CPP follows:

Oct. 1-Dec. 31, 2015 (Phase 2, Q1):

At the onset on Phase 2, UT accomplished the following tasks relating to the CPP:

1. Updated and submitted required data for the IODP Site Survey Data Bank (SSDB),
2. Organized and orchestrated the delivery of the proprietary 3D seismic data to the co-chair of IODP SEP so that the data and project could be evaluated by IODP,
3. Purchased additional data at the Orca Basin site and began working on additional mapping and prospecting in the Orca Basin area, and

4. Reviewed/updated the Operational Plan for the drilling campaign, including drill site sequence, core and logging data acquisition, and rig time estimates in preparation for the IODP-CPP technical review.

Jan. 1-Mar. 31, 2016 (Phase 2, Q2):

During period ending Mar. 31, 2016 (Phase 2, Q2), UT conducted extensive data analysis in support of the CPP:

1. Data Analysis
    a. Mapped new horizons in the extend Orca dataset, and selected six new drilling sites in the Orca Basin,
    b. Reprocessed USGS 2D seismic lines near Green Canyon and Walker Ridge sites,
    c. Selected two new drilling sites at Mad Dog, mapped two existing drilling targets in Exploration Dataset to compare previous maps generated from WAZ Dataset, identified and mapped possible third drilling target at Mad Dog in Exploration Dataset, and began tying well log data from three nearby wells to seismic traces,
    d. At Terrebonne, selected four new alternate drill sites, created a depositional model of the Terrebonne basin to explain the occurrence of reservoir quality channelized sands, created a synthetic seismic trace of WR313-G and WR313-H and correlated the traces to the actual seismic data, created a 1D synthetic seismic model of the orange unit across the base of hydrate stability, and mapped the top of the blue unit.
    e. At Sigsbee, completed a remapping of the target horizon and selected three sites for the marine field test.
2. Shipped laptop with 3D seismic data SEP Review Meeting at Scripps, held on Jan. 2016
3. Received the review of 887-CPP2, which were generally positive and the CPP was advanced to 'External Review'. Requirements of this review were to submit an Addendum (due April 1, 2016) and a Proponent Response Letter (due prior to June 2016).

Apr. 1-Jun. 30, 2016 (Phase 2, Q3):

In project period ending Jun. 30, 2016 (Phase 2, Q3), UT submitted the CPP Addendum and uploaded data as required by the SEP Review Meeting. Key decisions from addendum were that Orca Basin and Terrebonne Basin would be maintained as primary sites, and that Mad Dog would be maintained as an alternate site.

During this period, UT received external reviews, independent of the IODP system. Three of the four were laudatory, and one had some modest criticism.

A Proponent Response Letter was submitted in May 2016, as a formal response to the reviews of the CPP.

The CPP was ranked as “excellent” by the SEP in June 2016, and forwarded to the EPSP for a safety review of the proposed sites in preparation for final scheduling.

Jul. 1-Sep. 30, 2016 (Phase 2, Q4):

In period ending Sep. 30, 2016, IODP 887-CPP2 was reviewed at the IODP Environmental Protection and Safety Panel (EPSP) held at TAMU in College Station, TX, on July 11-13, 2016.

Contents of the EPSP Presentation included the following:

1. Scientific goals of the proposed drilling expedition
2. Drilling and sampling strategy
3. Review of proposed sites in the Terrebonne Basin
4. Review of proposed sites Orca Basin
5. Review of proposed sites in the Mad Dog Basin
6. Summary of Meeting Events

CPP-887 was reviewed on July 13, 2016. Attendees were required to sign a non-disclosure agreement in order to view seismic profiles included in the presentation. The panel reviewed all of the PowerPoint slides and made recommendations for each site. The panel provided guidance on (1) whether any of the proposed sites would have the potential to move forward in the drilling program or (2) whether there were clear issues that would require that a site's position be optimized or relocated. However, because the seismic data could not be interactively reviewed in a live format it was decided to consider the meeting a "pre-review" and therefore no final recommendation would be made. UT received no request or indication ahead of the meeting to bring live format data. It was determined that a full day review of this proposal would be scheduled for the next EPSP meeting in May 2017, and much of that time would be spent in an interactive format with live seismic data.

EPSP Meeting minutes were received in July 2016. Primary results included the following items:

1. A full day review for this proposal was scheduled at the next EPSP meeting in May 2017, requiring a live data review of the seismic data in order to facilitate discussion on repositioning any sites, if necessary.
2. It was suggested to investigate the feasibility of reprocessing seismic data to increase resolution.
3. The panel was concerned with sites at Orca and Mad Dog that intersect faults and therefore it is recommended to the team to reposition these sites away from faults or to justify the need to intersect faults.

UT received a letter from the JRFB Chair and held subsequent discussions that resulted in the requirements that 1) UT was to meet a revised schedule that culminated in an early May 2017 EPSP review, and 2) Re-processing of seismic data was suggested.

Oct. 1-Dec. 31, 2016 (Phase 2, Q5):

During period ending Dec. 31, 2016, UT focused on strengthening its ability to perform geological and geophysical analysis in order to meet the planning needs for both the marine field test and for the CPP. To accomplish this UT took the following measures:

1. Hiring of a Postdoctoral scientist with industry experience to work on the G&G,
2. Hiring of a stratigraphic and shallow hazards specialist to assist with the geological analysis,

3. UT visited with Western Geco and purchased seismic data over Green Canyon (GC) Bock 955 (the region where UT planned perform the marine field test), which greatly improved the quality of seismic data,
4. UT visited with BP and Shell to discuss the Mad Dog and the Orca regions, respectively. Insights from these visits were integrated into the mapping analysis.

UT and project Sub-Awards took the following steps towards strengthening geological and geophysical analysis:

1. Orca Location: Ohio State University (OSU) assembled and presented analysis of all of the industry wells in the Orca Basin dataset, and worked with Bureau of Ocean Energy Management (BOEM) to help select better sites for the Orca Basin. OSU worked with UT to help identify channel systems in the Orca Basin area and held weekly meetings to mature prospects at Orca, Terrebonne and Mad Dog.
2. Terrebonne: UT and OSU worked to finalize drill sites. Detailed work was expended in moving well locations to account for shallow hazards. Lamont-Doherty Earth Observatory (LDEO) processed USGS 2D seismic lines near Terrebonne sites and prepared for initial seismic inversion.
3. Mad Dog: UT worked to analyze possible hydrate targets across the Mad Dog region, and re-located its drill sites in order to avoid shallow hazards.

Jan. 1-Mar. 31, 2017 (Phase 2, Q6):

In period ending Mar. 31, 2017, UT held an EPSP Safety Review workshop, which was attended by members of UT, Columbia University, Ohio State, BOEM, USGS, DOE, and a representative from the IODP EPSP. The purpose of this workshop was to review the geology and geophysics of well locations proposed for the upcoming marine field test (Sigsbee, GC 955) and the envisioned IODP Expedition (Terrebonne-Walker Ridge [WR] 313, Orca, and Mad Dog).

1. UT compiled for each location (Mad Dog, Terrebonne, and Orca):
    a. a regional geological overview
    b. An analysis of all previously drilled wells.
    c. A well prognosis and a hazard prediction for all proposed drill sites

During this period, UT submitted CPP-887 Addendum 2 to the IODP, summarizing proposed drill locations and scientific motivation for drilling each location. UT uploaded data to the IODP site survey database for each of the proposed wells.

Apr. 1-Jun. 30, 2017 (Phase 2, Q7):

UT and the Advisory Team presented at an IODP EPSP on May 3, 2017. The meeting was attended by members of UT, Columbia University, Ohio State, BOEM, and USGS. The response was overwhelmingly positive. Following the EPSP Meeting on May 3, 2017, the JRFB recommended CPP-887 for scheduling. IODP Expedition 386 was subsequently scheduled for January 21 through March 22, 2020.

3.3 Task 7.0: Continued Pressure Coring and Core Analysis System Modification and Testing

The Recipient will continue to plan and undertake the modification or upgrade and testing of pressure coring and core analysis tools, as deemed necessary by mutual agreement of the Recipient, DOE and the Project Advisory Team, to assure the readiness of the system for use in the planned Marine Field Test (Task 8). This will include modifications considered necessary both prior to and after land testing identified in Subtask 7.2.

3.3.1 Subtask 7.1: Review and Complete NEPA Requirements

Objectives:

The Recipient will complete all necessary NEPA documentation for the specific site / location to be included as part of the land test of the PCTB pressure coring system and / or any other necessary project tools. Those land test activities (subtask 7.2) shall not be conducted until an appropriate final NEPA determination is issued by the DOE / NETL NEPA compliance office.

***Accomplishments**:*

UT submitted and received approval for PCTB Land Test NEPA Requirements in period ending 12/31/2015 (Phase 2, Quarter 1).

3.3.2 Subtask 7.2: Pressure Coring Tool with Ball Land Test

Objectives:

The Recipient will perform a test of the DOE PCTB. This test will be conducted on land at a test facility borehole to be determined to be mutually acceptable to DOE and the Recipient. The coring interval will be chosen to be within an interval of the borehole determined to suitably reflect conditions similar to reservoir sands that are saturated with hydrate.

Accomplishments:

UT successfully coordinated and executed a land-based field test of the PCTB (PCTB Land Test) from Dec. 8-18, 2015 at Schlumberger's Cameron Testing Facility (CTTF) near Cameron, TX. Representatives from Geotek Coring, Pettigrew Engineering, US DOE, USGS, and UT participated in the testing.

The PCTB Land Test involved three Flow Tests, four Closure Tests, and eight Coring Tests.

The first two Flow Tests (one in the 10⅝" face-bit configuration, one in the 9⅞" cutting-shoe configuration) indicated that the pressure at the rig floor would reach the expected 330 pounds-per-square-inch (psi) liner-collapse pressure at a flow rate of ~200 gallons-per-minute (gpm). The liner did not collapse at these flow rates and pressures. A third Flow Test, a liner-collapse test, demonstrated that the liner would collapse at a rig floor pressure of 775 psi with a flow rate of 400 gpm.

Closure Tests in the 9⅞" cutting-shoe configuration were partially successful, but two runs had problems with a late or slow charge in the N2 boost. The slow charge was discovered to be due to human error in setting up the tool.

In four Coring Tests in the 9⅞” cutting-shoe configuration, the ball valve did not close due to material (cuttings or core) that was trapped in the ball valve. One Coring Test in the 9⅞” cutting-shoe configuration recovered core under pressure, but the N2-boost occurred near the rig floor after pressures inside the liner had dropped to nearly atmospheric conditions. Three final Coring Tests with the 10⅝” face-bit configuration were more successful with the final two tests recovering core under pressure. For both tools, coring penetration rates were very low and in the more mudstone rich penetrations, the jets on the cutting-shoe became clogged with rock paste.

The tests demonstrated the successful operation of the PCTB despite slow coring in the rock formations present at the Cameron Facility. Late firing of the N2 boost after the core barrel was raised from the bottom occurred in one of four Closure Tests and one of eight Coring Tests. The face-bit configuration was more successful than the cutting-shoe configuration in coring the mudstone and limestone formations at the Cameron location. This configuration appeared to have less problems with balling at the bit and was more successful at recovering core.

The PCTB Land Test is described in detail in the *GOM^2 Pressure Coring Tool with Ball Valve (PCTB) Land Test Initial Report* (**Appendix A**), and the *Hybrid Pressure Coring Tool with Ball Valve (PCTB) 2015 Land Test Program* report (**Appendix B**).

3.3.3 Subtask 7.3: PCTB Land Test Report

Objectives:

The Recipient will document the process and results of the PCTB Land Test and report that information to DOE via a dedicated Land Test Pressure Coring Field Test Report.

Accomplishments:

UT completed and submitted the PCTB Land Test Initial Report in January 2016 (**Appendix A**). UT’s subcontractor for the PCTB Land Test, Geotek Coring, completed and submitted a PCTB Land Test Program report in February 2016 (**Appendix B**).

3.3.4 Subtask 7.4: PCTB Tool Modifications

Objectives:

If necessary, as a result of tool performance on prior tests and/or the PCTB Land Test, Recipient will perform modification or upgrades of pressure coring and core analysis tools.

Accomplishments:

Subsequent to the PCTB Land Test, UT, Pettigrew Engineering, USGS, DOE, and Geotek assessed the need for performance-improving modifications to the PCTB, as well as any additional testing prior to deployment on the UT-GOM^2-1 marine field test.

The following list outlines the team study outcomes and path forward in preparation for the marine field test:

1. Flow rate v. pressure drop
    a. During the land test, the increased bit Total Flow Area (TFA) showed no marked difference in the flow rates v. pressure drop. This suggested overriding pressure drop occurs higher up in the Outer Core Barrel assembly (OCB) before the circulating fluid gets to the bit.
    b. To further study this issue it was determined that flow tests would be performed during the marine field test to measure the pressure drops at several strategic points within the OCB and PCTB.
    c. The recommendation was to move forward with the following:
        i. Explore interchangeable nozzles for bit to optimize jetting and cleansing action.
        ii. Perform an additional vertical flow test using fish pills to characterize pressure drop through OCB and PCTB.
2. PCTB internal closure stroke space out issue resulting in observed late boost
    a. Test results from the PCTB Land Test were reviewed to determine what was and was not related to the late boost. Drill Stem Test (DST) data were reviewed and clarified which tests had late boost issues or slow boost/human error. It was determined that one of the four closure tests had a late boost, and one of the eight coring tests had a late boost. In five of the eight coring tests, the timing of the boost was uncertain due to the failed closure of the ball valve or failure of the DST.
    b. PCTB internal space out was reviewed and it was determined there is was closure stroke timing issue that could have resulted in a late boost occurring as well as release of the PCTB from the OCB prior to the ball valve closing completely.
    c. PCTB design was modified to eliminate the closure stroke timing issue.
    d. The recommendation was to move forward with the following:
        i. Fabricate new parts to modify the PCTB with the purpose of eliminating the internal closure stroke timing issue.
        ii. Set up bench test at Geotek Coring in Salt Lake City, Utah to determine force required to drive autoclave seal sub into the seal sleeve (autoclave upper seal mechanism) using multiple seal sub seal and seal sleeve configurations.
        iii. Set up vertical full function pressure test at Geotek Coring in Salt Lake City, Utah to verify proper mechanical function of modified parts.
        iv. Set up horizontal latch in test Geotek Coring in Salt Lake City, Utah using complete OCB and PCTB assemblies to verify proper mechanical function during latch in and release.
3. Main bit diameter to core diameter ratio
    a. It was determined that core quality/quantity is improved the smaller the main bit diameter is to core diameter ratio. The original PCTB system was designed for a 10-5/8 bit. The smallest bit that can be used with the existing PCTB is 9-7/8. By going to a 9-7/8 bit, the annular velocity passed the drill collars is increased by ~60%, which would improve hole cleaning.
4. Cutting shoe extension
    a. Based on the face bit configuration results from the land test, it was thought that spacing out the cutting shoe to near flush might produce the best core recovery. Extending the cutting shoe

further ahead of the main bit was still an option, however the plan for the marine field test was to deploy the PCTB with the cutting shoe spaced out near flush to the main bit.

5. Number and placement of stabilizers
    a. Discussions regarding the number and placement of stabilizers in the Bottom Hole Assembly (BHA) resulted in a plan to deploy two stabilizers, in conjunction with the stabilized bit sub, during the marine field test. One stabilizer would be placed immediately on top of the OCB and the other stabilizer would be placed onto of the drill collar string.
6. Core catcher configuration and combinations
    a. No modifications were recommended.
7. Main bit configuration, tapered, piloted, etc.
    a. After extensive discussions, the decision was made to continue with the conventional bit shape while continuing to explore changing the location of the jets and adding interchangeable nozzles to improve bit and hole cleaning.
8. Composition of drilling fluids
    a. It was decided that properly sized filtrates should be used for soft core.
    b. Working closely with the vessel mud engineer to design a proper mud program for the marine field test was determined to be a critical task.
    c. Explore using "sized filtrates."
9. Bumper subs
    a. After discussing the use of bumper subs, the decision was made to drop them from consideration for the following reasons.
        i. Bumper subs are expensive to purchase and maintain.
        ii. Bumper subs make for a weak point in the BHA.
        iii. Bumper subs cannot be used in conjunction with a heave compensator.
        iv. Off-the-shelf bumper subs with a 4-1/4 bore do not exist.
10. Other modifications/upgrades
    a. To reduce contamination, the use of bottom up circulation before running the wireline was discussed. Time permitting, this technique would be employed during the marine field test.
    b. If core liner collapse were an issue, the option would be to strengthen the lower part of the core liner (below the inner tube) with aluminum or steel and coordinate engineering with Pressure Core Analysis and Transfer System (PCATS). However, the current belief was the high-pressure drop that previously collapsed the core liner was generated near the top of the PCTB and migrated down inside the tool to the liner. To prevent this from occurring the following design modification was undertaken:
        i. Incorporate improved sealing to prevent a high-pressure drop from being applied to the core liner and to prevent the introduction of detritus inside the tool, which may prevent the ball valve from closing.
        ii. The PCTB design was modified to add seals to some of the internal components as well as eliminating the long open slot in the middle barrel.
    c. The question of modifying the flapper valve came about due to the chance the ball valve housing may hang up on the flapper valve while retrieving the tool. After discussion, it was

decided the best path is to add a lead in chamfer to the ball valve housing, in lieu of modifying the flapper.

The PCTB Development Team made a determination to proceed with modifications to the PCTB focused on rectifying four issues encountered during the Land Test: 1) preventing hang up of the upper seal of the autoclave possibly resulting in a late N2 boost, 2) reducing the potential for debris-laden fluid to flow into the PCTB, 3) reducing the potential for core liner collapse at high flow rates, and 4) improving latch performance.

The decision was also made to perform additional testing to validate modifications made to the PCTB prior to deployment the UT-GOM^2-1 marine field test. These tests are described in further detail in the *Pettigrew Engineering PCTB Testing Report* (**Appendix C**), and *Hybrid Pressure Coring Tool with Ball Valve Mark III (PCTB III) 2016 Pre-Sea Trial Tests* (**Appendix D**).

Modifications to the PCTB and pre-marine field tests were completed in period ending Sep. 30, 2016 (Phase 2, Q4).

3.4 Task 8.0: Pressure Coring Tool with Ball Marine Field Test

The Recipient will perform a marine field test of the DOE PCTB. The Recipient will report to DOE specifically regarding any issues that would prevent the incorporation and use of this DOE equipment system, and, if necessary, identify alternate system(s) deemed to be of equal or greater utility for the planned project activities.

3.4.1 Subtask 8.1: Review and Complete NEPA Requirements

Objectives:

The Recipient will complete all necessary NEPA documentation for the specific sites / locations to be included as part of the Marine Field Test of the DOE PCTB system or any other necessary project tools, as well as for the specific vessel / drillship from which the Marine Field Test activity will be conducted. No Marine Field Test activities shall be conducted until an appropriate final NEPA determination is issued by the DOE / NETL NEPA compliance office.

Accomplishments:

UT initiated the process of collecting information for NEPA paperwork in period ending Jun. 30, 2016 (Phase 2, Q3) and completed preparation of NEPA DOE Environmental Questionnaire (EQ) in quarter ending Dec. 31, 2016 (Phase 2, Q5). During this period, the preliminary preview by BOEM was also completed. The NEPA EQ was approved in period ending Mar. 31, 2017 (Phase 2, Q6).

3.4.2 Subtask 8.2: Marine Field Test Detailed Operational Plan

Objectives:

The Recipient, in coordination with the project Advisory Team, will develop a specific drilling/coring/and sampling plan based on the selection of a specific vessel from which the test is to be conducted. The test, at a minimum, will evaluate the ability of the system to effectively and consistently capture, collect and recover (under hydrate-stable conditions) pressure core to the ship deck. The test will also demonstrate the ability to perform preliminary characterization of the cores and transfer those samples to pressurized storage devices on the drilling platform in a manner that will enable the cores to be stored and analyzed, in a manner mutually agreed upon by the Recipient and DOE, following the conclusion of shipboard activities.

Accomplishments:

UT prepared a draft Preliminary Operational Plan for the UT-GOM^2-1 marine field test in periods ending Mar. 31, 2016 (Phase 2, Q2) and June 30, 2016 (Phase 2, Q3). The UT-GOM^2-1 Operational Plan was continually updated and refined as warranted. During this period, UT completed review of past mud programs used with the PCTB tool and during logging-while-drilling (LWD) at Green Canyon.

UT organized a marine field test-planning workshop on Sep. 7, 2016 with Helix (the operator of the Q4000 interventional vessel retained for the UT-GOM^2-1 marine field test) and other subcontractors. The purpose of this workshop was to discuss and clarify project objectives, geologic prognosis, global hydrate projects and 2009 Hydrate Joint Industry Program (JIP) offset review, drilling & coring plans, mud and cement program requirements, wireline logging proposal, deck layout requirements, mobilization & demobilization requirements, logistical plans, & permit requirements.

The workshop also provided opportunity for identification and discussion of concerns and issues. Also identified were actions and issues that needed resolution prior to permit application. An action list of outstanding planning activities with assigned accountabilities was developed for resolution by mid-Oct. 2016:

1. First drafts of mud program, deck layout, and plug-and-abandonment (P&A) program,
2. Evaluations for wireline access through the top drive, BHA protection during cementing, cold shuck hang-off, use of a lockable float valve, and wellbore re-entry options,
3. Review of historical use of drilling mud with the PCTB system, and
4. Minimum training requirements for UT science group.

In period ending Dec. 31, 2016 (Phase 2, Q5), UT conducted the following activities pertaining to development of the UT-GOM^2-1 marine field test operational plan:

1. Held reviews of the UT- GOM^2-1 well program with Helix and subcontractors on Oct. 14 and Oct. 27, 2016,
2. Held weekly and ad hoc planning teleconferences to discuss detailed well design, deck layout, and logistics planning,
3. Reviewed winch & cable options for running & pulling coring tools. Agreed to purchase a fit-of-purpose cable to run on a rental wireline unit,
4. Evaluated options for wireline access through the top drive,
5. Commenced design of BHA cement-protection liner, cold shuck hang-off adapter, and mousehole adapter,
6. Commenced detailed logistics planning for the mobilization & demobilization,
7. Finalized surface locations for proposed locations,
8. Confirmed that proposed well location GC955H-002 would be the first well drilled and would be wireline-logged over the cored interval,
9. Developed a wireline logging program,
10. Developed a detailed coring program,
11. Developed a plan for taking inclination and azimuth surveys in both wells,
12. Continued to revise mud and cement programs,
13. Commenced modeling of the blowout scenario and development of detailed well control contingency plan, and
14. Commenced sourcing freezer and workspace options for storing cores for microbiology studies.

In period ending Mar. 31, 2017 (Phase 2, Q6), UT conducted the following activities pertaining to development of the UT- GOM^2-1 marine field test operational plan:

1. Held HAZID & DWOP workshop at Helix Offices to prepare for the marine field test. (Mar. 6 and 7, 2017),
2. Continued to hold weekly and ad hoc planning teleconferences to discuss detailed well design, deck layout, and logistics planning,
3. Reviewed winch & cable options for running & pulling coring tools. Agreed to purchase a fit-of-purpose cable to run on a rental wireline unit,

4. Further evaluated options for wireline access through the top drive,
5. Finalized detailed logistics planning for the mobilization & demobilization,
6. Finalized mud programs and plug and abandonment programs for 2 locations,
7. Refined wireline logging program,
8. Refined detailed coring program,
9. Refined plan for surveying borehole, and
10. Refined shipboard and science-based program.

3.4.3 Subtask 8.3: Marine Field Test Documentation and Permitting

Objectives:

The Recipient will conduct all activities as required to prepare documentation for field test of pressure coring system operational and environmental permits. This will include, but not be limited to, all necessary drilling permit applications, hazard site reviews, and specialty-engineering studies required in order to gain permissions required to execute the Marine Field Test Operational Plan as defined in Subtask 8.2.

Accomplishments:

As an operator in the Gulf of Mexico, UT was required to comply with all applicable permitting and reporting requirements promulgated by state and federal regulatory agencies, including the United States Environmental Protection Agency (US EPA), Bureau of Ocean Energy Management (BOEM), and Bureau of Safety and Environmental Enforcement (BSEE) and Louisiana Department of Natural Resources (LDNR).

A summary of the permits that the University of Texas was required to obtain is presented as Table 3-3; a summary of the regulatory reporting and notification requirements that the University of Texas was obligated to fulfill is presented as Table 3-4.

Table 3-3: UT-GOM²-1 related regulatory permits and approvals

Permits and Approvals	Regulatory Agency	Reference No.	Date Approved
NEPA Environmental Questionnaire /Categorical Exclusion Designation	DOE-NETL	DE-FE0023919	03/06/17
Qualified Operator Status for OCS Right-of-Use-and-Easement	BOEM	GoM Operator # 3487	03/21/17
Exploration Plan	BOEM	N-9978	04/28/17
Right of Use and Easement	BOEM	RUE OCS-G 30344	04/28/17
Permit for Geological Exploration for Mineral Resources or Scientific Research on the Outer Continental Shelf	BOEM	L17-001	05/05/17
Coastal Zone Management Federal Consistency Determination	LDNR	C20170064	04/21/17
CZM public comment waiver	LDNR	C20170064	04/20/17
Application for Permit to Drill – H002	BSEE	API # 608114068600	05/05/2017
Application for Permit to Drill – H005	BSEE	API # 608114068700	05/05/2017
Application for Permit to Modify (P&A) – H002 & H005	BSEE		05/17/2017 05/20/2017 05/23/2017
USCG Letter of Determination for foreign nationals	USCG	160881 160971	02/13/17 04/14/17
NPDES General Permit for New & Existing Sources and New Discharges in the Offshore Subcategory of the Oil & Gas Extraction Point Source Category for the Western Portion of the Outer Continental Shelf of the Gulf of Mexico - Notice of Intent	US EPA	GMG290609	05/02/17

Table 3-4: UT-GOM^2-1 related regulatory planning documents, reports, and notifications

Regulatory, Reports, & Notifications	Regulatory Agency	Form	Date Submitted
Notification of Commencement – BOEM Resource Evaluation.	BOEM	Email Comm.	05/07/17
Notification of Commencement – BOEM G&G Permitting	BOEM	Email Comm.	05/08/17
Notification of Completion (use of RUE has ceased)	BOEM	Email Comm.	05/26/17
Monthly records of annual fuel consumption	BOEM	Email comm.	Feb 1, Annually
Rig Move Notification – Arrival on location	BSEE	BSEE-0144	05/04/17
Rig Move Notification – From H002 to H005	BSEE	BSEE-0144	05/14/17
Rig Move Notification – Departure from location	BSEE	BSEE-0144	05/21/17
Dropped Rigging Notification (NSS # 750191)	BSEE	E-Mail Comm.	05/7/17
Open Hole Data Report – H002	BSEE	BSEE-0133S	05/12/17
Open Hole Data Report – H002	BSEE	BSEE-0133S	05/17/17
Open Hole Data Report – H005	BSEE	BSEE-0133S	05/24/17
Well Activity Report – H002	BSEE	BSEE-0133	05/12/17
Well Activity Report (Final) – H002	BSEE	BSEE-0133	05/17/17
Well Activity Report (Final) – H005	BSEE	BSEE-0133	05/24/17
Well Activity Report (Final) – H005 (Rev.)	BSEE	BSEE-0133	07/27/17
Notification APM: Site Clearance – H002	BSEE	BSEE-0124	05/31/17
Notification APM: Site Clearance – H005	BSEE	BSEE-0124	05/31/17
End of Operations Report – H002	BSEE	BSEE-0125	05/31/17
End of Operations Report – H005	BSEE	BSEE-0125	05/31/17
Notification of ROV As-found Survey results – H002	BSEE	Email Comm.	05/08/17
Notification of ROV As-found Survey results – H005	BSEE	Email Comm.	05/08/17
Site Clearance ROV dive video – H002/H005	BSEE	Electronic	07/24/17
As-Found & As-Left Survey Reports – H002	BSEE	12817-GC-WOP-PR	05/23/17
As-Found & As-Left Survey Reports – H005	BSEE	12817-GC-WOP-PR	05/23/17
Directional survey data – H002/H005	BSEE	Courier	08/09/17
Well Log data	BSEE	Courier	08/24/17
Notice of Intent for US EPA Region 6 Offshore General Permit	US EPA	Electronic	05/02/17
Discharge Monitoring Report (Period ending 6/30/17)	US EPA	Electronic	07/06/17
Discharge Monitoring Report (Period ending 9/30/17)	US EPA	Electronic	07/06/17
NPDES Notice of Termination	US EPA	Electronic	07/31/17

3.4.4 Subtask 8.4: Marine Field Test of Pressure Coring System

Objectives:

The Recipient will plan and coordinate the testing of the Pressure Coring Tool with Ball and Pressure Core Analysis and Transfer System (PCATS), in accordance with the Marine Field Test drilling/logging/coring and sampling plan developed in Subtask 8.2, in an offshore well within known gas hydrate occurrences or in settings with sufficiently analogous pressure and mechanical conditions, to ensure it is fully operational for an offshore methane hydrate field coring program. The Recipient will work with representatives from geotechnical drilling companies and/or other organizations mutually agreeable to the Recipient and DOE, to develop and execute this test.

Accomplishments:

UT executed a contract with Helix on Nov. 30, 2016 for the contractual use of the Q-4000 well intervention vessel. Subsequently, UT completed a risk evaluation and purchased insurance through UT Office of Risk Management and insurance brokers.

From May 2, 2017 to May 22, 2017, the UT-GOM^2-1 Hydrate Pressure Coring Expedition drilled two wells in Green Canyon Block 955 (GC 955) in the deep-water Gulf of Mexico: Hole GC 955 H002 (H002) and Hole GC 955 H005 (H005). Twenty-one 10 ft. pressure cores were attempted in and near the methane hydrate reservoir. In the first hole, H002, 1 of the 8 cores were recovered under pressure and there was 34% recovery of sediment (both pressurized and depressurized). In the second hole, H005, 12 of the 13 cores were recovered under pressure and there was 72% recovery of sediment. The pressure cores were imaged and logged under pressure. Samples were quantitatively degassed either on-board or on-shore to determine the hydrate concentration and the gas composition. Pore water analyses were performed on depressurized samples, and sediment samples were collected to enable characterization of the microbial community. Twenty-one 3.3 ft. vessels containing pressure core sections were returned to the University of Texas for storage, distribution, and further analysis. These cores will provide

A summary of UT-GOM^2-1 activities is provided as an appendix to this report (**Appendix E**).

3.4.5 Subtask 8.5: Marine Field Test Report

Objectives:

The Recipient will document the process and results of the pressure coring system test and report that information to DOE via a dedicated Marine Pressure Coring Field Test Report.

Accomplishments:

A preliminary structure of the UT-GOM^2-1 marine-based field test report was constructed in period ending Dec. 31, 2016 (Phase 2, Q5), and finalized in period ending Mar. 31, 2017 (Phase 2, Q6).

A first draft of the UT-GOM^2-1 Report was initiated by the UT-GOM^2-1 Science Party on the drilling vessel. A Sharepoint site was created to function as a repository for the field data. All data logs were uploaded to the site and the UT-GOM^2-1 Science Party was granted access.

A preliminary UT-GOM^2-1 Expedition Summary was submitted to DOE in the Quarterly Research Performance and Progress Report (QRPPR) for period ending Jun. 30, 2017 (Phase 2, Q7).

The UT-GOM^2-1 final data was uploaded to a private data directory. Chapter 1 of the final UT-GOM^2-1 Expedition Summary is provided in this document as **Appendix E**. UT and DOE are currently working with different scientific journals to have a dedicated volume to publish further results from this expedition.

3.5 Task 9.0: Pressure Core Transport, Storage, and Manipulation

The Recipient will demonstrate the ability to appropriately handle, transport, store, subsample and characterize, pressure cores that are to be recovered during the Marine Field Test.

3.5.1 Subtask 9.1: Review and Complete NEPA Requirements

Objectives:

The Recipient will complete all necessary NEPA documentation for the specific sites / locations and activities to be included as part of the development and use of pressure core storage and manipulation (as defined in subtasks 9.3 – 9.7). No activity in these subtasks activities shall be conducted until an appropriate final NEPA determination is issued by the DOE / NETL NEPA compliance office.

Accomplishments:

UT submitted NEPA paperwork for approval in period ending Dec. 31, 2015 (Phase 2, Q1), and received approval in period ending Mar. 31, 2016 (Phase 2, Q2).

3.5.2 Subtask 9.2: Hydrate Core Transport

Objectives:

The Recipient will transport cores acquired during the Marine Field Test to storage facilities in the U.S. for subsequent analysis. The Recipient will identify a specific technology for transporting pressure core from where the research vessel docks to research institutions in the United States (e.g. USGS, U.T.) via over road transfer. The technology will meet required U.S. regulations to allow for transport. The Recipient will either build or lease the capability to transport a minimum of eight 1.2 m long pressure cores.

Accomplishments:

In period ending Mar. 31, 2016 (Phase 2, Q2), UT established a contract with Geotek for the transport of ten 1.2 m long cores acquired during the UT-GOM^2-1 marine field test using overpacks and a reefer truck that meet required U.S. regulations to allow for transport. Per the contract, the cores were to be transported to the UT PCC for subsequent analysis.

Following the UT-GOM^2-1 marine field test and dockside science operations, the pressure cores were successfully transported over land by Geotek using Geotek overpacks in a reefer unit. Twenty-one pressure cores were delivered to UT in three shipments that occurred from Jun. 2-6, 2017.

3.5.3 Subtask 9.3: Storage of Hydrate Pressure Cores

Objectives:

The Recipient will store individual hydrate pressure cores in pressure vessels. The Recipient will identify a specific technology for storing pressure core at research institutions in the United States. The Recipient will either build or lease the capability to store a minimum of ten 1.2 m long pressure cores.

Accomplishments:

UT successfully stored 21 pressure cores acquired during UT-GOM^2-1 at the UT PCC (**Fig. 3-5**). The cores are stored in chambers acquired from Geotek. The pressure of the chambers is maintained by a pressure maintenance and relief safety system at 3480 psi.

Figure 3-1: Pressure cores at refrigerated UT Pressure Core Center

3.5.4 Subtask 9.4: Refrigerated Container for Storage of Hydrate Pressure Cores

Objectives:

The Recipient will develop a container specifically to store the pressurized cores. The walk-in container will have the ability to be cooled to 3 degrees Celsius and will be capable of storing, moving, and monitoring the pressure cores anticipated to be collected throughout project activities. Storage capability shall include the ability to maintain conditions necessary to keep twenty 1.2 m pressure cores (within their pressurized storage vessels) under hydrate stable conditions for the duration of the project.

Accomplishments:

In period ending Mar. 31, 2016 (Phase 2, Q2), the GOM^2 project team worked with U.T. Facilities, architects (including mechanical, engineering, and plumbing (MEP) and Environmental Chamber experts), and laboratory staff to establish a 95% design plan for the design and location of a walk-in container, capable of storing, moving, and monitoring pressure cores. Storage capability specifications included the ability to maintain conditions necessary to keep twenty 1.2 m pressure cores for the duration of the project.

Design of the container was completed in period ending Sep. 30, 2016 (Phase 2, Q4), at which time bids were received for construction and delivery.

A bid for the construction of the container by Harris Environmental was accepted and the contract was finalized in period ending Sep. 30, 2016 (Phase 2, Q4).

The container was built, installed inside the Jackson School building, and hooked up in period ending Dec. 31, 2016 (Phase 2, Q5).

The UT pressure core center was completed and operational in period ending June 30, 2017 (Phase 2, Q7).

3.5.5 Subtasks 9.5-9.7: Hydrate Core Manipulator and Cutting Tool, Effective Stress Chamber, and Depressurization Chamber

Objectives:

The Recipient will design and build a manipulator tool and associated cutter to allow subsampling of the pressure core. The Manipulation and Cutting Tool will allow the pressure cores to be cut into smaller subsections, transferred from the storage chambers to analysis chambers for various physical property measurements, all while under pressure. The subsampling capability will consist of a core cutter, which will connect between the manipulator and other analysis tools and allow short sections of core to be cut and loaded into the analysis tools (including, but not limited to the effective stress chamber described in Subtask 9.6). The cutter will consist of an automated metal saw blade capable of effectively and efficiently cutting through the types of material anticipated to be within the collected cores. The manipulator connections must be fully compatible with all other analysis tools and cutters.

The Recipient will design and build an effective stress chamber. The Effective Stress Chamber will allow the analysis of petrophysical properties at in-situ conditions. The effective stress chamber will be designed such that the sample sits inside a flexible sleeve. The confining pressure applied around the sample will have the capability to be dynamically monitored and adjusted to maintain zero lateral strain. The top and bottom of the sample will have connections for flow-through of seawater as well as electrodes for measurement of electrical conductivity in the axial direction. One end of the sample will have a piston actuator that will be used to apply axial loading for consolidation testing. The chamber will be designed with sufficient electrical feed-through ports to allow the addition of other measurements (e.g., acoustic velocities) in the future. The chamber will be capable of receiving pressurized samples from the Manipulator and Cutter Tool.

Initially the effective stress chamber will include the capability to measure permeability under conditions of uniaxial strain at in-situ effective stress conditions. The recipient will endeavor to add the capability to measure electrical conductivity, and geotechnical properties such as compression index and Young's modulus

The Recipient will design and build a device to allow cores to be depressurized. The Depressurization Chamber will allow the systematic degassing of pressure cores to interpret concentration and composition. The device will have the capability of depressurizing the pressure core in a safe and controlled fashion, in accordance with approved UT safety and environmental standards and practices. The device will be able to monitor the mass of gas removed during depressurization. The device will connect to the cutter/manipulator to accept subsamples. The chamber will additionally have ports to allow collection of any fluids produced during depressurization.

<u>Accomplishments:</u>

In period ending Mar. 31, 2016 (Phase 2, Q2), UT completed a purchase order for the design, build, and installation of the following:

1. Miniature Pressure Core Manipulator and Cutting Tool (mPCATS)
    a. This is a smaller version of the Geotek PCATS. It will handle up to 1.2 m core and is compatible with PCTB processed cores and any PCATS compatible equipment.
2. Hydrate Core Effective Stress Chamber
    a. This chamber will couple with the Manipulator and Cutting Tool to receive samples cut from the storage 1.2 m core.
    b. The chamber will be capable of measuring effective stress, permeability, and extracting liquids for pore fluid analysis.
3. Depressurization Chamber
    a. The chamber will analyze up to 30 cm length pressure core and will include a high pressure gas manifold and gas sampling equipment

The Pressure Core Manipulator and Cutting Tool, Hydrate Core Effective Stress Chamber, and Depressurization Chamber were assembled and tested in periods ending Dec. 31, 2016 (Phase 2, Q5), and Mar. 31, 2017 (Phase 2, Q6). The UT PC Laboratory Manager traveled to the UK for training of this equipment. Subsequently, this equipment was assembled and tested with no issues identified.

3.6 Task 10.0: Pressure Core Analysis

Objectives:

Continued planning for acquisition of pressure cores. Two documents one outlining the Pressure Core Analysis to be done on-board the Marine Test Rig (Marine Test Science On-Board Plan) and the other outlining the details of the Pressure and Routine Core analysis to be done on-shore (Marine Test Science On-Shore Plan) are being developed and will be released. We still envision the establishment of a technical advisory council to provide guidance on the analysis and distribution of routine and pressure cores. We will ask the council to review these documents.

Accomplishments:

The first round of sample and data requests have been received by UT. The technical advisory council met to review the requests provide guidance on the analysis proposed by each group. There were no objections to the initial round of requests but requests need to be revised based on the actual core samples and data recovered. Requestors were asked to join the UT-GOM^2-1 Science Party assuming they could fulfill obligations to the study of those samples including obligations for reporting and publication. After the expedition, depressurized (conventionalized) core samples were distributed according to the quality of the depressurized core and consistent with the core requests reviewed by the council. As discussed all pressure core was transported to UT pending further discussion with the council on how it will be distributed from there. A detailed core recovery report was distributed to the UT-GOM^2-1 Science Party and these results were reported to the greater hydrate community at International Conference on Gas Hydrates (ICGH). Requesters are expected to refine their pressure core and additional depressurized core requests based on the report.

A process for receiving sample requests, approving requests, and distributing core was finalized and approved by the GOM^2 technical advisory council. A form by which members of the greater hydrate community could request samples and data from the UT-GOM^2-1 marine field test was distributed.

3.6.1 Subtask 10.1: Routine Core Analysis

Objectives:

The Recipient will perform, or facilitate performance by others, routine core analysis on any depressurized cores and any conventional cores acquired in the Marine Field Test (Task 8). Routine core analysis will include but not be limited to: whole core-logging using gamma scanner and x-ray computed tomography (for bulk density and internal structure), splitting core into archival and working halves, complete visual core description (sediment type, sedimentary structure, color, etc.), photographs of split core, and moisture and density, including water content and grain density measurements to determine porosity.

Accomplishments:

Depressurized cores from the UT-GOM^2-1 marine field test were divided, stored, and shipped according to sample handling protocols established for mud lab operations on the rig and at the dock.

The following samples were distributed for on-shore analysis:

- Interstitial waters at the University of Washington
- Microbiology at ExxonMobil and Oregon State University
- Whole core-logging using gamma scanner, x-ray computed tomography (for bulk density and internal structure), visual core description (sediment type, sedimentary structure, color, etc.), Photographs of split core, porosimetry, SEM, XRD, and headspace gas at Ohio State University.
- Smear slide and coarse fraction petrography, CHNS elemental analysis, laser diffraction grain size distribution, and biostratigraphy at the University of New Hampshire
- Grain size analysis (hydrometer method) and grain density at the University of Texas.

UT was unable to distribute depressurized core for geotechnical analysis and the full suite of physical properties analysis due to the nature of the core recovered. It may be possible to complete geotechnical analysis on depressurized cores from very slow depressurization and/or slow depressurization with confining pressure.

Initial results from the analysis are included in the UT-GOM^2-1 summary (**Appendix E**). Additional work is still on going, as proposed, into Phase 3.

3.6.2 Subtask 10.2: Pressure Core Analysis

Objectives:

The Recipient will perform, or facilitate performance by others, analysis of selected pressure cores in the Marine Field Test (Task 8) to include, but not be limited to, the following:

- *Determination of the concentration of methane (or other hydrocarbons) for select depressurized samples. The chemical concentration of the resultant pore waters will be measured.*
    - *Recipient will analyze hydrocarbon composition (C1 to C6) stable isotopes of hydrocarbons (example: d13C) and noble gasses (He, Ne, Ar, Kr, Xe) from gas samples collected as pressure core is degassing.*
    - *Recipient will analyze pore water samples to determine residence time of the fluids.*
- *Measurement of the permeability and geotechnical properties (such as compression index and Young's modulus) of pressurized samples using an effective stress chamber*

Accomplishments:

All pressure core acquired from the UT-GOM^2-1 marine field test were analyzed in PCATS and divided according to the sampling plan for long-term storage at the UT PCC, quantitative degassing, and rapid degassing. PCATS analysis included full scan p-wave, gamma density, and 3D tomography. Gas samples were analyzed on board the vessel and at the dock for oxygen, nitrogen, methane, ethane, propane, butane, isobutane, isopentane, and pentane content. Gas samples from the quantitative degassing efforts were also distributed for concentration of C1 to C20 gaseous alkanes, concentration of C2 and C3 alkene gases, $\delta^{13}C$ and δD of methane, $\delta^{13}C$ of ethane, concentration of CO_2, and concentration of noble gases (He, Ne, Ar, Kr, Xe) to Ohio State University. Samples were collected for analysis of the methane “clumped” isotopologue $^{13}CH_3D$ at Cal Tech. Material depressurized from the quantitative degassing studies underwent grain size analysis at the dock.

After initial pressure core analysis during the expedition, twenty-one pressure cores were transported to the University of Texas for further distribution at a later time. Samples are expected to be distributed to the University of Texas, USGS Woods Hole, Georgia Tech, National Energy Technology Laboratory (NETL), and the National Institute of Advanced Industrial Science and Technology (AIST).

Protocols for Pressure Core cutting and analysis were tested at UT using synthetic cores made from concrete. Once the protocols have been fully tested, UT will being testing using one of the pressure cores compromised during retrieval and analysis using the expedition, Core UT-GOM^2-1-H005-6FB-2.

Analysis will continue into GOM^2 Phase 3.

3.6.3 Subtask 10.3: Hydrate Core-Log-Seismic Synthesis

Objectives:

The Recipient will perform, or facilitate performance by others, analysis of the hydrate pressure cores acquired in Task 8 to include, but not be limited to, the following. Comparison of hydrate concentration calculated from Core Analysis with estimates of hydrate concentration derived from logging data. Development of Petrophysical models to predict the physical and acoustic behavior of the hydrate reservoir.

Accomplishments:

UT is currently comparing measurements at the core scale to the logging results from previous drilling at GC 955. UT is also building models to relate core velocity measurements to actual velocity measurements.

3.7 Task 11.0: Update Pre-Expedition Drilling/Logging/Coring/Sampling Operational Plan

Objectives:

The Recipient will continue to develop, in consultation with the project Advisory Team, the pre-expedition drilling / logging / coring / sampling Operation Plan. This will include modifications considered necessary both prior to and after the marine field test identified in Task 8. The Recipient will document the developed Operational Plans as a dedicated preliminary drilling / logging / coring / sampling Operational Plan report.

Accomplishments:

Throughout Phase 2, UT revised the draft Operational Plan in response to CPP review by IODP SEP committee (see Section 6.0 *Technical and Operational Support of the CPP Proposal* for further details). Additionally, the draft operational plan was updated based on experiences encountered during UT-GOM^2-1 and other changes in project plans and as required. Revisions included reprocessing high-resolution seismic profiles, reviewing additional or revising site locations and target depths, updating the preliminary rig time estimate, mud usage estimates, wireline logging, and LWD programs (**Appendix F**).

Following the UT-GOM^2-1 marine field test, the Recipient reviewed technical and operational outcomes and initiated deliberation the expedition drilling / logging / coring / sampling programs with the Advisory Team.

The Recipient held a kickoff web conference on June 27, 2017 with TAMU and the Advisory Team regarding scheduling of the *JR* and operational requirements for IODP Expedition 386. Attendees to this meeting included IODP, DOE, LDEO, Geotek, and USGS.

In quarter ending 09/30/17, the Recipient initiated weekly Operations Team meetings to provide guidance and consensus on refinement of the Operational Plan. During this period, the Recipient developed specifications for wireline logging, LWD, remotely operated vehicle (ROV), and coring services, and engaged subcontractors with requests for revised scopes of work for IODP Expedition 386 based on UT's refined Operational Plan and feedback from the Project Advisory Team.

The *IODP Expedition 386 Operational Plan* is provided in this document as **Appendix F.** The purpose of the IODP Expedition 386 Operational Plan is to define the scope and technical activities required to achieve the scientific goals of this project. As such, it is a 'living document' that will be modified and refined throughout the life of the project as warranted.

3.8 Task 12.0: Field Program/Research Expedition Vessel Access

Objectives:

The Recipient will notify DOE and the Project Advisory Team whether the IODP Science Evaluation Panel (SEP) has forwarded the Complementary Program Proposal (CPP) submitted by the Recipient to the JOIDES Resolution Facility Board (JRFB) for consideration for implementation. The Recipient will notify DOE within 1 week of their notification by IODP. Notification will include, at a minimum, an indication of whether IODP has forwarded the Complementary Program Proposal (CPP) to the JOIDES Resolution Facility Board (JRFB) and if so, the anticipated timing of ship availability and approximate ship costs (as available).

If the CPP is not forwarded to the JOIDES Resolution Facility Board (JRFB) (or in parallel with the CPP process if deemed to be needed by mutual agreement of Recipient and DOE), the Recipient in coordination with the project Advisory Team, may investigate alternate potential means of gaining access to a mutually acceptable vessel suitable for conducting the planned research expedition.

Accomplishments:

UT and the Hydrates Project Advisory Team presented for the IODP EPSP final review on May 3, 2017. The meeting was attended by members of UT, Columbia University, Ohio State, BOEM, and USGS. The IDOP review panel notified UT on May 24, 2017 that they had recommended CPP-887 for scheduling to the JRFB. The JRFB approved CPP-887 and scheduled IODP Expedition 386 for January 15 – March 15, 2020.

Further information regarding the technical and operational support of CPP887 conducted during Phase 2 is described in Section 3.2 of this document: *Technical and Operational Support of the CPP Proposal*.

4 PRODUCTS DEVELOPED

4.1 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 American Geophysical Union, Fall Meeting, San Francisco, CA.

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

Cook, A.E., and Waite, B. (2016). *Archie's saturation exponent for natural gas hydrate in coarse-grained reservoir*. Presented at Gordon Research Conference, Galveston, TX.

Cook, A.E., Hillman, J., & Sawyer, D. (2015). *Gas migration in the Terrebonne Basin gas hydrate system*. Abstract OS23D-05 presented at American Geophysical Union, Fall Meeting, San Francisco, CA.

Cook, A.E., Hillman, J., Sawyer, D., Treiber, K., Yang, C., Frye, M., Shedd, W., Palmes, S. (2016). *Prospecting for Natural Gas Hydrate in the Orca & Choctaw Basins in the Northern Gulf of Mexico*. Poster presented at American Geophysical Union, Fall Meeting, San Francisco, CA.

Flemings, P.B., Phillips, S.C, Collett, T., Cook, A., Boswell, R., and the UT-GOM2-1 Expedition Scientists (2018). UT-GOM2-1 Hydrate Pressure Coring Expedition Summary. In Flemings, P.B., Phillips, S.C, Collett, T., Cook, A., Boswell, R., and the UT-GOM2-1 Expedition Scientists*, UT-GOM2-1 Hydrate Pressure Coring Expedition Report.* University of Texas at Austin Institute for Geophysics, Austin, TX. https://ig.utexas.edu/energy/genesis-of-methane-hydrate-in-coarse-grained-systems/expedition-ut-gom2-1/reports/

Fortin, W. (2016). *Properties from Seismic Data*. Presented at IODP planning workshop, Southern Methodist University, Dallas, TX.

Fortin, W., Goldberg, D.S., Holbrook, W.S., and Küçük, H.M. (2016). *Velocity analysis of gas hydrate systems using prestack waveform inversion.* Presented at Gordon Research Conference on Natural Gas Hydrate Systems, Galveston, TX.

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. American Geophysical Union, Fall Meeting, San Francisco, CA.

Fortin, W., Goldberg, D.S., Küçük, H. M. (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. American Geophysical Union, Fall Meeting, New Orleans, LA.

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*. Presented at American Geophysical Union, Fall Meeting, San Francisco, CA.

Goldberg, D., Küçük, H.M., Haines, S., Guerin, G. (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*. Presented at Gordon Research Conference on Natural Gas Hydrate Systems, Galveston, TX.

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 American Geophysical Union, Fall Meeting, New Orleans, LA.

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 Gordon Research Conference, Galveston, TX.

Hillman, J, Cook, A.E., Sawyer, D., Küçük, H.M., and Goldberg, D.S. (2017). The character and amplitude of bottom-simulating reflectors in marine seismic data. *Earth & Planetary Science Letters,* 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.

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*. Presented at Gordon Research Conference on Natural Gas Hydrate Systems, Galveston, TX.

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*. Abstract OS23B-2003 presented at American Geophysical Union, Fall Meeting, San Francisco, CA.

Malinverno, A. (2016). *Modeling gas hydrate formation from microbial methane in the Terrebonne basin, Walker Ridge, Gulf of Mexico*. Presented at Gordon Research Conference on Natural Gas Hydrate Systems, Galveston, TX.

Malinverno, A., Cook, A. E., Daigle, H., Oryan, B. (2017). *Methane Hydrate Formation from Enhanced Organic Carbon Burial During Glacial Lowstands: Examples from the Gulf of Mexico.* EOS Trans. American Geophysical Union, Fall Meeting, New Orleans, LA.

Meazell, K., & Flemings, P.B. (2016). *Heat Flux and Fluid Flow in the Terrebonne Basin, Northern Gulf of Mexico.* Presented at American Geophysical Union, Fall Meeting, San Francisco, CA

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

Meazell, K., & Flemings, P.B. (2016). *The depositional evolution of the Terrebonne basin, northern Gulf of Mexico*. Presented at 5th Annual Jackson School Research Symposium, University of Texas at Austin, Austin, TX.

Meazell, K. (2015), *Methane hydrate-bearing sediments in the Terrebonne basin, northern Gulf of Mexico*. Abstract OS23B-2012 presented at American Geophysical Union, Fall Meeting, San Francisco, CA.

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 American Geophysical Union, Fall Meeting, New Orleans, LA.

Oryan, B., Malinverno, A., Goldberg, D., Fortin, W. (2017). *Do Pleistocene glacial-interglacial cycles control methane hydrate formation? An example from Green Canyon, Gulf of Mexico*. EOS Trans. American Geophysical Union, Fall Meeting, New Orleans, LA.

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 American Geophysical Union, Fall Meeting, New Orleans, LA.

Phillips, S.C., Borgfedlt, T., You, K., Meyer, D., and Flemings, P. (2016). *Dissociation of laboratory-synthesized methane hydrate by depressurization*. Poster presented at Gordon Research Conference and Gordon Research Seminar on Natural Gas Hydrates, Galveston, TX.

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.* Presented at American Geophysical Union, Fall Meeting, San Francisco, CA.

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 at Gordon Research Conference, Galveston, TX.

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 The University of Texas at Austin, GeoFluids Consortia Meeting, Austin, TX.

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 Gordon Research Conference, 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?.* Presented at American Geophysical Union, Fall Meeting, San Francisco, CA.

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, Galveston, TX.

4.2 Website(s) or other Internet Site(s)

Project Website: https://ig.utexas.edu/energy/genesis-of-methane-hydrate-in-coarse-grained-systems/

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

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

4.3 Other Products

Methane Hydrate: Fire, Ice, and Huge Quantities of Potential Energy

https://www.youtube.com/watch?v=f1G302BBX9w

Fueling the Future: The Search for Methane Hydrate

https://www.youtube.com/watch?v=z1dFc-fdah4

5 LIST OF ACRONYMS AND ABBREVIATIONS

A list of acronyms and abbreviations used in this document is presented in Table 6-1.

Table 6-1: List of Acronyms and Abbreviations

ACRONYM	DEFINITION
BHA	Bottom Hole Assembly
BOEM	Bureau of Ocean Energy Management
BP	Budget Period
BSEE	Bureau of Safety and Environmental Enforcement
CHNS	carbon, hydrogen, nitrogen, sulfur
CPP	Complimentary Project Proposal
DOE	U.S. Department of Energy
DST	Drill Stem Test
DWOP	Drill Well on Paper
EPA	Environmental Protection Agency
EPSP	Environmental Protection and Safety Panel
EQ	Environmental Questionnaire
ft.	feet
GC	Green Canyon
GOM2	Genesis of Methane Hydrates in the Gulf of Mexico
gpm	gallons-per-minute
HAZID	Hazard Identification Study
ICGH	International Conference on Gas Hydrates
IODP	International Ocean Drilling Program
JIP	Joint Industry Program
JR	JOIDES Resolution
JRFB	JOIDES Resolution Facility Board
LDEO	Lamont-Doherty Earth Observatory
LDNR	Louisiana Department of Natural Resources
LWD	Logging-While-Drilling
m	meter
MEP	Mechanical, Engineering, and Plumbing
NEPA	National Environmental Policy Act
NETL	National Energy Technology Laboratory
NPDES	National Pollutant Discharge Elimination System
OCB	Outer Core Barrel
OCS	Outer Continental Shelf
OSU	Ohio State University
PCATS	Pressure Core Analysis and Transfer System
PCC	Pressure Core Center
PCS	Pressure Core System

ACRONYM	DEFINITION
PCTB	Pressure Coring Tool with Ball Valve
PM	Project Manager
PMP	Project Management Plan
psi	pounds-per-square-inch
QRPPR	Quarterly Research Performance and Progress Report
ROV	Remotely Operated Vehicle
RUE	Right of Use and Easement
SEM	Scanning Electron Microscope
SEP	Science Evaluation Panel
SOW	Scope of Work
SSDB	Site Survey Data Bank
TAMU	Texas A&M University
TFA	Total Flow Area
USCG	U.S. Coast Guard
USGS	U.S. Geological Survey
UT	The University of Texas at Austin
WR	Walker Ridge
XRD	X-ray Diffraction

National Energy Technology Laboratory

626 Cochrans Mill Road
P.O. Box 10940
Pittsburgh, PA 15236-0940

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

1450 Queen Avenue SW
Albany, OR 97321-2198

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

Visit the NETL website at:
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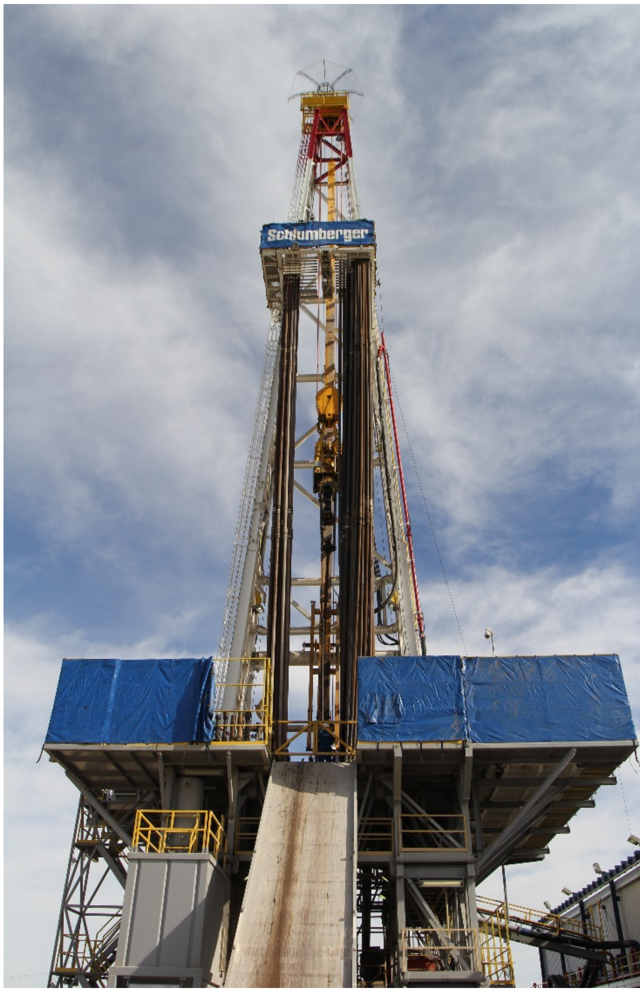
APPENDIX A

GOM2 PRESSURE CORING TOOL WITH BALL VALVE (PCTB) LAND TEST INITIAL REPORT



GOM^2 PRESSURE CORING TOOL WITH BALL VALVE (PCTB) LAND TEST INITIAL REPORT

Submitted by:
Peter B. Flemings
Stephen Phillips
Tom Pettigrew
Tessa Green

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

GOM^2 PRESSURE CORING TOOL WITH BALL VALVE (PCTB) LAND TEST INITIAL REPORT

Table of Contents

Executive Summary:

The UT DOE Hydrates program performed a field test of the PCTB tool at the Schlumberger Cameron Test and Training Facility. This field test involved 3 Flow Tests, 4 Closure Tests, and 8 Coring Tests.

The first two Flow Tests (one in the 10⅝" face-bit configuration, one in the 9⅞" cutting-shoe configuration) indicated that the standpipe pressure (pressure at the rig floor) would reach the expected 330 psi liner-collapse pressure at a flow rate of ~200 Gpm. The liner did not collapse at these flow rates and pressures. A third Flow Test, a liner-collapse test, demonstrated that the liner would collapse at a standpipe (rig floor) pressure of 775 psi with a flow rate of 400 Gpm.

Closure Tests in the 9⅞" cutting-shoe configuration were partially successful, but two runs had problems with a late or slow charge in the N_2 boost. The slow charge was discovered to be due to human error in setting up the tool.

In four Coring Tests in the 9⅞" cutting-shoe configuration, the ball valve did not close due to material (cuttings or core) that was trapped in the ball valve. One Coring Test in the 9⅞" cutting-shoe configuration recovered core under pressure, but the N_2-boost occurred near the rig floor after pressures inside the liner had dropped to nearly atmospheric conditions. Three final Coring Tests with the 10⅝" face-bit configuration were more successful with the final two tests recovering core under pressure. For both tools, coring penetration rates were very low and in the more mudstone rich penetrations, the jets on the cutting-shoe became clogged with rock paste.

The tests demonstrated the successful operation of the PCTB despite slow coring in the rock formations present at the Cameron Facility. Late firing of the N_2 boost after the core barrel was raised from the bottom occurred in 1 of 4 Closure Tests and 1 of 8 Coring Tests. The face-bit configuration was more successful than the cutting-shoe configuration in coring the mudstone and limestone formations at the Cameron location. This configuration appeared to have less problems with balling at the bit and was more successful at recovering core.

1. Introduction:

The UT DOE Hydrates program performed a field test of the PCTB ('Pressure Core Tool with Ball') from Tuesday 12/8/2015 to Friday 12/18/2015. Representatives from Geotek Coring, Pettigrew Engineering, U.S. Department of Energy, U.S. Geological Survey, and The University of Texas at Austin participated in the testing. The test was performed at Schlumberger's Cameron Testing Facility (near Cameron, TX).

2. Test Description:

Three types of tests were performed: 1) Flow Tests, 2) Closure Tests, and 3) Coring Tests.

2.1. Flow Tests:

The purpose of the Flow Test was to establish the pressure drop through the BHA (Bottom Hole Assembly) at various flow rates so as to establish an upper bound flow rate above which the potential for collapsing the core liner exists. In a flow test, the PCTB is lowered into the BHA within the borehole but above the base of the hole. Drilling fluid is then pumped down the drill string and pressure on the rig floor (the standpipe pressure) is measured. Flow rates are increased by increments, while the standpipe pressure is measured. Previous laboratory testing of the PCTB suggests that when the pressure differential across the liner is increased above 300 PSI, the core liner collapses.

2.2. Closure Tests:

In the Closure Test, the PCTB was deployed by wireline in the drill pipe, actuated downhole, and then recovered by wireline while the BHA was suspended off bottom in the hole. The purpose of the Closure Tests was to verify overall mechanical function of the PCTB without actually coring. This included 1) complete mechanical exercising of the tool under hydrostatic pressure, 2) successful actuation of the autoclave boost nitrogen charge, 3) retention of near downhole hydrostatic pressure, without the introduction of core, and 4) verification that the PCTB wireline deployment and retrieval tools worked successfully in an actual wellbore environment.

2.3. Coring Tests:

The purpose of a Coring Test was to verify the complete overall function of the PCTB. This included 1) wireline deployment, 2) cutting of core, 3) capture of core, 4) closing of the autoclave, 5) actuation of the autoclave boost nitrogen charge, 6) wireline retrieval of the PCTB, and 7) retention of the core under near in situ or boosted pressure conditions in an actual well bore environment.

3. Test Results:

During the 9 day test, 3 Flow Tests, 4 Closure Tests, and 8 Coring Tests were performed (Table 1 and Table 2).

Test Type	***Cutting-shoe***	***Face-bit***
Flow	2	1
Closure	4	0
Coring	5	3

Table 1: Summary of different tests performed during the Land Test of the PCTB tool.

Date	*Activity*
Tuesday, December 08, 2015	***Rig up***
Wednesday, December 09, 2015	***Flow Tests 1 (face-bit) and 2 (cutting-shoe)***
Thursday, December 10, 2015	***Closure Tests 1 and 2; Coring Test 1***
Friday, December 11, 2015	***Drilling through Buda Limestone; Coring Test 2***
Monday, December 14, 2015	***Coring Test 3; Liner Collapse Test; Coring Test 4***
Tuesday, December 15, 2015	***Closure Tests 3 and 4; Coring Test 5***
Wednesday, December 16, 2015	***PCTB-Face-bit: Coring Tests 6, 7, and 8***
Thursday, December 17, 2015	***Rig down, dress and pack tools, ship drill pipe***
Friday, December 18, 2015	***Ship containers***

Table 2: Summary of daily activities.

3.1. Flow Test Results:

The Flow Test 1 results are illustrated in Figure 1. Flow Test 1 tested the 10⅝" face-bit configured PCTB tool as one continuous flow test, starting with a pump rate of 25 GPM, and continuously ramping up the flow rate at 25 GPM increments. The first Flow Test ramped up the flow rate by 25 GPM increments to 200 GPM, increasing standpipe pressures to 246 psi. Examination of the core liner after the test showed no indications of collapse. Pressure data from inside the core liner measured by "fish pill" data storage tags (DST) show an increase to 30 psi during the first two flow rate steps, and then a leveling off at 25 psi for the remainder of the test.

Flow Test 2 tested the cutting-shoe configured PCTB. The flow test was conducted with the cutting-shoe tool with a 9⅞" cutting-shoe bit. It was performed as one continuous flow test, starting with a pump rate of 25 GPM, and continuously ramping up the flow rate at 25 GPM to 200 GPM, reaching a standpipe pressure of 236 psi (Fig. 2). The flow was further increased to 213 GPM reaching a pressure of 283 psi. Examination of the core liner after the test showed no indications of collapse. The DST pressure transducer failed during this test.

Flow Test 3 was performed to liner collapse with the PCTB cutting-shoe configuration PCTB and the 9⅞" cutting-shoe bit. In this test, the flow rate was incrementally increased. However, between each flow rate, the PCTB was extracted by wireline and the core liner was examined for evidence of collapse. In this case, at a flow rate of 450 Gpm, the standpipe pressure was 972 psi and when the core liner was examined it was slightly deformed. At the next flow rate of 500 Gpm, the standpipe pressure was 1184 psi and the liner was found to have been collapsed when examined. No DST data were available from within the core liner. Results of Flow Test 3 are shown in Figures 2 and 3.

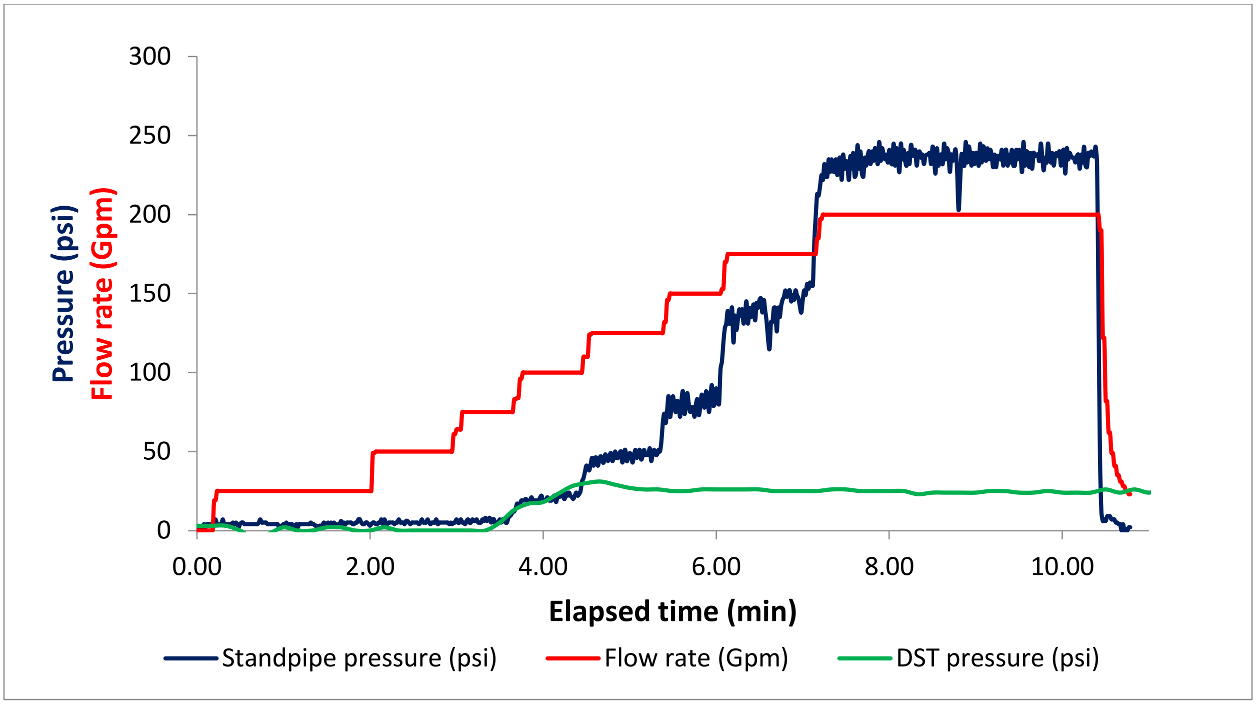


Figure 1: Flow Test 1 results. Pressure was measured at the rig floor (standpipe pressure, blue line) and inside the core liner ('DST' is acronym for 'data storage tag', which is a 'fish pill'). At a pump rate of 200 Gpm, the flow standpipe pressure is ~250 psi.

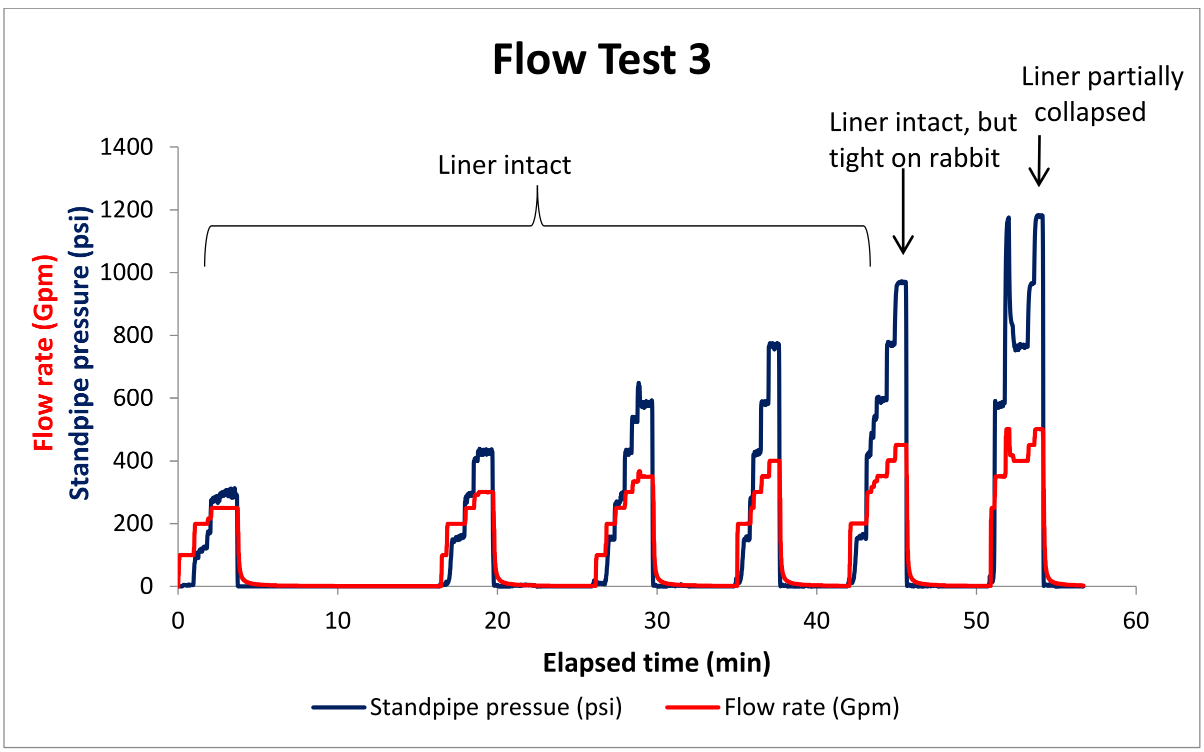


Figure 2: Flow Test 3 (liner collapse test). Flow rate in red and standpipe pressure in blue.

Between each flow rate increase, the PCTB was extracted by wireline and the core liner was examined for evidence of collapse. At 450 Gpm, the standpipe pressure was 972 psi and when the core liner was examined it was slightly deformed. At the next flow rate of 500 Gpm, the standpipe pressure was 1184 psi and the liner was found to have been collapsed when examined. No DST data were available from within the core liner.

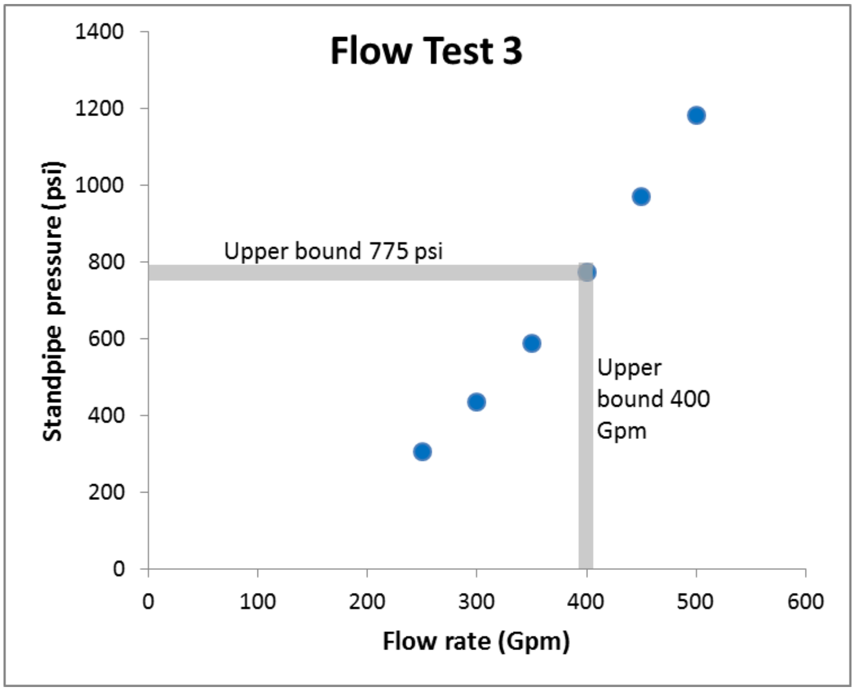


Figure 3: The results of Flow Test 3 suggest 400 Gpm is an upper bound for the PCTB cutting-shoe configuration.

A. Flow Test Discussion:

Previous Static Laboratory Collapse Tests demonstrated that above a differential pressure (between the inside and outside of the core liner) of 330 psi, the liner collapsed (Geotek Coring, Inc., 2015). A PCTB autoclave was used as the pressure vessel. In these tests, the core liner and liner tube were installed in the normal coring configuration except that the bottom of the core liner was sealed with a plug. A static hydrostatic pressure was then applied internally to the autoclave, producing a differential pressure across the core liner and liner tube. Fish pill (DST) data recorders were used to monitor the autoclave internal pressures during the tests.

The Field Dynamic Flow Test contrasts that of the Static laboratory Collapse Test because the collapsing pressure is dynamically applied by pumping down the drill string and the bottom of the core liner was not plugged. In addition, the field test was performed with the PCTB in a vertical position, while the laboratory test was performed in a horizontal position. Also, the differential pressure between the inside and outside of the liner cannot be measured directly in real time. Thus, the only real time feedback the operator has is the standpipe pressure. The standpipe pressure represents the total pressure differential between the upstream pressure at the rig floor and the annulus pressure at the rig floor. It thus includes a pressure loss due to the frictional forces of driving fluid through the entire system. If it is assumed that all of the pressure loss is due to driving fluid through the tool around the liner, the standpipe pressure may be a measure of the maximum possible differential pressure felt by the liner.

The results of Flow Tests 1 and 2 suggest that the flow rate must be kept below 200 Gpm in order for the standpipe pressure to be less than 300 psi to avoid collapsing the core liner. The cutting-shoe configuration and the face-bit configuration version of the PCTB tool behaved similarly, suggesting that bit configuration is not a major factor in the internal pressure of the PCTB. The most conservative approach would be to keep the flow rate less than 200 GPM under the assumption that all of the pressure loss is felt by the liner. During Flow Test 1, DST pressure data from within the core liner show a leveling off at 25 psi, even as the standpipe pressure approaches 300 psi, suggesting that the standpipe pressure minus 25 psi is the maximum differential pressure across the liner.

Flow Test 3 (liner collapse test) suggests that a significantly larger standpipe pressure can be applied without collapsing the liner. In this example, during the Field Dynamic Flow Test, no liner deformation was observed up to a flow rate of 400 GPM or a standpipe pressure of 770 PSI. This is perhaps an upper bound for the standpipe pressure that the tool can withstand without collapsing the core liner. At a flow rate of 500 GPM with a corresponding standpipe pressure of 1184 PSI, the liner was found to have collapsed. Upon recovery we noted that only part of the core liner had collapsed (Fig. 4), the area from the ball-valve up about 3 feet. In this section of the tool, the liner is not supported by the inner-tube when in the coring position, which allows for the pressure differential to establish between the liner and the inner-tube. This test indicates that a flow rate of 400 GPM with a corresponding stand pipe pressure of 770 psi is perhaps a true upper bound for operating the PCTB without collapsing the liner (Fig. 3).

The dramatic differences between the Static and Dynamic Flow Tests results is due to the complex fluid dynamics within the BHA and within the PCTB tool itself as fluid is pumped past and through the PCTB and out of the bit jets. Thus, the need for the empirical data generated by the Dynamic Flow Test.

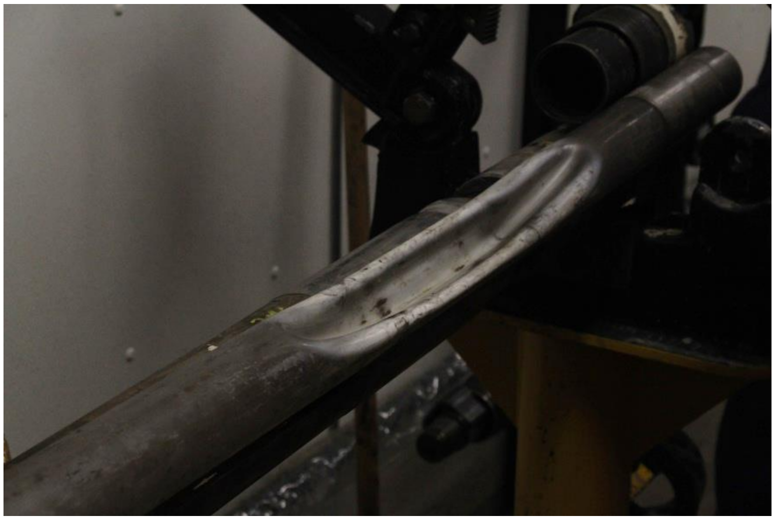


Figure 4: Collapsed liner after Flow Test 3.

3.2. Closure Tests Result:

Field Closure Tests 1 and 2 were conducted at a depth of 1871 ft. with a calculated hydrostatic pressure of 925 psi. Plots of DST data from all closure tests are available in Appendix A.

Closure Test 1: The autoclave boost was set at ~1500 psi. Upon recovery, the autoclave was found to contain 1408 psi pressure. Subsequent review of the fish pill data indicated that the autoclave boost occurred slowly over a brief period of time. This was attributed to a nearly fully closed bullet valve which restricted the hydraulic boost flow driven by the nitrogen gas charge in the accumulator. However, at no time did the autoclave pressure drop below ~800 psi.

Closure Test 2: The autoclave boost was set at ~1500 psi. Upon recovery, the autoclave was found to be at 1580 psi.

Subsequently, after four less-than-successful coring tests, two additional closure tests were conducted at a depth of 2050 ft. and a calculated hydrostatic pressure of 1010 psi.

Closure Test 3: The PCTB was deployed on wireline and actuated. The PCTB was then recovered and the autoclave maintained a pressure of 1484 psi. DST (fish pill) data indicate that the autoclave boost fired correctly but the boost was late.

Closure Test 4: The PCTB was deployed on wireline and actuated. The PCTB was then recovered and the autoclave maintained a pressure of 1486 psi (Fig. 5). DST data indicate the autoclave boost fired correctly.

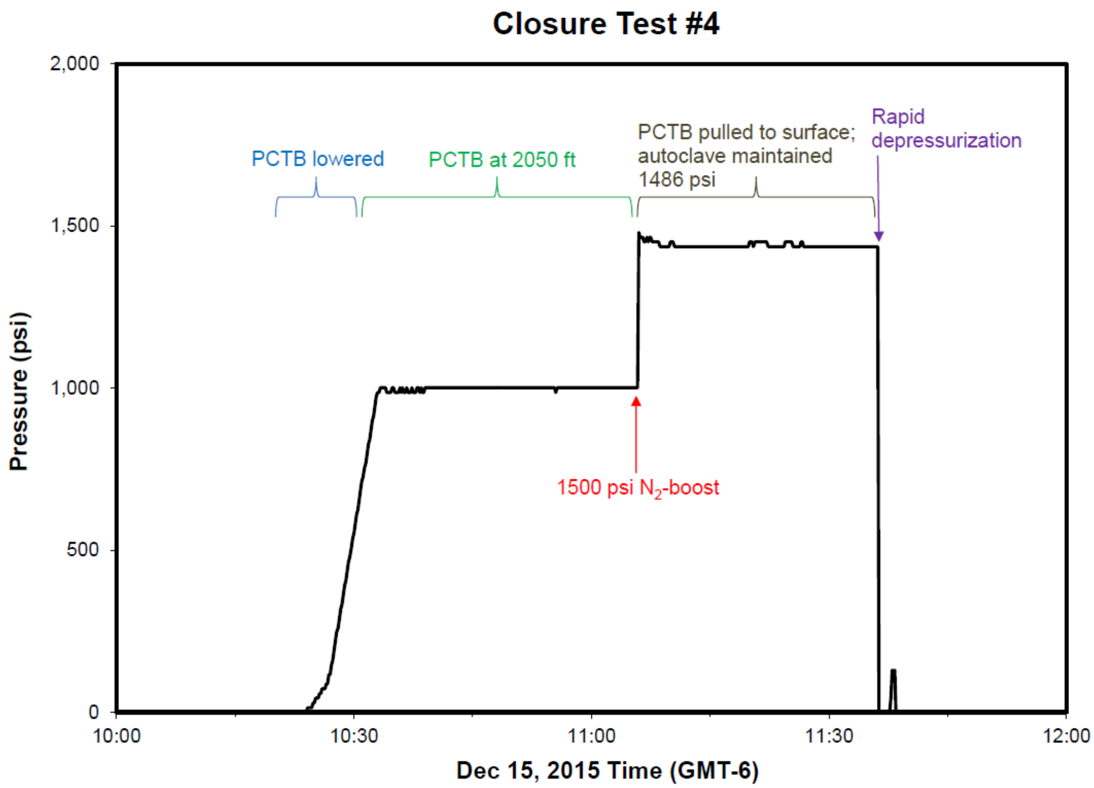


Fig 5: DST pressure from Closure Test 4.

A. Field Closure Test Discussion:

The Field Closure Test contrasts that of the Laboratory Closure Test in that the field closure test was conducted vertically, in a wellbore environment and using wireline tools to actuate the PCTB. In contrast, the laboratory closure test was conducted horizontally with simulated hydrostatic pressure and simulated wireline actuation.

Although the autoclave boost was slightly delayed during Closure Test 1, both Closure Test 1 and Closure Test 2 were able to maintain pressure at the rig floor. The success of Closure Tests 3 and 4 further demonstrate that the PCTB is functioning correctly and maintaining pressure during recovery. All closure tests were performed using the cutting-shoe configuration, so it is unclear if the late-firing issues were due to this type of configuration. Successful coring attempts using the face-bit configuration indicate that the tool functions properly in this configuration. However, it is unlikely that late-firing is influenced by cutting-shoe or face-bit configuration.

3.3. Coring Test Results:

8 coring tests in total were run; 5 in the cutting-shoe configuration and 3 in the face-bit configuration (Table 3). Plots of DST data from all coring tests except Coring Test 5 (DST failure) are available in Appendix B.

Coring Test 1: Coring began at a depth of 1938 ft. using the 9-7/8” cutting-shoe configuration, then proceeded slowly with a penetration of 5 ft. over 3 hr. The PCTB was recovered with a pressure of 1490 psi. The DST (fish pill) data show that the boost fired late while the tool was being raised up the hole, at ~100 ft. A 1.5 ft. core of silty shale to siltstone was recovered. The flow ports on the cutting-shoe were clogged and the outer edge of the core showed evidence of grinding.

Core Test 2: The hole was drilled using a center bit from 1943 ft. to 1992 ft. before attempting Coring Test 2. Core Test 2 (9-7/8” cutting-shoe configuration) cored ~3 ft. to 1995 ft. over 2 hr and when the PCTB was recovered, although the ball valve had closed, it was not sealed and the autoclave pressure was found to be 0 PSI. The seal on the ball valve was coated with mud containing angular fragments preventing a seal. 29” of core and ~ 9” of core catcher material were recovered. The DST (fish pill) data was inconclusive in that the DST worked only intermittently and there was no useful data during recovery of the core.

Core Test 3: The hole was drilled using a center-bit to the top of the Grayson Formation at 2060 ft. before attempting Coring Test 3 (9-7/8” cutting-shoe configuration). Coring began at a depth of 2060 ft., just below the expected transition from the Buda Formation limestone to the Grayson Formation mudstone and ended at a depth of 2063.8 ft after 2 hr of coring. Upon recovery, the ball valve on the PCTB was not fully closed. The PCTB did not maintain pressure due to jamming of the ball valve by rock fragments. 27” of core were recovered (60% recovery) plus additional pulverized material in the core catcher.

Core Test 4: Core Test 4 (9-7/8” cutting-shoe configuration) began at a depth of 2063.8 ft. and ended at a depth of 2069.02 ft after 1.5 hr of coring. Upon recovery, the core liner was found to be broken just above the core catcher and the ball valve was not closed. No material was present in the core liner, but the cutting-shoe and core catcher were packed by ground-up material with a polished rind.

Coring Test 5: Coring Test 5 (9-7/8” cutting-shoe configuration) began at a depth of 2069 ft. in the Grayson Formation. This test was drilled for 1 hr. with approximately half the bit weight (10,000 lb. – 14000 lb.) that was applied during the previous coring tests in an attempt to recover a short core without building up a fine paste and jamming the PCTB. Coring stopped at a depth of 2069.57 and the PCTB was recovered. The PCTB autoclave maintained a pressure of 1494 psi and no core was recovered.

Coring Test 6: Coring Test 6 began at a depth of 2069.57 ft. using the PCTB face-bit configuration and 10-5/8” face-bit and ended at a depth of 2075 ft after 45 min of coring. Upon recovery of the PCTB the ball valve was found not to have closed due to a piece of core sticking out of the core catcher. A total of 36” of rock was recovered.

Coring Test 7: Coring Test 7 began at a depth of 2075 ft. using the PCTB face-bit configuration and 10-5/8” face-bit. Coring ended at a depth of 2076.25 ft after 1 hr of coring. The ball valve closed properly following a successful twist-off of the formation, and the autoclave maintained a pressure of 1710 psi. 20” of mudstone were recovered under near the nitrogen boost set pressure.

Coring Test 8: The eighth and final coring test of the land test began at a depth of 2076.25 ft. using the same face-bit configuration as tests 6 and 7. Coring ended at a depth of 2078.38 ft. after 1 hr of coring and the PCTB recovered. The ball valve closed properly following a successful twist-off of the formation, and the autoclave maintained a pressure of 1501 psi. 29" of shale with limestone were recovered at the nitrogen boost set pressure (Fig. 6).

Coring Test	Configuration	Correct ball valve closure?	Correct N_2 boost timing?	Pressure at surface (psi)	Coring begin depth (ft)	Coring stop depth (ft)	Penetration (ft)	Core recovered (ft)	Formation
1	Cutting shoe	Y	N	1490	1938	1943	5	1.5	Eagle Ford shale
2	Cutting shoe	N	Unknown	0	1992	1995	3	2.5	Eagle Ford shale
3	Cutting shoe	N	Unknown	0	2060	2063.8	3.8	2.3	Buda Limestone
4	Cutting shoe	N	Unknown	0	2063.8	2069	5.2	0.5	Grayson shale
5	Cutting shoe	Y	Unknown	1494	2069	2069.6	0.6	0	Grayson shale
6	Face bit	N	Unknown	0	2069.6	2075	5.4	3	Grayson shale
7	Face bit	Y	Y	1710	2075	2076.3	1.3	1.6	Grayson shale
8	Face bit	Y	Y	1501	2076.3	2078.4	2.1	2.4	Grayson shale

Table 3: Coring summary noting the configuration, success of pressure boost/ball valve operation, pressure on recovery, coring intervals (in feet below rig floor), and penetration depths.

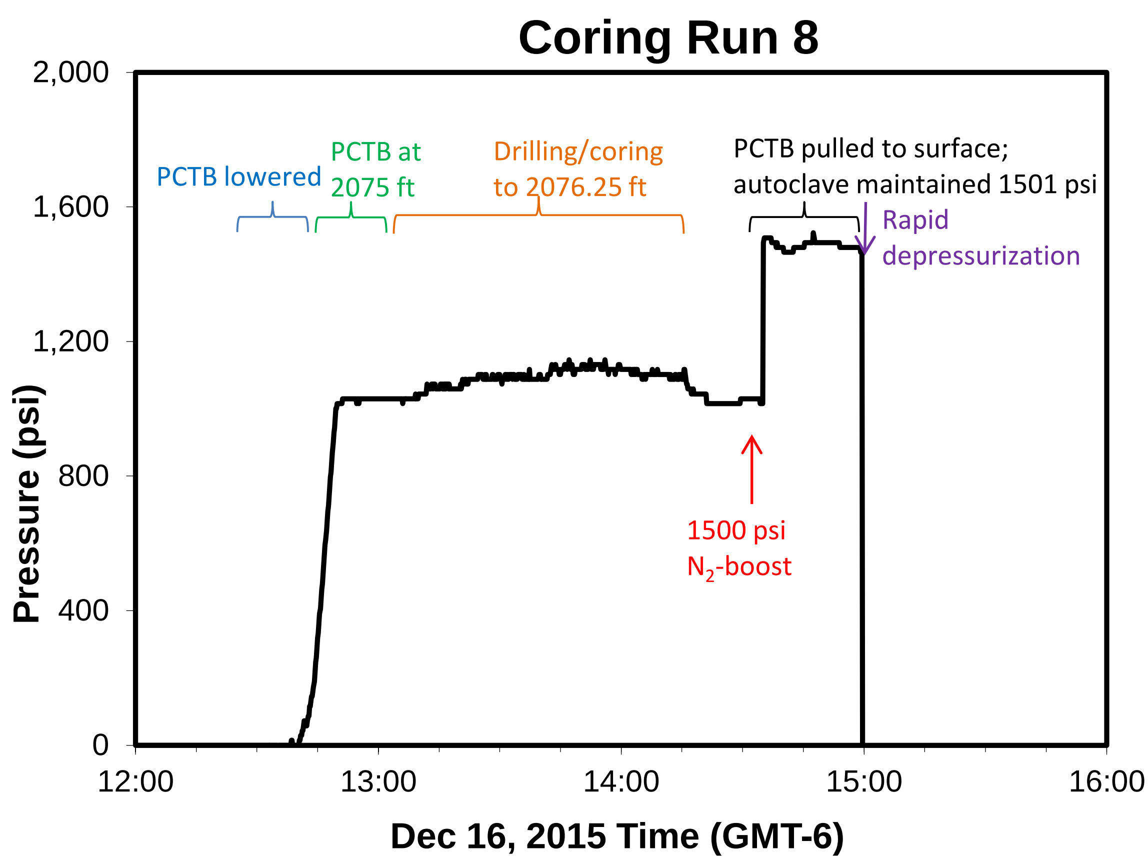


Fig 6: Successful operation of Coring Test 8.

A. Coring Test Discussion

The first two Coring Tests were made in the relatively soft mudrock of the Eagle Ford Formation. Coring Test 3 was performed at the base of the limestone Buda Formation, and Coring Tests 4 through 8 were made in the marlstone and interbedded mudstone and limestone of the Grayson formation (Fig. 7).

Overall, coring rates were very low during each the Coring Tests (Fig. 8). Penetration rates did not differ by PCTB configuration. Coring Tests 1 through 5 were made with the cutting-shoe configuration, in the clay-rich Eagle Ford Formation and the more carbonate-rich Buda and Grayson Formations. (Fig. 7). A core was recovered at boosted pressure during Coring Test 1; however, the N_2 boost occurred near the rig floor after the core had nearly dropped to atmospheric pressure. Several attempts were made to drill down to more favorable formations without an increase in successful coring using the cutting-shoe configuration. Bit-balling and jet-plugging were problematic in the cutting-shoe configuration, but the problem appeared to be lessened in the carbonate formations. In Core 3, after coring the most carbonate-rich interval of the test, the PCTB recovered an intact core, but without proper ball valve closure. As the amount of clay increased again in Cores 4 and 5, recovery dropped drastically. Slow penetration rates persisted in the hard carbonate-rich rock, and jamming of the ball valve continued to be an issue. After the liner collapse tests, the flow rates during Coring Tests 4 and 5 were increased up to 300 Gpm from 225 Gpm in previous tests. Even with increased flow rates in Coring Test 5, these issues persisted.

Based on these results, and the previous and successful face-bit coring results using the JOGMEC HPCT III in this same hole, the decision was made to change over to the PCTB face-bit configuration. Flow rates up to 250 Gpm were used during the face-bit Coring Tests. Successful Coring Tests 7 and 8, indicate that the face-bit configuration is a better choice for these formations. Bit-balling was not observed when coring in the face-bit configuration, even with lower flow rates compared to Coring Tests 4 and 5. This occurred despite the fact that some of the rock was a relatively soft mudstone. Although penetration rates remained slow in the face-bit configuration, core recovery was high.

If a successful run is defined as recovering intact core and maintaining in situ or boosted pressure back to the surface, then only Coring Tests 7 and 8 were completely successful. Other runs recovered core without maintaining pressure, maintained pressure but recovered no core, or maintained core under pressure but fired after the core barrel was pulled off the bottom. In the end, 2 of the 3 face-bit configuration Coring Tests were completely successful, but 0 of 5 in the cutting-shoe configuration were completely successful. It is clear that in these consolidated, lithified formations the face-bit is the most appropriate configuration.

These successful coring tests also indicate that the improvements to the PCTB have increased the tools overall reliability considerably. Although the formations being cored were not ideal, much was learned regarding the overall operation of the PCTB and an increased confidence in the tool was gained. Late firing was an issue in 1 of the 8 Coring Tests; however, in 5 tests there were problems with ball valve closure or DST measurements that leave uncertainty in the timing of the N_2 boost, and it is not known if the N_2 boost occurred at the correct time.

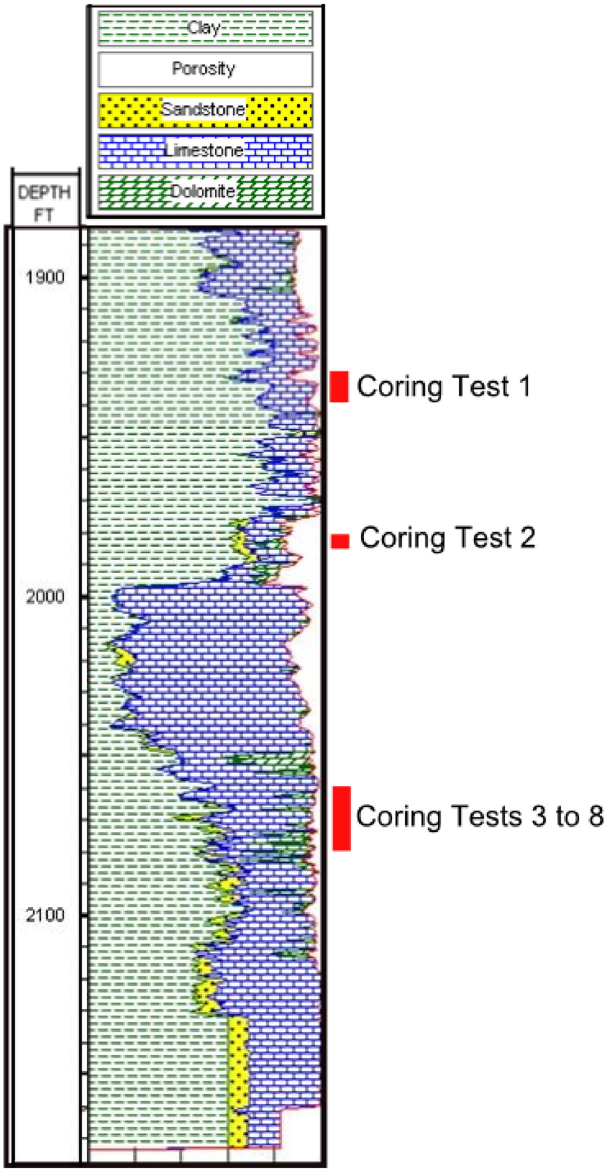


Figure 7: Depths of coring tests plotted with lithology. Lithologic logs from the Cameron Test and Training Facility were provided by Schlumberger.

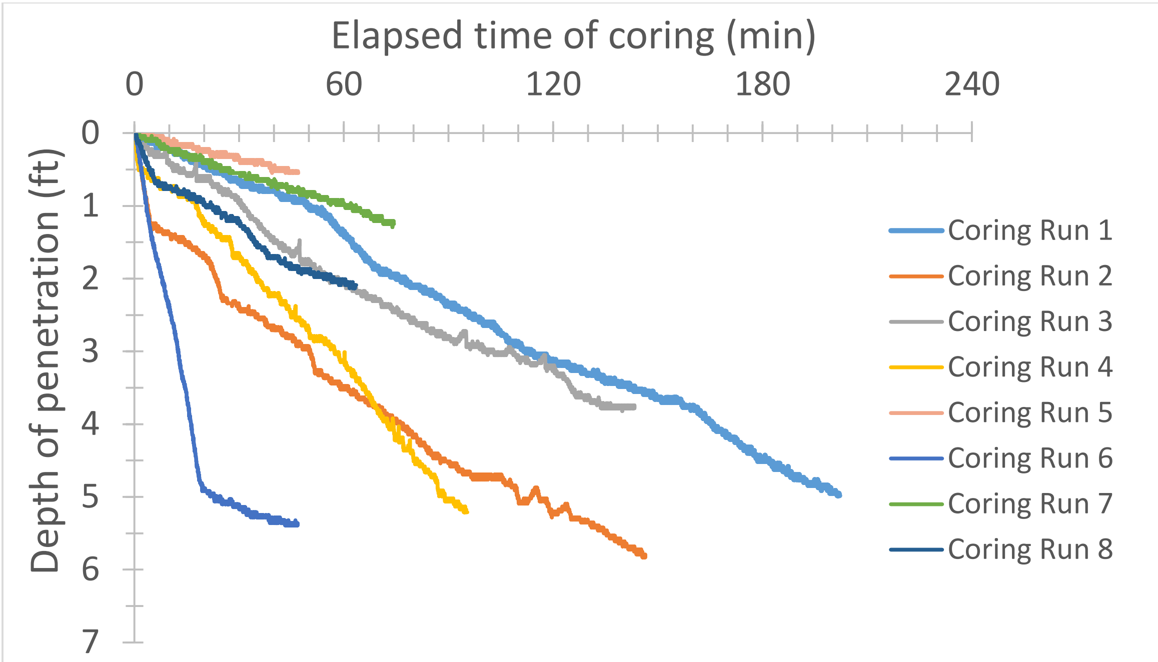


Figure 8: Depth versus penetration for all coring tests.

4. Summation

The PCTB Land Test provided additional operational experience with the PCTB tool in an actual wellbore environment. The results indicate that the PCTB is a reliable tool. Penetration rates were low at this location due to bit-balling during coring of mudstone and due to the hardness of carbonate rocks. The test results also suggest that the liner can withstand a higher operational pressure than was previously thought, which will allow for the use of a higher flow rate.

The following issues will be examined further. First, the tool design will be studied to determine if there are possible modifications that will improve the reliability of the nitrogen boost. Second, the cutting-shoe configuration will be examined to determine if there is any way to reduce bit-bit balling and poor recovery.

Finally, the cutting-shoe tool has the distinct operational advantage that it can be used with other downhole tools during drilling. In contrast, the face-bit tool cannot accommodate other tools. This operational efficiency is contrasted with the improved recovery demonstrated by the face-bit configuration. Finally, it should be remembered that the intervals of marine gas hydrate that will be drilled may have very different properties than the rocks drilled at Cameron and may pose a different set of challenges than was encountered in the formations in Cameron.

5. GOM^2 PCTB Land Test at the Cameron Test and Training Facility Daily Reports

5.1. Daily Report for December 8, 2015

Preparations for the PCTB land test began on 12/8/2015, one day early due to the faster-than-expected completion of JOGMEC HPCT testing.

The 6⅝" drill pipes were laid out and 22 stands of 5" drill pipes were made up and stood up in the derrick. The face-bit bottom-hole assembly was assembled. It was discovered that the DOE vans do not have any sinker bars. The Japanese sinker bars were used for this test because they are compatible with DOE wireline tools, and will be used for testing. Geotek does not have a bit seal for the bits. One will be shipped overnight, scheduled to arrive mid-day on December 9. Electricity, air, and water were connected to the PCTB service van. Work stopped at approximately 19:30.

5.2. Daily Report for December 9, 2015

Work with the PCTB tool began at approximately 10:00. Initial configuration of the tool within the bottom-hole assembly at 11:00 revealed a spacing issue in which the PCTB was ¾" too long, which prevented proper latching of the tool with the wireline. By 15:00, the bit seal had arrived and was installed. By 16:00 the tool was adjusted in length and the spacing was too short, and only ¼" of adjustment was necessary. After lengthening the tool by ½", it was sufficient to move forward with configuration with the 10 ⅝" face-bit.

The first flow test began at 17:00, ramping up the flow rate by 50 GPM increments to 200 GPM, increasing standpipe pressures to 246 psi. Examination of the core liner after the test showed no collapse. The second flow test was configured with a 9⅞" cutting-shoe bit, and the test began after dinner, at approximately 19:00. The flow was increased again with 50 GPM increments to 200 GPM, reaching a standpipe pressure of 236 psi. The flow was further increased to 213 GPM reaching a pressure of 283 psi. The results of these tests suggest a 200 GPM flow rate as an upper bound for both configurations. Work ended at approximately 20:00.

We also obtained a sample rig data from Schlumberger to ensure we could import and read the data properly. We were able to successfully open the data.

5.3. Daily Report for December 10, 2015

The bottom hole assembly was lowered to 1871 ft. for the first Closure Test at approximately 08:40. The Closure Test will test the overall function of the tool without actually coring. This includes the following:

- fully exercising the wireline tools: running the core barrel on wireline, actuating the tool (the mechanical pull actuates the tool), and recovering the core barrel.

- testing the autoclave pressure boost feature, testing the pressure-retaining capability, and confirming the overall mechanical function of the tool.

Closure Test 1: Operational time from 07:00hr to 11:00hr. The PCTB cutting-shoe version run into hole on wireline at 10:10. It was latched into the BHA. The running tool was recovered and then the PCTB recovery tool was run into the hole. The tool latched onto the PCTB and the tool was brought to the surface. The core barrel was recovered at 11:20.The DST (fish pill) data record an initial modest pressure drop (~100 psi) followed by a slow pressure build over ~40 minutes. The final pressure reached was 1408 psi before the tool was opened. The slow pressure build up was attributed to a bullet valve that was not fully open that slowed the boost. The expected downhole pressure was 924 psi (hydrostatic pressure calculated with a 9.5 PPG mud). The nitrogen pressure boost to a total of 1500 psi and therefore the ideal pressure that would be recovered in the pressure core would be approximately 1500 psi not accounting for any changes due to temperature.

Closure Test 2-First Lowering: Operational time: 13:00hr to 15:00hr (similar setup to Closure Test 1). The PCTB-cutting-shoe version was run in on wireline. However, the PCTB could not pass the bore-seal of the BHA. Tool was recovered to surface and one of the valve ports in the pressure section had backed off and was scraping along the inside of the drill pipe. The tool was returned to the service van to tighten the valve port.

Closure Test 2- Second Lowering: Operational time from 15:00hr to 16:00hr (similar setup to Closure Test 1). BHA set at 1871 ft. The PCTB-cutting-shoe version was run in on wireline at 15:35. The PCTB latched into the BHA and released – normal operation, no running in or latching problems. The PCTB was recovered with PCTB recovery tool. No tripping problems. The core barrel was recovered at 16:10. Upon recovery the ball valve was closed with internal pressure of 1580 psi (boost set pressure at 1500 psi), and boost section still had pressure. The DST (fish pill) data indicated that the pressure boost (and therefore the closing of the ball valve) reached approximately 1500 psi which dropped to 1408 psi just before the tool was opened.

Coring Test 1: Operational time 16:30hr to 21:00 hr. BHA set at 1871 ft. at start of test. At 17:50, the BHA reached the bottom of the hole to begin drilling at 1938 ft. for the first coring test. The PCTB was then lowered by wireline into the hole. Coring began at 17:30. Drilling then proceeded slowly, with a penetration of 5 ft. over 3 hr. The PCTB was recovered at 22:00 with a pressure of 1490 psi. The PCTB was recovered at 22:00 with a pressure of 1490 psi. The DST (fish pill) data show that the boost fired late while the tool was being raised up the hole, at around 100’ MD. A 1.5 ft. core of silty shale to siltstone was recovered. The flow ports on the cutting-shoe were clogged and the outer edge of the core showed evidence of grinding.

5.4. Daily Report for December 11&12, 2015

Work began at 08:00 with cleaning the drill bit at the rig floor. Core 1P, recovered during the previous night, was cut in the liner, labeled, capped, and boxed. UT helped cut, box, and label JOGMEC cores.

Drilling with cutting-shoe-version and center bit from 1953'MD began at 11:30. The goal was to drill out of the Eagle Ford Shale to the underlying Buda Limestone and Grayson Formation, which was felt to be a more appropriate lithology for coring.

Drilling ceased at 17:10 at a depth of 1992 ft. It was felt that this location, although still within the Eagle Ford Shale, offered the potential of a better pressure core. The center bit was recovered at 17:50 and the PCTB was rigged on the wireline at 18:20. Coring for Core 2P began at 19:00. Coring ceased at 21:30. The PCTB was recovered with some pressure at the rig floor (inferred from the mechanical status of the tool) but although the ball valve had fired it was not sealed and fluid was observed leaking from around the ball valve seal. On connection to the pressure read out device in the service van the pressure was found to be 0 PSI. The seal on the ball valve was coated with mud containing angular fragments. 29" of core and ~ 9" of core catcher material were recovered. The outer surface of the core appeared to be grinded and coated with a rind of mud. The DST (fish pill) data indicated that the pressure boost (and therefore the closing of the ball valve) occurred near to the rig floor, perhaps during handling. The DST data is incomplete during the recovery phase of the tool (pressure drop outs) but the boost generated at least 170 PSI in the autoclave despite the leaking ball valve.

At 12/11/2015 24:00 hr., drilled out with cutting-shoe-version and center bit. Operational time from 12/12/15 00:25 hr. to 12/12/15 05:20. RIH center-bit on wireline, no deployment problem. Spud into formation at 12/12/2015 00:25hr at a depth of 1997.85 ft. MD. Drilling parameters at spud included weight on bit to 18,000 lbs., pump rate 400 GPM, pump pressure up to about 210 psi; torque variable ranging from 300-500 ft-lb.

The top of the Buda Limestone was encountered on 12/12/15 00:48 hr. at 1998.9 ft. MD. This was marked by a significant and sustained increase in the measured DS torque. The drilling torques became highly variable ranging from 800 to greater than 6000 ft-lb. Weight on bit at a constant of about 17,000 lbs., pump rate 400 GPM, pump pressure up to about 210 psi. Penetration rates increased significantly to as high as 23 ft. /hr.

Reached the target of the top of the Grayson Formation 2060' MD at around12/12/15 05:20 with an ROP varying around a little but up at around 20 ft. /hr., particularly in the lower section. Bit was then returned to surface and is very clean.
Operations ceased at 12/12/15 07:00.

5.5. Daily Report for December 14, 2015

Start 07:00 hr., end of operations 01:00 hr. (next day, 12/15/2015).

From the morning of 12-Dec-2015, the entire drill string and BHA was recovered and stacked in the rig. Inspected the bit from Saturday (12/12/15) morning's drilling and found to be in good shape. Retrieved center bit and then lowered the bit to 2050 ft. for the next coring run.

Coring Test 3: BHA set at 2047 ft. MD at start of test. PCTB cutting-shoe version was run into the BHA. The BHA was then lowered and coring began at 2060.00 ft. Coring began at 10:45 at a depth of 2060 ft., just below the expected transition from the Buda Formation limestone to the Grayson Formation mudstone. Coring stopped at 13:03 at a depth of 2063.8 ft. after a total of 3.8 ft. was drilled. Upon recovery, the ball valve on the PCTB was not fully closed. The PCTB did not maintain pressure, due to the jamming of the ball valve by rock fragments. 27" of core were recovered (60% recovery) plus additional pulverized material in the core catcher. Core 3P recorded a transition from limestone to marlstone containing limestone rip-up clasts.

Pump Test: Decision was made to move ahead with plan to test the upper limits of internal working pressures of the PCTB. The drill string was tripped in preparation for a liner collapse test to determine the maximum flow rate that will not collapse the liner. The goal of increasing flow rates was to enhance the clearing of material around the bit, increasing the speed of drilling and improving core recovery.

Flow rate (GPM)	Standpipe Pressure (psi)	Comments
250	308	
300	437	
350	590	
400	775	
450	972	Liner a little snug on rabbit
500	1184	Liner collapsed

A series of flow tests were performed starting at 16:20 by increasing the maximum flow rate in 50 GPM increments and then checking the condition of the liner after each flow increase. The liner showed no sign of collapse up through a flow rate of 400 GPM with a corresponding pressure of 775 psi. At 450 GPM (972 psi), the liner showed signs of slight collapse and at 500 GPM (1184 psi) the liner fully collapsed near the ball valve. It was determined that the liner could safely withstand pressures associated with flow rates of 350 GPM, with some uncertainty of how core in the liner will affect the pressure differential across the liner.

Coring Test 4: The second coring run of the day (Core 4P) began at 21:00 from a depth of 2063.8 ft. with a flow in rate of 275 GPM. At 21:15 at a depth of 2064.5, the flow rate was increased to 300 GPM. At 22:35, coring was stopped at a depth of 2069.02 ft. Recovered tool without any problem. Upon recovery, the core liner was found to be broken just above the core catcher and the ball valve was not closed. It is speculated that the core catcher ripped off the liner during pull off of the tool, preventing the ball valve from closing. No material was present in the core liner, but the cutting-shoe and core catcher were packed by ground-up material with a polished rind. Recovered about 1.0 ft. of core, consisting of well lithified carbonate and carbonate-cemented mudstone. The cutting-shoe was filled with welded sediment and some mud caking, but the ports were open.

Operations ceased at 12/14/2015 01:00.

5.6. Daily Report for December 15, 2015

Start: 07:00 hr., end of operations: 21:30

Closure Test 3: The PCTB was deployed starting at 08:30 for Closure Test 3. The PCTB was recovered at 09:35 and the autoclave maintained a pressure of 1484 psi. DST (fish pill) data indicate that N-boost fired correctly at the 2050 ft. testing depth.

Closure Test 4: The PCTB was deployed for Closure Test #4 at 10:25. The PCTB was recovered at 11:35 with an autoclave pressure of 1486 psi. Again, the DST data indicate the N-boost fired at the target depth. These tests demonstrate the functionality of the PCTB tool in actuating at the correct depth and maintaining pressure during recovery. The small variation in autoclave pressures from 1500 psi is likely driven by temperature changes between the borehole and the surface.

Coring Test 5: Coring Test 5 began at 13:30 from a depth of 2069 ft. in the Grayson Formation with a flow in rate of 250 GPM. This run was drilled for 1 hr. with approximately half the bit weight compared to previous runs, in an attempt to recover a short core without building up a fine paste and jamming the PCTB. Drilling stopped at 14:30 at a depth of 2069.57. The PCTB autoclave maintained a pressure of 1494 psi, but with zero core recovery.

After Coring Test 5, the bit was switched to a 10⅝" bit. At 17:50, a spacing test of the PCTB in the face-bit configuration indicated no problems with spacing or latching. The hole was reamed down to the bottom of the hole using the 10⅝" bit by approximately 21:30.

5.7. Daily Report for December 16, 2015

Start time: 05:30. End of operations: 15:30.

Coring Test 6: Coring Test 6 began at 06:22 at a depth of 2069.57 ft using the face-bit configuration, with an 8 klb bit weight and 250 Gpm flow rate. 5 ft of Grayson Formation were penetrated by 06:35. Rate of penetration went to zero at 06:42. From 06:42 to 07:00 there was little to no penetration. At 07:03 coring ended at a depth of 2075 ft. At 07:45 the PCTB was recovered. The ball valve did not close due to a piece of core sticking out of the core catcher. 36” of rock was recovered in core 6P, primarily fissile shale with a transition to a hard carbonate-cemented mudstone at the base of the core.

Coring Test 7: Coring Test 7 began at 09:00 from a depth of 2075 ft using the face-bit configuration, with an 8-10 klb bit weight and 250 Gpm flow rate. Coring ended at 10:10 at a depth of 2076.25 ft. The PCTB was recovered at 10:45. The PCTB ball valve closed properly following a successful twist-off of the formation, and the autoclave maintained a pressure of 1710 psi. 20” of mudstone were recovered in core 7P with a spiral fracture visible at the bottom of the core. The mudstone appeared to be carbonate-cemented, but was not nearly as hard as the rock in the bottom of core 6P.

Coring Test 8: The eighth and final coring run of the land test began at 13:17 from a depth of 2076.25 ft, using the same configuration as Runs 6 and 7. Coring ended at 14:21 at a depth of 2078.38 ft. The PCTB was recovered at 14:45. The PCTB ball valve closed properly following a successful twist-off of the formation, and the autoclave maintained a pressure of 1501 psi. 29” of shale with limestone were recovered in core 8P with the twisted-off surface visible at the bottom of the core. The top of core 8P appeared to match the fractured surface at the bottom of core 7P.

Coring Runs 7 and 8 successfully demonstrated the functionality of the PCTB to maintain a core under pressure.

6. References:

Geotek Coring, Inc. (2015), Hybrid Pressure Coring System (PCTB) 2015 Laboratory Test Program Final Report, September 30, 2015.

Appendix A: Closure Test DST plots

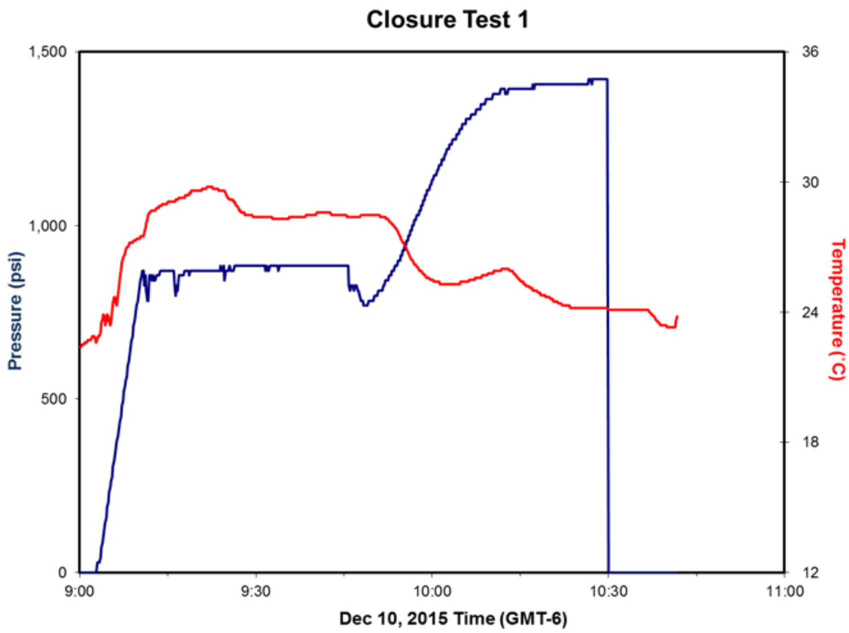


Figure A1: DST data from Closure Test 1.

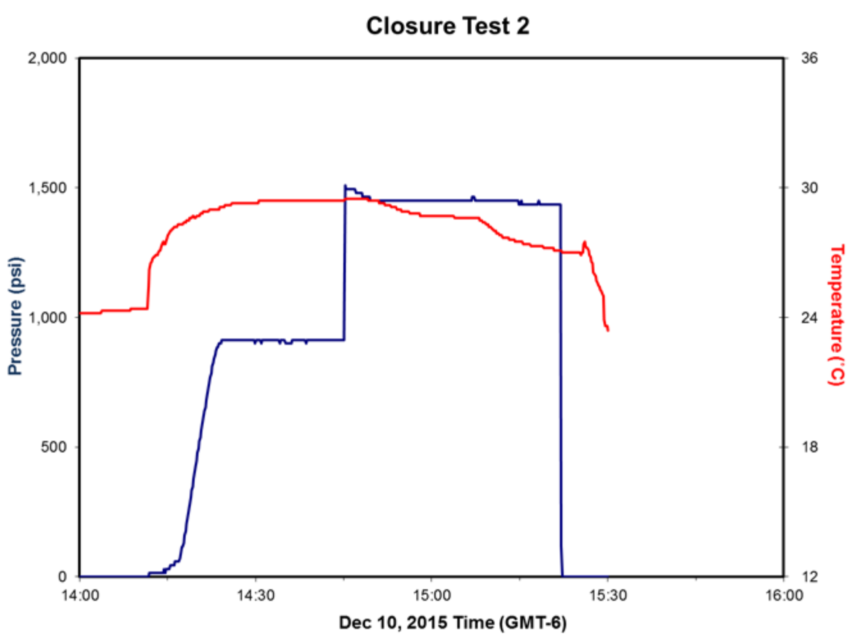


Figure A2: DST data from Closure Test 2.

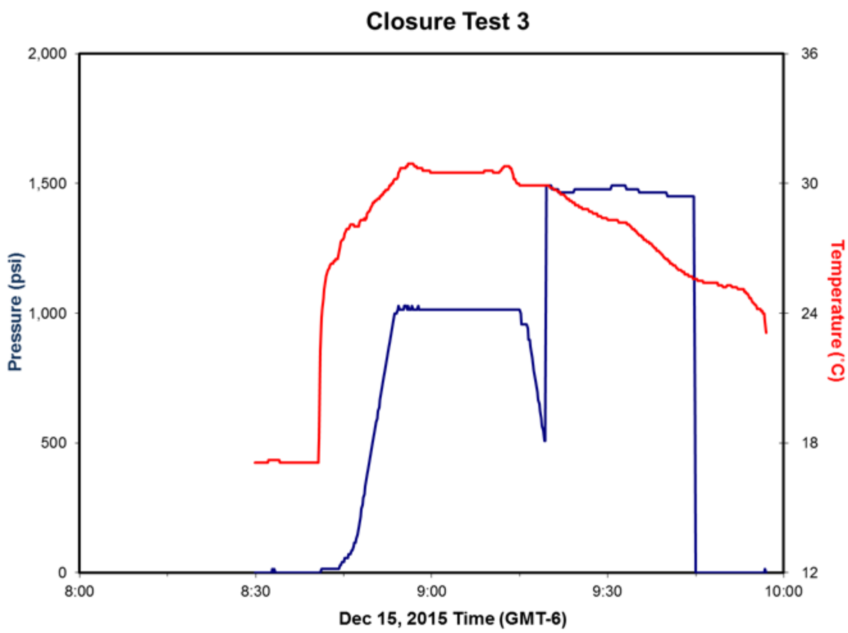


Figure A3: DST data from Closure Test 3.

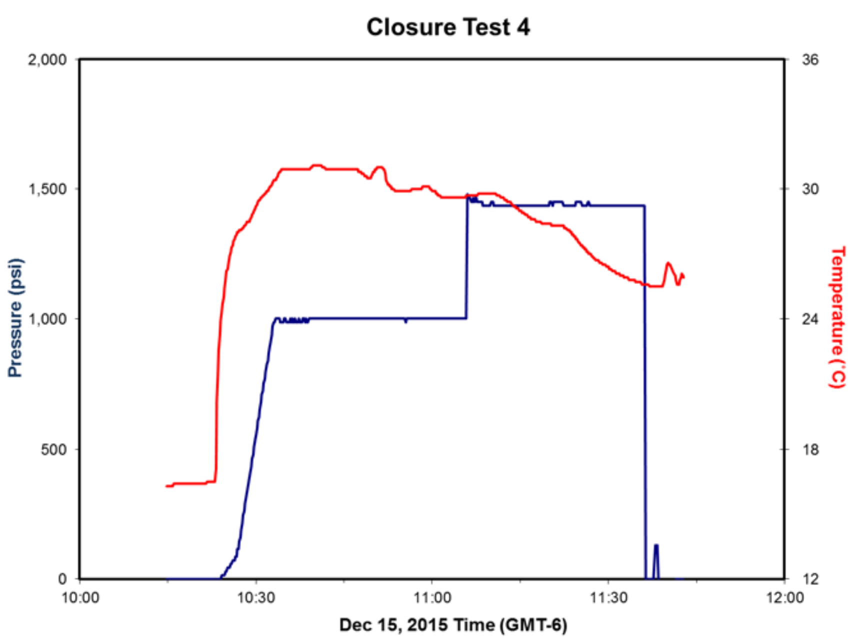


Figure A4: DST data from Closure Test 4.

Appendix B: Coring Test DST plots

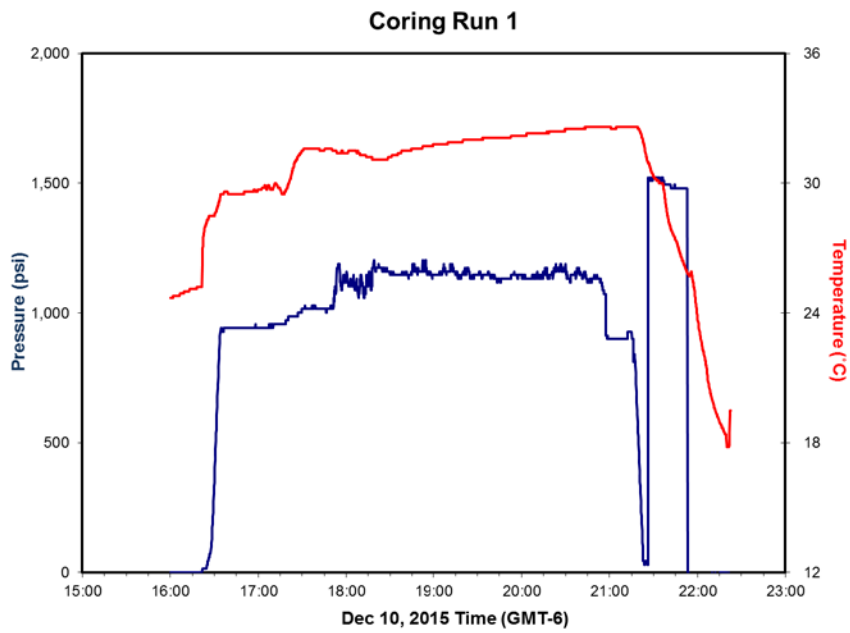


Figure B1: DST data from Coring Run 1.

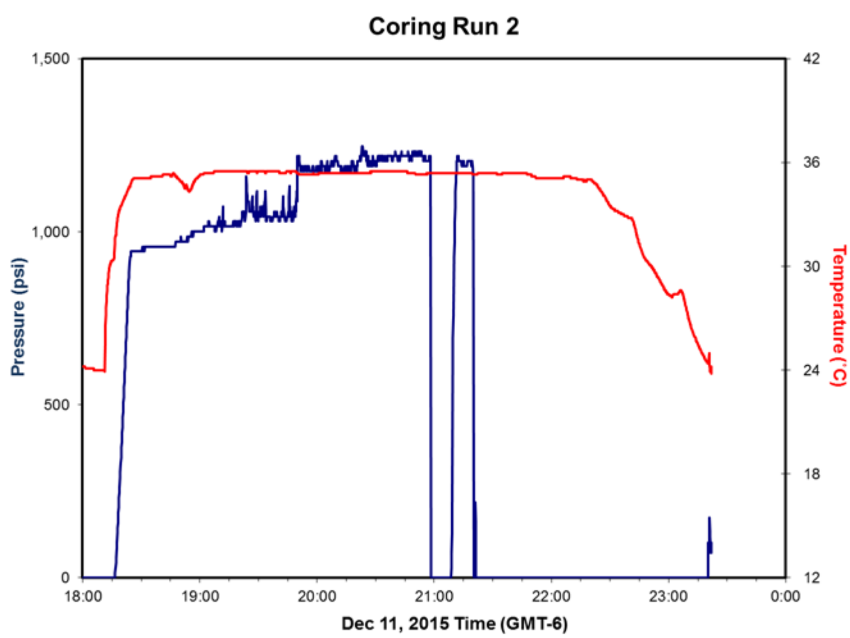


Figure B2: DST data from Coring Run 2. Note the dropouts in data starting at 21:00.

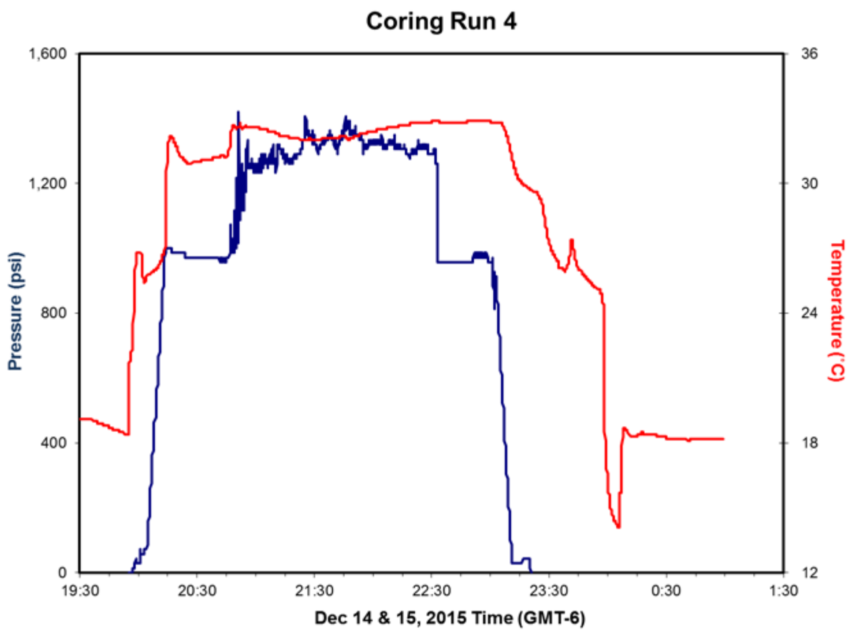


Figure B3: DST data from Coring Run 4.

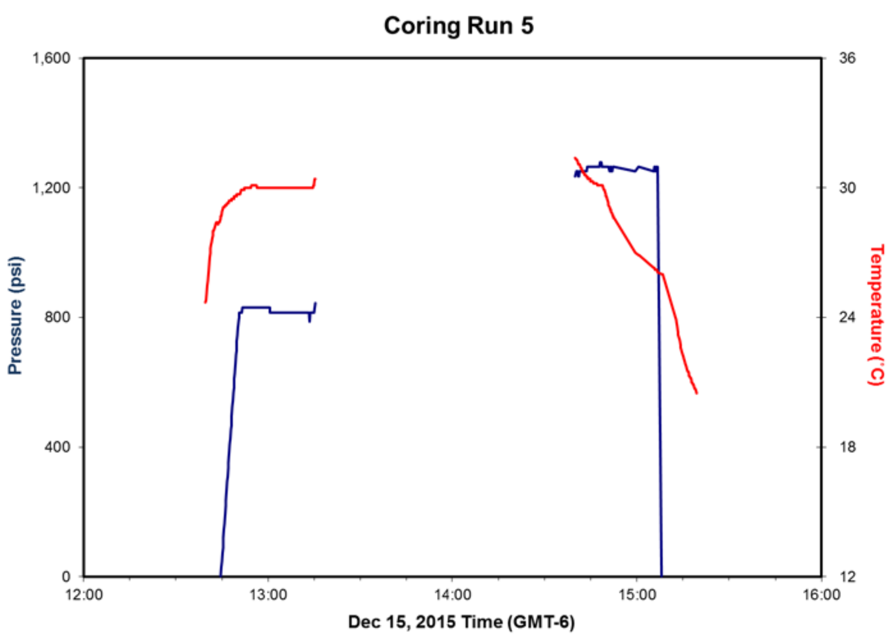


Figure B4: DST data from Coring Run 5. There is a drop out of data in the middle of the run.

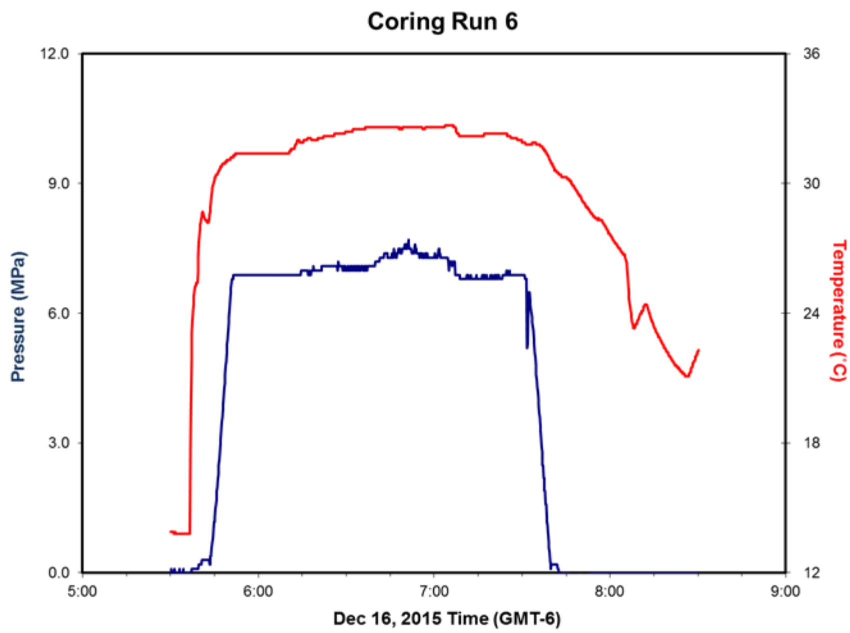


Figure B5: DST data from Coring Run 6.

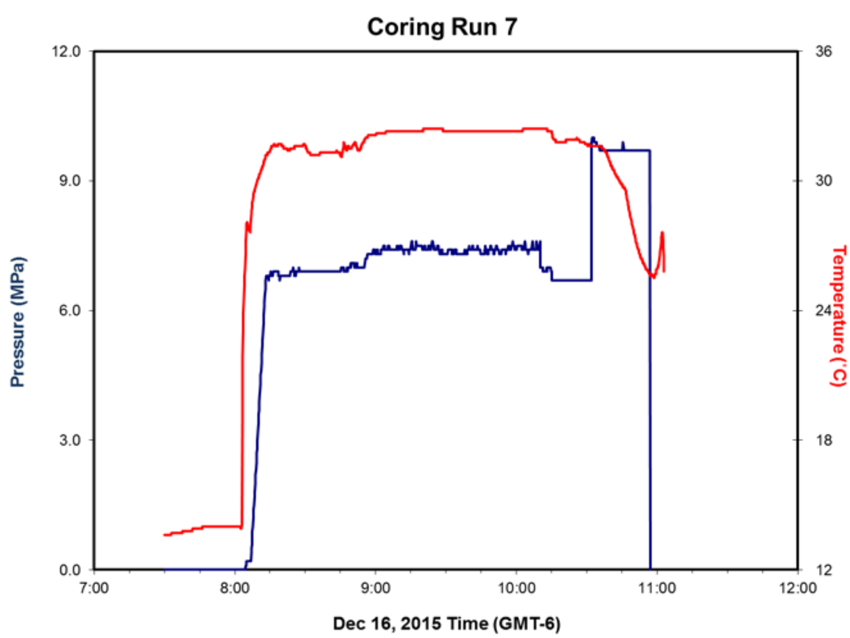


Figure B6: DST data from Coring Run 7.

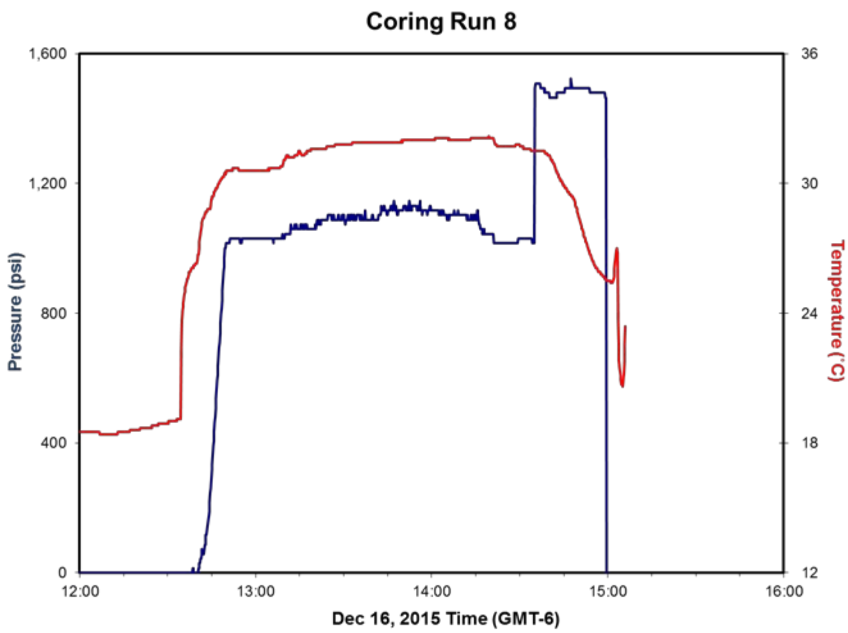


Figure B7" DST data from Coring Run 8

Appendix C: Core Photos

Figure C1: Core 1

Figure C2: Core 2

Figure C3: Core 6

Figure C4: Core 7

Figure C5: Core 8

APPENDIX B

HYBRID PRESSURE CORING TOOL WITH BALL VALVE (PCTB) 2015 LAND TEST PROGRAM

HYBRID PRESSURE CORING TOOL WITH BALL VALVE (PCTB)

2015 LAND TEST PROGRAM

GEOTEK LTD DOCUMENT NO. UT1-2016 (R1)

PREPARED FOR:

UNIVERSITY OF TEXAS

PREPARED BY:

GEOTEK CORING INC
2698 South Redwood Rd, Suite N,
West Valley City,
Utah 84119.
United States

T: +1 801 631 2874
F: +1 801 886 9040
E: info@geotekcoring.com
W: www.geotekcoring.com

ISSUE	REPORT STATUS	PREPARED	APPROVED	DATE
R1	Final Report	SR/JA/JR	JA/PS	02-Feb-2016

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1. EXECUTIVE SUMMARY

The Pressure Coring Temperature Barrel (PCTB) is an improved version of the original PCTB core barrel that was developed by Aumann & Associates, Inc. This PCTB tool was developed in 2013 and tested that year in offshore coring in China. The next year it was again tested at the Catoosa Test Facility for the DoE. During further development the PCTB was utilized successfully to recover methane hydrate bearing cores during operations offshore Japan and China in 2015. The PCTB tool is a wireline retrievable system designed to recover a 2.00 in. diameter x 3.0 m long core at pressures up to 5000 psi. It is also compatible with, and can transfer pressurized cores to the Geotek Pressure Core Analysis and Transfer System (PCATS) for analysis of the core under pressure thereby preventing loss of pressure sensitive materials such as methane hydrate, expanding gas, oil or other fluids as well as changes in mechanical properties due to pressure reduction.

The PCTB Onshore Test Program at the Schlumberger Cameron Test and Training Facility (CTTF) was designed to test the effectiveness and efficiency of drilling and coring with the new PCTB pressure core barrel and as a qualification test prior to proposed 2017 offshore operations for the DoE-UT in the Gulf of Mexico. The CTTF test program did, in fact, fully confirm that the tools are "fit for purpose" for future offshore coring operations as detailed in this report. The test program ran according to the 9 day planned schedule, commencing December 9, 2015 with rig-up, December 10 with first core, and continued through final core on December 16 and rig-down, December 17. All equipment was shipped off site by December 18.

The tool testing proved full acceptability of the PCTB for future offshore coring work. A few minor challenges did arise but were overcome as described in this report. A clear risk mitigation plan is also presented.

2. PROJECT GOALS & RESULTS

Testing goals were all fully accomplished, included the following:

- Prove recent tool improvements – complete. New parts were run and found to be fit for purpose, including: a shorter inner tube, combination catcher (flapper-slip, basket-slip, etc.), skirted spring core catcher, smaller diameter bit, and stabilizer above bit.
- Perform full function downhole land pressure test of the PCTB under controlled test conditions at Schlumberger Cameron Test Facility - completed.
    - Eight cores were taken, two center bit intervals were drilled and two additional downhole operational tests were conducted. 60% of the tests brought back full pressure (five out of the last six runs had full pressure). One was retrieved with core in the ball valve and it was suggested that, due to core jamming, two others may have had core in the ball valve when they were activated.
    - One of the eight cores drilled failed to retrieve a sample due to the short length of core drilled. Of the other seven, they averaged recovery of 66%. This was not primarily related to core barrel functionality but to the formations cored. With the very hard sandstone and shale lithology and low ROP, the drillers tended to apply very high WOB possibly causing core jamming in the shoe. As discussed below, the cutting shoe bit design may have balled up with the shale also reducing ROP.

- Coring capability in formation lithology as similar as possible to what may be seen downhole in expected deep-water applications: sand, limestone, clay. Coring start depth selected at CTTF to match formations – completed. Coring started at depth-below-rotary of 1,948 ft. Based on visual inspection as well as lithology logs, the tests included coring through competent shale, limestone, and medium to hard sandstone. These formations will not be encountered in the Gulf of Mexico in gas hydrate coring but less competent sands are more likely.

  - Tim Collett stated in a memo dated 8/30/15 that "the failure mode of most concern to our plans in the GOM are the failures we observed in the Area-B sites where we experienced a significant drop in the core system performance in thick, relatively massive, sand units with high gas hydrate saturations. This is a reservoir type that we must be able to sample with a relatively high degree of success." During this test program at CTTF we proved good function of the PCTB coring system in thick, massive medium and hard sand and shale formations. Though no methane hydrate was present, and the penetration rates were much less than hoped for, the core barrel functioned as designed, recovering 94% core on the last three cores with the face bit and full pressure on five of the last six runs.

- Test new core catchers including basket catcher, slip (spring) catcher, and combination arrangements as needed – completed. Tested the following combinations of core catchers: basket + slip; basket alone; and slip alone. Skirted slip catchers were used except on Core #7 which used a non-skirted slip catcher. Although flapper catcher combinations were successful in the previous JOGMEC testing, it was decided to only test those catchers most appropriate for harder formation coring – hence the emphasis on slip catcher trials. Core was missing on some runs but the cause could not be determined: core falling out or being ground up after jamming in the barrel. Some cores were seen to be jammed in the shoe. No catcher problems were specifically identified in any cores with one exception.

  - On Core #5 there was no core recovery. This was likely due to only coring one ft., only six inches of which would have protruded above the catcher. In the sometimes fractured shale it is likely that the short length of core in/above the catcher disintegrated and was not held. That combination of circumstances (very short, possibly fractured core in a slip catcher) apparently led to the loss of core in this case. If used, a flapper or basket catcher may have retained parts of that core.

  - It was also observed that in the final test, the slip or spring catcher twisted from friction with the core and was carried a few feet into the liner. This did, in no way, affect the function of the catcher to prevent the full core from entering the barrel or allow it to fall out.

- Provide pressure vs. flow characterization of pressure core barrel through flow testing and determine pressure and flow rate required to collapse the liner – completed. In order to provide this characterization the core barrel was lowered below rig floor and circulation established. The prescribed flow rate was applied and the standpipe pressure (SPP) recorded. The core barrel was then raised above the rig floor far enough to insert an 11.5 ft. long probe into the bit. This was long enough to reach through the entire liner and verify whether it was collapsed or not. The results are tabulated below. The liner was suspected to partially collapse at 450 gpm and 972 psi standpipe pressure. Full collapse was documented at 500 gpm which created standpipe pressure of 1184 psi. So with this weight, viscosity and temperature of mud the liner was found to at least partially collapse at 450 gpm, which created standpipe pressure of 972 psi. This flow rate limit should be more than adequate for virtually all formations typically cored in the methane hydrate business.

FLOW RATE (GPM)	STANDPIPE PRESSURE (PSI)	COLLAPSE?
100	6	None
200	120	None
250	309	None
300	437	None
350	590	None
400	775	None
450	972	Partial
500	1184	Yes

Table 1. Results of 14 December flow test to liner collapse.

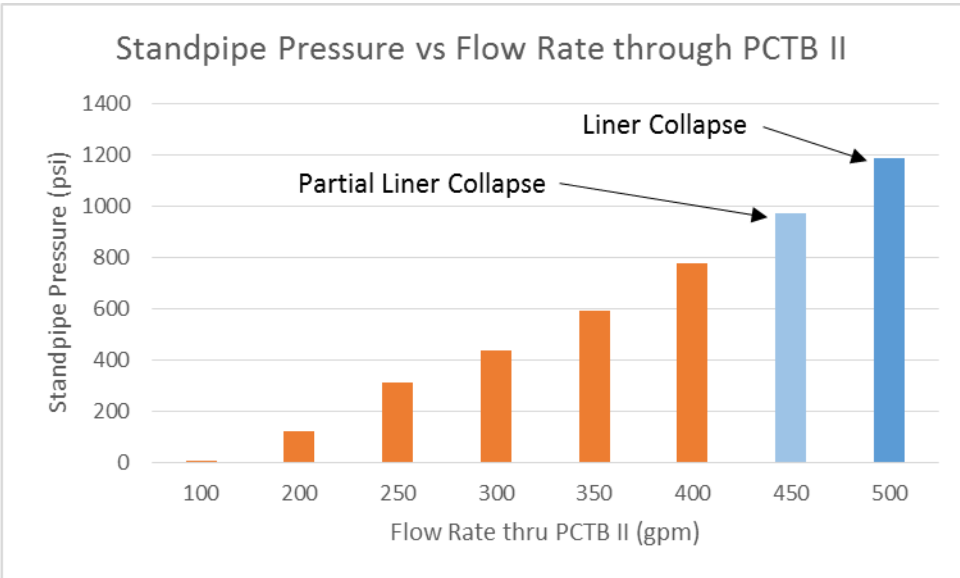


Figure 1. Plot of standpipe pressure vs. flow through PCTB.

- <u>Examine inconsistencies in the timing of the tool's pressure boost, as noted in the past</u> – See DST results in Appendix. The PCTB pressure core barrel is designed so that when the Retrieval Tool unlatches and pulls the inner assembly out of the BHA, the ball valve ball rotates, sealing the core, and almost simultaneously the pressure section sliding valve opens the communication between the core and the nitrogen backed accumulator, at a regulated pressure. This is called the boost and is designed to increase core barrel pressure to compensate for (1) decreasing temperature coming out of the hole, (2) expansion of the inner barrel as confining pressure reduces, and (3) minor pressure leaks in the core barrel. Secondly, the pressure boost also assists the ball valve spring in seating the seal carrier and ball valve seal against the ball to ensure pressure capture.

- The DST only identified two tests to have a late pressure boost, indicative of a late activation of the pressure section. These two late boosts were on Closure Test #3 (first Water Core) and Core #1. DST data showed Closure Tests #1, 2, and 4 to be perfect runs, although #1 was a gradual boost reflective of a valve adjustment problem in the pressure section. The DST also showed Cores #5, 7, and 8 to be perfect runs. Obviously the DST didn't indicate a pressure boost on the cores which didn't seal: Cores #2, 3, 4 and 6.

- Test different coring flow rates to attempt to optimize core recovery and quality, starting at 200 gpm, then moving lower and higher depending upon recovery results – completed. Started first core run (Core 1) with 201 gpm and tested higher up to 300 gpm, settling later on 250 gpm for giving the best results and highest rate of penetration for these particular formations. The hard sandstone and shale lithology required as much flow as possible to clean the bit, along with using liquid soap additive to the mud suction. However, with the PCTB barrel the standpipe pressure needed to be limited to prevent liner collapse. The testing was conservative with average SPP of 346 psi, not close to collapse at 972 psi, documented above. When coring more typical gas hydrate zones with soft sand lithology, using lower flow rates have shown to be most successful. On this well, however, lower flow rates seemed to generally correlate with more bit balling and lower ROP. Exceptions to that rule, as in the lower relative ROP of Core 7 are probably related more to lithology, formation hardness, and shale content.

  - In fact, the previous test series for JOGMEC with the HPTC III pressure core barrel had average ROP of 21.6 fph over 6 cores compared to this tool with ROP of 2.5 fph over 8 cores. Why is that? Lithology may have been a cause, although it appeared similar. Primarily, the HPTC III barrel of JOGMEC had much lower pressure drop allowing higher flow rates and hence, better bit cleaning than the PCTB. The JOGMEC barrel runs averaged a flow rate of 485 gpm (only 295 psi SPP) compared to DoE-UT of half the flow rate, 241 gpm (and higher pressure of 346 psi).

- Determine coring parameters which minimize core biscuiting/jamming – completed. The rate of penetration (ROP) during coring was found to be so low and core jamming to be so prevalent that it was impossible to determine precise cause and effect of biscuiting and jamming. However, the four cores with the highest average WOB averaged 45% recovery whereas the 3 cores with the lowest average WOB averaged 94% recovery. This implies that lower bit weight results in higher core recovery – a conclusion likely applying to all coring, and not limited to pressure coring alone. What caused the low ROP and thus higher WOB? Probably a combination of hard and/or shale formation with the use of cutting shoe type bit. The cutting shoe bit seemed to be more prone to shale bit balling and lower ROP. This seems to warrant more study.

  - It was determined that the formation was very hard and contained shale which had a tendency to ball the bit at lower flow rates. One problem noted during drilling was the improper operation of the automatic driller on the rig. Traditionally the automatic driller software would provide for applying a constant WOB and attaining the resulting ROP – or controlling ROP and automatically applying the WOB required to attain that ROP. In our case at

CTTF there was an admitted failure of the automatic driller. A service technician was called and confirmed that the problem had existed for some time but was scheduled for repairs in the following weeks. The system seemed to apply WOB until the set WOB was reached, at which point the ROP would be locked until the WOB gradually drilled off. This caused serious troubleshooting problems with coring parameters as well as occasional load spikes and likely resultant bit balling.

Figure 2. Automatic Driller Display showing WOB and ROP spikes.

- Compare coring results between face bit and cutting shoe bit and between 9 7/8" bits and 10 5/8" bits – completed. Both a 9-7/8 in. cutting shoe bit (PN ABT0220 with TFA 1.7 sq. in.) and a 10-5/8 in. face bit (PN CBT0221 with TFA 1.2 sq. in.) were run on this test series. By differing bit type and size simultaneously on the same set of bits, the multiple variables could make it difficult to draw conclusions, depending on the results. For example, what attribute caused what improvement? And how did lithology figure into the results? All results turned out in favor of the face bit but the sample size is small and one wonders if the one face bit run with a very good ROP skewed the results.
    - A pressure vs. flow rate comparison of the core barrel with each of two bits yielded almost identical results. See chart and table below. This is because the choke point in the system is the core barrel, not the bit. With the same core barrel, changing bits gives insignificant pressure drop difference. For example, given the TFA of the cutting shoe bit of 1.7 sq. inches, then that would create a calculated pressure drop of only 19 psi with 250 gpm flow. That is a very small part of the total measured 290 psi pressure drop at that flow rate. Changing to the face bit, decreasing the TFA from 1.7 to 1.2 (for a 29% decrease) is seen below to give an insignificant and unnoticeable system pressure increase. Again, the bit is not the choke point – the core barrel internal flow path is. Having larger bit TFA through changeable nozzles would not be an improvement in reducing standpipe pressure of the system.

FLOW RATE THROUGH CORE BARREL (GPM)	STANDPIPE PRESSURE 12/11/15 BEFORE CORE 1	STANDPIPE PRESSURE 12/16/15 BEFORE CORE 6
	9-7/8" CUTTING SHOE BIT (TFA 1.7)	10-5/8" FACE BIT (TFA 1.2)
25	17	
50	27	26
75	24	
100	23	17
125	37	
150	73	77
175	134	
200	203	200
225	264	
240	291	
250		310

Table 2. Pressure vs. flow for cutting shoe and face bit options.

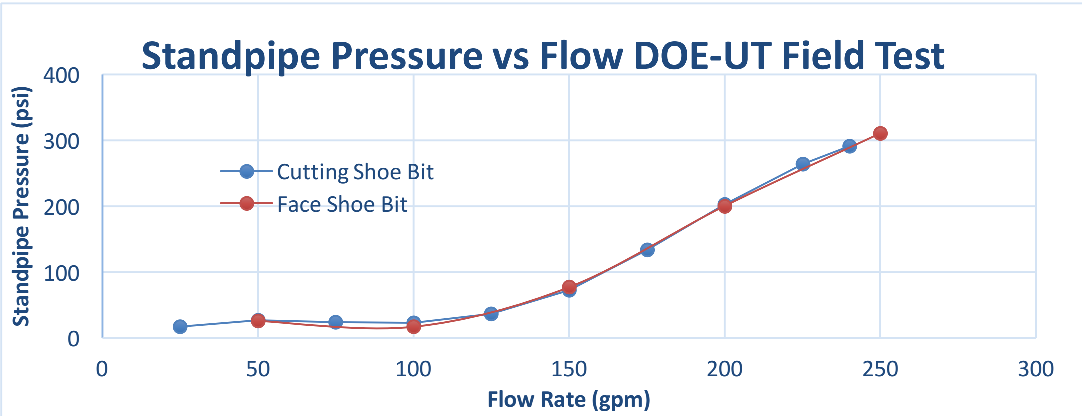


Figure 3. Plot of pressure vs. flow rate for the two bit types.

- The smaller (9-7/8") cutting shoe bit required more weight (average 12.3 klb) to cut at the slower ROP of 2.0 ft. per hour while recovering less (36.2%) core recovery – probably due to core jamming from the higher WOB necessary. Also the cutting shoe bit runs had slightly lower mud flowrate (236 vs. 250 gpm) promoting less bit cleaning and lower ROP. It was seen that the cutting shoe, itself, tended to ball up with cuttings and plug the cutting shoe flow ports causing much lower cutting efficiency than the face bit. This cutting shoe bit cut most (71%) of the hole interval.
- The larger (10-5/8") face bit required less weight (average 9.5 klb) to cut faster (3.4 fph) and recover more core (94.3%). This bit cut 29% of the hole interval.
- Ignoring differences of lithology and flow rate which may have had an influence, it would be easy to conclude that the face bit performance is superior to the cutting shoe bit and would be even more superior if it was the same size. More study may be required.

- <u>Are modifications to the main bit profile design warranted?</u> – As mentioned above, ROP was not acceptable. If these hard to medium sandstone and shale rock sections are expected to be common drilling objectives in the future then a bit profile design change would be warranted. A bit with more cutter exposure and less depth-of-cut control feature would be desirable. If most future project coring will be in formations such as soft, unconsolidated water sands, then the current face bit profile will be successful. If a combination of formations are expected with harder and less consolidated rock then a redesigned bit would definitely be useful. It was noted that at the CTTF rig that the drilling to core point with a 12 ¼" PDC bit was done in excess of 100 ft. per hour. This particular drill bit had a more aggressive cutting structure and profile than ours.

- Goals not accomplished were:
  - Follow a mud program utilizing filtrates and higher mud weights to reduce sand core loss and strengthen borehole – not completed. We did utilize higher weights and filtrates but the lithology cored did not contain sand, therefore improvement could not be documented.
  - Core with reduced flow rates to prevent sand core loss – again, no weak sand was cored, leaving no opportunity to prove this theory.

3. RESULTS SUMMARY

- Drilling Parameters: ROP was a problem, but not due to the functionality of the PCTB pressure core barrel. The formation was significantly harder than expected or would typically be encountered drilling for methane hydrates. We adapted coring parameters beyond what would normally be called for and did prove that the core barrel functioned properly. A properly functioning automatic driller would have likely improved performance but it was found that lower weights and higher flow rates seemed to be key. As Peter Schultheiss wrote in a group email, dated 8/30/15, regarding a previous coring job, "the fundamental elements of the tool are working correctly … It is the sensitivity of the tool to drilling conditions/drilling protocols/formation type that should be the primary focus of attention for this group." This seems to apply here. Correct tool operation under unusual drilling conditions and formations was proven.
- Flow Rates and Standpipe Pressure: The PCTB coring system tested in this program proved to have a smaller system TFA (total flow area) than some other systems such as the HPTC III, thereby producing higher standpipe pressure and limiting the flow rate. The flow rate limit was set on the PCTB by the liner collapse pressure which was determined through experimentation on this job. The core barrel TFA was seen to be significantly lower than that of the bit and therefore choked the flow. It was found that higher flow rates tended to clean the bit better and produce higher coring ROP.
- Core Catchers: Different catchers were tested as described in the preceding paragraphs. Most of the catchers used were slip-type. This choice was related solely to the harder formations cored, not to any superior general performance of this core catcher. The choice of catcher type should always be based on formation drilled: basket for very soft; flapper for soft or fractured; and slip type for hard, competent formations. Combinations of catcher types are available for mixed or uncertain formations.

- Bit Type: As noted above, the face bit drilled at higher ROP with better core recovery than the cutting shoe bit. The sample size was very small with one very good run out of three which may have skewed the results. Also, as the test progressed, the engineers' drilling skills in this particular formation may have improved, reflecting better recovery for the later (face type) bit. For harder formations, such as was drilled in this test well, a redesigned, more aggressive PDC bit would likely have improved penetration rate with reduced weight on bit, reduced core jamming and improved recovery.
- Core Recovery: The first six cores recovered less than was cored. Respectively they recovered 43.3, 51.7, 72.9, 12.9%, and zero (average of 36%). It could not be determined by visual inspection if the missing core was lost by core jamming and grinding the core or by a failure of the core catcher. It could easily be concluded that, with the high WOB used, that core jamming was the problem. As mentioned before, Core 5 recovered no core due probably, to the short length cored. Thereafter, with a new face bit and lower weights on bit, recovery was improved with Cores 6, 7, and 8 recovering an average of 94%. Table 3 summarizes the results.

	DATE/ TIME	CORED SECTION	ROP (FPH)	CORE RECOVERED	PRESSURE RECOVERED (PSI)
CLOSURE TEST 1 W/CUTTING SHOE BIT	12/10 10:45	1871			1406
CLOSURE TEST 2	12/10 15:15	1869			1580
CORE 1	12/10 17:10	1948-1953	1.54	2.17 ft. (43%)	1490
CENTER BIT 1	12/11 11:20	1953-1992	7.0		
POOH CLEANED BALLED BIT	12/11 16:45				
CORE 2	12/11 18:20	1992-1998	2.45	3.0 ft. (52%)	Zero
CENTER BIT 2	12/12 00:15	1998-2060	12.4		
POOH CLEANED BIT (SOME BALLING)	12/12 05:15				
CORE 3	12/14 10:05	2060-2064	1.62	2.9ft. (73%)	Zero
FLOW TEST 1 CUTTING SHOE BIT	12/14 15:06				
CORE 4	12/14 20:15	2064-2069	3.27	0.7 ft. (13%)	Zero
CLOSURE TEST #3 (WATER CORE)	12/15 08:55	2051			1484
CLOSURE TEST #4 (WATER CORE)	12/15 10:41	2051			1486

CORE 5	12/15 12:45	2069-2070	1.05	Zero	1494
REAMING	12/15	1948-2070	100		
POOH BIT MINOR BALLING; P/U FACE BIT	12/15				
CORE 6	12/16 05:45	2070-2075	7.24	2.8 ft. (52%)	Zero
CORE 7	12/16 08:33	2075-2076	1.05	1.7 ft. (119%)	1710
CORE 8	12/16 12:58	2076-2078	1.85	2.4 ft. (111%)	1501
POOH W/MINOR BALLING ON FACE BIT	12/16 17:28				

Table 3. Chronology of Job for DoE-UT at CTTF, commencing December 9, 2015

4. CHALLENGES AND RESPONSES

- The automatic driller feature on the rig was not operating properly. This was minimized by very carefully directing controller input to force it to respond reasonably.
- Formations at CTTF were found to be harder sandstone and shale rather than the medium to soft sandstone expected. This was overcome by patiently drilling as fast as possible, which was typically very slow.
- The problem of low penetration rate was partly caused by shale bit balling. This was compounded by the flow limitation imposed by the pressure limit of the core barrel in preventing liner collapse. Higher flow was needed to properly clean the bit cutting structure. After running a liner collapse test the mud flow rate was increased in later tests, but they could have safely been increased further, further increasing ROP.
- Core jamming and biscuiting in the shoe or liner will always be a possibility and was seen in this test. Core recovery on the first five cores was unusually low, averaging 36% with one zero recovery. By changing to a face bit and reducing WOB the average recovery increased to 94% on the final 3 cores.
- Core pressure recovery is always a critical metric in pressure coring. Of all closure tests, including water cores, and rock cores, the core barrel brought back full pressure on eight of the twelve runs (67%). However, on those tests actually coring rock, that pressure recovery dropped to only four of eight (50%). One may conclude that the pressure barrel, itself, operates correctly since it closed without fail when tested only with drilling mud. However, all four failures occurred when rock was involved. This suggests that drill cuttings or crumbling rock from the core interfered with the ball closing.
  - One scenario that may explain what the problem was follows. After coring is completed the core barrel is lifted a small distance off bottom. The retrieval tool is circulated into the hole on wireline with 50 gpm flow. After latching in,

the pumps are shut down for a short time and the wireline pulls to rotate the ball and retrieve the inner assembly. After disengagement from the BHA is confirmed the pumps are restarted with 35 gpm. The problem could be that during the short time the pumps are off the flow immediately u-tubes, pulling cuttings through the bit ports and around the ball. As the ball rotates, these cuttings may wedge in the seal and prevent sealing.

- The pressure boost can be monitored by way of the DST record of pressure inside the inner barrel. The DST records attached in the Appendix indicate The DST only identified two tests to have a late pressure spike, indicative of a late activation of the pressure section. These two late boosts (Closure Test #3- first Water Core and Core #1) reflect a challenge to evaluate. The likely cause is not a design flaw but a result of one of or a combination of fine grit and cuttings in the drilling mud and seals getting hung up as the tool is operated by hauling on the wireline. The grit may accumulate through the bit ports during tripping in the hole and whenever the pumps are off (e.g., after coring). The static pressure outside the core barrel is higher than inside, caused by the weight of cuttings in the annulus. Therefore, when the pumps are off, the flow immediately reverses direction and u-tubes, carrying fines and coarse cuttings into the core barrel. These may interfere with the operation of the sliding valve or even with the ball valve sealing. It is possible that the seals at the top end of the autoclave can get hung up as they enter the seal bore. Some evidence of damaged seals was noted on tool disassembly however it is unclear at what time these seals were damaged.

- On Closure Test #2 the inner assembly would not latch into the BHA properly. This was the first attempt with #3 autoclave and #3 pressure section. After POOH and disassembling the tool in the service van, the problem was diagnosed to be a drain plug protruding. Assembly technicians were reminded to have redundant witnesses on assembly steps. No further problems of this sort were seen on the job.

5. CHALLENGE MITIGATION PLAN FOR FUTURE OPERATIONS

- Failure of an automatic driller feature cannot be anticipated or planned for. The results of the workaround were as positive as possible. The coring was slow and with patience allowed the job to proceed.

- Mitigation for hard formation and low penetration rate in coring is to understand the formation and utilize an appropriate bit and drilling program. If in the offshore work that DoE-UT is likely to be involved with, similar medium to hard formations are expected to be encountered, along with those prone to balling with shale, it should be possible to redesign the bit with a more aggressive cutting structure to increase penetration rates in harder formations and still be effective in more friable material.

- Higher flow rates could be utilized resulting in higher SPP while still not exceeding the core barrel limits. Less conservative flow rates could have been used, better cleaning the bit, increasing ROP and reducing shale balling. If sticky shale is encountered it is necessary to utilize a soap protocol in the mud, which was done at CTTF, such as adding one gallon of liquid soap at the pump suction every 700 strokes or 10 minutes. The soap tends to prevent cuttings agglomeration and bit balling. The soap may also lower friction and reduce core jamming inside the core liner. It should have similar properties to that which we used for this purpose: DynaDet wetting agent manufactured by Newpark Drilling Fluids of Katy, Texas.

- The loss of core on some of the runs can be attributed to core jamming in the liner and/or bit balling. Bit balling seemed to occur in the cutting shoe which then stacked weight on the formation adjacent to the core and crushed the core into the shoe, causing a jam. Using a face bit seemed to eliminate core jamming in the last three cores. Going with the face bit rather than the cutting shoe bit seems to be one significant mitigation strategy that may be implemented.
- To improve core pressure recovery where the ball did not seal properly, a strategy may be implemented to maintain some flow throughout the inner barrel retrieval process. Possibly reducing the flow to 5 gpm when disengaging the inner barrel could prevent cuttings from u-tubing into the ball seal.
- To prevent a late pressure boost in the PCTB, one strategy would be to reduce fines and cuttings in the core barrel which, perhaps, interfere with proper operation of the sliding valve. This may be done by maintaining small mud flow at all times rather than totally shutting down the pumps. An evaluation of the operational procedure may be required to identify these times. The potential for seals hanging up in the seal bore on tool operation should be evaluated and if these can be damaged during tool operation on the wireline.

6. WELLSITE OPERATIONS

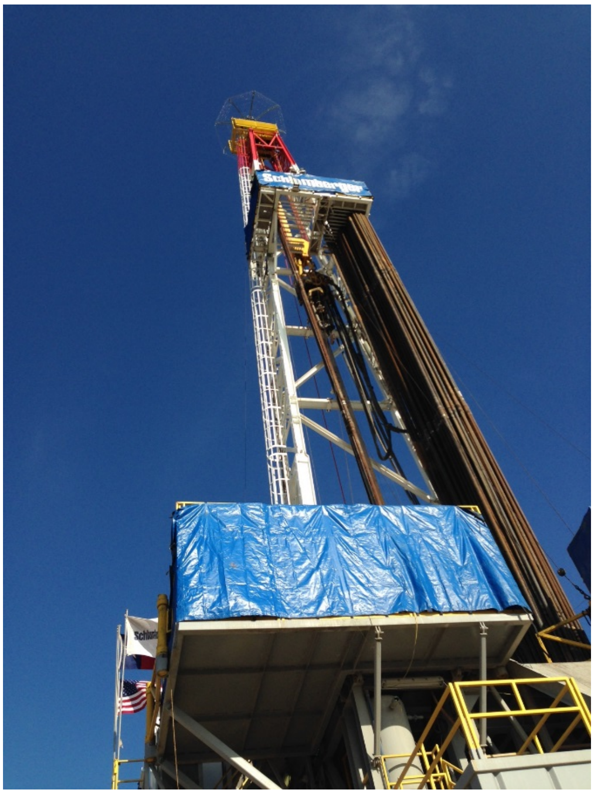


Figure 4. Schlumberger's Cameron Test and Training Facility (CTTF) near Cameron, TX.

- Survey: The first core was taken for DoE-UT starting at a depth below rig floor of 1948 ft. The last survey was taken at a depth of 1855 ft. The last survey found an inclination of 2.27 degrees with an azimuth of 241.25 degrees. The last reading showed a building trend of 0.13 degrees per 100 ft. This should not have any noticeable effect on the coring.

- BHA stack up:
    - Core bit (1.3 ft. length) started with a 9-7/8" cutting shoe bit and changed later to a 10-5/8" face bit
    - Stabilizer (4.7 ft. length)
    - Outer core barrel (31.85 ft. length)
    - Crossover (1.6 ft. length)
    - Stabilizer (3.32 ft. length)
    - Slick Sub (1.09 ft. length)
    - Slick Sub (3.32 ft. length)
    - Drill collars (120.13 ft. length)
    - Crossover (3.01 ft. length)
    - Drill pipe
- Latching and space out of each Autoclave assembly was completed prior to Core 1 and Core 2 with the BHA just below the rig floor (Closure Test #1 and #2). In each case the tool spaced out as designed with 1/16-1/8" of space between the bit and shoe.
- For reference, mud properties were measured at CTTF on 12/2/2015 after drilling to core point and before coring commenced for JOGMEC. They were recorded as:
    - Mud volume in system: 693 bbl. (pit volume 450 bbl.)
    - Mud weight: 9.4 ppg
    - Funnel viscosity: 46 sec/qt. at 120° F mud temperature
    - Viscometer: (600, 200, 100, 60, 6 rpm): 29, 15, 10, 7, 3 cP
    - Yield point: 9 lb /100 ft^2
    - Water/solids/sand % by volume: 94/6/0.1
    - pH at 120°F: 9.6
- Closure Test #1
    - Stack up and closure test was accomplished successfully recovering 1406 psi mud
    - DST showed that the pressure supply was choked allowing a slow pressure boost. This was repaired for future cores.
    - Depth 1871 ft.
- Closure Test #2

- First attempt did not latch due to a drain plug improperly installed - resolved
- Stack up and closure test was accomplished successfully recovering 1580 psi mud
- DST showed perfect run.
- Depth 1869 ft.

- Core #1:
  - 9-7/8" Cutting Shoe bit, PN ABT0220 with TFA 1.7 sq. in. (with cutting shoe)
  - Combination slip plus basket catcher
  - Input parameters: 201 gpm; 40-100 rpm; 5.3-17.1 k-lb. WOB
  - For this and all core runs, detergent was added to mud to prevent cuttings agglomeration. Detergent was added at approximately one gallon per 700 strokes pumped (one bottoms up in volume).
  - ROP: 5.0 ft. cored in 3.25 hours for ROP of 1.54 fph.
  - Slow coring attributed to shale bit balling
  - Variation in ROP was observed caused by faulty automatic driller controls: providing spurts of 30-40 fph with zero ROP between for average of 1.54 fph. This was observed on all runs throughout this job at CTTF.
  - Recovered 2.17 ft. of 5 ft. cored (43%) at 1490 psi.
  - DST showed late firing near surface.
  - Core jammed in shoe
- Center Bit #1:
  - Drilling down to find easier coring with less shale, more typical of gas hydrate formation drilling. This was not found.
  - Input parameters: 209-669 gpm; 100-135 rpm; 1-17.4 k-lb. WOB
  - ROP: Overall we drilled 39 ft. in 5.55 hours for average ROP of 7.0 fph.
  - After run, tripped BHA to surface to inspect bit. Found to be severely balled with shale. Cleaned bit and TIH
- Core #2:
  - Basket catcher. Bit seal removed prior to this run for balance of cores to allow more flow through the bit.
  - Input parameters: 200-226 gpm; 70-120 rpm; 5-17.2 k-lb. WOB
  - ROP: 5.8 ft. cored in 2.37 hours for ROP of 2.45 fph.
  - Wireline would not initially unlatch when retrieving core. Followed normal procedure to then achieve unlatching.

- Recovered 3 ft. of 5.8 ft. cored (52%) at zero pressure. Ball valve seal was coated with angular debris and silt, resulting in no sealing. Flow was visible leaking from ball valve.
- DST showed late pressure spike but no final pressure in autoclave.

Figure 5. PCTB ball valve coming out of hole after Core #2 – closed but not holding pressure.

- Center Bit #2
  - Drilled down again to find more representative core with less shale
  - ROP: Overall we drilled 62 ft. in 5 hours for average ROP of 12.4 fph.
  - After run, again tripped BHA to surface to inspect bit. Found to be partly balled with shale and partly clean. Cleaned bit and TIH
- Core #3:
  - Slip catcher
  - Input parameters: 200-209 gpm; 60-90 rpm; 7-15 k-lb. WOB
  - ROP: 4 ft. cored in 2.47 hours for ROP of 1.62 fph.
  - Recovered 2.92 ft. of the 4 ft. cored (73%) at zero pressure.
  - Ball was half open when retrieved on rig floor. It closed gradually while transporting it to service van. Small rock fragments were found in the ball valve seal.
  - No DST data was available as the DST was not readable on recovery.

Figure 6. Core #3 removed from liner.

- Flow Test to Collapse Liner
  - POOH and cleaned bit. Minor bit balling was noted. Tested one stand below rig floor. Used 11.5 ft. long probe into liner to detect collapse.
  - No collapse was seen until 450 gpm which created 972 psi SPP and partial collapse
  - Full collapse occurred with 500 gpm which created SPP of 1184 psi
- Core #4:
  - Slip catcher
  - Cutting shoe was modified to allow more flow for this and future runs.
  - Input parameters: 276-300 gpm; 61-120 rpm; 14.5-19.4 k-lb. WOB
  - ROP: 5.2 ft. cored in 1.58 hours for ROP of 3.27 fph.
  - Recovered 0.67 ft. of 5.2 ft. cored (13%) at zero pressure.
  - Core and cuttings were jammed in shoe and catcher. Broken liner above core catcher. Ball was open when retrieved to rig floor.
  - DST showed no pressure spike, indicative of open ball valve.
- Closure Test #3 (Water Core):
  - Core barrel was TIH to depth of 2050 ft. then activated
  - Operated as designed and recovered 1484 psi mud
  - DST showed late firing.
- Closure Test #4 (Water Core):
  - Core barrel was TIH to depth of 2050 ft. then activated
  - Operated as designed and recovered 1486 psi mud
  - DST showed perfect run.
- Core #5:
  - Slip catcher

    - Input parameters: 225-250 gpm; 50 rpm; 4.8-7 k-lb. WOB
    - Felt that perhaps lower bit weight could improve recovery and reduce core jamming
    - ROP: 1.1 ft. cored in 1.05 hours for ROP of 1.1 fph.
    - Recovered no core at 1494 psi pressure.
    - DST showed that a boost had occurred but it is unclear exactly when this happened due pressure data dropouts during tool recovery. Comparing the temperature profile to coring runs #6 & #7 one could infer that the pressure boost did occur on retrieval from the BHA.
    - This short core only protruded about 6 inches above the catcher. If it slipped in the catcher at all and/or fractured then that would have allowed it to pull out and be lost.
    - After this core, barrel was POOH to change bits. The cutting shoe bit was mostly clean.
- Core #6:
    - New face bit was made up to core barrel and TIH. 10-5.8" face bit, PN CBT0221 with TFA 1.2 sq. in.
    - Input parameters: 250 gpm; 60-100 rpm; 4.8-12.5 k-lb. WOB
    - ROP: 5.43 ft. cored in 0.75 hours for ROP of 7.24 fph.
    - Recovered 2.83 ft. of 5.43 ft. cored (52%) at zero pressure.
    - Piece of core was recovered projecting through catcher and ball, preventing ball from closing. Ball was open when retrieved to rig floor.
    - DST showed no pressure spike, indicative of open ball valve.
- Core #7:
    - Input parameters: 250 gpm; 60-90 rpm; 6-12.2 k-lb. WOB
    - ROP: 1.4 ft. cored in 1.3 hours for ROP of 1.05 fph.
    - Recovered 1.67 ft. of 1.4 ft. cored (119%) at 1710 psi pressure
    - DST showed perfect run.
- Core #8:
    - Input parameters: 250 gpm; 60-90 rpm; 6.7-11.3 k-lb. WOB
    - ROP: 2.17 ft. cored in 1.17 hours for ROP of 1.85 fph.
    - Recovered 2.4 ft. of 2.17 ft. cored (111%) at 1501 psi pressure
    - DST showed perfect run.
    - After this core run, we tripped the BHA and noted only minor BHA bit balling with shale but significant shale cuttings balled above bit and stabilizer on BHA. This may have occurred during trip out of hole. Indicative of quantity of cuttings circulating out of hole.

Figure 7. BHA with cuttings balling up after POOH after Core #8.

APPENDICES

1. JOB SUMMARY SHEET – DOE-UT FIELD TEST OF PCTB CORING SYSTEM

DOE-UT Onshore Test for PCTB II Pressure Coring System

Rig Floor Report

Core	Date	Time Deployed	WL RIH (ft/min)	WL RIH (gpm)	Time Start Coring	Time End Coring	Coring Time (hr)	Interval (ftbrf)	Cored (ft)	Rcvr'd (ft)	% Recovery
P1	12/10/15	17:10	175	50	17:30	20:45	3:15	1948	5.00	2.17	43.3%
P2	12/11/15	18:20	175	50	19:00	21:22	2:22	1992	5.8	3.00	51.7%
P3	12/14/15	10:05	175	50	10:35	13:03	2:28	2060	4	2.92	72.9%
P4	12/14/15	20:15	175	50	20:55	22:30	1:35	2064	5.20	0.67	12.9%
W1	12/15/15	8:55	175	50	9:10	9:10	0:00	2051			
W2	12/15/15	10:41	175	50	10:56	10:56	0:00	2051			
P5	12/15/15	12:45	175	50	13:10	14:13	1:03	2069	1.10	0.00	0.0%
P6	12/16/15	5:45	175	50	6:22	7:07	0:45	2070	5.43	2.83	52.2%
P7	12/16/15	8:33	175	50	8:55	10:15	1:20	2075	1.40	1.67	119.3%
P8	12/16/15	12:58	175	50	13:09	14:19	1:10	2076	2.17	2.42	111.4%

Rig Floor Report

Core	Date	WOB (avg*)	WOB (max*)	RPM (ave*)	GPM (ave*)	SPP (psi ave*)	ROP (ft/hr)	POOH on WL (ft/min)	POOH on WL (gpm)	Time On Deck	Ball Closed
P1	12/10/15	13.7	17.1	78.8	201.0	262.4	1.54	150	50	21:10	yes
P2	12/11/15	11.7	17.2	89.2	216.5	277.7	2.45	150	35	22:09	yes
P3	12/14/15	13.1	15.0	64.2	203.0	276.8	1.62	150	35	13:32	no
P4	12/14/15	17.5	19.4	105.9	297.0	568.9	3.27	150	35	22:58	no
W1	12/15/15							150	35	9:35	yes
W2	12/15/15							150	35	11:29	yes
P5	12/15/15	5.7	7.0	50	262.0	337.5	1.05	150	35	14:33	yes
P6	12/16/15	8.5	12.5	80	250.0	330.9	7.24	150	35	7:39	yes
P7	12/16/15	10.3	12.2	71.7	250.0	357.2	1.05	150	35	10:32	yes
P8	12/16/15	9.8	11.3	85.7	250.9	357.0	1.85	150	35	14:55	yes

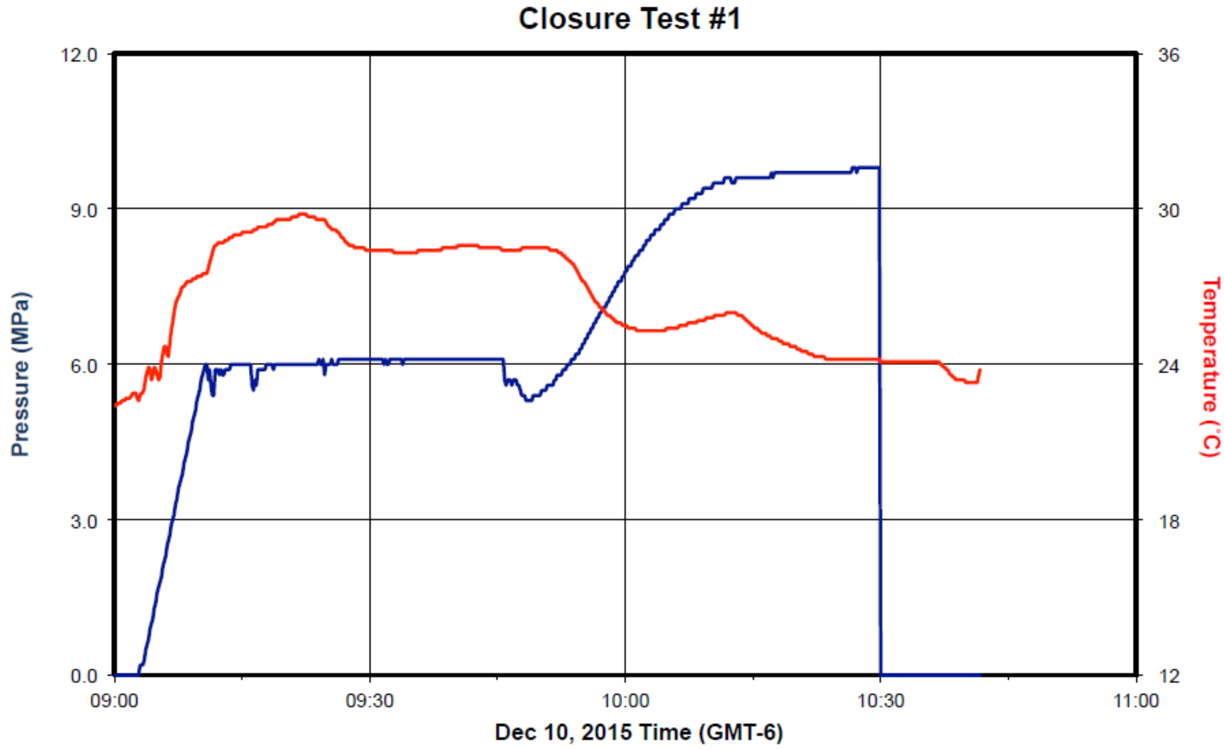
Notes:

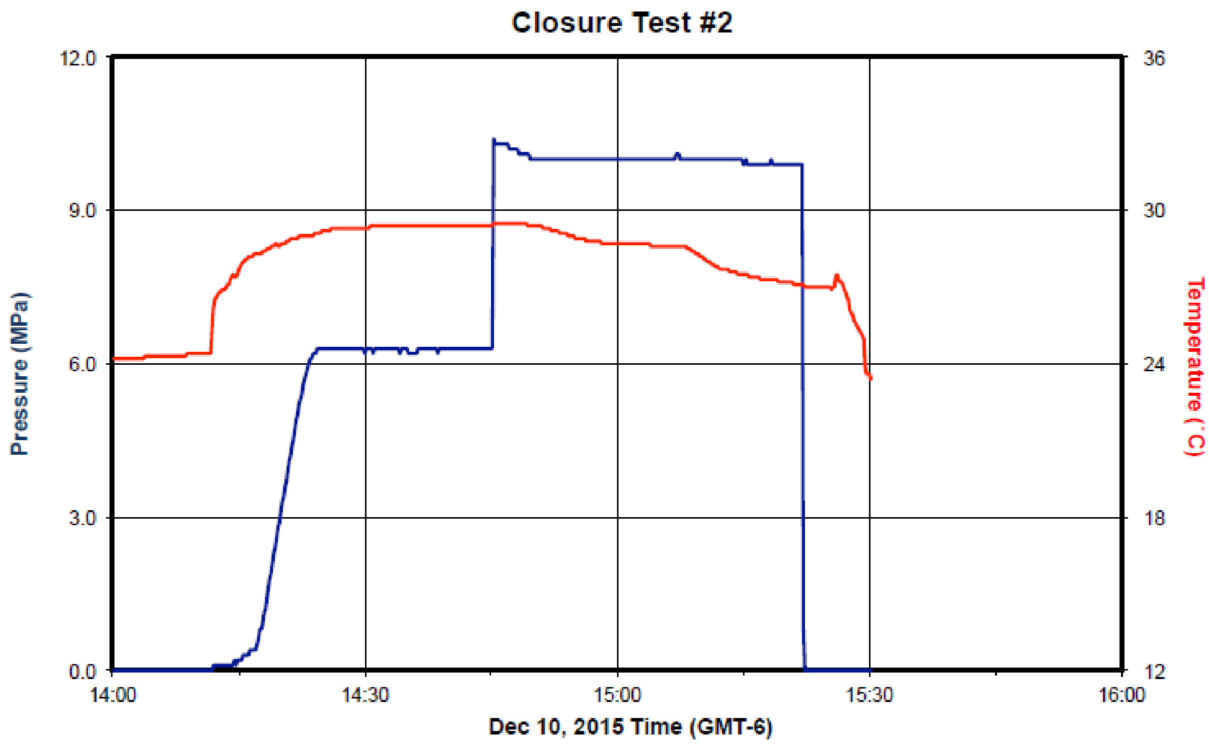
* These values are taken from a set of discreet data points manually recorded

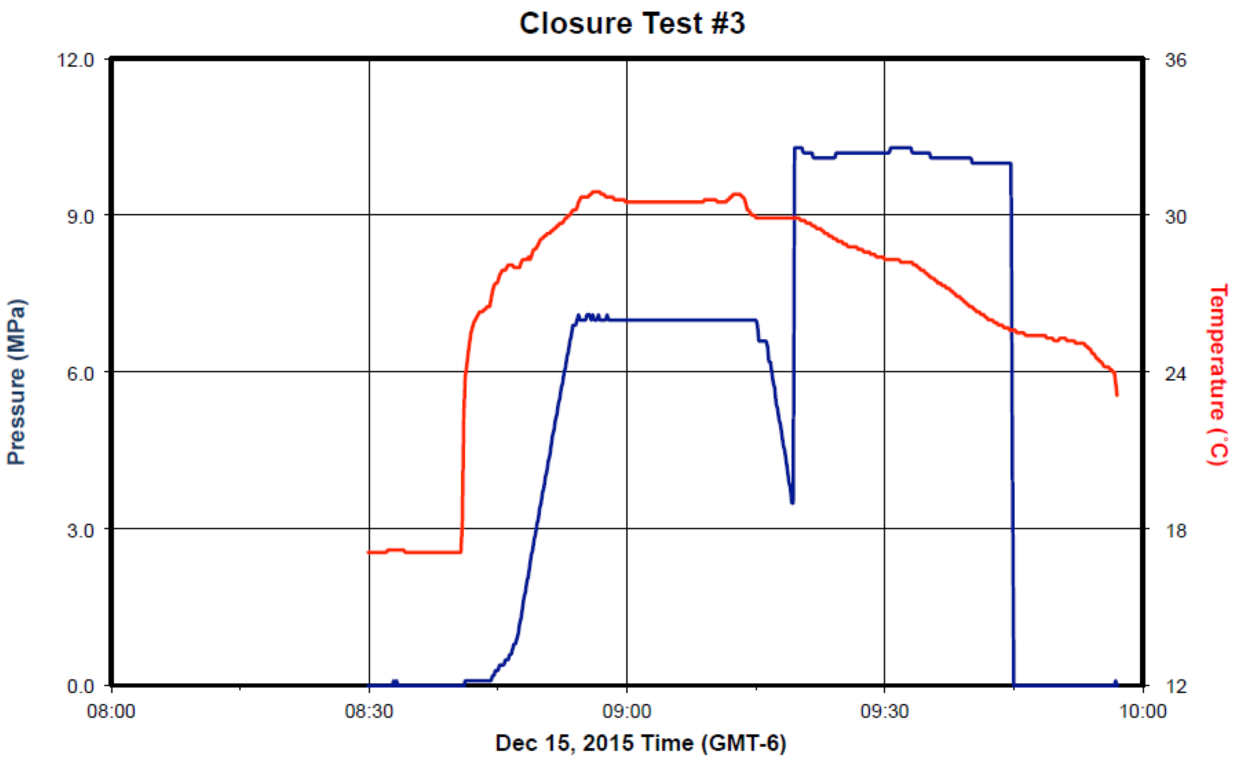
Coring Run Report / **Post-Run Status**

Core	Date	PC Section	Autoclave	Core Catcher Kit	DST (Plug)	DST (Rabbit)	Set Pressure (psi)	Reservoir Pressure (psi)	Transducer Pressure (psi)
P1	12/10/15	4	4	slip+bsk	7055	N/A	1514	3807	1490
P2	12/11/15	3	3	bsk	7604	N/A	1542	3798	0
P3	12/14/15	4	4	slip	7064	N/A	1575	3864	0
P4	12/14/15	3	3	slip	7073	N/A	1542	3830	0
W1	12/15/15	4	4		7076	N/A	1541	3809	1484
W2	12/15/15	3	3		7073	N/A	1525	3832	1486
P5	12/15/15	4	4	slip	7072	N/A	1565	3886	1494
P6	12/16/15	4	4	slip	7073	N/A	1546	3802	0
P7	12/16/15	3	3	slip	7077	N/A	1542	3858	1710
P8	12/16/15	4	4	non-skrt. slip	7071	N/A	1558	3862	1501

2. DST (FISH PILL) PLOTS FROM TOOL RUNS






Closure Test #3
12.0
9.0
6.0
3.0
0.0
Pressure (MPa)
36
30
24
18
12
Temperature (°C)
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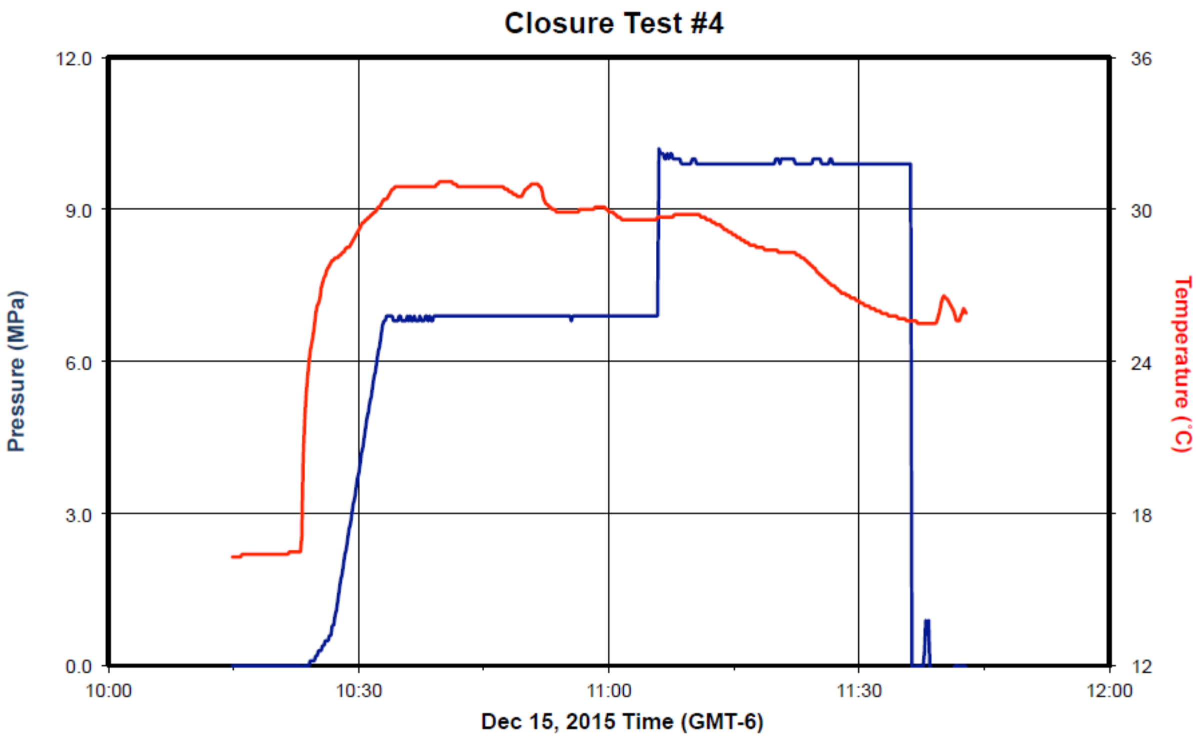
08:30
09:00
09:30
10:00
Dec 15, 2015 Time (GMT-6)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9.0
6.0
3.0
0.0
Pressure (MPa)
36
30
24
18
12
Temperature (°C)
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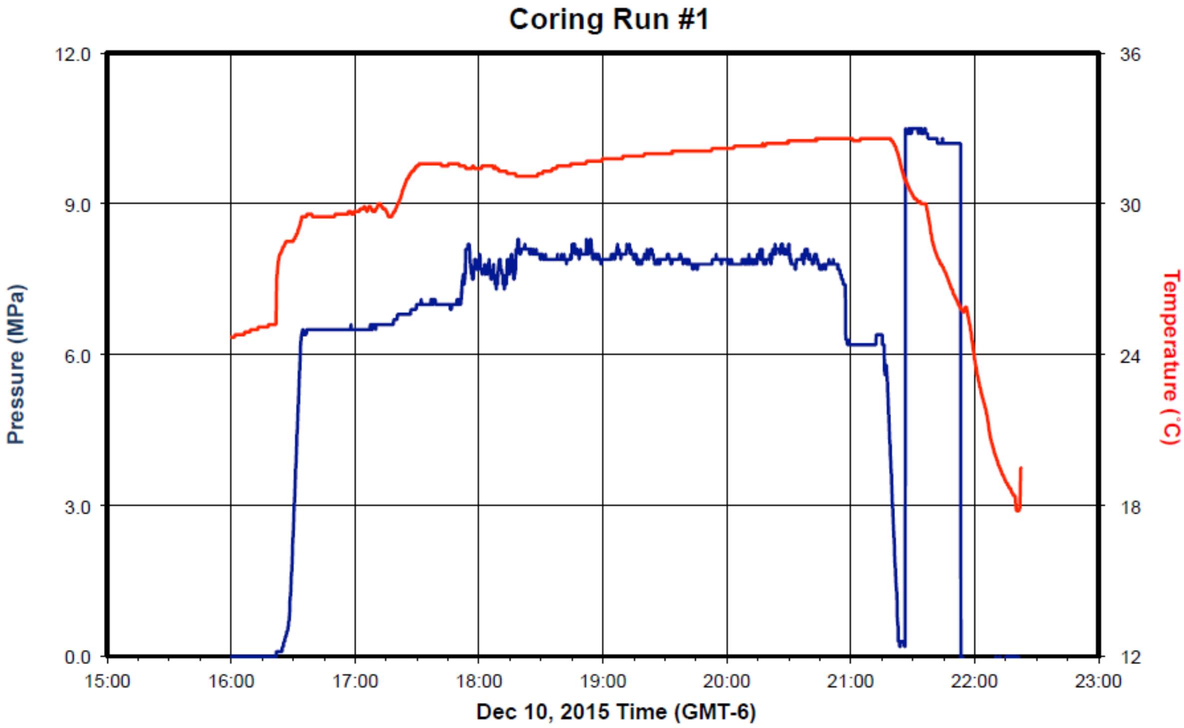
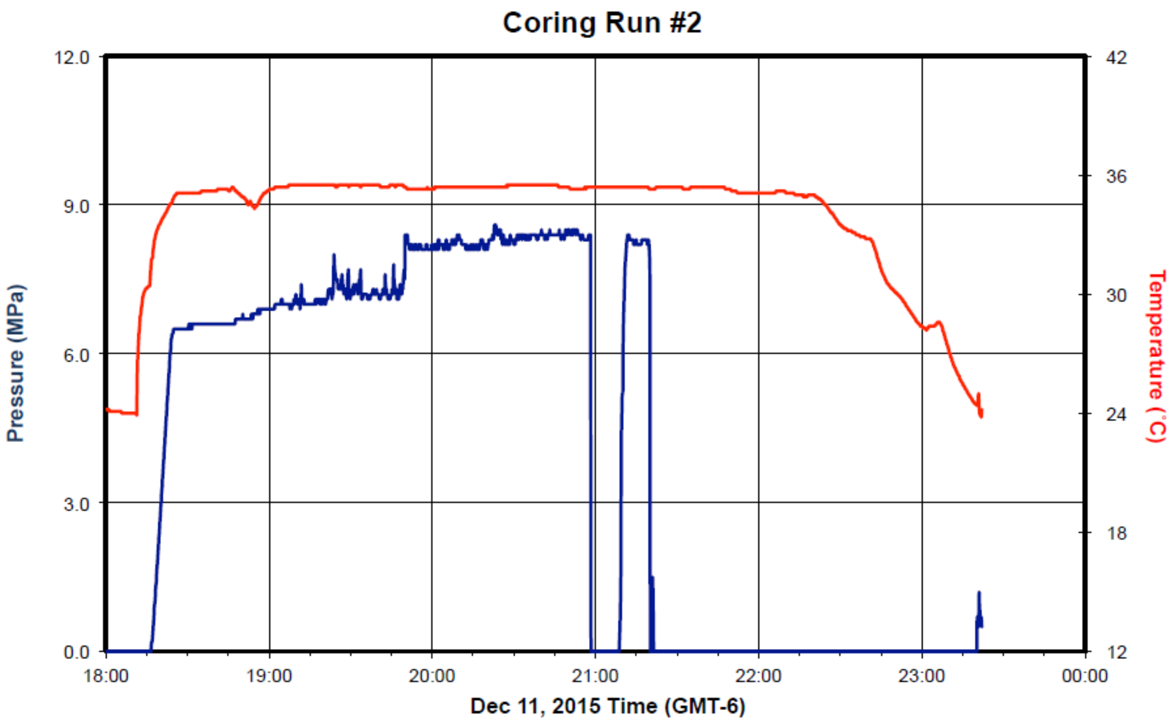
10:30
11:00
11:30
12:00
Dec 15, 2015 Time (GMT-6)


Coring Run #1
Pressure (MPa)
Temperature (°C)
12.0
9.0
6.0
3.0
0.0
36
30
24
18
12
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
Dec 10, 2015 Time (GMT-6)


Coring Run #2
Pressure (MPa)
Temperature (°C)
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9.0
6.0
3.0
0.0
42
36
30
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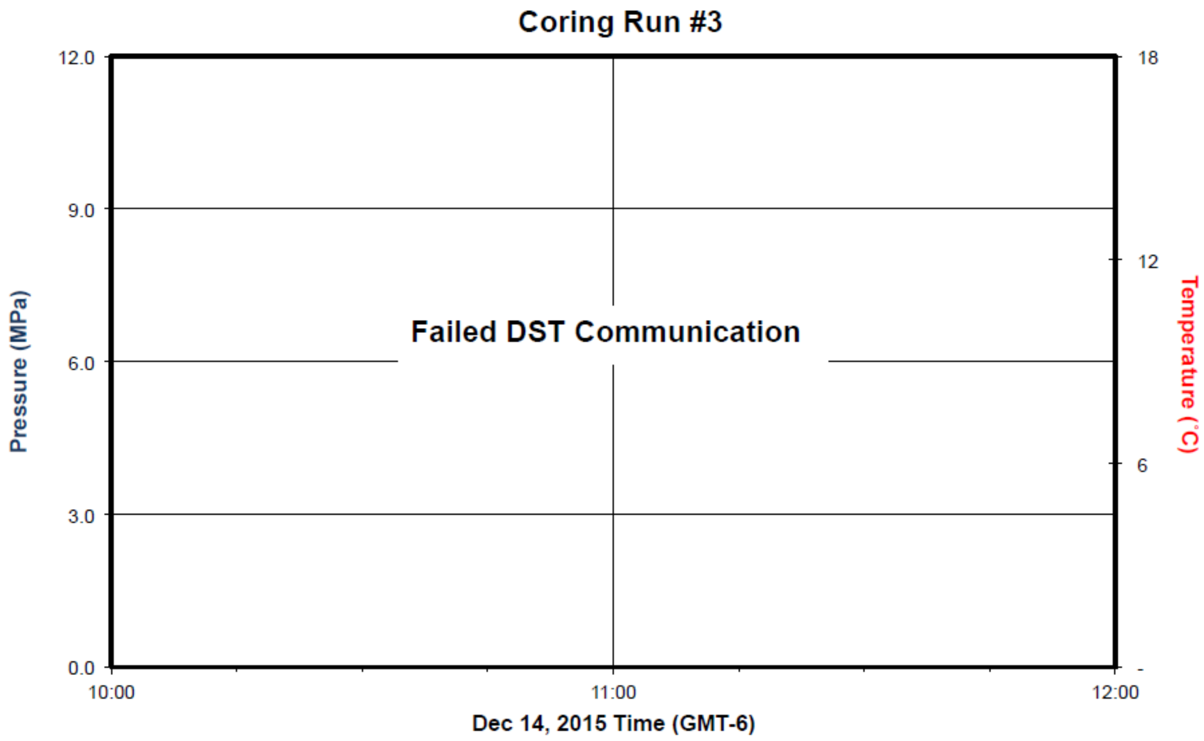
18
12
18:00
19:00
20:00
21:00
22:00
23:00
00:00
Dec 11, 2015 Time (GMT-6)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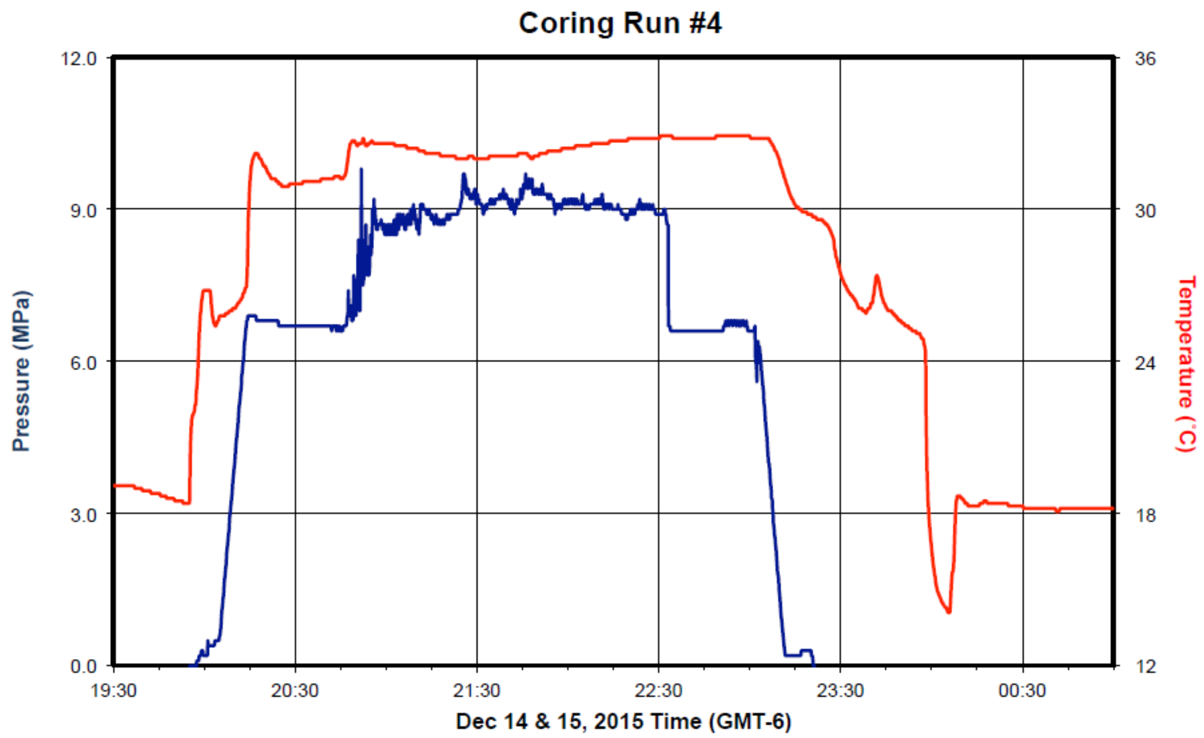
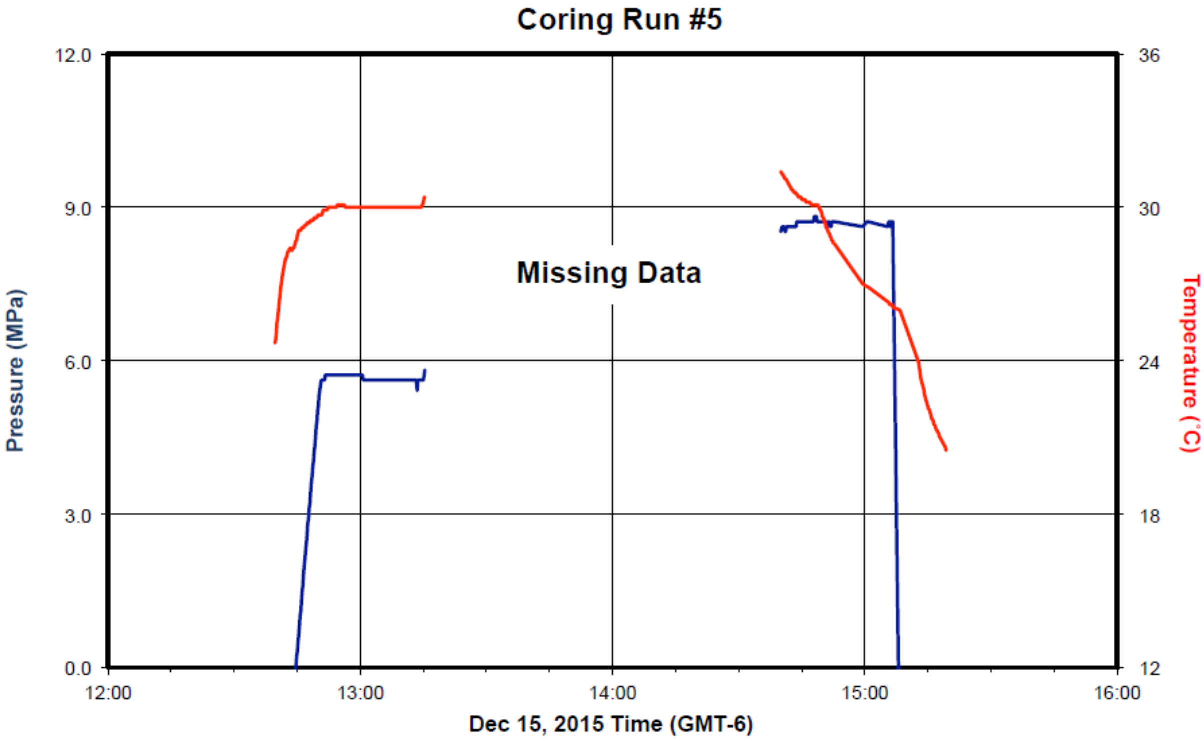
9.0
6.0
3.0
0.0
Pressure (MPa)
18
12
6
Temperature (°C)
10:00
11:00
12:00
Dec 14, 2015 Time (GMT-6)


Coring Run #4
12.0
9.0
6.0
3.0
0.0
Pressure (MPa)
36
30
24
18
12
Temperature (°C)
19:30
20:30
21:30
22:30
23:30
00:30
Dec 14 & 15, 2015 Time (GMT-6)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Pressure (MPa)
Temperature (°C)
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6.0
3.0
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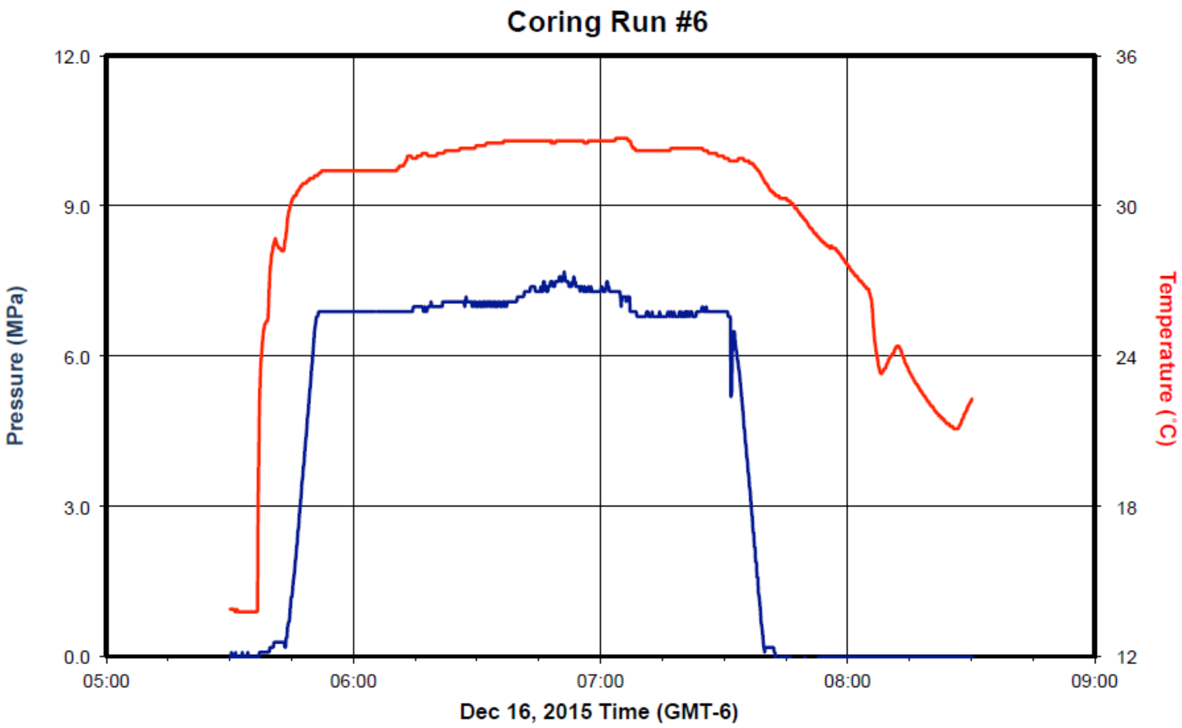
30
24
18
12
12:00
13:00
14:00
15:00
16:00
Dec 15, 2015 Time (GMT-6)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Pressure (MPa)
Temperature (°C)
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9.0
6.0
3.0
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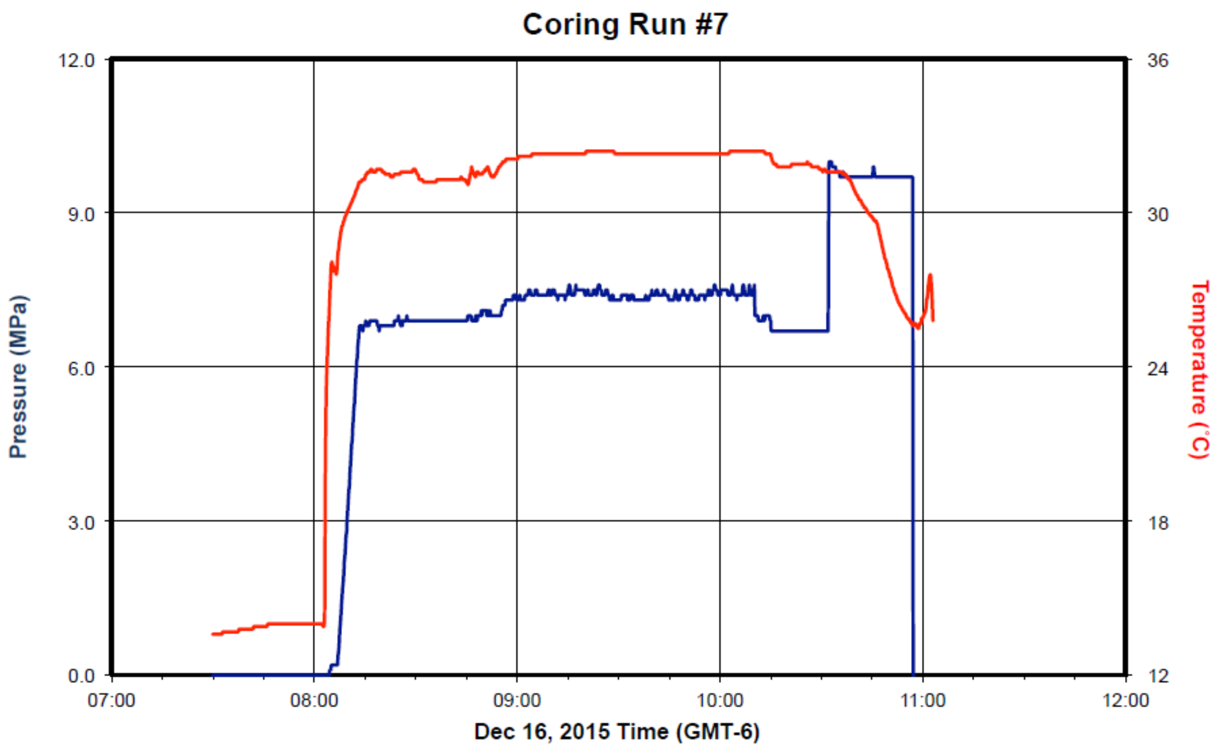
24
18
12
05:00
06:00
07:00
08:00
09:00
Dec 16, 2015 Time (GMT-6)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Pressure (MPa)
Temperature (°C)
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9.0
6.0
3.0
0.0
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24
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12
07:00
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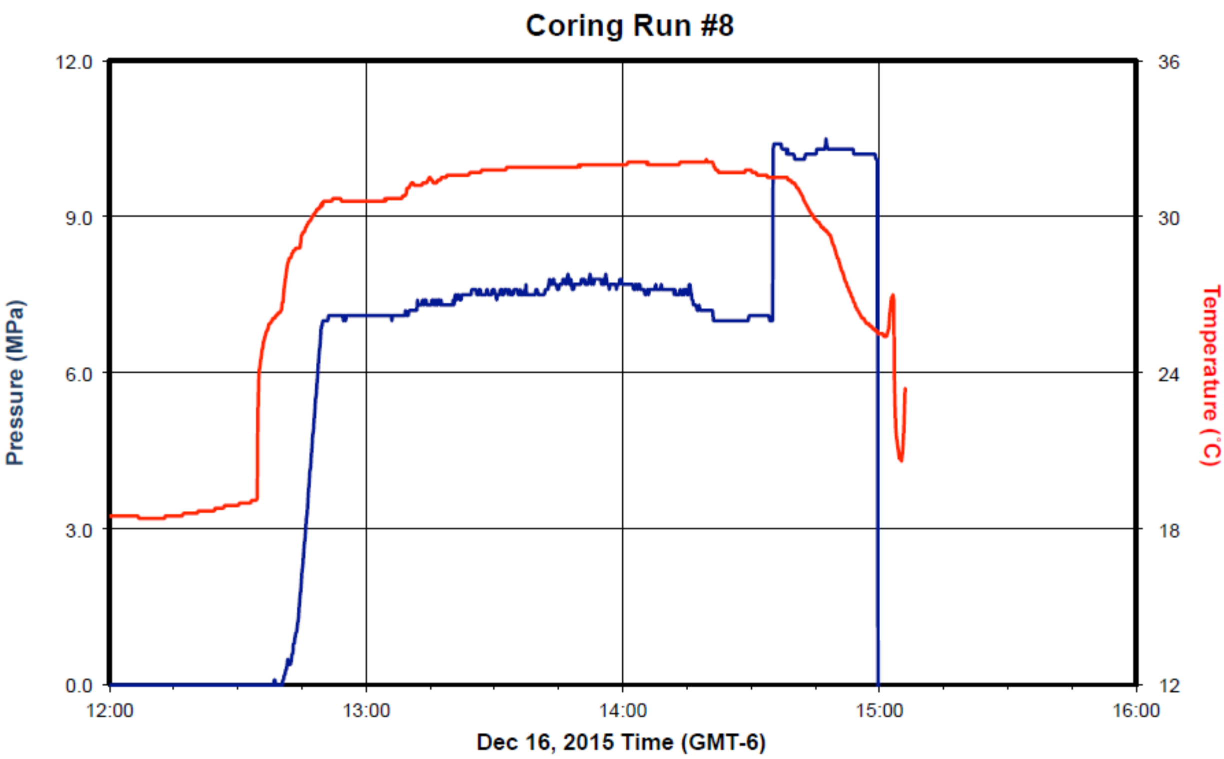
09:00
10:00
11:00
12:00
Dec 16, 2015 Time (GMT-6)


Coring Run #8
Pressure (MPa)
Temperature (°C)
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9.0
6.0
3.0
0.0
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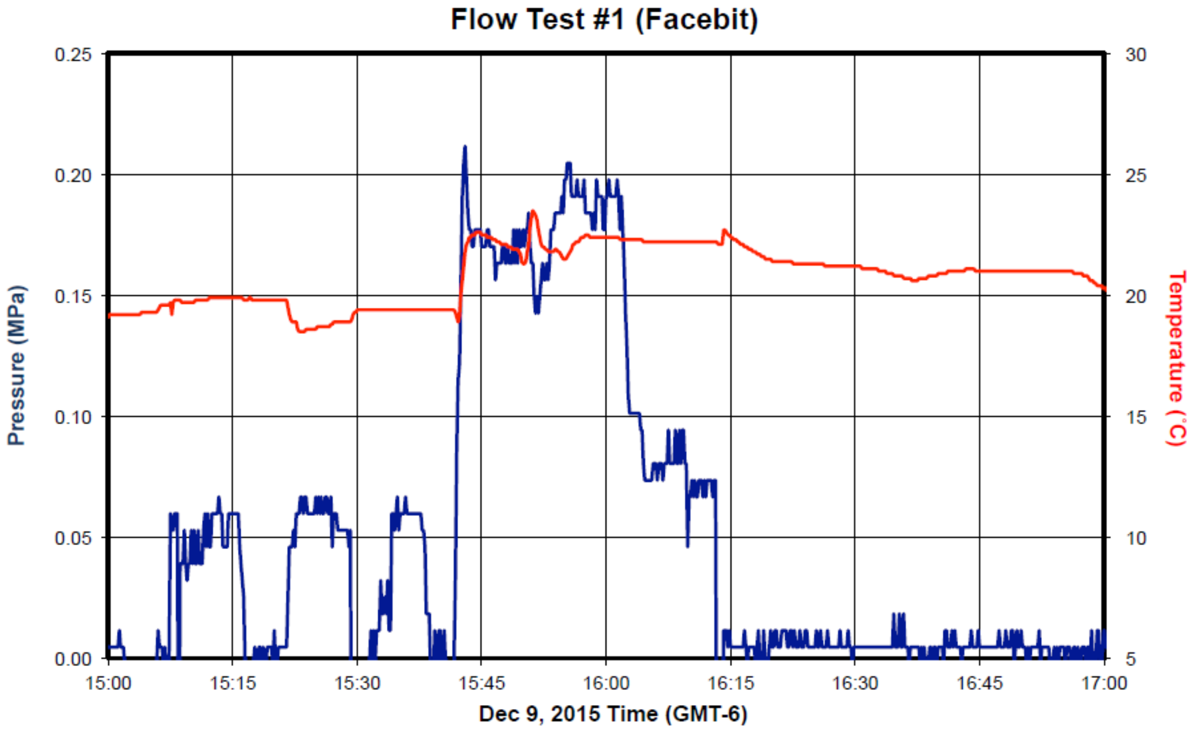
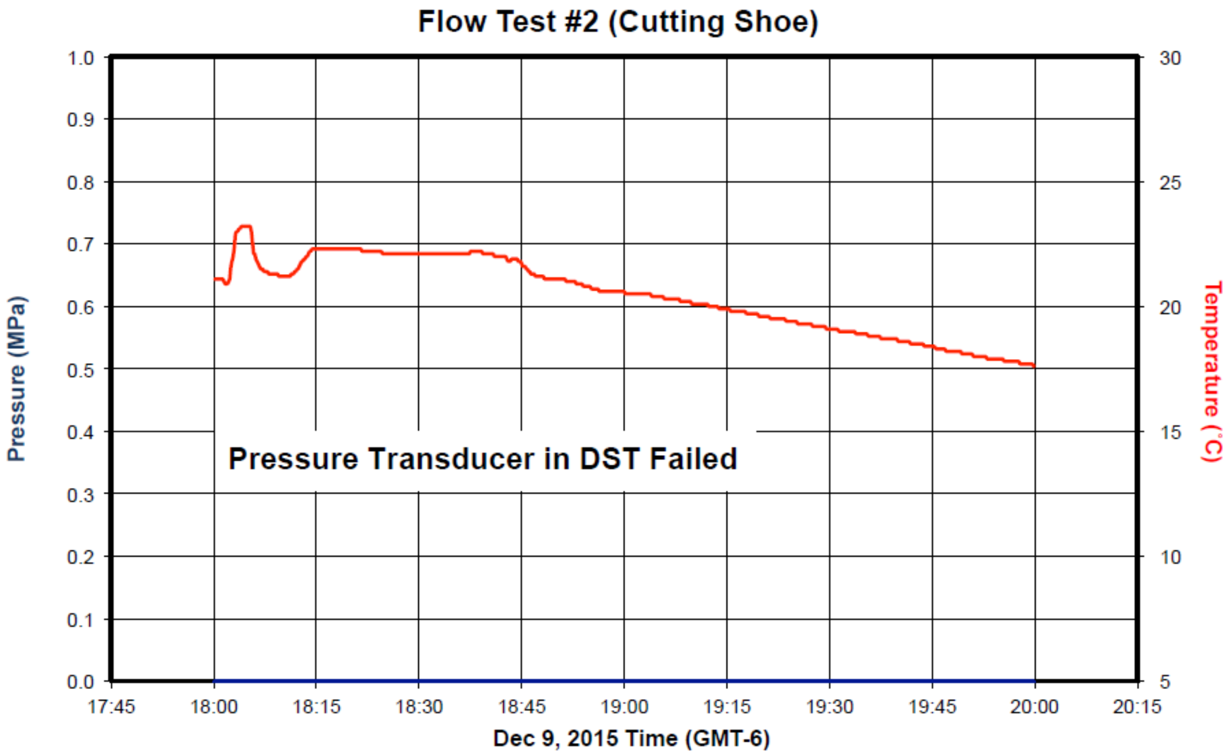
24
18
12
12:00
13:00
14:00
15:00
16:00
Dec 16, 2015 Time (GMT-6)


Flow Test #1 (Facebit)
Pressure (MPa)
Temperature (°C)
0.25
0.20
0.15
0.10
0.05
0.00
30
25
20
15
10
5
15:00
15:15
15:30
15:45
16:00
16:15
16:30
16:45
17:00
Dec 9, 2015 Time (GMT-6)


Flow Test #2 (Cutting Shoe)
Pressure (MPa)
Temperature (°C)
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0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
30
25
20
15
10
5
Pressure Transducer in DST Failed
17:45
18:00
18:15
18:30
18:45
19:00
19:15
19:30
19:45
20:00
20:15
Dec 9, 2015 Time (GMT-6)

3. COMPILATION OF SCANNED RIG FLOOR REPORTS

Geotek Coring, Inc.
2698 S. Redwood Rd, STE N
West Valley City, Utah 84119

Released 150509
V. 1.3

Rig Floor Run Report

Core #: PS15 - PTCB #2	*Date/Time Deployed:* 12/11/15 1840 hr
Time Start Coring: 1900 hr.	*Time End Coring:* 2122 hr
BIT MINUTES: 2 hr 22 min (2.37 hr.)	*Time PCTB unlatched from BHA:* 2206 hr
	TOD (Time on Deck): 2209 hr.
Top (mbsf): 1992 ft.	*Time Put Into Ice Shuck (45min):* N/A
Bottom (mbsf): 1997.8 ft (5.8 ft.)	*Time Taken Out Of Ice Shuck:* N/A
ROP Ave: 2.45 fph	
GPM (RIH): 50	*GPM (first pull, ball valve closing):* 0
GPM (cutting core): @ 1997.4 200 gpm	*Pullout (tons):* N/A
WOB (cutting core, tons): 15.5 K-lb	*Upper Assembly #:*
RPM (cutting core): 180	*Autoclave:* 3
GPM (POOH): 35	*Core catcher type:* Flapper

Remarks

• wireline wouldn't unlatch after core - pulled 3500 lb overpull (pulled 1350 with 1000 lb tool) - with 25, 50, 62 gpm which released with 311 psi)

Depth	GPM	RPM	WOB	ROP	T	SPP	Time	Flow Test gpm	Flow Test psi
1992	225	120	5	12	305	237	1900 hr.		
1993	225	120	5	13	433	262	1907	25	17
1993.5	226	70	6	0	286	293	1915	50	27
1994	226	70	10	8	332	287	1926	75	24
1994.4	226	70	10	0	358	299	1930	100	23
1994.7	226	70	14	3	351	283	1935	125	37
1995	221	90	13.2	2	382	273	1945	150	73
1995.4	209	90	13.7	2	418	268	1952	175	134
1996	209	100	15	2	476	262	2012	200	203
1996.4	204	100	16	4	463	290	2022	225	264
1997.1	200	70	17.2	0	452	290	2042	230	266
1997.8	201	100	15	4	437	288	2122	238	291

~~Mudline (mbrf)~~:	PCTB Length: 9.5 m	Sinker Bars Length: 4.5 m	Total: 14 m
RIH (m/min): 175 fpm	PCTB Weight: 2.60 kN	Sinker Bars Weight: 1.30 kN	Total: 4.0 kN
POOH (m/min): 150 fpm			

Result: Recovered 27" in liner + 9" in shoe (36") at zero pressure (52%)

Geotek Coring, Inc.
2698 S. Redwood Rd, STE N
West Valley City, Utah 84119

Released 150509
V. 1.3

Rig Floor Run Report

Core #: PS15 - PCTB - Center Bit #2	Date/Time Deployed: 12/12/15
Time Start Coring: 0015	Time End Coring: 0515
BIT MINUTES: 5 hrs	Time PCTB unlatched from BHA:
	TOD (Time on Deck):
Top (mbsf): 1998 ft	Time Put Into Ice Shuck (45min):
Bottom (mbsf): 2060 ft (62 ft. drilled)	Time Taken Out Of Ice Shuck:
ROP Ave: 12.4 fph.	
GPM (RIH):	GPM (first pull, ball valve closing):
GPM (cutting core):	Pullout (tons):
WOB (cutting core, tons):	Upper Assembly #:
RPM (cutting core):	Autoclave:
GPM (POOH):	Core catcher type:

Remarks

after run tripped bit out -

Mudline (mbrf):	PCTB Length: 9.5 m	Sinker Bars Length: 4.5 m	Total: 14 m
RIH (m/min):	PCTB Weight: 2.60 kN	Sinker Bars Weight: 1.30 kN	Total: 4.0 kN
POOH (m/min):			

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Rig Floor Run Report

Core #: PS15 - PCTB#3	Date/Time Deployed: 12/14/15 1005 hr.
Time Start Coring: 1036 hr.	Time End Coring: 1303 hr.
BIT MINUTES: 2 hr. 28 min (2.47 hr.)	Time PCTB unlatched from BHA: 1327 hr.
	TOD (Time on Deck): 1332 hr.
Top (mbsf): 2060 ft.	Time Put Into Ice Shuck (45min): N/A
Bottom (mbsf): 2064 ft. (4 ft)	Time Taken Out Of Ice Shuck: N/A
ROP AVG: 1.62 fph	
GPM (RIH): 50	GPM (first pull, ball valve closing): 0
GPM (cutting core): 200 (@2068.45 ft.)	Pullout (tons): N/A
WOB (cutting core, tons): 14 K-lb	Upper Assembly #:
RPM (cutting core): 60	Autoclave: 4
GPM (POOH): 35	Core catcher type: Slip

Remarks

Depth	GPM	RPM	(K-lb) WOB	(fph) ROP	(ft-lb) T	(psi) SPP	(hr.) Time
2060.2	200	60	7	6	779	248	1039
2060.5	209	↓	13.7	0	490	292	1041
2060.8	209	↓	13	0	581	278	1102
2061.3	200	↓	13.3	4	1031	267	1112
2062.1	↓	70	13	4	526	311	1136
2062.3	↓	70	12	4	551	300	1150
2062.8	↓	60	13	3	491	305	1206
2063	↓	↓	15	0	638	274	1221
2063.3	↓	↓	15	0	434	270	1243
2063.5	↓	↓	14	7	1118	255	1249
2063.7	209	↓	14	0	372	268	1254
2063.8	"	90	14	0	522	254	1302
2063.82	Finish			(73%)		(BV open)	

Result: Recovered 27" in liner + 8" in shoe (35"); zero pressure

Mudline (mbrf):	PCTB Length: 9.5 m	Sinker Bars Length: 4.5 m	Total: 14 m
RIH (m/min): 175 fpm	PCTB Weight: 2.60 kN	Sinker Bars Weight: 1.30 kN	Total: 4.0 kN
POOH (m/min): 150 fpm			

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Rig Floor Run Report

Core #: PS15 - PCTB #4	Date/Time Deployed: 12/14/15 2015 hr.
Time Start Coring: 2055 hr.	Time End Coring: 2230 hr
BIT MINUTES: 1 hr. 35 min (1.58 hr.)	Time PCTB unlatched from BHA: 2250 hr.
	TOD (Time on Deck): 2258 hr.
Top (mbsf): 2063.82	Time Put Into Ice Shuck (45min): N/A
Bottom (mbsf): 2069.0 (5.18 ft.)	Time Taken Out Of Ice Shuck: N/A
ROP Ave: 3.27 fph	
GPM (RIH): 50	GPM (first pull, ball valve closing): 0
GPM (cutting core): 300 @ 2066 ft.	Pullout (tons):
WOB (cutting core, tons): 18 K-lb.	Upper Assembly #:
RPM (cutting core): 100	Autoclave: 3
GPM (POOH): 35	Core catcher type: Slip.

Remarks

Depth	GPM	RPM	WOB	ROP	T	SPP	Time
2064.1	276	61	14.5	3	1218	455	2055
2065.5	300	100	16.4	5	820	629	2124
2066		120	18.0	5	927	599	2134
2066.7		120	18.1	5	681	603	2148
2067.7			19.4	0	1500	584	2206
2068.4			18.4	0	680	555	2215
2069			17.5	4	613	557	2230

Results: Recovered 8" in shoe (jammed) with broken liner (13%) with zero pressure - ball open

Mudline (mbrf): ~~175 fpm~~	PCTB Length: 9.5 m	Sinker Bars Length: 4.5 m	Total: 14 m
RIH (m/min): 175.0 fpm	PCTB Weight: 2.60 kN	Sinker Bars Weight: 1.30 kN	Total: 4.0 kN
POOH (m/min): 150 fpm			

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Rig Floor Run Report

Core #: PS15 - Water Core i	Date/Time Deployed: 12/15/15 0855
Time Start Coring: 0910	Time End Coring: 0910
BIT MINUTES:	Time PCTB unlatched from BHA: 0920
	TOD (Time on Deck): 0935 hr.
Top (mbsf): 2050.76	Time Put Into Ice Shuck (45min):
Bottom (mbsf):	Time Taken Out Of Ice Shuck:
GPM (RIH): 50	GPM (first pull, ball valve closing): 0
GPM (cutting core):	Pullout (tons):
WOB (cutting core, tons):	Upper Assembly #:
RPM (cutting core):	Autoclave: 4
GPM (POOH): 35	Core catcher type:

Remarks

Closed ball and tripped out without coring.

Result: Retrieved water at 1484 psi

Mudline (mbrf):	PCTB Length: 9.5 m	Sinker Bars Length: 4.5 m	Total: 14 m
RIH (m/min): 175 fph	PCTB Weight: 2.60 kN	Sinker Bars Weight: 1.30 kN	Total: 4.0 kN
POOH (m/min): 150 fph			

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Rig Floor Run Report

Core #: PS15 - Water Core 2	*Date/Time Deployed:* 12/15/15 1041
Time Start Coring: 1056 hr.	*Time End Coring:* 1056 hr.
BIT MINUTES:	*Time PCTB unlatched from BHA:* 1114
	TOD (Time on Deck): 1129
Top (mbsf): 2050.76	*Time Put Into Ice Shuck (45min):*
Bottom (mbsf):	*Time Taken Out Of Ice Shuck:*
GPM (RIH): 50	*GPM (first pull, ball valve closing):* 0
GPM (cutting core):	*Pullout (tons):*
WOB (cutting core, tons):	*Upper Assembly #:*
RPM (cutting core):	*Autoclave:* 3
GPM (POOH): 35	*Core catcher type:*

Remarks

Pumped 5 minutes at 100 gpm prior to closing ball and tripping out.

Result: Retrieved water at 1486 psi.

Mudline (mbrf):	PCTB Length: 9.5 m	Sinker Bars Length: 4.5 m	Total: 14 m
RIH (m/min):	PCTB Weight: 2.60 kN	Sinker Bars Weight: 1.30 kN	Total: 4.0 kN
POOH (m/min):			

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Rig Floor Run Report

Core #: PS15 - PCTB #5	Date/Time Deployed: 12/15/15 1245 hr.
Time Start Coring: 1310 hr. (1.05 hr.)	Time End Coring: 1413 hr.
BIT MINUTES: 1 hr. 3 min. (~~1.1 ft~~)	Time PCTB unlatched from BHA: 1424
	TOD (Time on Deck): 1433
Top (mbsf): 2068.53	Time Put Into Ice Shuck (45min):
Bottom (mbsf): 2069.57 (1.1 ft)	Time Taken Out Of Ice Shuck:
ROP Ave: 1.05 fph	
GPM (RIH): 50	GPM (first pull, ball valve closing): 0
GPM (cutting core): 225 at 2069.35 ft	Pullout (tons):
WOB (cutting core, tons): 4.8 k-lb	Upper Assembly #: 4
RPM (cutting core): 50	Autoclave: 4
GPM (POOH): 35	Core catcher type: slip.

Remarks

Depth	GPM	RPM	WOB	ROP	T	SPP	Time
2068.53	Began Coring						
2069.13	250	50	5.7	2	553	377	1340
2069.21	250	↓	5.3	0	425	376	1345
2069.35	225	↓	4.8	2	349	295	1358
2069.46	225	↓	7.0	0	420	302	1406

Results: Recovered NO Core at 1494 psi
Suspected core too short to be grabbed by slip core catcher.

Mudline (mbrf):	PCTB Length: 9.5 m	Sinker Bars Length: 4.5 m	Total: 14 m
RIH (m/min): 175 fpm	PCTB Weight: 2.60 kN	Sinker Bars Weight: 1.30 kN	Total: 4.0 kN
POOH (m/min): 150 fpm			

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Rig Floor Run Report

Core #: PS15 - PCTB #6	Date/Time Deployed: 12/16/15 0545
Time Start Coring: 0622 hr	Time End Coring: 0707
BIT MINUTES: 45 min (.75 hr.)	Time PCTB unlatched from BHA: 0719
	TOD (Time on Deck): 0739
Top (mbsf): 2069.57 ft	Time Put Into Ice Shuck (45min):
Bottom (mbsf): 2075 ft (5.43 ft)	Time Taken Out Of Ice Shuck:
ROP Ave: 7.24 fph	
GPM (RIH): 50	GPM (first pull, ball valve closing): 0
GPM (cutting core): 250 at 2072 ft.	Pullout (tons):
WOB (cutting core, tons): 8.1 K-lb.	Upper Assembly #: 8
RPM (cutting core): 90	Autoclave: 3
GPM (POOH): 35	Core catcher type: slip

Remarks

Depth	ROP	RPM	GPM	WOB	T	SPP	Time
2069.6	24	60	250	8	507	314	0622
2071	15	60		7.5	918	313	0627
2072	12	90		8.1	919	312	0632
2073	16	90		8.7	1311	314	0637
2074	19	90		4.8	1096	318	0640
2074.7	0	60		8.5	492	341	0649
2074.85	0	100		9.8	840	361	0655
2075	0	90		12.5	650	374	

Results: Recovered 34" core at zero pressure (52%)

Mudline (mbrf):	PCTB Length: 9.5 m	Sinker Bars Length: 4.5 m	Total: 14 m
RIH (m/min): 175 fpm	PCTB Weight: 2.60 kN	Sinker Bars Weight: 1.30 kN	Total: 4.0 kN
POOH (m/min): 150 fpm			

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Rig Floor Run Report

Core #: PS15 - PCTB #7	Date/Time Deployed: 12/16/15 0833
Time Start Coring: 0855 hr.	Time End Coring: 1015 hr
BIT MINUTES: 1 hr. 20 min (1.3 hr.)	Time PCTB unlatched from BHA: 1022
	TOD (Time on Deck): 1032
Top (mbsf): 2074.85	Time Put Into Ice Shuck (45min):
Bottom (mbsf): 2076.25 (1.4 ft)	Time Taken Out Of Ice Shuck:
ROP Ave: 1.05 fph	
GPM (RIH): 50	GPM (first pull, ball valve closing): 0
GPM (cutting core): 250 at 2076.1'	Pullout (tons):
WOB (cutting core, tons): 11.5 K·lb	Upper Assembly #:
RPM (cutting core): 80	Autoclave: 4
GPM (POOH): 35	Core catcher type: slip

Remarks

Depth	GPM	RPM	WOB	ROP	T	SPP	Time
2074.85	250	60	6	2	579	305	0857
2075.37		90	10.7	0	470	346	0920
2075.66		60	~~10.7~~ 9.6	2	385	360	0940
2075.85		60	11.5	0	451	363	0955
2076.1		80	11.5	0	500	385	1006
2076.21		80	12.2	0	452	387	1015

Results: Recovered 20 inch (1.67 ft) - 119% core at 1710 psi

Mudline (mbrf):	PCTB Length: 9.5 m	Sinker Bars Length: 4.5 m	Total: 14 m
RIH (m/min): 175 fpm	PCTB Weight: 2.60 kN	Sinker Bars Weight: 1.30 kN	Total: 4.0 kN
POOH (m/min): 150 fpm			

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Rig Floor Run Report

Core #: PS15 - PCTB #8	*Date/Time Deployed:* 12/16/15 1258
Time Start Coring: 1309 hr.	*Time End Coring:* 1419 hr
BIT MINUTES: 1 hr 10 min (1.17 hr)	*Time PCTB unlatched from BHA:* 1438
	TOD (Time on Deck): 1455
Top (mbsf): 2076.21	*Time Put Into Ice Shuck (45min):*
Bottom (mbsf): 2078.38 (2.17 ft)	*Time Taken Out Of Ice Shuck:*
Ave RoP: 1.85 fph	
GPM (RIH): 50	*GPM (first pull, ball valve closing):* 0
GPM (cutting core): 251 @ 2078.01 ft.	*Pullout (tons):*
WOB (cutting core, tons): 11.3 K-lb.	*Upper Assembly #:*
RPM (cutting core): 90	*Autoclave:* 3
GPM (POOH): 35	*Core catcher type:* slip-skirtless

Remarks

On rig floor, ~~pin~~ tube would not slide after removing pin
Repaired and second tool operated well.

Depth	GPm	RPM	WOB	ROP	T	SPP	Time
2076.9	250	60	6.7	4	576	332	1323
2077.1	251	90	8.3	2	638	356	1331
2077.4	↓	↓	10	7	832	353	1342
2077.7	↓	↓	11.3	4	820	362	1341
2078	↓	↓	11.3	2	518	380	1358
2078.26	↓	↓	10.5	1	320	366	1412
2078.34	↓	↓	10.2	2	408	355	1417

Result: Recovered 29 inches (2.4 ft) 111% at 1501 psi

Mudline (mbrf):	PCTB Length: 9.5 m	Sinker Bars Length: 4.5 m	Total: 14 m
RIH (m/min): 175 fpm	PCTB Weight: 2.60 kN	Sinker Bars Weight: 1.30 kN	Total: 4.0 kN
POOH (m/min): 150 fpm			

4. CTTF DAILY REPORTS

No. DAILY DRILLING REPORT REPORT NO. 111

LEASE	WELL NO.	API WELL NUMBER	WATER DEPTH	DATE
JPG Training July 2015	Slot 3	42-331-33557		09-Dec-2015

OPERATOR	CONTRACTOR	RIG NO.
Schlumberger / CTTF	JPEG	Explorer

SIGNATURE OF OPERATOR'S REPRESENTATIVE

SIGNATURE OF CONTRACTOR'S TOOL PUSHER

DP SIZE	WEIGHT	GRADE	TOOL JT O.D.	TYPE THREAD	STRING NO.	PUMP NO.	PUMP MANUFACTURER	TYPE	STROKE LENGTH
						1			
						2			
						3			
						4			

TIME DISTRIBUTION HOURS

CODE NO.	OPERATION	NIGHT	DAY
1	RIG UP AND TEAR DOWN		
2	DRILL ACTUAL		
3	REAMING		
4	CORING		8:30
5	CONDITION MUD & CIRCULATE		0:30
6	TRIPS		
7	LUBRICATE RIG		
8	REPAIR RIG		
9	CUT OFF DRILLING LINE		
10	DEVIATION SURVEY		
11	WIRELINE LOGS		
12	RUN CASING & CEMENT		
13	WAIT ON CEMENT		
14	NIPPLE UP B.O.P.		
15	TEST B.O.P.		
16	DRILL STEM TEST		
17	PLUG BACK		
18	SQUEEZE CEMENT		
19	FISHING		
20	DIR. WORK		
21			
22	UT DOE slot 6	12:00	3:00
23			
COMPLETION A.	PERFORATING		
B.	TUBING TRIPS		
C.	TREATING		
D.	SWABBING		
E.	TESTING		
F.			
G.			
H.			
TOTALS		12:00	12:00

DAYWORK TIME SUMMARY (OFFICE USE ONLY): HOURS W/CONTR D.P.; HOURS W/OPR D.P.; HOURS WITHOUT D.P.; HOURS STANDBY; TOTAL DAYWORK; NO. OF DAYS FROM SPUD; CUMULATIVE ROTATING HOURS; DAILY MUD COST; TOTAL MUD COST

DRILLING ASSEMBLY (AT END OF TOUR): NO. | ITEM | O.D. | LENGTH; STANDS D.P.; SINGLES D.P.; KELLY DOWN; TOTAL; WT. OF STRING; REMARKS; DRILLER

BIT RECORD: BIT NO.; SIZE; IADC CODE; MANUFACTURER; TYPE; SERIAL NO.; JETS; TFA; DEPTH OUT; DEPTH IN; TOTAL DRILLED; TOTAL HOURS; CUTTING STRUCTURE: INNER, OUTER, DULL CHAR, LOCATION; BEARINGS/SEALS, GAGE, OTHER DULL CHAR, REASON PULLED

MUD RECORD: TIME; WEIGHT; PRESSURE GRADIENT; FUNNEL VISCOSITY; PV/YP; GEL STRENGTH; FLUID LOSS; pH; SOLIDS; MUD & CHEMICAL ADDED: TYPE | AMOUNT | TYPE | AMOUNT

DAILY DRILLING REPORT WELL Slot 3 REPORT NO. 111 DATE 09-Dec-2015

FIELD OR DISTRICT: Cameron TX; COUNTY: Milam; STATE / COUNTRY: TX / United States

LAST CASING TUBING OR LINER: SIZE | MAKE | WEIGHT GRADE | NO. JOINTS | LENGTH | RKB. TO CSG. HD. | SET AT

WIRE LINE RECORD REEL NO.: SIZE; NO LINES; LENGTH SLIPPED; LENGTH CUT OFF; PRESENT LENGTH; WEAR OR TRIPS SINCE LAST CUT; CUMULATIVE WEAR OR TRIPS

DEPTH INTERVAL FROM / TO; DRILL D REAM R CORE C; CORE NO.; FORMATION (SHOW CORE RECOVERY); ROTARY TABLE SPEED; WT. ON BIT; PUMP PRESSURE; PUMP NO. 1–4 LINER SIZE / S.P.M.; TOTAL PUMP OUTPUT

DEVIATION RECORD: DEPTH | DEV | DIR. | TVD | HORZ. DISP.

NIGHT TOUR

From	To	Elapsed Time	Codeno	Details Of Operations In Sequence And Remarks
19:00	20:00	1:00	22	doe ut make up bha, work with test group
20:00	7:00	11:00	22	housekeeping, unload subs, clean rig floor, organize parts house and tool room

DAY TOUR

From	To	Elapsed Time	Codeno	Details Of Operations In Sequence And Remarks
7:00	10:00	3:00	22	UT DOE slot 6- Wait on o-ring for bit, house keeping, clean observation house, work on quest/ HSE training. Moved mud products to make room for UT work area.
10:00	13:30	3:30	4	Space out inner barrels, change out attachments on sinker bars.
13:30	16:00	2:30	4	Lay down inner core barrel for length and adjustment, remeasure outer core barrel, break off bit and installed new seal, make up bit,
16:00	16:45	0:45	4	Reset BHA in the rotary, Pick up inner barrel and check space out
16:45	17:15	0:30	5	Surface flow test
17:15	18:45	1:30	4	Lay down lower section of the inner core barrel to check flow sleeve, Break off bit number one and make up bit number two horazotoly
18:45	19:00	0:15	4	Reinstall inner core barrel for flow test

Page 1 of 1

DRILLING CREW PAYROLL DATA

DATE: 09-Dec-2015

WELL NAME & NO.: JPG Training July 2015 Slot 3

COMPANY: JPEG

TOOLPUSHER; RIG NO. Explorer

NIGHT TOUR FROM 19:00 TO 7:00

CREW	EMPL.ID NO.	NAME	HRS.	INJURED ON THIS TOUR? INITIAL	YES NO
Driller	***-**-1111	DAVID SMITH	12		
Derrickman	***-**-1111	JONATHON CARRILLO	12		
Derrickman	***-**-1111	ADAM SALINAS	12		
Floorman	***-**-1111	JIMMY EWALD	12		
Roustabout		CHRIS BROUGHTON	12		

NO. DAYS SINCE LAST LOST TIME ACCIDENT

DAY TOUR FROM 7:00 TO 19:00

CREW	EMPL.ID NO.	NAME	HRS.	INJURED ON THIS TOUR? INITIAL	YES NO
Driller	***-**-1111	JOHN LAWHON	12		
Derrickman	***-**-1111	PEDRO RODRIGUEZ	12		
Floorman	***-**-1111	MIKE TOMASCIK	12		
Floorman	***-**-1111	BOBBY WARE	12		

NO. DAYS SINCE LAST LOST TIME ACCIDENT

No. No. No.

No. DAILY DRILLING REPORT REPORT NO. 112

LEASE	WELL NO.	API WELL NUMBER	WATER DEPTH	DATE
JPG Training July 2015	Slot 3	42-331-33557		10-Dec-2015

OPERATOR	CONTRACTOR	RIG NO.
Schlumberger / CTTF	JPEG	Explorer

SIGNATURE OF OPERATOR'S REPRESENTATIVE — SIGNATURE OF CONTRACTOR'S TOOL PUSHER

DP SIZE	WEIGHT	GRADE	TOOL JT O.D.	TYPE THREAD	STRING NO.	PUMP NO.	PUMP MANUFACTURER	TYPE	STROKE LENGTH
						1			
						2			
						3			
						4			

TIME DISTRIBUTION HOURS

CODE NO.	OPERATION	NIGHT	DAY
1	RIG UP AND TEAR DOWN		
2	DRILL ACTUAL		
3	REAMING		
4	CORING		1:45
5	CONDITION MUD & CIRCULATE		2:45
6	TRIPS		1:15
7	LUBRICATE RIG		
8	REPAIR RIG		
9	CUT OFF DRILLING LINE		
10	DEVIATION SURVEY		
11	WIRELINE LOGS		
12	RUN CASING & CEMENT		
13	WAIT ON CEMENT		
14	NIPPLE UP B.O.P.		
15	TEST B.O.P.		
16	DRILL STEM TEST		
17	PLUG BACK		
18	SQUEEZE CEMENT		
19	FISHING		
20	DIR. WORK		
21	Wait on test	0:30	0:45
22	Pick up inner	11:30	5:30
23			
COMPLETION A.	PERFORATING		
B.	TUBING TRIPS		
C.	TREATING		
D.	SWABBING		
E.	TESTING		
F.			
G.			
H.			
	TOTALS	12:00	12:00

DAYWORK TIME SUMMARY (OFFICE USE ONLY): HOURS W/CONTR D.P.; HOURS W/OPR D.P.; HOURS WITHOUT D.P.; HOURS STANDBY; TOTAL DAYWORK; NO. OF DAYS FROM SPUD; CUMULATIVE ROTATING HOURS; DAILY MUD COST; TOTAL MUD COST

NIGHT TOUR

DRILLING ASSEMBLY (AT END OF TOUR): NO. | ITEM | O.D. | LENGTH — (no entries); STANDS D.P.; SINGLES D.P.; KELLY DOWN; TOTAL; WT. OF STRING

BIT RECORD: BIT NO.; SIZE; IADC CODE; MANUFACTURER; TYPE; SERIAL NO.; JETS; TFA; DEPTH OUT; DEPTH IN; TOTAL DRILLED; TOTAL HOURS; CUTTING STRUCTURE: INNER, OUTER, DULL CHAR, LOCATION, BEARINGS/SEALS, GAGE, OTHER DULL CHAR, REASON PULLED — (no entries)

MUD RECORD: TIME; WEIGHT; PRESSURE GRADIENT; FUNNEL VISCOSITY; PV/YP; GEL STRENGTH; FLUID LOSS; pH; SOLIDS — (no entries)

MUD & CHEMICAL ADDED: TYPE | AMOUNT | TYPE | AMOUNT — (no entries)

REMARKS

DRILLER

DAY TOUR

DRILLING ASSEMBLY (AT END OF TOUR)

NO.	ITEM	O.D.	LENGTH
1	bit		1.3
2	stab		4.7
3	outter barrel		31.85
4	xo		1.6
5	stab.		3.32
6	sub		1.09
7	sub		3.32
8	collars		120.13
9	xo		3.01
	STANDS D.P.		
	SINGLES D.P.		
	KELLY DOWN		
	TOTAL		170.32
	WT. OF STRING		

BIT RECORD: BIT NO.; SIZE; IADC CODE; MANUFACTURER; TYPE; SERIAL NO.; JETS; TFA; DEPTH OUT; DEPTH IN; TOTAL DRILLED; TOTAL HOURS; CUTTING STRUCTURE: INNER, OUTER, DULL CHAR, LOCATION, BEARINGS/SEALS, GAGE, OTHER DULL CHAR, REASON PULLED — (no entries)

MUD RECORD

TIME	09:00	11:00	
WEIGHT	9.5	9.5	
PRESSURE GRADIENT	0.49305	0.49305	
FUNNEL VISCOSITY	41	40	
PV/YP			
GEL STRENGTH			
FLUID LOSS			
pH	7.5	10	
SOLIDS			

MUD & CHEMICAL ADDED

TYPE	AMOUNT	TYPE	AMOUNT
Caustic			

REMARKS

DRILLER

No.

DAILY DRILLING REPORT WELL Slot 3 REPORT NO. 112 DATE 10-Dec-2015

FIELD OR DISTRICT	COUNTY	STATE / COUNTRY
Cameron TX	Milam	TX / United States

LAST CASING TUBING OR LINER: SIZE | MAKE | WEIGHT GRADE | NO. JOINTS | LENGTH | RKB. TO CSG. HD. | SET AT — (no entries)

WIRE LINE RECORD REEL NO.: SIZE; NO LINES; LENGTH SLIPPED; LENGTH CUT OFF; PRESENT LENGTH; WEAR OR TRIPS SINCE LAST CUT; CUMULATIVE WEAR OR TRIPS

DEPTH INTERVAL FROM / TO; DRILL D REAM R CORE C; CORE NO.; FORMATION (SHOW CORE RECOVERY); ROTARY TABLE SPEED; WT. ON BIT; PUMP PRESSURE; PUMP NO. 1–4 LINER SIZE / S.P.M.; TOTAL PUMP OUTPUT — (no entries)

DEVIATION RECORD: DEPTH | DEV | DIR. | TVD | HORZ. DISP. — (no entries)

NIGHT TOUR

From	To	Elapsed Time	Code No	Details Of Operations In Sequence And Remarks
19:00	19:30	0:30	21	ut doe slot 6 pump test 25 gpm increase to 300 psi
19:30	19:45	0:15	22	break tool apart laydown core barrel
19:45	21:30	1:45	22	laydown single dp, pu collars off catwalk, tih to 500'
21:30	7:00	9:30	22	housekeeping, clean observation house, clean and organize mud house, organize around catwalk area, clean and pressure wash mud pumps, trash walk take out trash

DAY TOUR

DEVIATION RECORD: DEPTH | DEV | DIR. | TVD | HORZ. DISP. — (no entries)

From	To	Elapsed Time	Code No	Details Of Operations In Sequence And Remarks
7:00	7:30	0:30	21	UT-DOE slot 6 - Wait on test group. Housekeeping
7:30	8:15	0:45	22	Rig up wire line.
8:15	8:30	0:15	21	Wait on test group. Rebuilding inner core.
8:30	9:30	1:00	6	Plan change trip in to 1900'.
9:30	9:45	0:15	5	Circulate and condition mud, move tools for test group.
9:45	10:45	1:00	22	Rig up wire line and run inner core barrel.
10:45	11:15	0:30	22	Retrieve inner core for water core sample.
11:15	11:30	0:15	22	Rig down wire line and lay down inner core.
11:30	13:15	1:45	5	Wait on tools to get ready, circulate and condition mud. Process water.
13:15	13:30	0:15	22	Rig up wire line and pick up lower section of inner barrel.
13:30	13:45	0:15	22	Rig down wire line. lay down lower section of inner core barrel. (trouble latching tool)
13:45	14:30	0:45	5	Wait on tools to get ready circulate and condition mud, house keeping, process water.
14:30	15:30	1:00	22	Rig up wire line, pick up lower section of inner core barrel. (work on wire line setup)
15:30	16:00	0:30	22	Retrieve inner core for water core sample.
16:00	16:30	0:30	22	Rig down wire line, lay down inner section of coring tool.
16:30	17:00	0:30	22	Pick up inner core barrel and run in on wire line, rig down wire line.
17:00	17:15	0:15	6	Pick up stand and circulate. (Flow test)
17:15	19:00	1:45	4	Core from 1948' to1950'

No.

Page 1 of 1

DRILLING CREW PAYROLL DATA

DATE: 10-Dec-2015

WELL NAME & NO.: JPG Training July 2015 Slot 3

COMPANY: JPEG

TOOLPUSHER — RIG NO. Explorer

NIGHT TOUR FROM 19:00 TO 7:00

CREW	EMPL.ID NO.	NAME	HRS.	INJURED ON THIS TOUR? INITIAL	YES NO
Driller	***-**-1111	DAVID SMITH	12		
Derrickman	***-**-1111	JONATHON CARRILLO	12		
Derrickman	***-**-1111	ADAM SALINAS	12		
Floorman	***-**-1111	JIMMY EWALD	12		
Roustabout		CHRIS BROUGHTON	12		

NO. DAYS SINCE LAST LOST TIME ACCIDENT

DAY TOUR FROM 7:00 TO 19:00

CREW	EMPL.ID NO.	NAME	HRS.	INJURED ON THIS TOUR? INITIAL	YES NO
Driller	***-**-1111	JOHN LAWHON	12		
Derrickman	***-**-1111	PEDRO RODRIGUEZ	12		
Floorman	***-**-1111	MIKE TOMASCIK	12		
Floorman	***-**-1111	BOBBY WARE	12		

NO. DAYS SINCE LAST LOST TIME ACCIDENT

No.

No. DAILY DRILLING REPORT REPORT NO. 113

LEASE	WELL NO.	API WELL NUMBER	WATER DEPTH	DATE
JPG Training July 2015	Slot 3	42-331-33557		11-Dec-2015
OPERATOR: Schlumberger / CTTF		CONTRACTOR: JPEG		RIG NO.: Explorer

SIGNATURE OF OPERATOR'S REPRESENTATIVE — SIGNATURE OF CONTRACTOR'S TOOL PUSHER

DP SIZE	WEIGHT	GRADE	TOOL JT O.D.	TYPE THREAD	STRING NO.	PUMP NO.	PUMP MANUFACTURER	TYPE	STROKE LENGTH
						1			
						2			
						3			
						4			

TIME DISTRIBUTION HOURS

CODE NO.	OPERATION	NIGHT	DAY
1	RIG UP AND TEAR DOWN		
2	DRILL ACTUAL		5:30
3	REAMING		
4	CORING		1:30
5	CONDITION MUD & CIRCULATE		1:00
6	TRIPS	0:45	1:15
7	LUBRICATE RIG		
8	REPAIR RIG		
9	CUT OFF DRILLING LINE		
10	DEVIATION SURVEY		
11	WIRELINE LOGS		0:30
12	RUN CASING & CEMENT		
13	WAIT ON CEMENT		
14	NIPPLE UP B.O.P.		
15	TEST B.O.P.		
16	DRILL STEM TEST		
17	PLUG BACK		
18	SQUEEZE CEMENT		
19	FISHING		
20	DIR. WORK		
21	UT-DOE slot 6	2:00	1:30
22	Break off bit	9:15	0:45
23			
COMPLETION A	PERFORATING		
B	TUBING TRIPS		
C	TREATING		
D	SWABBING		
E	TESTING		
F			
G			
H			
	TOTALS	12:00	12:00

DAYWORK TIME SUMMARY (OFFICE USE ONLY): HOURS W/CONTR D.P.; HOURS W/OPR D.P.; HOURS WITHOUT D.P.; HOURS STANDBY; TOTAL DAYWORK; NO. OF DAYS FROM SPUD; CUMULATIVE ROTATING HOURS; DAILY MUD COST; TOTAL MUD COST

NIGHT TOUR

DRILLING ASSEMBLY (AT END OF TOUR): NO. / ITEM / O.D. / LENGTH; STANDS D.P.; SINGLES D.P.; KELLY DOWN; TOTAL; WT. OF STRING

BIT RECORD: BIT NO.; SIZE; IADC CODE; MANUFACTURER; TYPE; SERIAL NO.; JETS; TFA; DEPTH OUT; DEPTH IN; TOTAL DRILLED; TOTAL HOURS; CUTTING STRUCTURE (INNER, OUTER, DULL CHAR, LOCATION, BEARINGS/SEALS, GAGE, OTHER DULL CHAR, REASON PULLED)

MUD RECORD: TIME; WEIGHT; PRESSURE GRADIENT; FUNNEL VISCOSITY; PV/YP; GEL STRENGTH; FLUID LOSS; pH; SOLIDS; MUD & CHEMICAL ADDED (TYPE, AMOUNT, TYPE, AMOUNT)

REMARKS

DRILLER

DEVIATION RECORD: DEPTH, DEV, DIR., TVD, HORZ. DISP.

From	To	Elapsed Time	Code No	Details Of Operations In Sequence And Remarks
19:00	21:00	2:00	21	ut doe slot 6 core from 1950' to 1953'
21:00	22:00	1:00	22	rack back std dp rig up wireline, retrieve core barrel,latch on core barrel with 500 gpm, rig down wireline, lay down core barrel and corring tools
22:00	22:45	0:45	6	pooh yo inspect bit
22:45	23:00	0:15	22	take pictures of bit test group inspect bit make call for moving forward
23:00	23:15	0:15	22	fill hole
23:15	7:00	7:45	22	housekeeping, clean rig floor, process water,prime sib street sign, trash, organize parts house, clean dope off shakers

DAY TOUR

DRILLING ASSEMBLY (AT END OF TOUR)

NO.	ITEM	O.D.	LENGTH
1	bit		1.3
2	stab		4.7
3	outter barrel		31.85
4	xo		1.6
5	stab.		3.32
6	sub		1.09
7	sub		3.32
8	collars		120.13
9	xo		3.01
	STANDS D.P.		
	SINGLES D.P.		
	KELLY DOWN		
	TOTAL		170.32
	WT. OF STRING		

BIT RECORD: BIT NO.; SIZE; IADC CODE; MANUFACTURER; TYPE; SERIAL NO.; JETS; TFA; DEPTH OUT; DEPTH IN; TOTAL DRILLED; TOTAL HOURS; CUTTING STRUCTURE (INNER, OUTER, DULL CHAR, LOCATION, BEARINGS/SEALS, GAGE, OTHER DULL CHAR, REASON PULLED)

MUD RECORD: TIME; WEIGHT; PRESSURE GRADIENT; FUNNEL VISCOSITY; PV/YP; GEL STRENGTH; FLUID LOSS; pH; SOLIDS

MUD & CHEMICAL ADDED

TYPE	AMOUNT	TYPE	AMOUNT
DynaDet	5	Caustic	1

REMARKS

DRILLER

DEVIATION RECORD: DEPTH, DEV, DIR., TVD, HORZ. DISP.

From	To	Elapsed Time	Code No	Details Of Operations In Sequence And Remarks
7:00	8:30	1:30	21	UT-DOE slot 6 / Test group in meeting, Inspect bit, Housekeeping, Clean bit
8:30	9:15	0:45	22	Break off bit, Remove inner seal, Make up bit
9:15	9:30	0:15	6	Run BHA
9:30	10:30	1:00	6	TIH to1856'
10:30	11:00	0:30	11	Rig up wireline, Run center bit ballel, Rig down wireline
11:00	11:45	0:45	5	Circulate and condition
11:45	17:15	5:30	2	Drill from 1953' to 1992'
17:15	18:45	1:30	4	Rig up wireline, Change upper and lower core barrels, Rig down wireline
18:45	19:00	0:15	5	Flow test

No.

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DAILY DRILLING REPORT WELL Slot 3 REPORT NO. 113 DATE 11-Dec-2015

FIELD OR DISTRICT	COUNTY	STATE / COUNTRY
Cameron TX	Milam	TX / United States

LAST CASING / TUBING / OR LINER: SIZE, MAKE, WEIGHT GRADE, NO. JOINTS, LENGTH, RKB. TO CSG. HD., SET AT

WIRE LINE RECORD REEL NO.: SIZE; NO LINES; LENGTH SLIPPED; LENGTH CUT OFF; PRESENT LENGTH; WEAR OR TRIPS SINCE LAST CUT; CUMULATIVE WEAR OR TRIPS

DEPTH INTERVAL (FROM, TO); DRILL'G REAM'G CORE'G; CORE NO.; FORMATION (SHOW CORE RECOVERY); ROTARY TABLE SPEED; WT. ON BIT; PUMP PRESSURE; PUMP NO. 1–4 (LINER SIZE, S.P.M.); TOTAL PUMP OUTPUT

No.

DRILLING CREW PAYROLL DATA

DATE: 11-Dec-2015

WELL NAME & NO.: JPG Training July 2015 Slot 3

COMPANY: JPEG

TOOLPUSHER — RIG NO. Explorer

NIGHT TOUR FROM 19:00 TO 7:00

CREW	EMPL.ID NO.	NAME	HRS.	INITIAL	INJURED ON THIS TOUR? YES NO
Driller	***-**-1111	DAVID SMITH	12		
Derrickman	***-**-1111	JONATHON CARRILLO	12		
Derrickman	***-**-1111	ADAM SALINAS	12		
Floorman	***-**-1111	JIMMY EWALD	12		
Roustabout		CHRIS BROUGHTON	12		

NO. DAYS SINCE LAST LOST TIME ACCIDENT

DAY TOUR FROM 7:00 TO 19:00

CREW	EMPL.ID NO.	NAME	HRS.	INITIAL	INJURED ON THIS TOUR? YES NO
Driller	***-**-1111	JOHN LAWHON	12		
Derrickman	***-**-1111	PEDRO RODRIGUEZ	12		
Floorman	***-**-1111	MIKE TOMASCIK	12		
Floorman	***-**-1111	BOBBY WARE	12		

NO. DAYS SINCE LAST LOST TIME ACCIDENT

No.

No.

DAILY DRILLING REPORT

REPORT NO. 114

LEASE	WELL NO.	API WELL NUMBER	WATER DEPTH	DATE
JPG Training July 2015	Slot 3	42-331-33557		12-Dec-2015
OPERATOR: Schlumberger / CTTF		CONTRACTOR: JPEG		RIG NO.: Explorer
SIGNATURE OF OPERATOR'S REPRESENTATIVE		SIGNATURE OF CONTRACTOR'S TOOL PUSHER		

DP SIZE	WEIGHT	GRADE	TOOL JT O.D.	TYPE THREAD	STRING NO.	PUMP NO.	PUMP MANUFACTURER	TYPE	STROKE LENGTH
						1			
						2			
						3			
						4			

TIME DISTRIBUTION HOURS

CODE NO.	OPERATION	NIGHT	DAY
1	RIG UP AND TEAR DOWN		
2	DRILL ACTUAL	5:00	
3	REAMING		
4	CORING		
5	CONDITION MUD & CIRCULATE		
6	TRIPS	1:00	
7	LUBRICATE RIG		
8	REPAIR RIG		
9	CUT OFF DRILLING LINE		
10	DEVIATION SURVEY		
11	WIRELINE LOGS		
12	RUN CASING & CEMENT		
13	WAIT ON CEMENT		
14	NIPPLE UP B.O.P.		
15	TEST B.O.P.		
16	DRILL STEM TEST		
17	PLUG BACK		
18	SQUEEZE CEMENT		
19	FISHING		
20	DIR. WORK		
21	doe/ut slot 6	2:30	
22	housekeeping,	3:30	
23			
COMPLETION A	PERFORATING		
B	TUBING TRIPS		
C	TREATING		
D	SWABBING		
E	TESTING		
F			
G			
H			
	TOTALS	12:00	

DAYWORK TIME SUMMARY (OFFICE USE ONLY)

HOURS W/CONTR D.P.		
HOURS W/OPR D.P.		
HOURS WITHOUT D.P.		
HOURS STANDBY		
TOTAL DAYWORK		
NO. OF DAYS FROM SPUD		
CUMULATIVE ROTATING HOURS		
DAILY MUD COST		
TOTAL MUD COST		

NIGHT TOUR

DRILLING ASSEMBLY (AT END OF TOUR)

NO.	ITEM	O.D.	LENGTH
	STANDS D.P.		
	SINGLES D.P.		
	KELLY DOWN		
	TOTAL		
	WT. OF STRING		

BIT RECORD: BIT NO. / SIZE / IADC CODE / MANUFACTURER / TYPE / SERIAL NO. / JETS / TFA / DEPTH OUT / DEPTH IN / TOTAL DRILLED / TOTAL HOURS

CUTTING STRUCTURE: INNER / OUTER / DULL CHAR / LOCATION / BEARINGS/SEALS / GAGE / OTHER DULL CHAR / REASON PULLED

MUD RECORD: TIME / WEIGHT / PRESSURE GRADIENT / FUNNEL VISCOSITY / PV/YP / GEL STRENGTH / FLUID LOSS / pH / SOLIDS

MUD & CHEMICAL ADDED: TYPE / AMOUNT / TYPE / AMOUNT

REMARKS

DRILLER

DAY TOUR

DRILLING ASSEMBLY (AT END OF TOUR)

NO.	ITEM	O.D.	LENGTH
1	bit		1.3
2	stab		4.7
3	outter barrel		31.85
4	xo		1.6
5	stab.		3.32
6	sub		1.09
7	sub		3.32
8	collars		120.13
9	xo		3.01
	STANDS D.P.		
	SINGLES D.P.		
	KELLY DOWN		
	TOTAL		170.32
	WT. OF STRING		

BIT RECORD: BIT NO. / SIZE / IADC CODE / MANUFACTURER / TYPE / SERIAL NO. / JETS / TFA / DEPTH OUT / DEPTH IN / TOTAL DRILLED / TOTAL HOURS

CUTTING STRUCTURE: INNER / OUTER / DULL CHAR / LOCATION / BEARINGS/SEALS / GAGE / OTHER DULL CHAR / REASON PULLED

MUD RECORD: TIME / WEIGHT / PRESSURE GRADIENT / FUNNEL VISCOSITY / PV/YP / GEL STRENGTH / FLUID LOSS / pH / SOLIDS

MUD & CHEMICAL ADDED: TYPE / AMOUNT / TYPE / AMOUNT

REMARKS

DRILLER

No.

DAILY DRILLING REPORT

WELL Slot 3 REPORT NO. 114 DATE 12-Dec-2015

FIELD OR DISTRICT	COUNTY	STATE / COUNTRY
Cameron TX	Milam	TX / United States

LAST CASING TUBING OR LINER	SIZE	MAKE	WEIGHT GRADE	NO. JOINTS	LENGTH	RKB. TO CSG. HD.	SET AT

WIRE LINE RECORD REEL NO.: SIZE / NO LINES / LENGTH SLIPPED / LENGTH CUT OFF / PRESENT LENGTH / WEAR OR TRIPS SINCE LAST CUT / CUMULATIVE WEAR OR TRIPS

DEPTH INTERVAL (FROM / TO) / DRILL.D REAM.R CORE.C / CORE NO. / FORMATION (SHOW CORE RECOVERY) / ROTARY TABLE SPEED / WT. ON BIT / PUMP PRESSURE / PUMP NO. 1–4 (LINER SIZE, S.P.M.) / TOTAL PUMP OUTPUT

DEVIATION RECORD: DEPTH / DEV / DIR. / TVD / HORZ. DISP.

NIGHT TOUR

From	To	Elapsed Time	CodeNo	Details Of Operations In Sequence And Remarks
19:00	21:30	2:30	21	doe/ut slot 6 core from 1992' to 1998'
21:30	0:15	2:45	22	rack back 1 std rig up wireline, latch core barrel,pump 50 gpm to wash around core barrel packed off pump 63 gpm to wash around core barrel, attempt to retrieve core barrel, pump 38 gpm adjust pack off onwireline, retrieve core barrel laydown core barrel, pick up center bit and tools, make up on rig floor, run center bit, rig down wireline
0:15	5:15	5:00	2	drill from 1998' to 2060'
5:15	6:15	1:00	6	pooh
6:15	7:00	0:45	22	housekeeping, fill hole, clena rig floor after trip, rig shutdown

DAY TOUR

From	To	Elapsed Time	CodeNo	Details Of Operations In Sequence And Remarks

No.

Page 1 of 1

DRILLING CREW PAYROLL DATA

DATE: 12-Dec-2015

WELL NAME & NO.: JPG Training July 2015 Slot 3

COMPANY: JPEG

TOOLPUSHER

RIG NO.: Explorer

NIGHT TOUR FROM 19:00 TO 7:00

CREW	EMPL.ID NO.	NAME	HRS.	INJURED ON THIS TOUR? INITIAL	YES NO
Driller	***-**-1111	DAVID SMITH	12		
Derrickman	***-**-1111	JONATHON CARRILLO	12		
Derrickman	***-**-1111	ADAM SALINAS	12		
Floorman	***-**-1111	JIMMY EWALD	12		
Roustabout		CHRIS BROUGHTON	12		

NO. DAYS SINCE LAST LOST TIME ACCIDENT

DAY TOUR FROM 7:00 TO 19:00

CREW	EMPL.ID NO.	NAME	HRS.	INJURED ON THIS TOUR? INITIAL	YES NO

NO. DAYS SINCE LAST LOST TIME ACCIDENT

No.

No.

DAILY DRILLING REPORT

REPORT NO. 115

LEASE	WELL NO.	API WELL NUMBER	WATER DEPTH	DATE
JPG Training July 2015	Slot 3	42-331-33557		14-Dec-2015

OPERATOR	CONTRACTOR	RIG NO.
Schlumberger / CTTF	JPEG	Explorer

SIGNATURE OF OPERATOR'S REPRESENTATIVE | SIGNATURE OF CONTRACTOR'S TOOL PUSHER

DP SIZE	WEIGHT	GRADE	TOOL JT O.D.	TYPE THREAD	STRING NO.	PUMP NO.	PUMP MANUFACTURER	TYPE	STROKE LENGTH
						1			
						2			
						3			
						4			

TIME DISTRIBUTION HOURS

CODE NO.	OPERATION	NIGHT	DAY
1	RIG UP AND TEAR DOWN		
2	DRILL ACTUAL		
3	REAMING		
4	CORING		2:45
5	CONDITION MUD & CIRCULATE		
6	TRIPS		3:00
7	LUBRICATE RIG		
8	REPAIR RIG		
9	CUT OFF DRILLING LINE		
10	DEVIATION SURVEY		
11	WIRELINE LOGS		
12	RUN CASING & CEMENT		
13	WAIT ON CEMENT		
14	NIPPLE UP B.O.P.		
15	TEST B.O.P.		
16	DRILL STEM TEST		
17	PLUG BACK		
18	SQUEEZE CEMENT		
19	FISHING		
20	DIR. WORK		
21			
22	Lay down sug		3:15
23	Rig up wire l		3:00
COMPLETION A	PERFORATING		
B	TUBING TRIPS		
C	TREATING		
D	SWABBING		
E	TESTING		
F			
G			
H			
TOTALS			12:00

DAYWORK TIME SUMMARY (OFFICE USE ONLY)

HOURS W/CONTR D.P.	
HOURS W/OPR D.P.	
HOURS WITHOUT D.P.	
HOURS STANDBY	
TOTAL DAYWORK	
NO. OF DAYS FROM SPUD	
CUMULATIVE ROTATING HOURS	
DAILY MUD COST	
TOTAL MUD COST	

NIGHT TOUR

DRILLING ASSEMBLY (AT END OF TOUR): NO. | ITEM | O.D. | LENGTH — no entries. STANDS D.P. | SINGLES D.P. | KELLY DOWN | TOTAL | WT. OF STRING

BIT RECORD: BIT NO. | SIZE | IADC CODE | MANUFACTURER | TYPE | SERIAL NO. | JETS | TFA | DEPTH OUT | DEPTH IN | TOTAL DRILLED | TOTAL HOURS | CUTTING STRUCTURE (INNER, OUTER, DULL CHAR, LOCATION) | BEARINGS/SEALS | GAGE | OTHER DULL CHAR | REASON PULLED — no entries.

MUD RECORD: TIME | WEIGHT | PRESSURE GRADIENT | FUNNEL VISCOSITY | PV/YP | GEL STRENGTH | FLUID LOSS | pH | SOLIDS — no entries. MUD & CHEMICAL ADDED: TYPE | AMOUNT | TYPE | AMOUNT — no entries.

REMARKS

DRILLER

DEPTH INTERVAL (FROM, TO) | DRILL'G SEAL'G CORE'G | CORE NO. | FORMATION (SHOW CORE RECOVERY) | ROTARY TABLE SPEED | WT. ON BIT | PUMP PRESSURE | PUMP NO. 1–4 (LINER SIZE, S.P.M.) | TOTAL PUMP OUTPUT — no entries.

DEVIATION RECORD: DEPTH | DEV | DIR. | TVD | HORZ. DISP. — no entries.

From	To	Elapsed Time	Code No	Details Of Operations In Sequence And Remarks

DAY TOUR

DRILLING ASSEMBLY (AT END OF TOUR)

NO.	ITEM	O.D.	LENGTH
1	bit		1.3
2	stab		4.7
3	outter barrel		31.85
4	xo		1.6
5	stab.		3.32
6	sub		1.09
7	sub		3.32
8	collars		120.13
9	xo		3.01
	STANDS D.P.		
	SINGLES D.P.		
	KELLY DOWN		
	TOTAL		170.32

WT. OF STRING

BIT RECORD: BIT NO. | SIZE | IADC CODE | MANUFACTURER | TYPE | SERIAL NO. | JETS | TFA | DEPTH OUT | DEPTH IN | TOTAL DRILLED | TOTAL HOURS | CUTTING STRUCTURE (INNER, OUTER, DULL CHAR, LOCATION) | BEARINGS/SEALS | GAGE | OTHER DULL CHAR | REASON PULLED — no entries.

MUD RECORD: TIME | WEIGHT | PRESSURE GRADIENT | FUNNEL VISCOSITY | PV/YP | GEL STRENGTH | FLUID LOSS | pH | SOLIDS — no entries.

MUD & CHEMICAL ADDED

TYPE	AMOUNT	TYPE	AMOUNT
DynaDet	2	Caustic	1

REMARKS

DRILLER

DEVIATION RECORD: DEPTH | DEV | DIR. | TVD | HORZ. DISP. — no entries.

From	To	Elapsed Time	Code No	Details Of Operations In Sequence And Remarks
7:00	7:15	0:15	22	UT-DOE test slot 6. Rig start up.
7:15	7:30	0:15	23	Inspect bit.
7:30	8:00	0:30	23	Remove center bit and upper core.
8:00	8:15	0:15	22	P/U BHA
8:15	9:15	1:00	6	TIH to 2051'
9:15	10:30	1:15	23	Rig up wire line, run core barrel and upper core barrel, rig down wire line.
10:30	13:15	2:45	4	Core from 2060' to 2064'
13:15	14:15	1:00	23	Rig up wire line, pull inner core, Rig down wire line.
14:15	15:30	1:15	6	POOH, work with group on data logs.
15:30	16:00	0:30	22	P/U single and cross over make up to top of BHA.
16:00	16:15	0:15	22	P/U upper and lower inner sleve.
16:15	17:30	1:15	22	Flow test and check sleve for calaps.
17:30	18:00	0:30	22	L/D upper and lower sleve.
18:00	18:15	0:15	22	Lay down sug and XO, make up BHA
18:15	19:00	0:45	6	TIH 1864'

No. No.

DAILY DRILLING REPORT WELL Slot 3 REPORT NO. 115 DATE 14-Dec-2015

Page 1 of 1

FIELD OR DISTRICT	COUNTY	STATE / COUNTRY
Cameron TX	Milam	TX / United States

LAST CASING, TUBING OR LINER: SIZE | MAKE | WEIGHT GRADE | NO. JOINTS | LENGTH | RKB. TO CSG. HD. | SET AT — no entries.

WIRE LINE RECORD REEL NO.: SIZE | NO LINES | LENGTH SLIPPED | LENGTH CUT OFF | PRESENT LENGTH | WEAR OR TRIPS SINCE LAST CUT | CUMULATIVE WEAR OR TRIPS — no entries.

DRILLING CREW PAYROLL DATA

DATE	14-Dec-2015
WELL NAME & NO.	JPG Training July 2015 Slot 3
COMPANY	JPEG
TOOLPUSHER	
RIG NO.	Explorer

NIGHT TOUR FROM 19:00 TO 7:00

CREW	EMPL.ID NO.	NAME	HRS.	INJURED ON THIS TOUR? INITIAL	YES NO

NO. DAYS SINCE LAST LOST TIME ACCIDENT

DAY TOUR FROM 7:00 TO 19:00

CREW	EMPL.ID NO.	NAME	HRS.	INJURED ON THIS TOUR? INITIAL	YES NO
Driller	***-**-1111	JOHN LAWHON	12		
Derrickman	***-**-1111	PEDRO RODRIGUEZ	12		
Floorman	***-**-1111	MIKE TOMASCIK	12		
Floorman	***-**-1111	BOBBY WARE	12		

NO. DAYS SINCE LAST LOST TIME ACCIDENT

No.

No. DAILY DRILLING REPORT REPORT NO. 116

LEASE	WELL NO.	API WELL NUMBER	WATER DEPTH	DATE
JPG Training July 2015	Slot 3	42-331-33557		15-Dec-2015
OPERATOR: Schlumberger / CTTF		CONTRACTOR: JPEG		RIG NO.: Explorer

SIGNATURE OF OPERATOR'S REPRESENTATIVE — SIGNATURE OF CONTRACTOR'S TOOL PUSHER

TIME DISTRIBUTION HOURS

CODE NO.	OPERATION	NIGHT	DAY
1	RIG UP AND TEAR DOWN		
2	DRILL ACTUAL		
3	REAMING		
4	CORING	1:30	7:30
5	CONDITION MUD & CIRCULATE		1:15
6	TRIPS		2:45
7	LUBRICATE RIG		
8	REPAIR RIG		
9	CUT OFF DRILLING LINE		
10	DEVIATION SURVEY		
11	WIRELINE LOGS	3:00	
12	RUN CASING & CEMENT		
13	WAIT ON CEMENT		
14	NIPPLE UP B.O.P.		
15	TEST B.O.P.		
16	DRILL STEM TEST		
17	PLUG BACK		
18	SQUEEZE CEMENT		
19	FISHING		
20	DIR. WORK		
21	ut doe slot 6	0:30	
22	UT/DOE/SLOT 6	7:00	0:30
23			
A.	PERFORATING		
B.	TUBING TRIPS		
C.	TREATING		
D.	SWABBING		
E.	TESTING		
TOTALS		12:00	12:00

DRILLING ASSEMBLY (AT END OF TOUR) — Night

NO.	ITEM	O.D.	LENGTH
1	bit		1.3
2	stab.		4.7
3	outter barrel		31.85
4	xo		1.6
5	stab		3.32
6	sub		1.09
7	sub		3.32
8	collar		120.13
9	xo		3.01
	TOTAL		170.32

DRILLING ASSEMBLY (AT END OF TOUR) — Day

NO.	ITEM	O.D.	LENGTH
1	bit		1.3
2	stab.		4.7
3	outter barrel		31.85
4	xo		1.6
5	stab		3.32
6	sub		1.09
7	sub		3.32
8	collar		120.13
9	xo		3.01
	TOTAL		170.32

DAILY DRILLING REPORT — WELL Slot 3 — REPORT NO. 116 — DATE 15-Dec-2015

Page 1 of 1

FIELD OR DISTRICT: Cameron TX — COUNTY: Milam — STATE / COUNTRY: TX / United States

NIGHT TOUR — Details Of Operations In Sequence And Remarks

From	To	Elapsed Time	Code No	Details Of Operations In Sequence And Remarks
19:00	19:30	0:30	21	ut doe slot 6 ream std down to 2057'
19:30	20:45	1:15	11	rig up wireline to set core barrel, rig down wireline
20:45	21:00	0:15	22	pick up std wash to bottom @ 2063'
21:00	22:30	1:30	4	core from 2063' to 2069'
22:30	0:15	1:45	11	rack back std rig up wireline, retrieve core barrel, l/d core tools, p/u center bit, run center bit in on wireline, rig down wireline
0:15	7:00	6:45	22	work with omron drum encoder mismatch, power down plc, hang blocks off, test tention links, power up plc, work on wash pipe, test milliamps on hook load cell, swap card on hookload cell, change washpipe

DAY TOUR — Details Of Operations In Sequence And Remarks

From	To	Elapsed Time	Code No	Details Of Operations In Sequence And Remarks
7:00	7:30	0:30	22	UT/DOE/SLOT 6 - Circulate and condition, Meeting with test group on ops.
7:30	9:15	1:45	4	Rig up wireline, Retrive center bit, Run upper and lower core barrel,
9:15	9:45	0:30	4	Retrive upper and lower core barrel for water core
9:45	10:30	0:45	4	Change sleave in core barrel
10:30	11:00	0:30	4	Run upper and lower core barrel, Flow at 100 GPM for 5 min.
11:00	11:45	0:45	4	Retrive inner and outer core barrel for water core, Rig down wireline
11:45	12:30	0:45	5	Circulate and condition, Wait on tools
12:30	13:15	0:45	4	Rig up wireline, Run inner and outer core barrels, Rig down wireline
13:15	14:30	1:15	4	Core from 2069' To 2070'
14:30	15:00	0:30	4	Rig up wireline, Retrive upper and lower core barrels
15:00	15:30	0:30	5	Circulate and condition, Wait on tools
15:30	16:45	1:15	6	POOH
16:45	17:30	0:45	6	Inspect bit, breack off 9 7/8 bit, Replace with 10 5/8 bit
17:30	18:15	0:45	4	Spaceout with new bit by picking up inner core and checking at the bit, Lay down inner core
18:15	19:00	0:45	6	TIH to

DRILLING CREW PAYROLL DATA

DATE: 15-Dec-2015
WELL NAME & NO.: JPG Training July 2015 Slot 3
COMPANY: JPEG
TOOLPUSHER:
RIG NO.: Explorer

NIGHT TOUR — FROM 19:00 TO 7:00

CREW	EMPL.ID NO.	NAME	HRS.
Driller	***-**-1111	DAVID SMITH	12
Derrickman	***-**-1111	JONATHON CARRILLO	12
Derrickman	***-**-1111	ADAM SALINAS	12
Floorman	***-**-1111	JIMMY EWALD	12
Roustabout		CHRIS BROUGHTON	12

NO. DAYS SINCE LAST LOST TIME ACCIDENT

DAY TOUR — FROM 7:00 TO 19:00

CREW	EMPL.ID NO.	NAME	HRS.
Driller	***-**-1111	JOHN LAWHON	12
Derrickman	***-**-1111	PEDRO RODRIGUEZ	12
Floorman	***-**-1111	MIKE TOMASCIK	12
Floorman	***-**-1111	BOBBY WARE	12

NO. DAYS SINCE LAST LOST TIME ACCIDENT

No. No. No.

No. DAILY DRILLING REPORT REPORT NO. 117

LEASE	WELL NO.	API WELL NUMBER	WATER DEPTH	DATE
JPG Training July 2015	Slot 3	42-331-33557		16-Dec-2015
OPERATOR Schlumberger / CTTF		CONTRACTOR JPEG		RIG NO. Explorer
SIGNATURE OF OPERATOR'S REPRESENTATIVE		SIGNATURE OF CONTRACTOR'S TOOL PUSHER		

DP SIZE	WEIGHT	GRADE	TOOL JT O.D.	TYPE THREAD	STRING NO.	PUMP NO.	PUMP MANUFACTURER	TYPE	STROKE LENGTH
						1			
						2			
						3			
						4			

TIME DISTRIBUTION HOURS

CODE NO.	OPERATION	NIGHT	DAY
1	RIG UP AND TEAR DOWN		
2	DRILL ACTUAL		
3	REAMING		
4	CORING		2:45
5	CONDITION MUD & CIRCULATE	8:00	0:30
6	TRIPS		
7	LUBRICATE RIG		
8	REPAIR RIG		
9	CUT OFF DRILLING LINE		
10	DEVIATION SURVEY		
11	WIRELINE LOGS	1:00	
12	RUN CASING & CEMENT		
13	WAIT ON CEMENT		
14	NIPPLE UP B.O.P.		
15	TEST B.O.P.		
16	DRILL STEM TEST		
17	PLUG BACK		
18	SQUEEZE CEMENT		
19	FISHING		
20	DIR. WORK		
21	ut doe slot 6	2:15	
22	R/u wireline,		4:15
23			
COMPLETION	A. PERFORATING		
	B. TUBING TRIPS		
	C. TREATING		
	D. SWABBING		
	E. TESTING		
	F		
	G		
	H		
TOTALS		11:15	7:30

DAYWORK TIME SUMMARY (OFFICE USE ONLY)

HOURS W/CONTR D.P.
HOURS W/OPR D.P.
HOURS WITHOUT D.P.
HOURS STANDBY

TOTAL DAYWORK
NO. OF DAYS FROM SPUD
CUMULATIVE ROTATING HOURS
DAILY MUD COST
TOTAL MUD COST

DRILLING ASSEMBLY (AT END OF TOUR) — Night

NO.	ITEM	O.D.	LENGTH
1	bit		1.3
2	stab.		4.7
3	outter barrel		31.85
4	xo		1.6
5	stab		3.32
6	sub		1.09
7	sub		3.32
8	collar		120.13
9	xo		3.01
	STANDS D.P.		
	SINGLES D.P.		
	KELLY DOWN		
	TOTAL		170.32

WT. OF STRING

REMARKS

DRILLER

BIT RECORD: BIT NO., SIZE, IADC CODE, MANUFACTURER, TYPE, SERIAL NO., JETS, TFA, DEPTH OUT, DEPTH IN, TOTAL DRILLED, TOTAL HOURS, CUTTING STRUCTURE (INNER, OUTER, DULL CHAR, LOCATION), BEARINGS/SEALS, GAGE, OTHER DULL CHAR, REASON PULLED

MUD RECORD: TIME, WEIGHT, PRESSURE GRADIENT, FUNNEL VISCOSITY, PV/YP, GEL STRENGTH, FLUID LOSS, pH, SOLIDS

MUD & CHEMICAL ADDED: TYPE, AMOUNT, TYPE, AMOUNT

DRILLING ASSEMBLY (AT END OF TOUR) — Day

NO.	ITEM	O.D.	LENGTH
	STANDS D.P.		
	SINGLES D.P.		
	KELLY DOWN		
	TOTAL		

WT. OF STRING

REMARKS

DRILLER

No.

Page 1 of 1

DAILY DRILLING REPORT WELL Slot 3 REPORT NO. 117 DATE 16-Dec-2015

FIELD OR DISTRICT	COUNTY	STATE / COUNTRY
Cameron TX	Milam	TX / United States

LAST CASING, TUBING OR LINER: SIZE, MAKE, WEIGHT GRADE, NO. JOINTS, LENGTH, RKB. TO CSG. HD., SET AT

WIRE LINE RECORD REEL NO.: SIZE, NO LINES, LENGTH SLIPPED, LENGTH CUT OFF, PRESENT LENGTH, WEAR OR TRIPS SINCE LAST CUT, CUMULATIVE WEAR OR TRIPS

DEPTH INTERVAL (FROM, TO), DRILL D REAM R CORE C, CORE NO., FORMATION (SHOW CORE RECOVERY), ROTARY TABLE SPEED, WT. ON BIT, PUMP PRESSURE, PUMP NO. 1–4 (LINER SIZE, S.P.M.), TOTAL PUMP OUTPUT

DEVIATION RECORD: DEPTH, DEV, DIR., TVD, HORZ. DISP.

NIGHT TOUR

From	To	Elapsed Time	CodeNo	Details Of Operations In Sequence And Remarks
19:00	21:15	2:15	21	ut doe slot 6 ream from 1950' to 2069'
21:15	5:15	8:00	5	circulate and work pipe @ 20 rpm 200 gpm housekeeping scrub derrick, rig floor, and windwalls, trash
5:15	6:15	1:00	11	rig up wireline run core barrel @ 50 gpm with wireline rig sown wireline, m/u 1 std to top drive
6:15				stage pumps up 50gpm @ a time start coring@ 2069'

DAY TOUR

From	To	Elapsed Time	CodeNo	Details Of Operations In Sequence And Remarks
7:00	8:45	1:45	22	Rack back stand, r/u wireline, retreave inner core barrel, run empty inner core barrel, (trouble latching)
8:45	10:15	1:30	4	Core F/2075 t/2076
10:15	11:45	1:30	22	R/u wireline, pull inner core, p/u redressed inner core.
11:45	12:00	0:15	22	L/d inner core (latch problems)
12:00	12:30	0:30	5	Circulate wait on tools, r/d wireline.
12:30	13:15	0:45	22	R/u wireline, run in inner core barrel, r/d wireline.
13:15	14:30	1:15	4	Core f/2076 t/2078.
14:30				

No.

DRILLING CREW PAYROLL DATA

DATE 16-Dec-2015
WELL NAME & NO. JPG Training July 2015 Slot 3
COMPANY JPEG
TOOLPUSHER
RIG NO. Explorer

NIGHT TOUR FROM 19:00 TO 7:00

CREW	EMPL.ID NO.	NAME	HRS.	INJURED ON THIS TOUR? INITIAL	YES NO
Driller	***-**-1111	DAVID SMITH	12		
Derrickman	***-**-1111	JONATHON CARRILLO	12		
Derrickman	***-**-1111	ADAM SALINAS	12		
Floorman	***-**-1111	JIMMY EWALD	12		
Roustabout		CHRIS BROUGHTON	12		

NO. DAYS SINCE LAST LOST TIME ACCIDENT

DAY TOUR FROM 7:00 TO 19:00

CREW	EMPL.ID NO.	NAME	HRS.	INJURED ON THIS TOUR? INITIAL	YES NO
Driller	***-**-1111	JOHN LAWHON	12		
Derrickman	***-**-1111	PEDRO RODRIGUEZ	12		
Floorman	***-**-1111	MIKE TOMASCIK	12		
Floorman	***-**-1111	BOBBY WARE	12		

NO. DAYS SINCE LAST LOST TIME ACCIDENT

No.

APPENDIX C

PETTIGREW ENGINEERING PCTB TESTING REPORT

Pettigrew Engineering PCTB Testing Report

18 July 2016 through 22 July 2016
Geotek Facility in West Valley City, Utah

Summary

Following land testing of the PCTB the decision was made to make some minor modifications to a) reduce or eliminate the potential for autoclave upper seal hang up and thus a delayed boost, b) reduce or eliminate core liner and core tube collapse, and c) reduce or eliminate migration of debris laden fluid from flowing inside the PCTB. A series of tests were performed to verify the function of the new and modified parts prior to the sea trial. The tests were performed at the Geotek facility in West Valley City, Utah from 18 July 2016 through 22 July 2016. The tests consisted of, a) bench testing various configurations of seal sub seal entry configurations and associated autoclave plug seal configurations, b) vertical full function pressure tests, and c) a full assembly space out with the outer core barrel sub assembly.

Over all the PCTB functioned quite well during the tests. Some minor problems occurred that where identified and fixed such that they should not occur again. All new and modified parts functioned as designed and are now considered part of the "standard" PCTB assembly.

Monday 18 July 2016

The day started with an overview presentation by Geotek of the modifications made to the PCTB and of the proposed testing procedures.

Bench Test of Various Seal Sub and Seal Configurations

Geotek also reviewed the results of the bench testing of the various seal sub and seal configurations which had been previously completed. The seal sub configurations included the current steep angle bevel seal entry, a double bevel seal entry resulting in a low angle seal contact surface, and a large radius seal entry. The seal configurations included the existing Poly-Pak and o-ring combination and a double Poly-Pak combination. The test results indicate that both the seal sub double bevel and large radius seal entry configurations, in conjunction with the double Poly-Pak seal configuration, produced a 10% reduction in the force required to drive the seals into the seal sub, as compared to the existing seal sub with a steep angle seal entry and a Poly-Pak and o-ring seal configuration.

Based on the bench test results, the vertical full function test procedure was amended to include only the double bevel seal entry and the large radius seal entry seal sub configurations in conjunction with only the double Poly-Pak seal configuration.

Vertical Full Function Testing

The Geotek proposed testing procedures called for starting with the current steep angle seal sub and Poly-Pak and o-ring seal combination. Since the current configured PCTB was deployed extensively during the land test and during horizontal full function bench testing prior to the land test, the decision was made not to repeat these tests and go directly to the modified configurations for testing.

Note, except for the full assembly space out test description, the term PCTB refers to only the autoclave, pressure section, and upper end subassembly.

Vertical Full Function Test #1

The PCTB was configured with all the modified parts including the double bevel seal sub and double Poly-Pak seals.
Boost pressure was set at ~1,500 psi.

1350: The PCTB was picked up vertically.
The annulus was pressurized and a leak occurred at one of the pressure hose connections and the PCTB was lowered and the connection tightened.

1410: The PCTB was picked up vertically.
The annulus was pressurized to ~1,000 psi.
The autoclave pressure increased to ~1,000 psi, indicating the ball valve was open.
The actuator was actuated, stroking the PCTB internally.
The annulus pressure remained at ~1,000 psi.
The autoclave pressure increased to ~1,550 psi, indicating the boost had fired and the ball valve had closed trapping the boost pressure.
The annulus pressure was slowly bled off to zero, simulating coming out of the hole on wireline.
The autoclave pressure remained at ~1,550 psi, indicating the ball valve was closed and sealed and the autoclave upper seal was engaged and sealed.

GOOD TEST!

Vertical Full Function Test #2

The PCTB was configured with all the modified parts including the double bevel seal sub and double Poly-Pak seals.
Boost pressure was set at ~1,500 psi.

1700: The PCTB was picked up vertically.
The annulus was pressurized to ~1,000 psi.
The autoclave pressure increased to ~1,000 psi, indicating the ball valve was open.
The actuator was actuated stroking the PCTB internally.
The annulus pressure remained at ~1,000 psi.
The autoclave pressure increased to ~1,550 psi, indicating the boost had fired and the ball valve had closed trapping the boost pressure.
The annular pressure was slowly bled off to zero, simulating coming out of the hole on wireline.
The autoclave pressure remained at ~1,550 psi, indicating the ball valve was closed and sealed and the autoclave upper seal was engaged and sealed.

GOOD TEST!

Tuesday 19 July 2016

Vertical Full Function Test #3

The PCTB was configured with all the modified parts including the double bevel seal sub and double Poly-Pak seals.
The boost pressure was set at ~1,500 psi.

1115: The PCTB was picked up vertically.
The annulus was pressurized to ~1,000 psi.
The autoclave pressure increased to ~1,000 psi, indicating the ball valve was open.
The actuator was actuated stroking the PCTB internally and it only partially stroked.
Note: A small hydraulic ram is used to stroke the tool.

The actuator was raised and lowered several times when the PCTB finally completed a full stroke.
The annulus pressure remained at ~1,000 psi.
The autoclave pressure increased to ~1,550 psi, indicating the boost had fired and the ball valve had closed, trapping the boost pressure.
The annular pressure was slowly bled off to zero, simulating coming out of the hole on wireline.
The autoclave pressure remained at ~1,550 psi, indicating the ball valve was closed and sealed and the autoclave upper seal was engaged and sealed.

GOOD TEST!

Discussion:

Since the boost pressure was captured, the cause of this particular hang up was not the autoclave upper seal hanging up on the seal sub.

The maximum force applied by the actuator to the release rod was ~2,000 lbs. This force is well within the capabilities of a wireline unit in the field. Since the modified parts now prevent the PCTB from releasing from the BHA until it is fully stroked internally, should this particular hang up occurred in the field, the wireline operator would be able to work the wireline up and down and achieve the same results. In the event the PCTB fails to stroke in the field, it will be necessary to shear release the pulling tool and pull it out of the hole. Then the emergency pulling tool, which engages only the PCTB upper latch, will have to be run in the hole to recover the PCTB.

Upon disassembly, no definitive evidence was observed as to the cause of the hang up. However, one of the port covers was found to be slightly above flush with the OD of the tool and may have been the cause of the hang up.

Although this incident by itself is not considered to be of concern, any further hang ups will be noted and evaluated collectively.

<u>Vertical Full Function Test #4</u>

The PCTB was configured with all the modified parts including the double bevel seal sub and double Poly-Pak seals.
The boost pressure was set at ~1,500 psi.

1400: The PCTB was picked up vertically.
The annulus was pressurized to ~1,000 psi.
The autoclave pressure increased to ~1,000 psi, indicating the ball valve was open.
The actuator was actuated stroking the PCTB internally without incident.
The annulus pressure remained at ~1,000 psi.
The autoclave pressure increased to ~1,550 psi, indicating the boost had fired and the ball valve had closed trapping the boost pressure.
The annular pressure was slowly bled off to zero, simulating coming out of the hole on wireline.
The autoclave pressure remained at ~1,550 psi, indicating the ball valve was closed and sealed and the autoclave upper seal was engaged and sealed.

GOOD TEST!

<u>Vertical Full Function Test #5</u>

The PCTB was configured as before except for installing the large radiused seal sub
The boost pressure was set at ~1,500 psi.

1400: The PCTB was picked up vertically.
The annulus was pressurized to ~1,000 psi.
The autoclave pressure increased to ~1,000 psi, indicating the ball valve was open.
The actuator was actuated stroking the PCTB internally without incident.
The annulus pressure remained at ~1,000 psi.
The autoclave pressure increased to ~1,550 psi, indicating the boost had fired and the ball valve had closed trapping the boost pressure.
The annular pressure was slowly bled off to zero, simulating coming out of the hole on wireline.
The autoclave pressure remained at ~1,550 psi, indicating the ball valve was closed and sealed and the autoclave upper seal was engaged and sealed.

GOOD TEST!

Wednesday 20 July 2016

Vertical Full Function Test #6

The PCTB was configured with all the modified parts including the large radiused seal sub and double Poly-Pak seals.
The boost pressure was set at ~1,500 psi.

1130: The PCTB was picked up vertically.
The annulus was pressurized to ~1,000 psi.
The autoclave pressure increased to ~1,000 psi, indicating the ball valve was open.
The actuator was actuated and the PCTB stroked only ~1/2".
The actuator was worked up and down several times without any further advancement in the stroke.
All pressure was bled off and the PCTB was rigged down for autopsy.

Discussion:

Upon disassembly, one of the detents under the collet release sleeve was found not to have retracted into its groove, thus jamming the collet release sleeve which in turn jammed on the seal sub ID.
Note, due to the short actuator stroke, the tool is partially stroked when it is picked up for the vertical full function test. The pre-set partial stroke positions the collet release sleeve immediately below the seal sub ID upset, resulting in the very short partial stroke before hang up.

An o-ring is used as a spring to force the detents into their groove. This o-ring is typically not changed between deployments and may have stretched somewhat, thus supplying less spring force to pull the detents into the groove. Also, a slight burr was observed on some of the detent edges. All of the edges on all of the detents were filed down to eliminate any remaining burrs that might have attributed to the hang up and the o-ring spring was changed out.

The PCTB was reassembled with a new detent o-ring spring and filed detents.
The boost pressure was set at ~1,500 psi.

1400: The PCTB was picked up vertically.
The annulus was pressurized to ~1,000 psi.
The autoclave pressure increased to ~1,000 psi, indicating the ball valve was open.
The actuator was actuated stroking the PCTB internally without incident.
The annulus pressure remained at ~1,000 psi.
The autoclave pressure increased to ~1,530 psi, indicating the boost had fired and the ball valve had closed trapping the boost pressure.

The annular pressure was slowly bled off to zero, simulating coming out of the hole on wireline.
The autoclave pressure remained at ~1,530 psi, indicating the ball valve was closed and sealed and the autoclave upper seal was engaged and sealed.

GOOD TEST!

Vertical Full Function Test #7

The PCTB was configured with the large radiused seal sub and double Poly-Pak seals.
The boost pressure was set at ~1,500 psi.

1600: The PCTB was picked up vertically.
The annulus was pressurized to ~1,000 psi.
The autoclave pressure increased to ~1,000 psi, indicating the ball valve was open.
The actuator was actuated and the PCTB only partially stroked.
The actuator was worked up and down several times when both the annulus pressure and the autoclave pressure were observed to increase to ~1,125 psi and the PCTB could not be stroked further.
The annular pressure was slowly bled off to zero, simulating coming out of the hole on wireline.
The autoclave pressure dropped from ~1,125 to ~1,070 psi and then remained there, indicating the ball valve was closed and sealed and the autoclave upper seal was engaged and sealed, trapping the partially boosted annular pressure.
The PCTB was rigged down for autopsy.

Discussion:

From visual observation of the pressure gauges and readouts, it appears the boost occurred before the autoclave was fully sealed, as indicated by both the annulus and the autoclave pressures increasing simultaneously while stroking the PCTB. Upon disassembly, the boost reservoir pressure was found to be below what is normally observed.

After reviewing the recorded fish pill pressure data plots of the annulus and autoclave pressures, it is apparent that the ball valve delayed closing. The boost fired as designed and since the ball valve was not sealed both the annulus and the autoclave pressures increased ~125 psi. Since the annular volume is connected to an accumulator during the test, the accumulator absorbed some of the boost pressure. Thus, only 125 psi was added to the system rather than the full 500 psi of the boost. This is indicated by a 1,175 psi spike in the autoclave pressure data before the system equalized at ~1,100 psi.

As the annulus pressure was slowly bled off, both the annulus pressure and autoclave pressure dropped together until the pressure reached ~1,025 psi at which point the autoclave pressure stopped dropping. This is when the ball valve finally closed, trapping the partially boosted annulus pressure.

Autopsy Results:

Upon disassembly of the ball valve, it was found to be closed in the normal position. The reset tool was installed to compress the ball valve spring for further disassembly. When the reset tool was removed, the seal carrier hung up inside the ball valve housing. A slight tap on the housing with a hammer freed the seal carrier and it slammed home driven by the compressed ball valve spring. The reset tool was installed again to compress the ball valve spring and again when the reset tool was removed the seal carrier hung up inside the ball valve housing.

Small dings were observed at the top of the ball valve housing windows on the ID. These are caused by the ball moving too far upward when the reset tool engaged and tightened too much. These dings may have contributed to a bureau drawer sticking problem.

Further Discussion:

As a rule of thumb, if the length of the throat of the seal housing divided by its diameter is equal to or near the coefficient of friction then a "bureau drawer effect" can occur. In this case that is 0.825 / 3.062 = 0.27 which is very close to the coefficient of friction for stainless steel. This appears to be a case of classic bureau drawer sticking. The suggestion was made to eliminate all dings and to look at reducing the coefficient of friction by coating the ID of the ball valve housing or the OD of the seal carrier, or both, with a low friction coating. Another possibility suggested is to add more centralization for the seal carrier as it moves through the housing seal bore.

Thursday 21 July 2016

The day began with the disassembly of the ball valve from the previous days test, looking for the cause of delayed ball valve closure. Refer to "Autopsy Results" and "Further Discussion" topics above.

<u>Vertical Full Function Test #8</u>

The PCTB was configured with the large radiused seal sub and double Poly-Pak seals.
The boost pressure was set at ~1,500 psi.

1210: The PCTB was picked up vertically.
The annulus was pressurized to ~1,000 psi.
The autoclave pressure increased to ~1,000 psi, indicating the ball valve was open.
The actuator was actuated stroking the PCTB internally without incident.
The annulus pressure remained at ~1,000 psi.
The autoclave pressure increased to ~1,545 psi, indicating the boost had fired and the ball valve had closed trapping the boost pressure.
The annular pressure was slowly bled off to zero, simulating coming out of the hole on wireline.
The autoclave pressure climbed to ~1,560 psi, indicating the ball valve was closed and sealed and the autoclave upper seal was engaged and sealed.

GOOD TEST!

<u>Vertical Full Function Test #9</u>

The PCTB was configured with the large radiused seal sub and double Poly-Pak seals.
The boost pressure was set at ~1,500 psi.

1345: The PCTB was picked up vertically.
The annulus was pressurized to ~1,000 psi.
The autoclave pressure increased to ~1,000 psi, indicating the ball valve was open.
The actuator was actuated stroking the PCTB internally without incident.
The annulus pressure remained at ~1,000 psi.
The autoclave pressure increased to ~1,535 psi, indicating the boost had fired and the ball valve had closed trapping the boost pressure.
The annular pressure was slowly bled off to zero, simulating coming out of the hole on wireline.
The autoclave pressure climbed to ~1,545 psi, indicating the ball valve was closed and sealed and the autoclave upper seal was engaged and sealed.

GOOD TEST!

End vertical full function testing.

Friday 22 July 2016

<u>Full Assembly Space Out Test</u>

1000: Begin assembling outer core barrel (OCB) components horizontally.
The PCTB lower section was slid part way into the OCB using a fork lift. A lifting clamp was attached to the top of the lower section to keep it from sliding further, similar to how it is done in the field except for the PCTB being horizontal. The PCTB upper section was picked up and made up to the lower section. The lifting clamp was removed and the full PCTB assembly was slid into the OCB. Note, the running tool was not used since it would go too far inside the OCB to be released manually. Thus a piece of 4x4 lumber was used to drive the PCTB assembly into the OCB.

The PCTB stopped sliding about 12" above the landing point when the outer latch dogs contacted the head sub ID. Note, normally the outer latch dogs are retracted by the weight of the PCTB hanging on the running tool. The PCTB was pulled out of the OCB until the outer latch dogs were accessible. The running tool was installed in the PCTB to retract the outer latch dogs. A spare latch sleeve was slid over the outer latch dogs to keep them retracted. The running tool was manually released and removed. The PCTB was then slid back into the OCB as far as it would go while removing the spare latch sleeve once the outer latch dogs had entered the head sub ID.

It appeared that the PCTB was within 1/4" - 1/2" of latching but had not latched. To confirm that the PCTB was not latched, a sledge hammer was used to bump the PCTB out of the OCB by hammering on the cutting shoe. The PCTB continued to slide out of the OCB confirming that it was not latched.

The assemblies were double checked and found to be OK. The head sub was removed from the OCB to verify that the latch sleeve had not come lose and backed off. Note, removing the head sub allowed the outer latch dogs to expand inside the OCB and they cannot be retracted without engaging the pulling tool. The latch sleeve was found to be tight and the length verified to be correct. The head sub was made up to the OCB again and shouldered against the top sub. Since the outer latch dogs were locked in the expanded configuration and could not pass through the latch sleeve ID when the head sub was made up, the PCTB had to be latched in place. To verify the PCTB was latched into the OCB the cutting shoe was once again bumped with a sledge hammer and the PCTB would not move, indicating the PCTB was latched into the OCB.

The overall space out was checked and found to be correct. Thus, when the PCTB is made up with the new modified parts it will latch into the normal/standard PCTB BHA in the field.

The pulling tool was then inserted into the PCTB. A strap was connected between the pulling tool and the fork lift. The fork lift was used to pull the PCTB out of the OCB. Closing of the ball valve could be heard as the PCTB was stroked internally while pulling the PCTB out of the OCB. This further verified that the space out was correct and the internal stroking of the PCTB was occurring in the proper sequence.

The PCTB was removed from the OCB and disassembled. The OCB was then disassembled, ending the testing program.

Discussion:

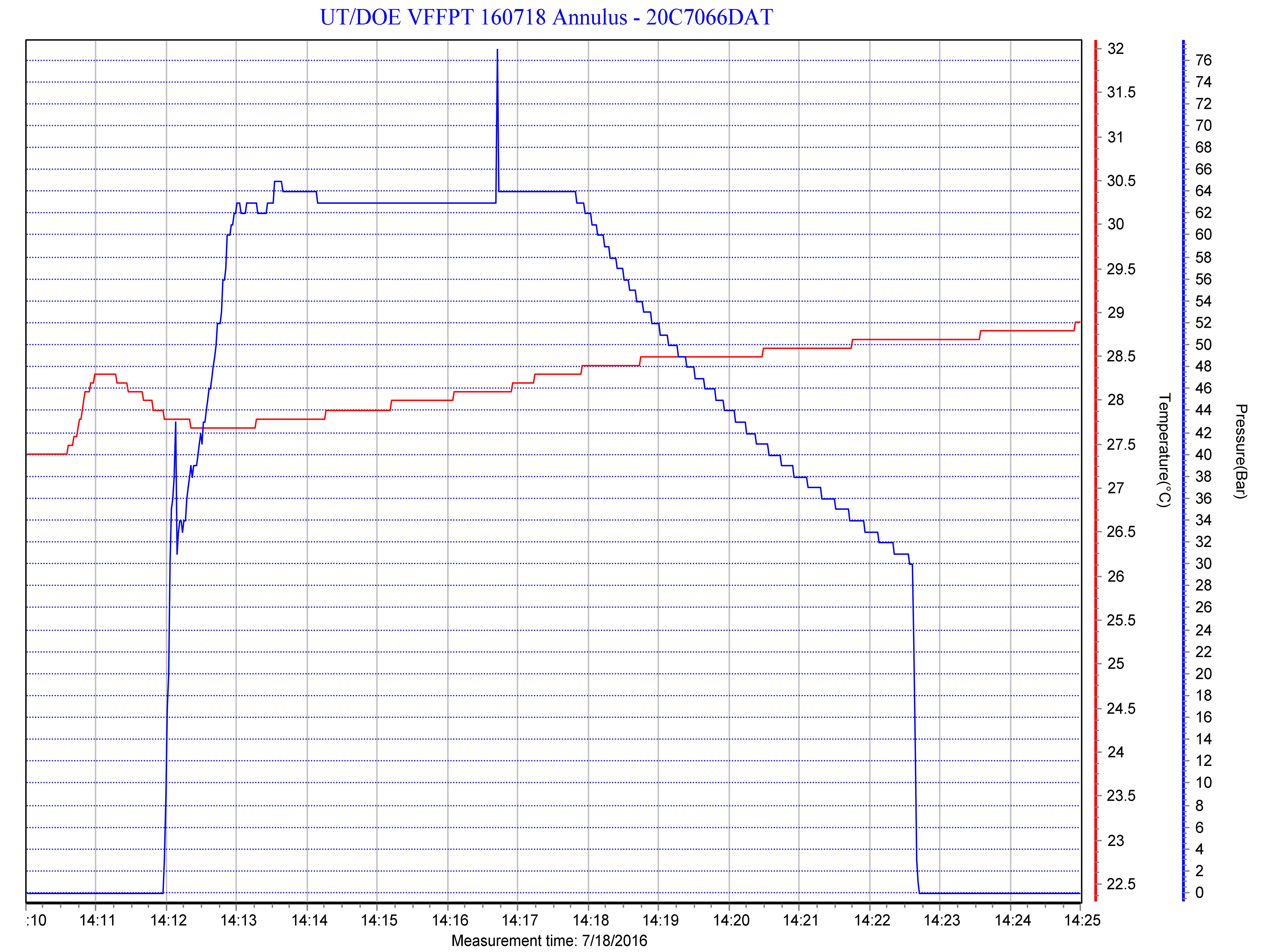
The failure of the PCTB to latch on the first attempt was due to friction caused by performing the test horizontally. When the head sub was made up the second time, the latch sleeve was able to push against the outer latch dogs more evenly and with the power screw effect of the thread the PCTB was seated properly. This type of failure to latch is not likely to occur in the field where everything is done vertically.

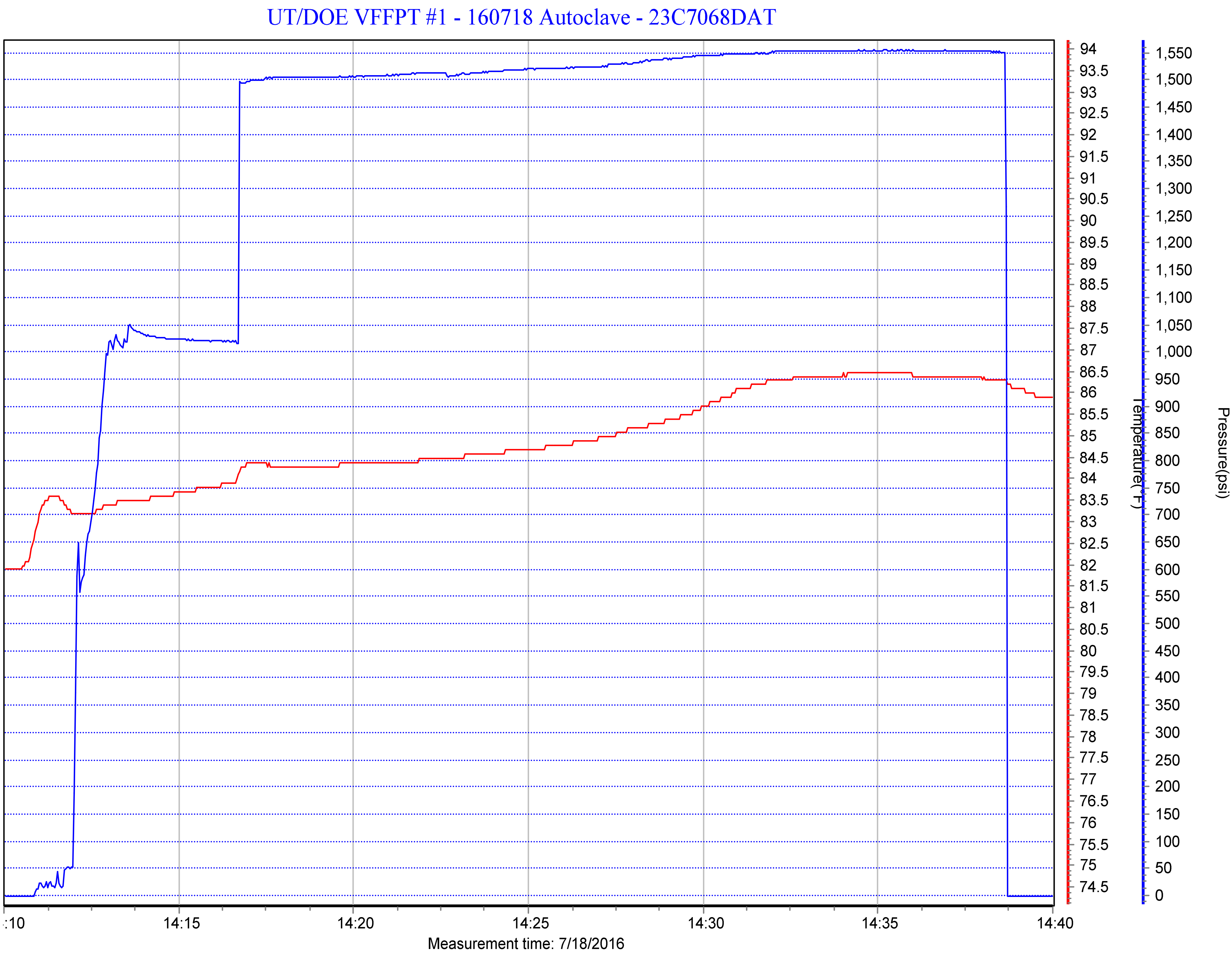
Conclusions

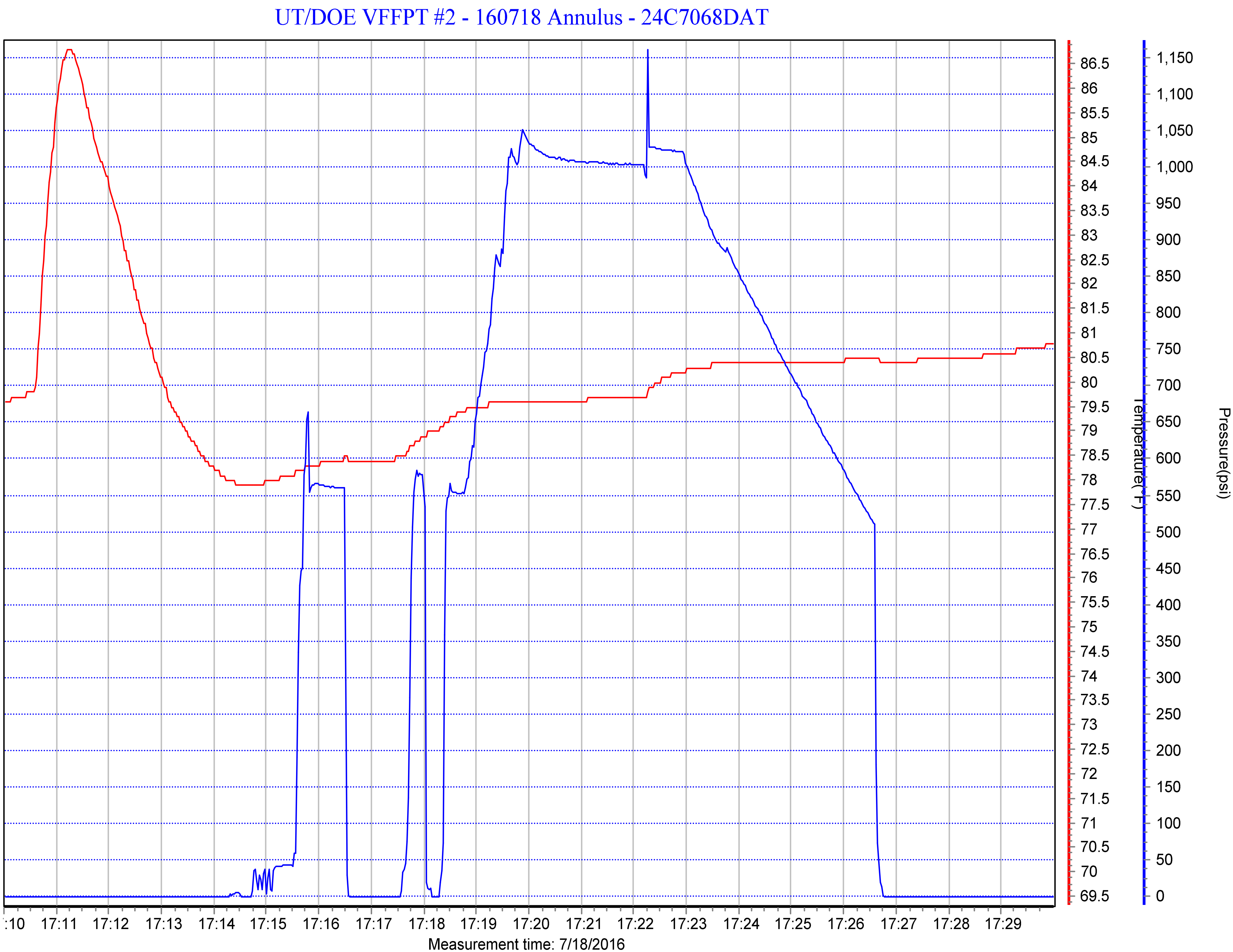
1. The double Poly-Pak autoclave plug seal configuration should be deployed in the future.
2. Either the double bevel or large radiused sea sub should be deployed in the future.
3. The PCTB space out, when configured with the new and modified parts, is compatible with the current PCTB BHA.
4. The PCTB functioned quite well during the tests showing no signs of delayed boost and trapping the boost pressure during all of the tests but one.

Appendix A
Vertical Full Function Pressure Fish Pill Pressure Data Plots

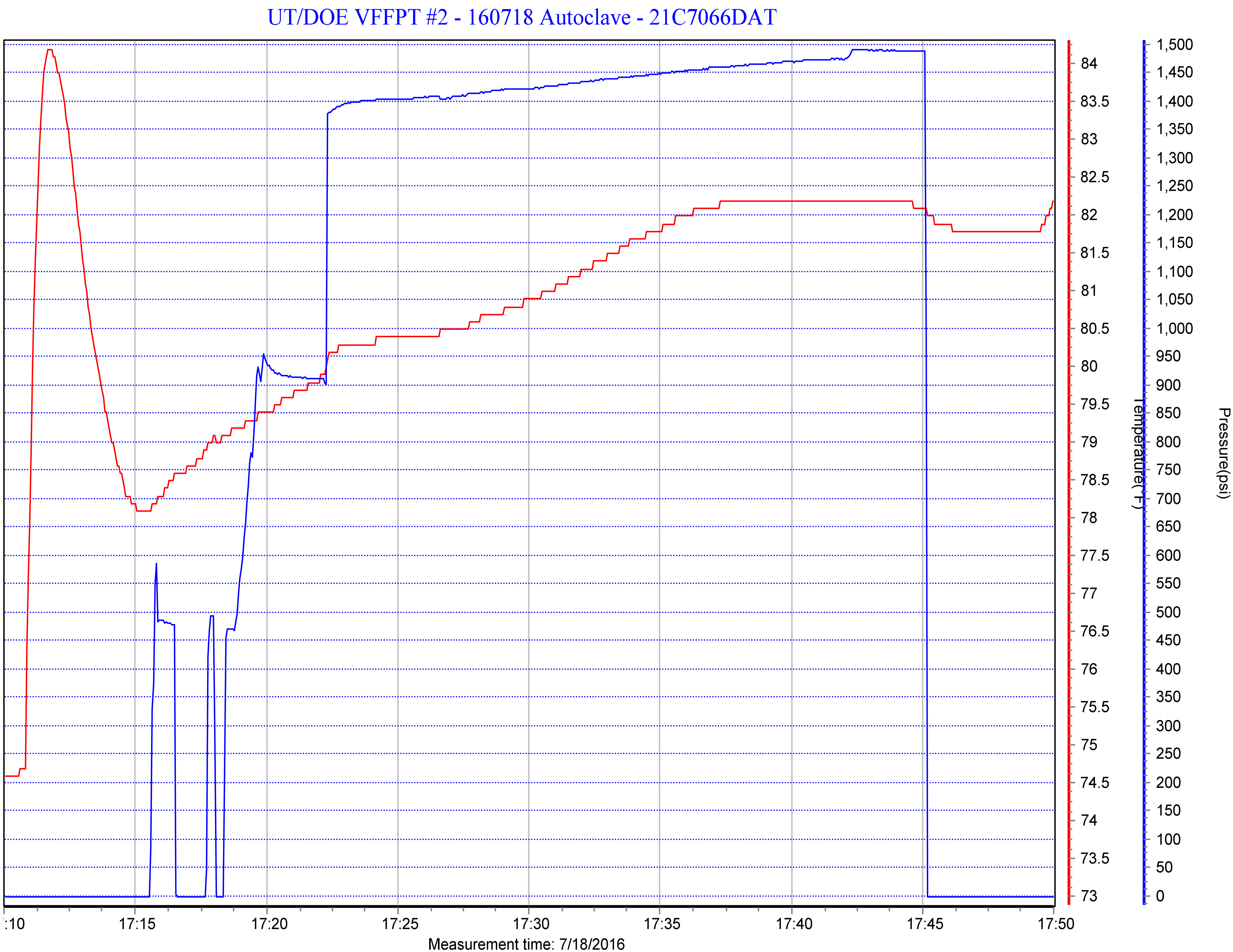
The following plots are of the vertical full function fish pill pressure data collected during the laboratory testing of the PCTB configured with new and modified parts from 18 July through 22 July 2016 at Geotek's facility in West Valley City, Utah. Note that the plots are from raw data. Final plots, with proper annotation, will be distributed as part of the Geotek testing report.


UT/DOE VFFPT 160718 Annulus - 20C7066DAT
Temperature(°C)
Pressure(Bar)
Measurement time: 7/18/2016
:10
14:11
14:12
14:13
14:14
14:15
14:16
14:17
14:18
14:19
14:20
14:21
14:22
14:23
14:24
14:25
32
31.5
31
30.5
30
29.5
29
28.5
28
27.5
27
26.5
26
25.5
25
24.5
24
23.5
23
22.5
76
74
72
70
68
66
64
62
60
58
56
54
52
50
48
46
44
42
40
38
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0


UT/DOE VFFPT #1 - 160718 Autoclave - 23C7068DAT
Temperature(°F)
Pressure(psi)
Measurement time: 7/18/2016
:10
14:15
14:20
14:25
14:30
14:35
14:40

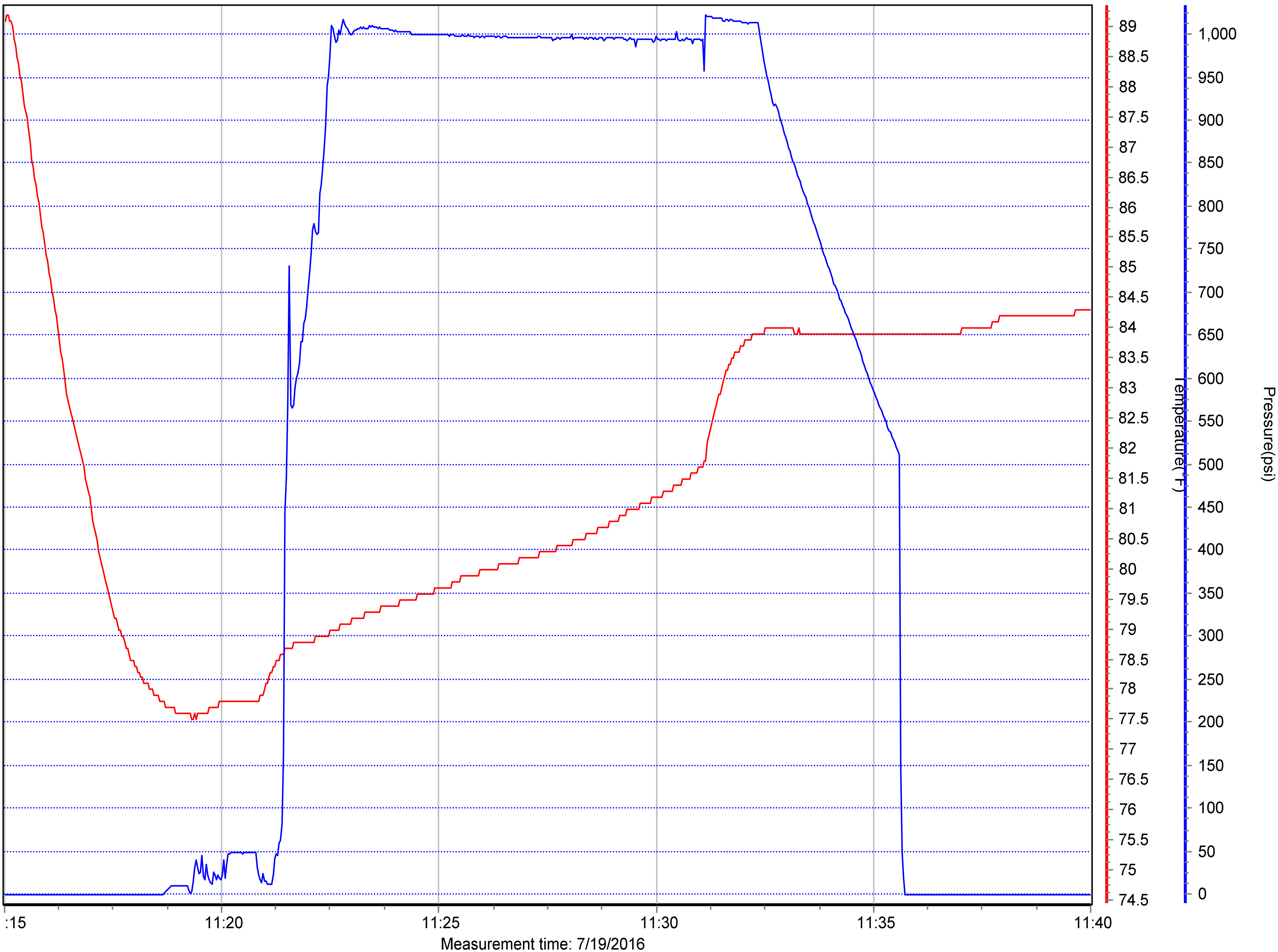


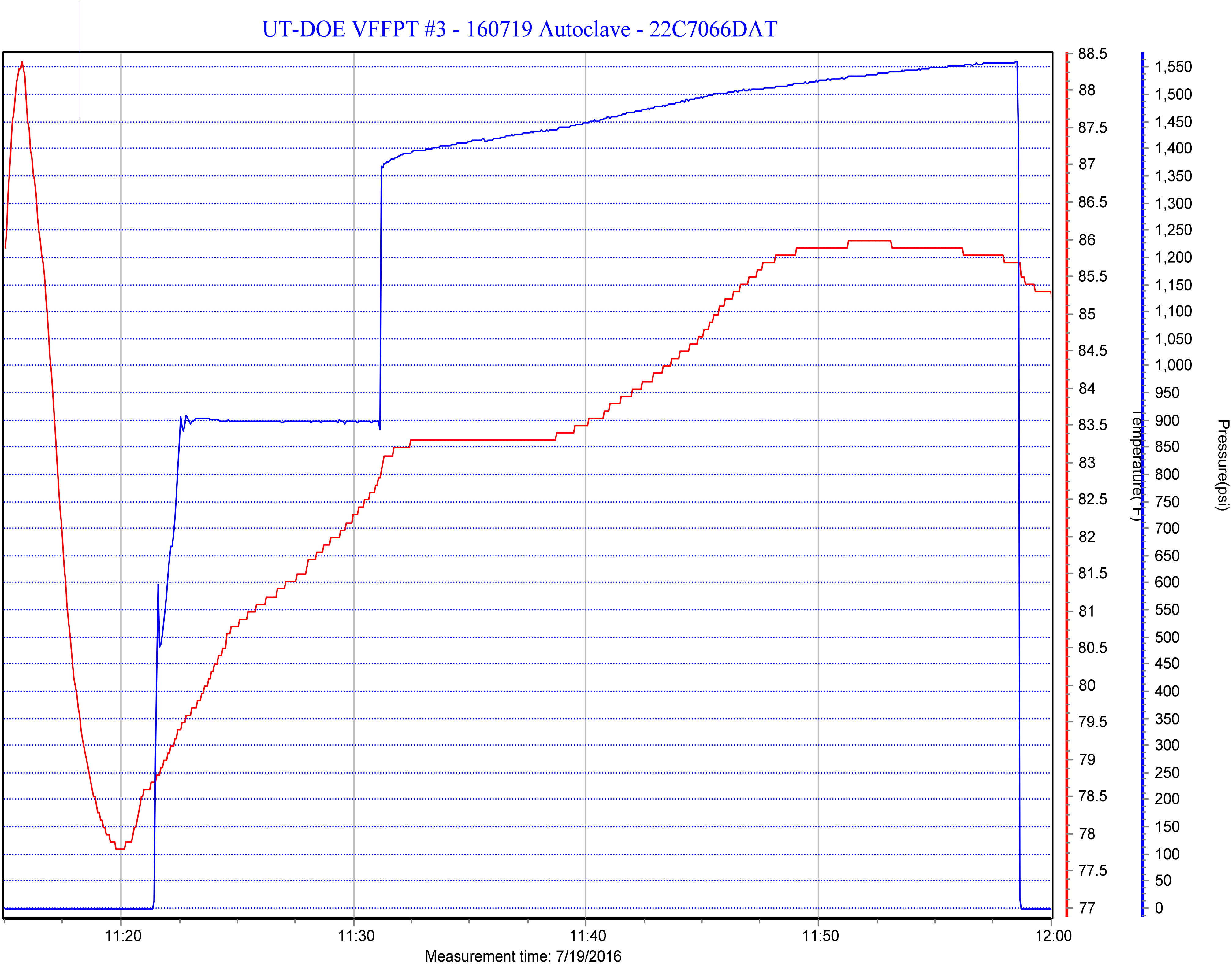
UT/DOE VFFPT #2 - 160718 Annulus - 24C7068DAT
Temperature(°F)
Pressure(psi)
86.5
86
85.5
85
84.5
84
83.5
83
82.5
82
81.5
81
80.5
80
79.5
79
78.5
78
77.5
77
76.5
76
75.5
75
74.5
74
73.5
73
72.5
72
71.5
71
70.5
70
69.5
1,150
1,100
1,050
1,000
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
:10
17:11
17:12
17:13
17:14
17:15
17:16
17:17
17:18
17:19
17:20
17:21
17:22
17:23
17:24
17:25
17:26
17:27
17:28
17:29
Measurement time: 7/18/2016



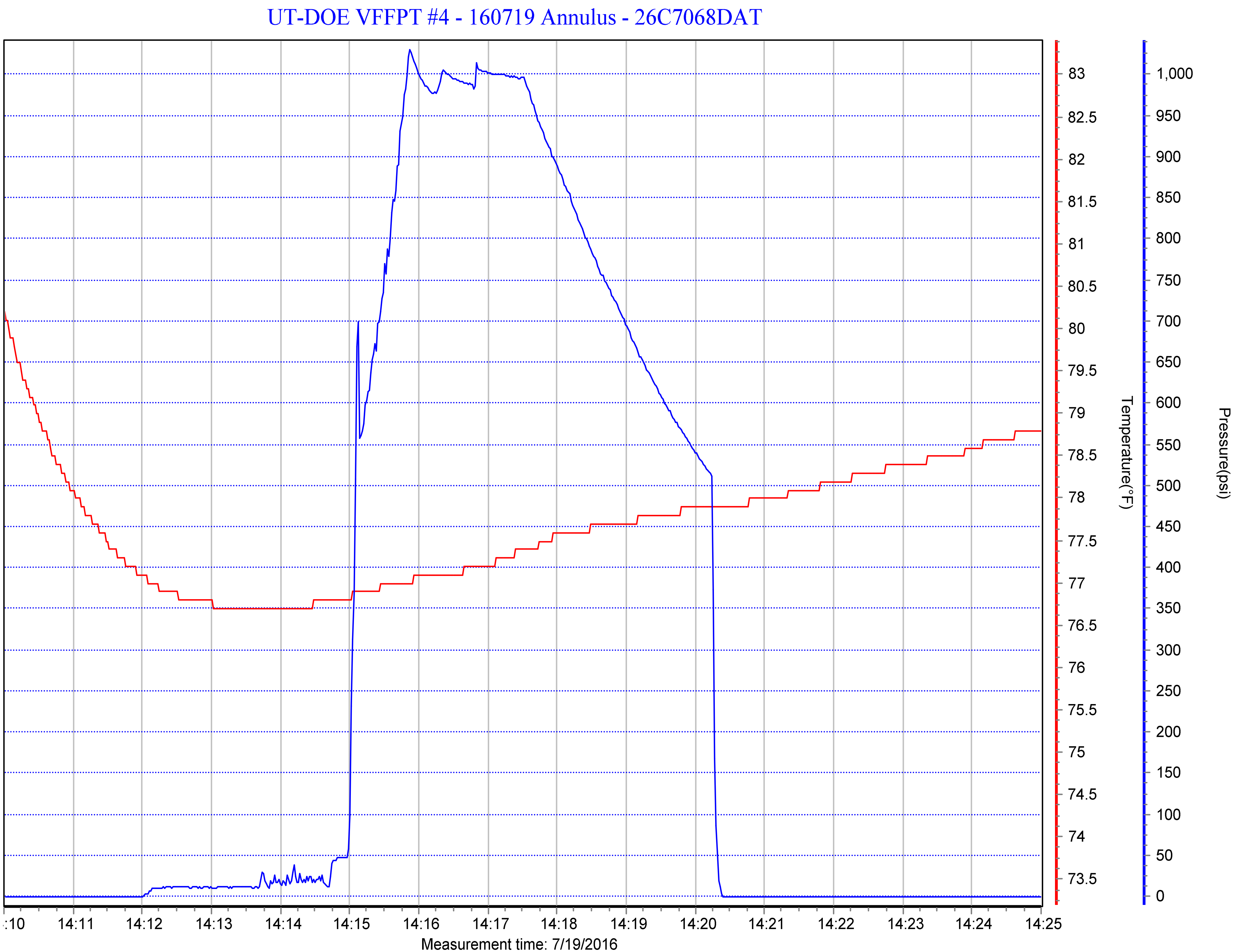
UT/DOE VFFPT #2 - 160718 Autoclave - 21C7066DAT
84
83.5
83
82.5
82
81.5
81
80.5
80
79.5
79
78.5
78
77.5
77
76.5
76
75.5
75
74.5
74
73.5
73
Temperature(°F)
1,500
1,450
1,400
1,350
1,300
1,250
1,200
1,150
1,100
1,050
1,000
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
Pressure(psi)
:10
17:15
17:20
17:25
17:30
17:35
17:40
17:45
17:50
Measurement time: 7/18/2016

UT-DOE VFFPT #3 - 160719 Annulus - 25C7068DAT

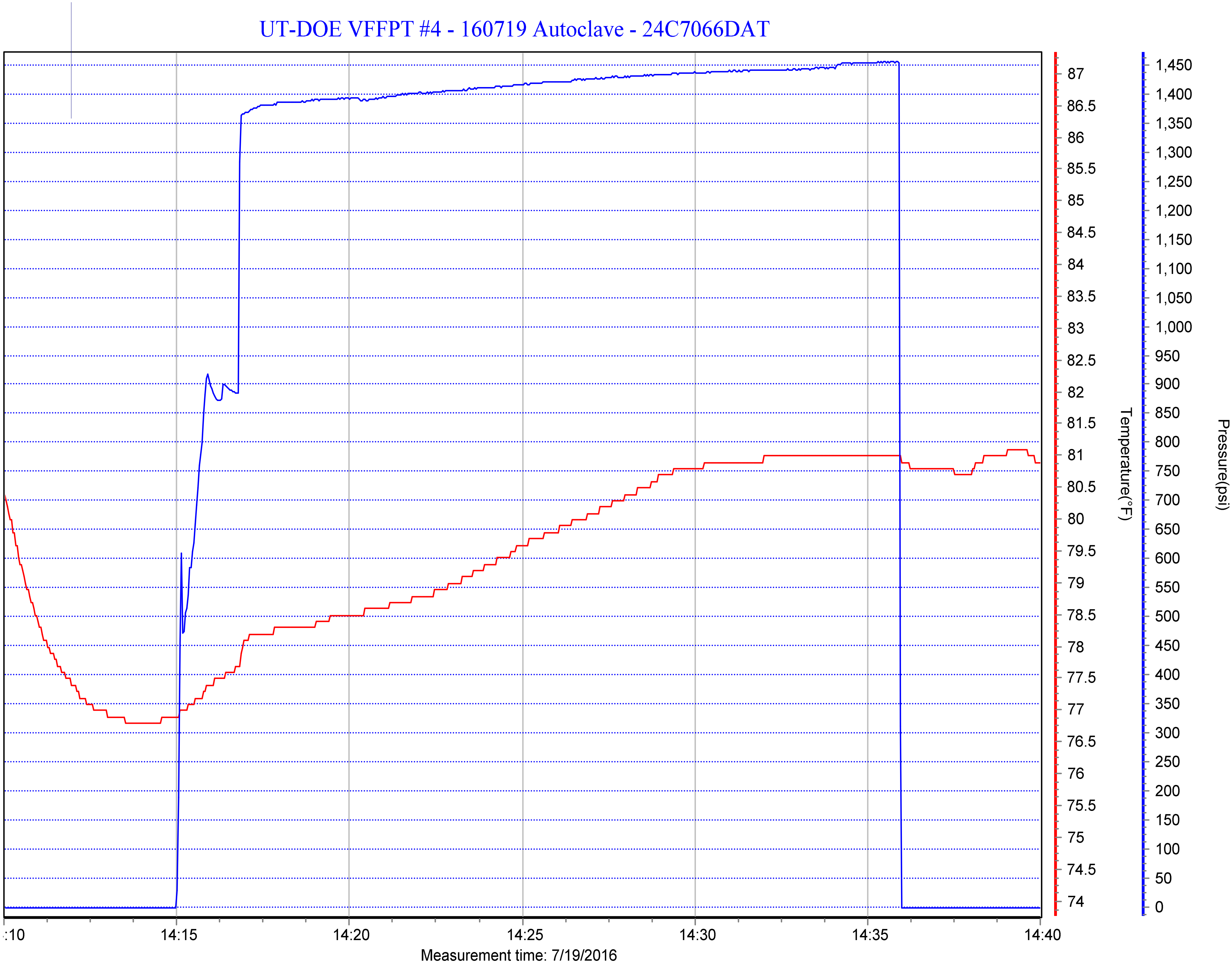


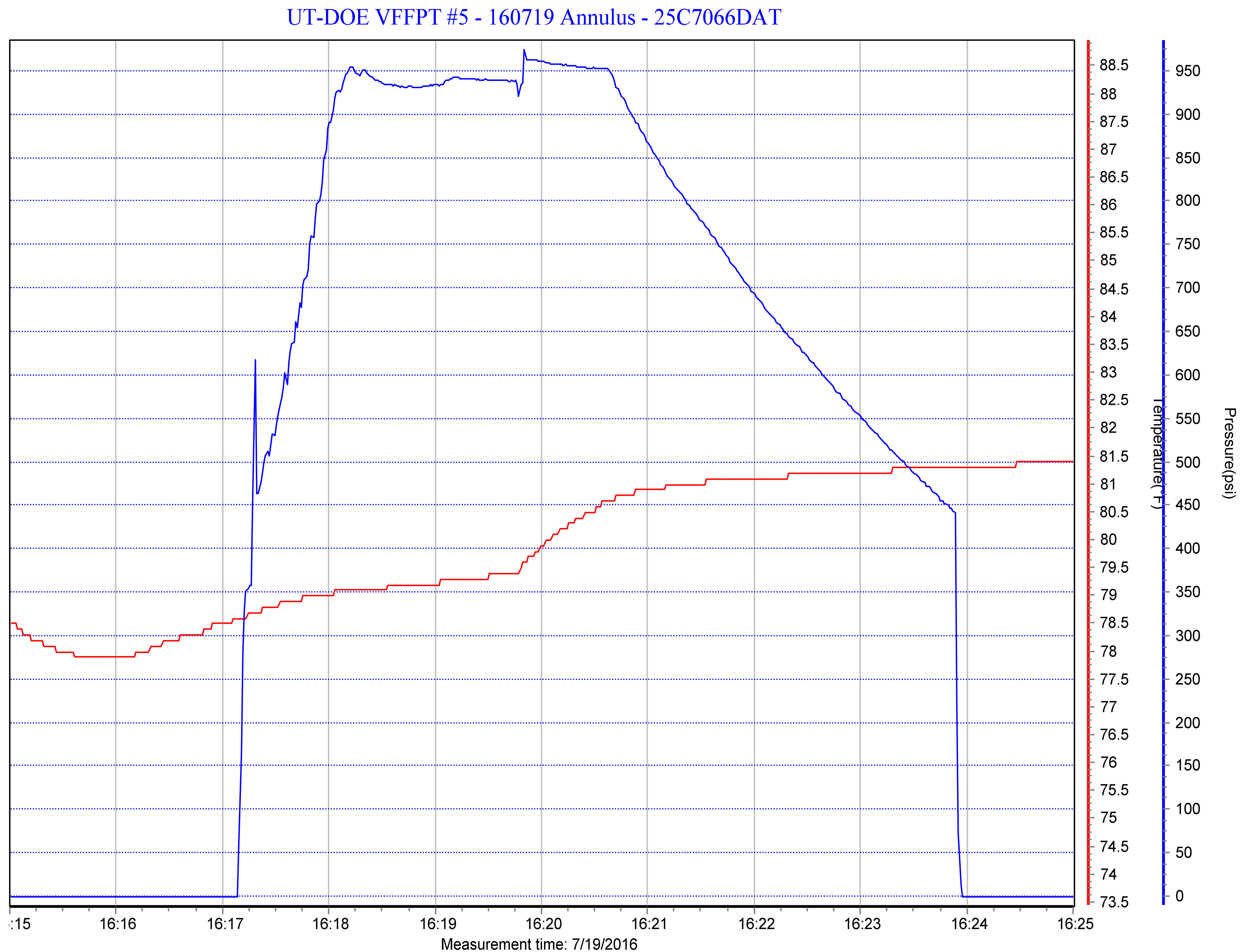


UT-DOE VFFPT #3 - 160719 Autoclave - 22C7066DAT
Temperature(°F)
Pressure(psi)
88.5
88
87.5
87
86.5
86
85.5
85
84.5
84
83.5
83
82.5
82
81.5
81
80.5
80
79.5
79
78.5
78
77.5
77
1,550
1,500
1,450
1,400
1,350
1,300
1,250
1,200
1,150
1,100
1,050
1,000
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
11:20
11:30
11:40
11:50
12:00
Measurement time: 7/19/2016

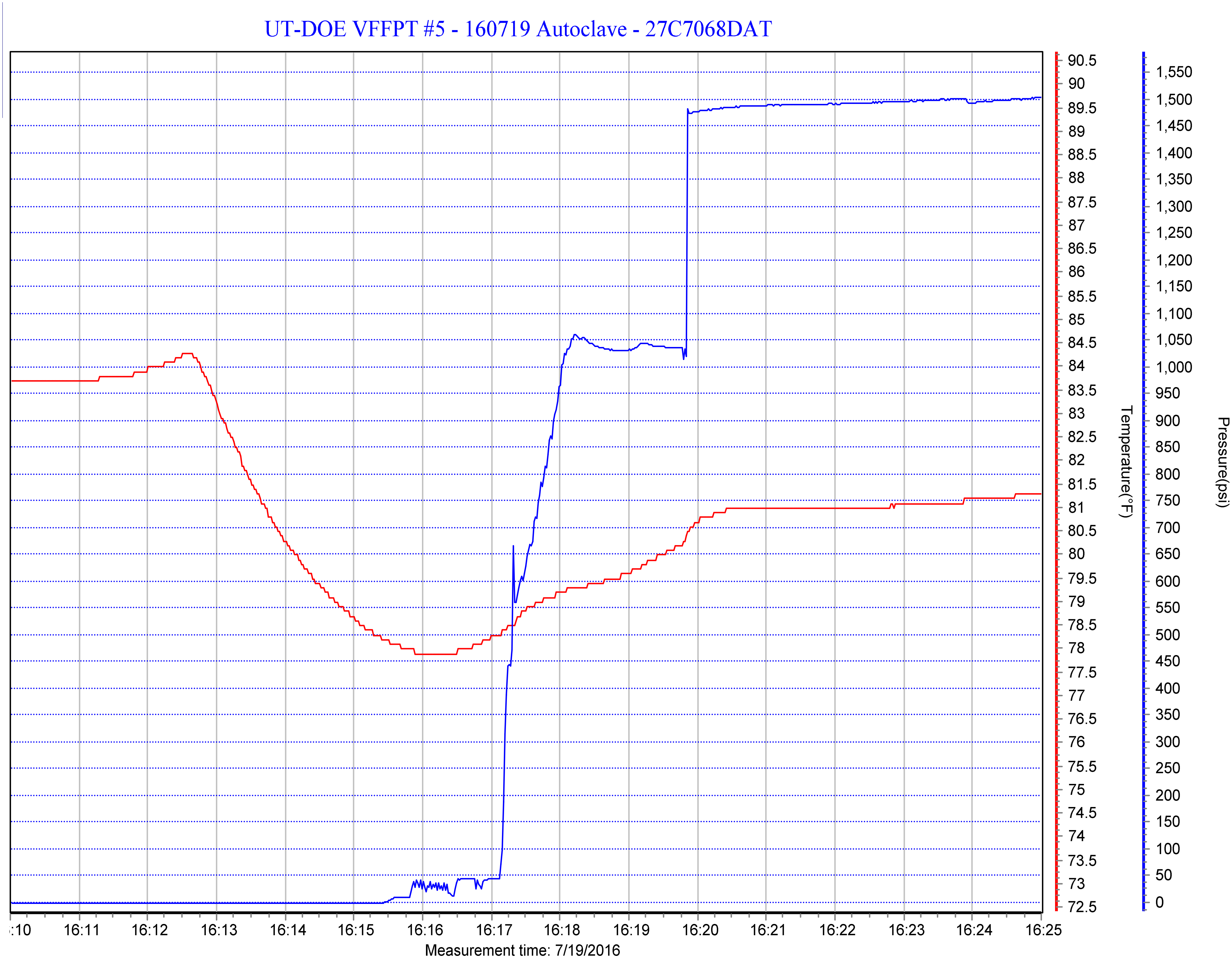


UT-DOE VFFPT #4 - 160719 Annulus - 26C7068DAT
83
82.5
82
81.5
81
80.5
80
79.5
79
78.5
78
77.5
77
76.5
76
75.5
75
74.5
74
73.5
Temperature(°F)
1,000
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
Pressure(psi)
:10
14:11
14:12
14:13
14:14
14:15
14:16
14:17
14:18
14:19
14:20
14:21
14:22
14:23
14:24
14:25
Measurement time: 7/19/2016

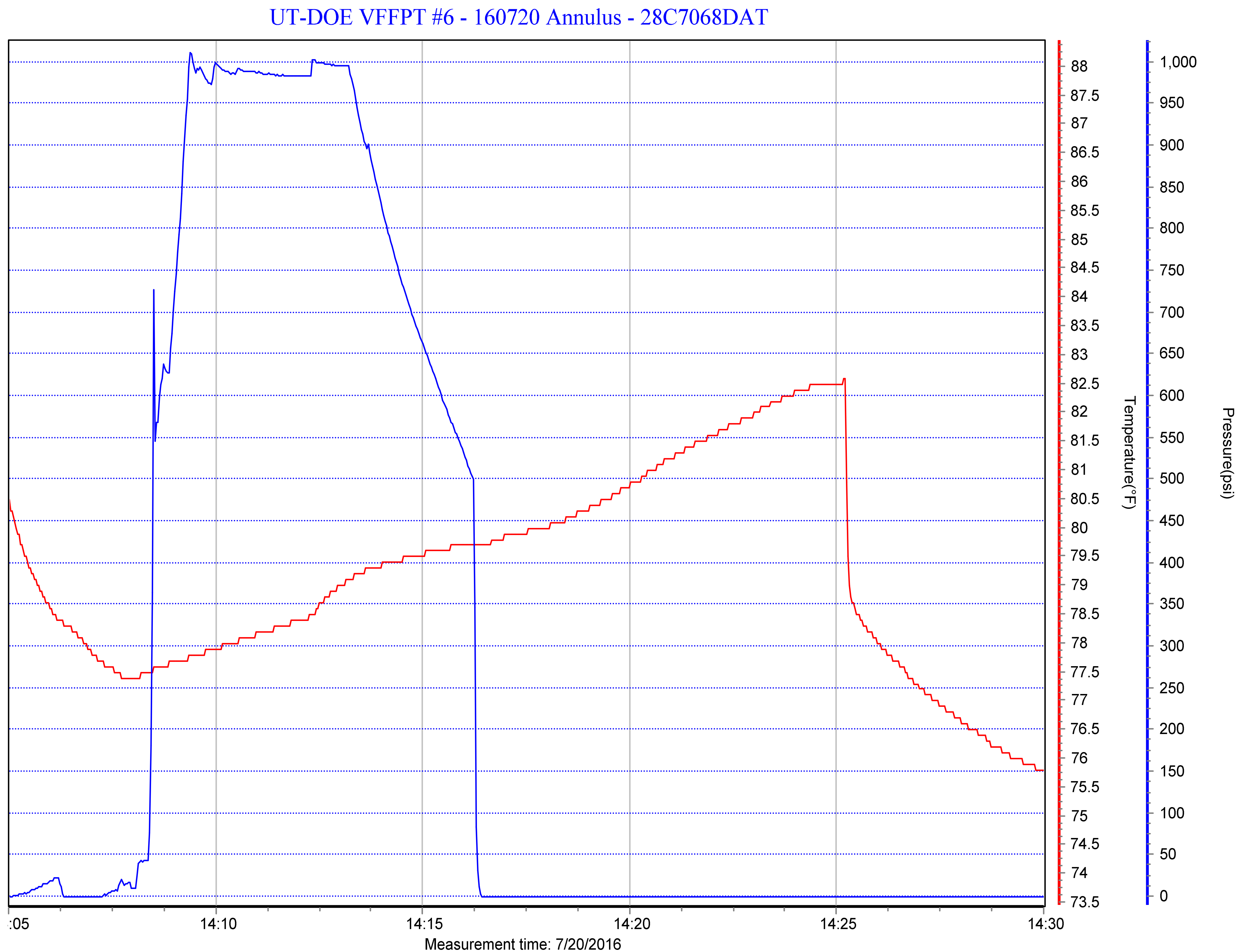

UT-DOE VFFPT #4 - 160719 Autoclave - 24C7066DAT
Temperature(°F)
Pressure(psi)
87
86.5
86
85.5
85
84.5
84
83.5
83
82.5
82
81.5
81
80.5
80
79.5
79
78.5
78
77.5
77
76.5
76
75.5
75
74.5
74
1,450
1,400
1,350
1,300
1,250
1,200
1,150
1,100
1,050
1,000
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
:10
14:15
14:20
14:25
14:30
14:35
14:40
Measurement time: 7/19/2016



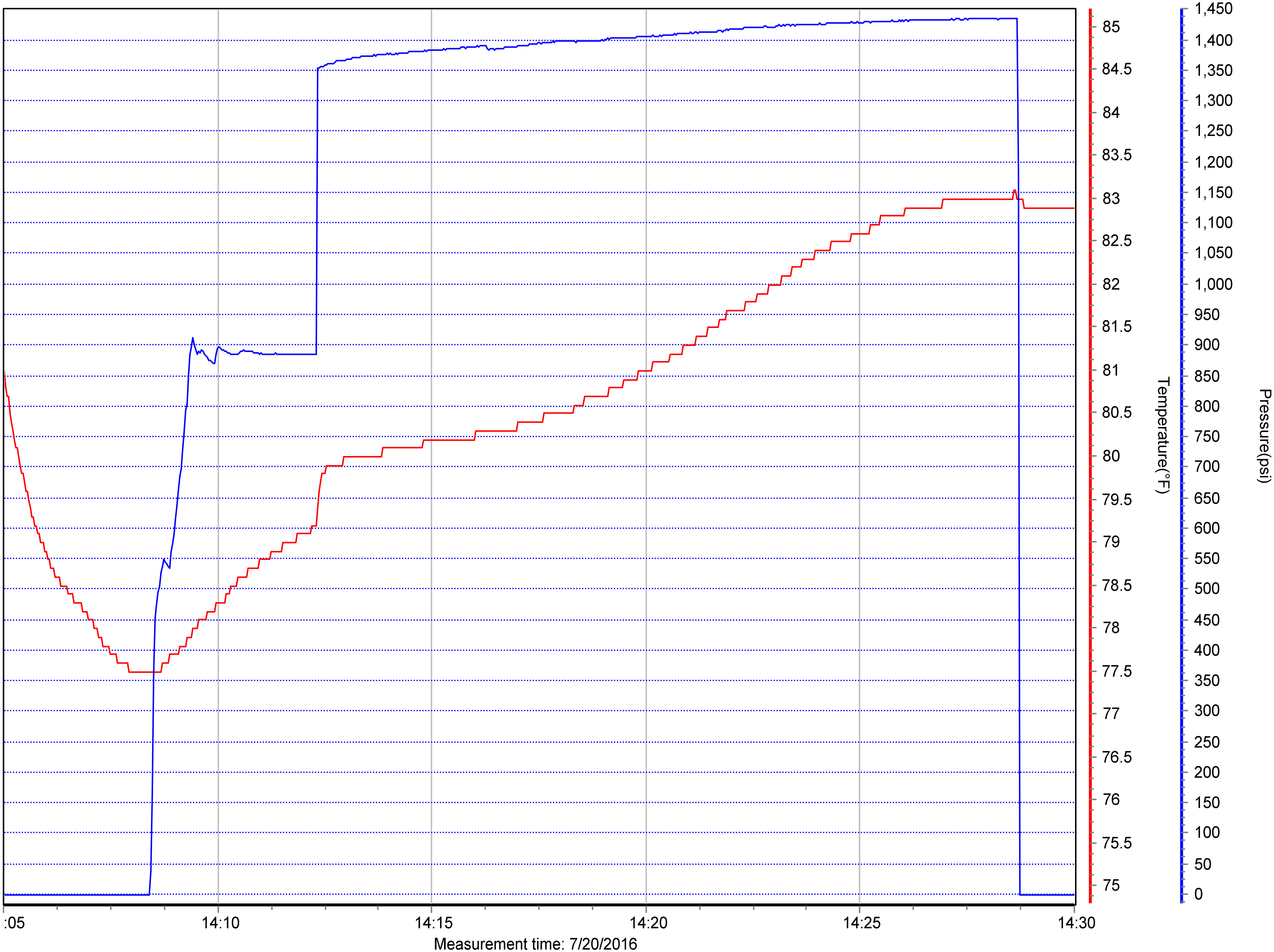
UT-DOE VFFPT #5 - 160719 Annulus - 25C7066DAT
Temperature(°F)
Pressure(psi)
88.5
88
87.5
87
86.5
86
85.5
85
84.5
84
83.5
83
82.5
82
81.5
81
80.5
80
79.5
79
78.5
78
77.5
77
76.5
76
75.5
75
74.5
74
73.5
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
:15
16:16
16:17
16:18
16:19
16:20
16:21
16:22
16:23
16:24
16:25
Measurement time: 7/19/2016

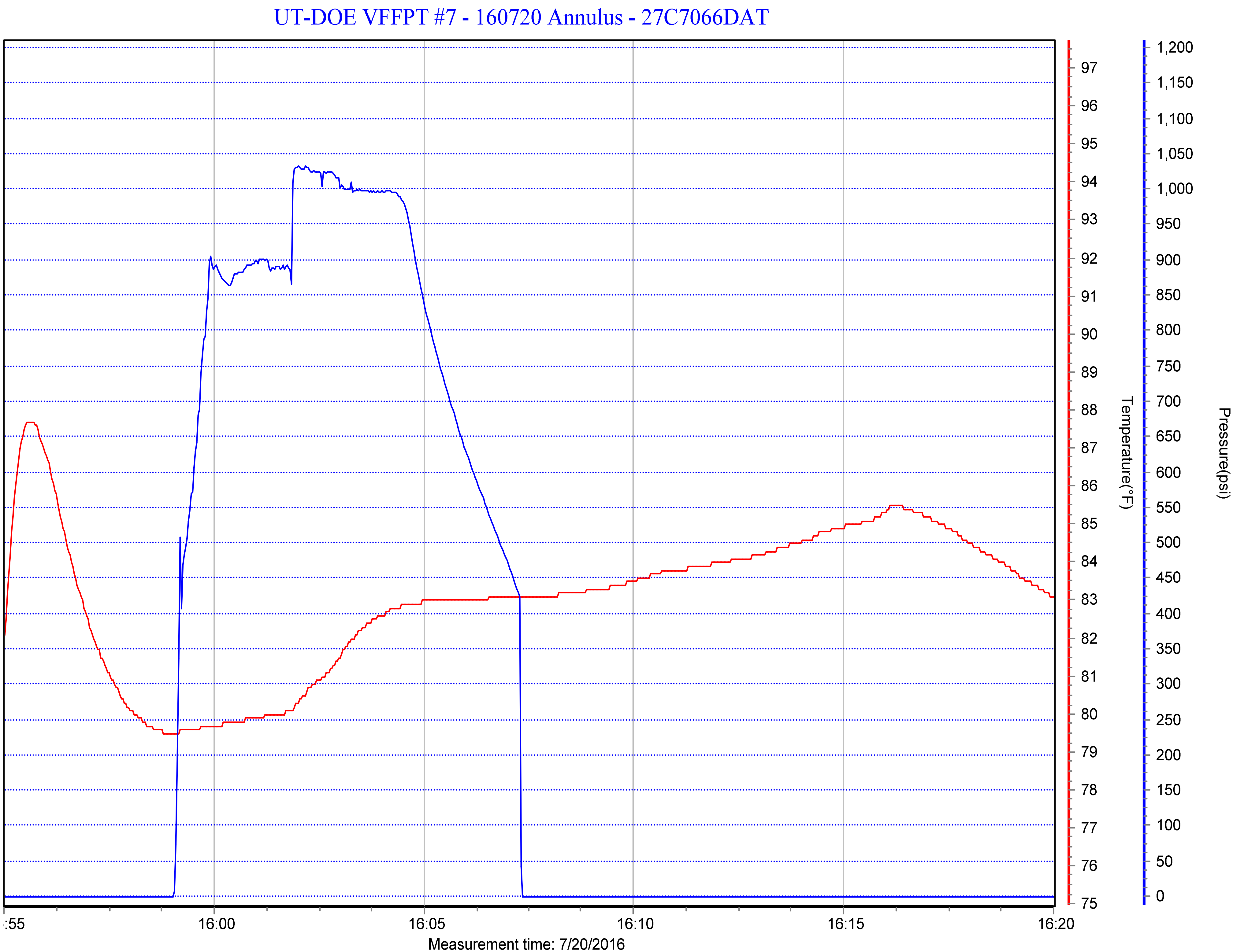


UT-DOE VFFPT #5 - 160719 Autoclave - 27C7068DAT
Temperature(°F)
Pressure(psi)
90.5
90
89.5
89
88.5
88
87.5
87
86.5
86
85.5
85
84.5
84
83.5
83
82.5
82
81.5
81
80.5
80
79.5
79
78.5
78
77.5
77
76.5
76
75.5
75
74.5
74
73.5
73
72.5
1,550
1,500
1,450
1,400
1,350
1,300
1,250
1,200
1,150
1,100
1,050
1,000
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
:10
16:11
16:12
16:13
16:14
16:15
16:16
16:17
16:18
16:19
16:20
16:21
16:22
16:23
16:24
16:25
Measurement time: 7/19/2016

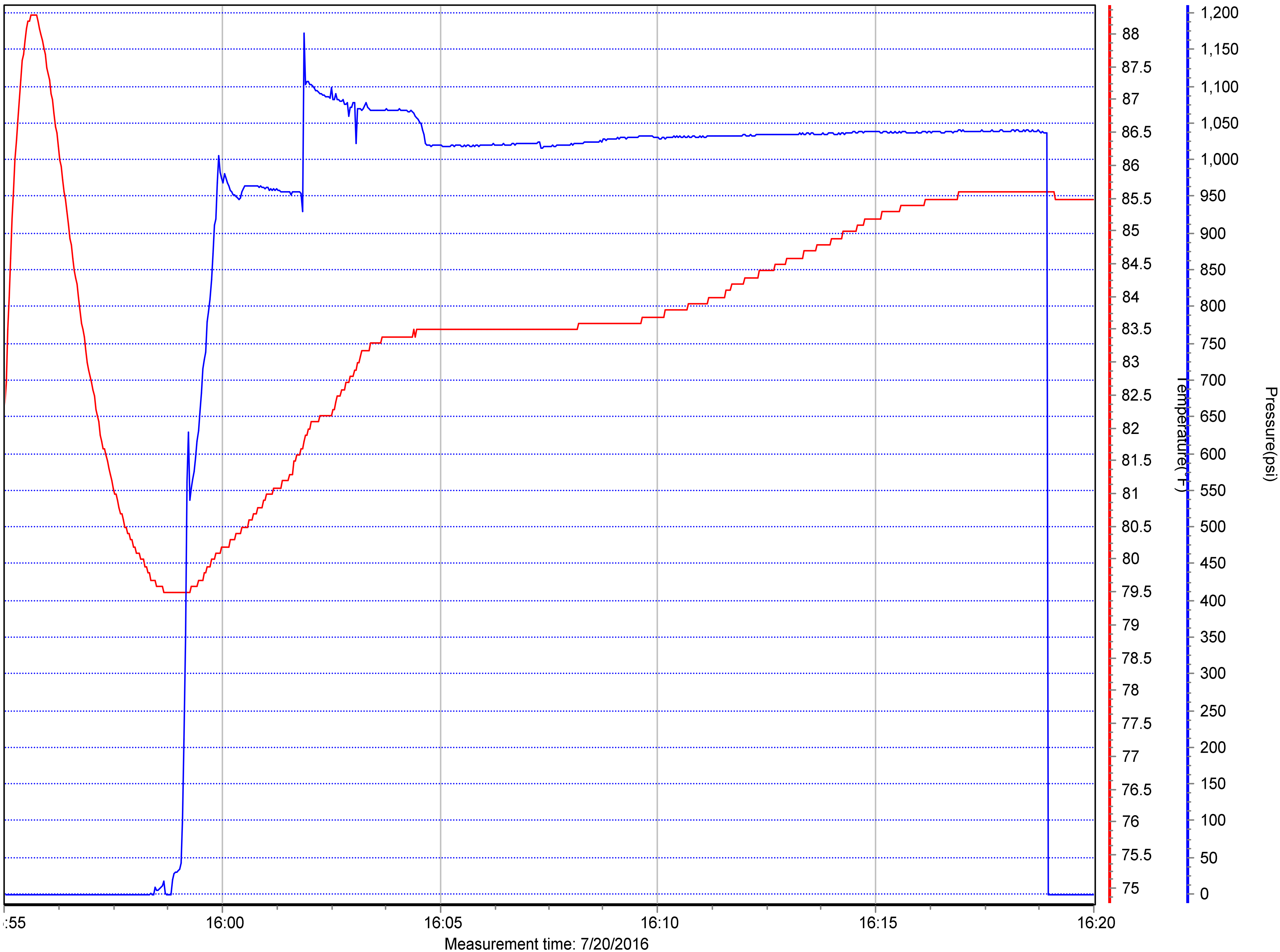

UT-DOE VFFPT #6 - 160720 Annulus - 28C7068DAT
Temperature(°F)
Pressure(psi)
Measurement time: 7/20/2016
:05
14:10
14:15
14:20
14:25
14:30
88
87.5
87
86.5
86
85.5
85
84.5
84
83.5
83
82.5
82
81.5
81
80.5
80
79.5
79
78.5
78
77.5
77
76.5
76
75.5
75
74.5
74
73.5
1,000
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0

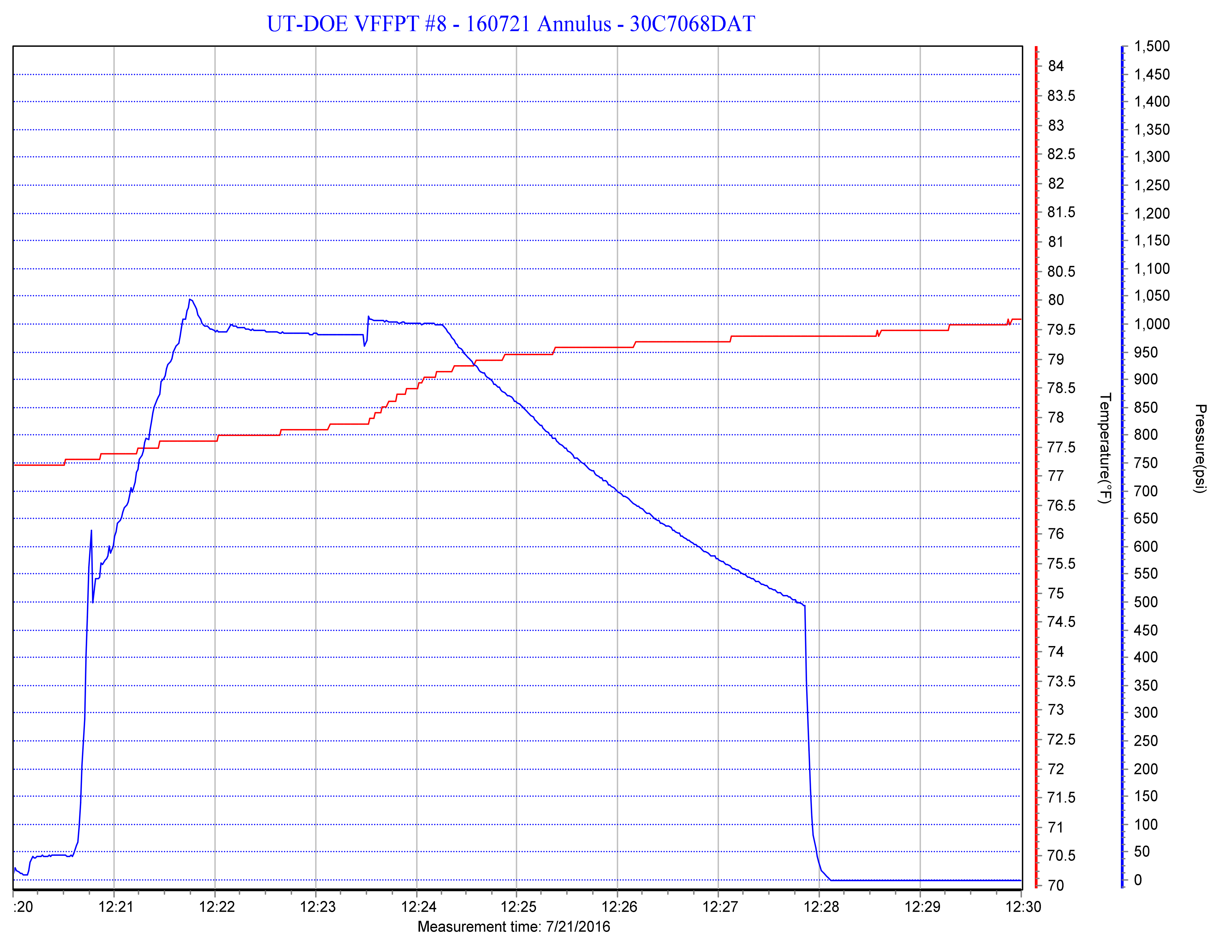
UT-DOE VFFPT #6 - 160720 Autoclave- 26C7066DAT

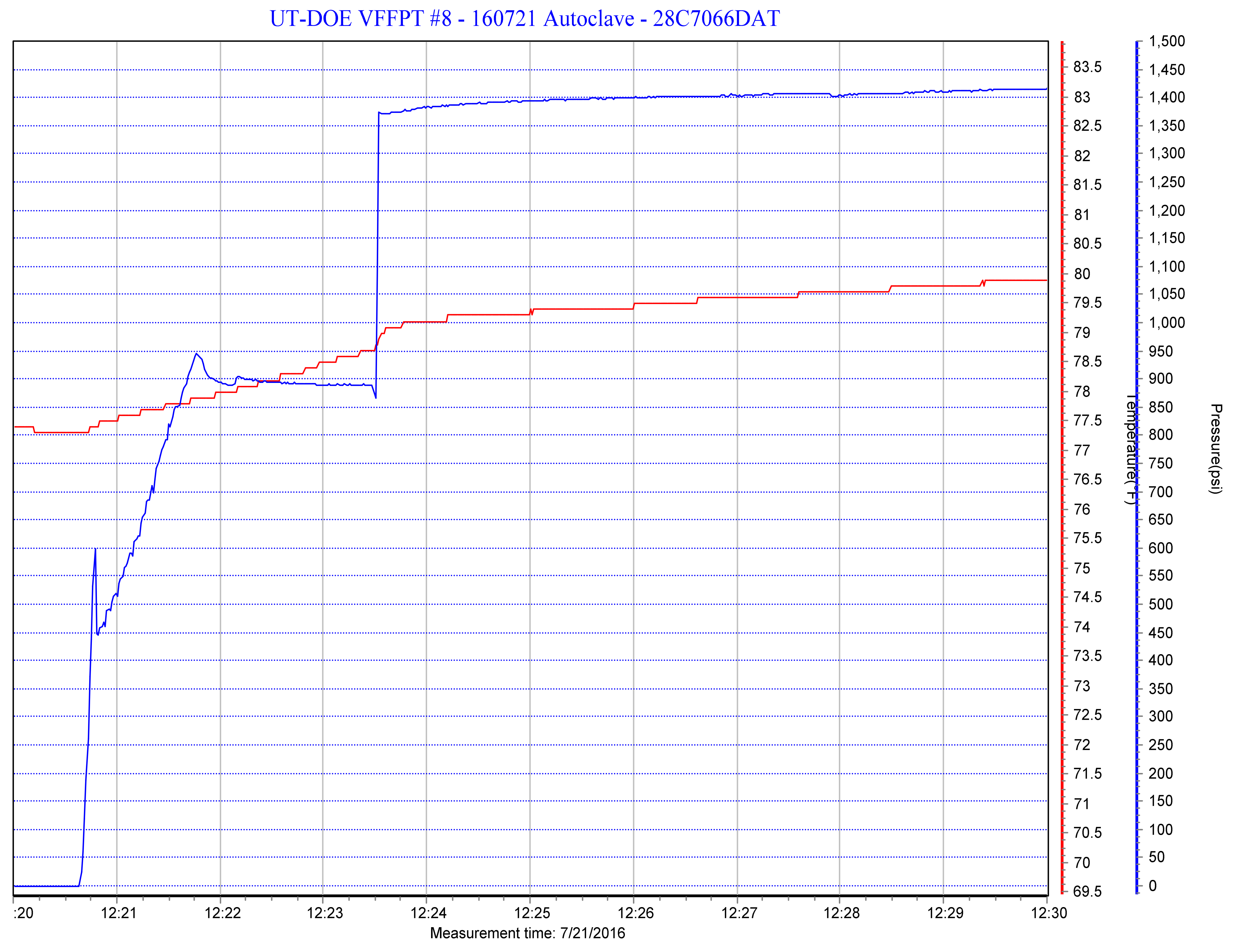


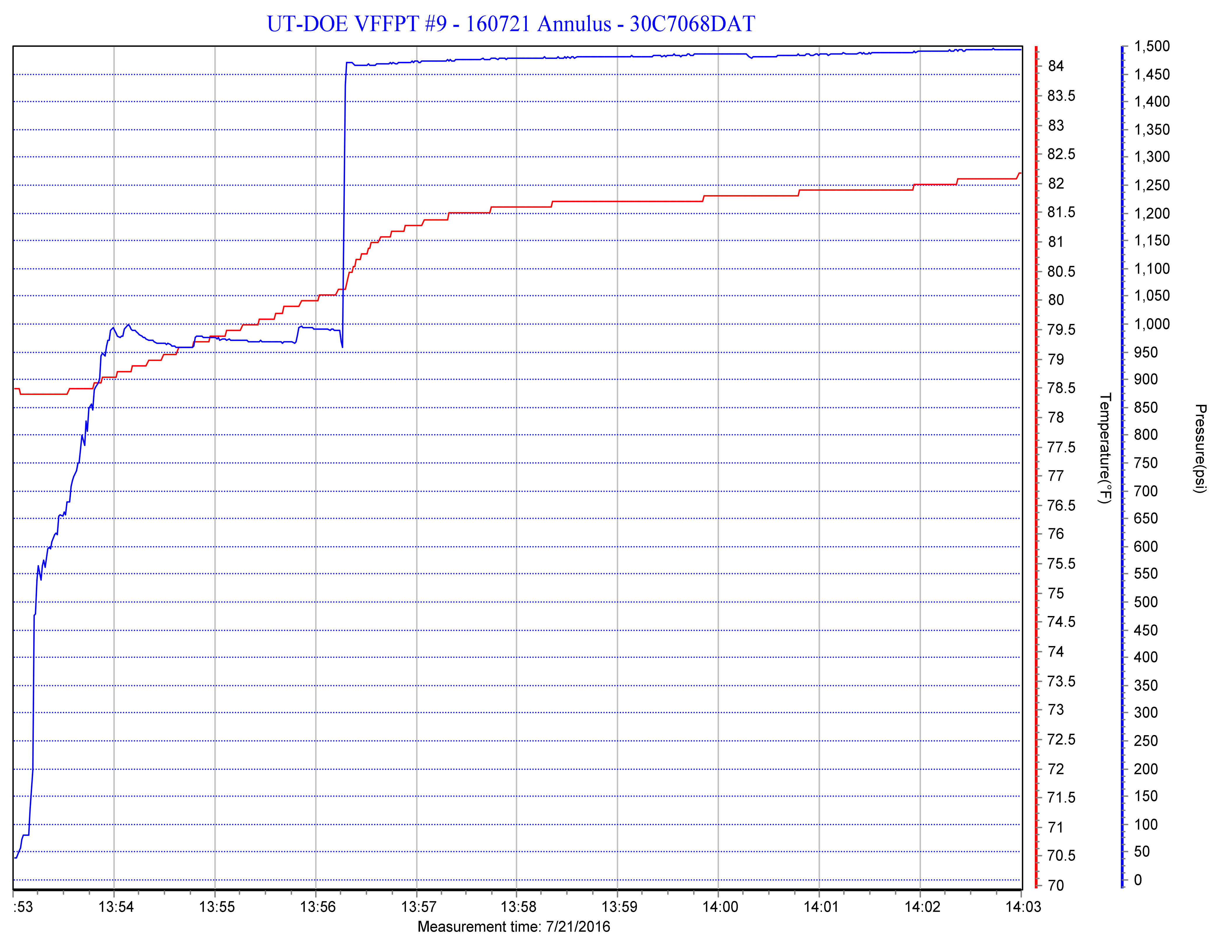

UT-DOE VFFPT #7 - 160720 Annulus - 27C7066DAT
Temperature(°F)
Pressure(psi)
97
96
95
94
93
92
91
90
89
88
87
86
85
84
83
82
81
80
79
78
77
76
75
1,200
1,150
1,100
1,050
1,000
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
:55
16:00
16:05
16:10
16:15
16:20
Measurement time: 7/20/2016

UT-DOE VFFPT #7 - 160720 Autoclave- 29C7068DAT

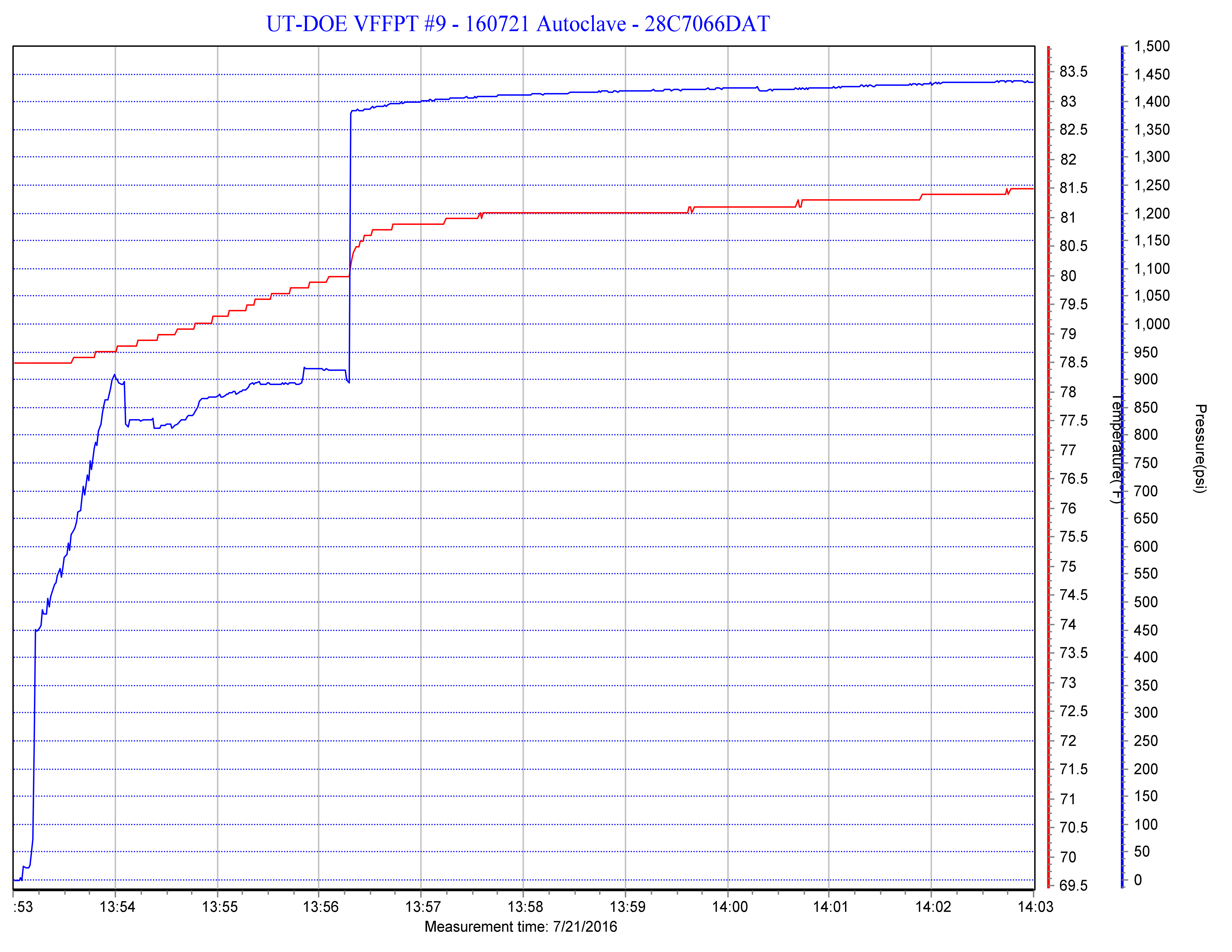



UT-DOE VFFPT #8 - 160721 Annulus - 30C7068DAT
Temperature(°F)
Pressure(psi)
84
83.5
83
82.5
82
81.5
81
80.5
80
79.5
79
78.5
78
77.5
77
76.5
76
75.5
75
74.5
74
73.5
73
72.5
72
71.5
71
70.5
70
1,500
1,450
1,400
1,350
1,300
1,250
1,200
1,150
1,100
1,050
1,000
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
:20
12:21
12:22
12:23
12:24
12:25
12:26
12:27
12:28
12:29
12:30
Measurement time: 7/21/2016


UT-DOE VFFPT #8 - 160721 Autoclave - 28C7066DAT
Temperature(°F)
Pressure(psi)
Measurement time: 7/21/2016
:20
12:21
12:22
12:23
12:24
12:25
12:26
12:27
12:28
12:29
12:30



UT-DOE VFFPT #9 - 160721 Annulus - 30C7068DAT
Temperature(°F)
Pressure(psi)
84
83.5
83
82.5
82
81.5
81
80.5
80
79.5
79
78.5
78
77.5
77
76.5
76
75.5
75
74.5
74
73.5
73
72.5
72
71.5
71
70.5
70
1,500
1,450
1,400
1,350
1,300
1,250
1,200
1,150
1,100
1,050
1,000
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
:53
13:54
13:55
13:56
13:57
13:58
13:59
14:00
14:01
14:02
14:03
Measurement time: 7/21/2016



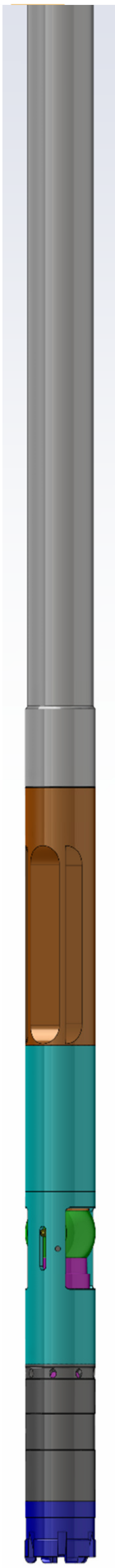
UT-DOE VFFPT #9 - 160721 Autoclave - 28C7066DAT
Temperature(°F)
Pressure(psi)
Measurement time: 7/21/2016
:53
13:54
13:55
13:56
13:57
13:58
13:59
14:00
14:01
14:02
14:03
69.5
70
70.5
71
71.5
72
72.5
73
73.5
74
74.5
75
75.5
76
76.5
77
77.5
78
78.5
79
79.5
80
80.5
81
81.5
82
82.5
83
83.5
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
800
850
900
950
1,000
1,050
1,100
1,150
1,200
1,250
1,300
1,350
1,400
1,450
1,500

APPENDIX D

HYBRID PRESSURE CORING TOOL WITH BALL VALVE MARK III (PCTB III) 2016 PRE-SEA TRIAL TESTS

HYBRID PRESSURE CORING TOOL WITH BALL VALVE MARK III (PCTB III)

2016 PRE-SEA TRIAL TESTS



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PREPARED FOR:

UNIVERSITY OF TEXAS

PREPARED BY:

GEOTEK CORING INC
3738 West 2340 South, STE C
West Valley City, Utah 84119
United States

T: +1 385 528 2536
E: info@geotekcoring.com
W: www.geotekcoring.com

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1. EXECUTIVE SUMMARY

The Pressure Coring Tool with Ball Valve Mark III (PCTB III) is an improved version of the original PCTB core barrel that was developed by Aumann & Associates, Inc. The PCTB II tool was developed in 2013 and tested that year in offshore coring in China. The next year it was again tested at the Catoosa Test Facility for the DoE. During further development the PCTB II was utilized successfully to recover methane hydrate bearing cores during operations offshore Japan and China in 2015. The PCTB tool is a wireline retrievable system designed to recover a 2.00 in. diameter x 3.0 m long core at pressures up to 5000 psi. It is also compatible with, and can transfer pressurized cores to the Geotek Pressure Core Analysis and Transfer System (PCATS) for analysis of the core under pressure thereby preventing loss of pressure sensitive materials such as methane hydrate, expanding gas, oil or other fluids as well as changes in mechanical properties due to pressure reduction.

The PCTB II Onshore Test Program at the Schlumberger Cameron Test and Training Facility (CTTF) was designed to test the effectiveness and efficiency of drilling and coring with the PCTB II pressure core barrel and as a qualification test prior to proposed 2017 offshore operations for the DoE-UT in the Gulf of Mexico. The CTTF test program did, in fact, largely confirm that the tools are "fit for purpose" for future offshore coring operations as detailed in this report. However, the CTTF test program also revealed a potential issue with a late nitrogen boost caused by an incomplete stroke of the tool. This caused the firing of the nitrogen boost after the PCTB was raised most of the way out of the hole or failure of the tool to hold pressure at all.

Since the land test, a variety of modifications were made in an attempt to improve performance. These changes were focused on preventing possible hang up of the upper seal of the autoclave, reducing the flow of debris and pipe scale into the inner workings of the PCTB, and preventing collapse of the core liner at higher flow rates. Additional small changes were made to improve latch performance. The modified design is has been named PCTB III. In addition, a special pseudo core liner and inner tube were designed and fabricated that incorporated DST's to measure and record the collapse pressures on the core liner and inner tube during flow tests to be conducted offshore during a Fugro pressure coring operation offshore China. The new parts and a special test fixture and control console required for the Pre-sea Trial Tests were completed and trial assembled without any issues.

The primary goal of this Pre-sea Trial Test program was to ensure proper function and improved performance of the PCTB III with the above modifications before committing to the Marine Trials. Four tests were developed to fully test the modified tool. The tests included 1) Upper Autoclave Seal Sub Test, 2) Vertical Full Function Pressure Test (VFFPT), 3) Horizontal Space-out Test and 4) Flow Test. Full description of the tests are provided in the body of this report.

The VFFPT test and Horizontal Space-out Tests were completed during the week of July 18, 2016. Representatives Tom Pettigrew and Steve Phillips, from UT/DoE witnessed the tests conducted at Geotek Coring Inc (GCI) facilities in West Valley City, Utah. The tests were successfully completed and revealed that the PCTB III is sufficiently reliable to be further tested and used in the Marine Trial. The results of the tests are detailed in the body of this report and the Appendix.

Unfortunately, customs delays in China and operations on board the drill ship prevented the Flow Test from being carried out. It is recommended that this test be completed during the Marine Trial.

2. DESCRIPTION OF THE TESTS

2.1. UPPER AUTOCLAVE SEAL SUB TEST

This test was an attempt to measure the axial force of the upper autoclave seal as it entered the bore of the Seal Sub. The original PCTB design incorporated two large cross-section o-rings which entered a rather steep ramp in the seal sub bore. It was believed that the o-rings could sometimes jam as they entered the bore and result in the incomplete stroke of the tool observed during the full function pressure tests and also occasionally in operations. Extrusion and cutting of the o-ring seals had occasionally been observed historically as well. For this reason a lip seal was selected to replace one of the o-rings during the PCTB II upgrade. The current modification includes changing to two lip seals and eliminating the large cross-section o-rings completely as well as reducing the angle of the entrance ramp with either a large radius or much lower 10° angle entry cone. The Full Function Pressure Test actuator in conjunction with the standard pressure control section was used to pull the inner tube plug, containing the upper autoclave seals, up and into the test Seal Sub bore. This was the best solution as it utilized the normally assembled parts to conduct the test. It also provided the normal upward vertical movement of the inner tube plug into the seal bore. It also easily permitted the test parts to be immersed in water during the tests.

During the test, the internal pressure of the actuator is slowly increased. The pressure is carefully monitored and the maximum pressure is noted. The force required can be calculated simply by multiplying the pressure by the area of the cylinder. Friction within the cylinder was not considered significant. The stated effective area 0.69 sq.in. The tare weight of the parts lifted was measured at 180 psi (the equivalent of 124 lbs) which must be subtracted from the cylinder pressure readings made during the test to arrive at the net force required for seal entrance into the bore. The original design, dual lip seal and the two new Seal Sub designs were tested. No lubricant was applied to the seals or test parts. The pull test was repeated ten times for each configuration for a good sample size.

2.2. VERTICAL FULL FUNCTION PRESSURE TEST (VFFPT)

The PCTB would sometimes lockup as it was manipulated during the horizontal Full Function Pressure Test (FFPT). This prevented full stroke and actuation of the PCTB. It was never clearly understood if these failures were due to the horizontal test setup or a design weakness inside the PCTB tool itself. The VFFPT is designed to eliminate the possibility of gravitational forces or the horizontal nature of the test setup contributing to or causing the observed lockups. A new test fixture was designed to safely conduct the VFFPT. The test fixture incorporates two large bearings attached to a standard lifting clamp. This fixture is securely mounted to a forklift truck as shown in the photo below. The bearings act as a hinge and enable the PCTB tool to be assembled and attached to the VFFPT fixture horizontally and then safely raised into the vertical test position simply by lifting the forks on the lift truck.

Figure 1, VFFPT Test Fixture mounted to a forklift. Note large bearings and lifting clamp.


Figure 2, VFFPT Test Fixture being raised to vertical position for test.

A hydraulic cylinder integrated into the balance chamber mounted to the top of the tool is used to simulate the wireline pulling tool function. Hydraulic pressure is used to stroke and activate the tool in a more controlled fashion than the come-a-long used with the original FFPT. A linear transducer is also integrated into this test fixture to easily and safely provide real-time observation as well as recording of the stroke position. The PCTB is fitted with a cylindrical cap to seal the bottom of the tool and extends over to seal the windows in the ball valve housing to providing a pressure chamber that simulates the area in the BHA below the PCTB.

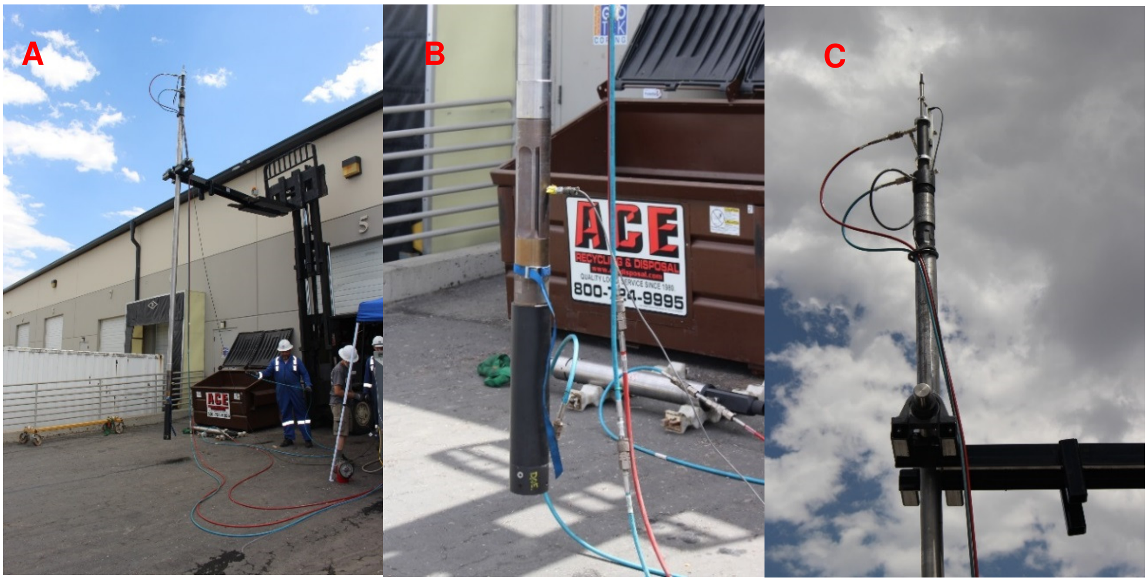


Figure 3: Setup of vertical full-function pressure test (VFFPT). A) PCTB in vertical orientation. B) Bottom cap with water lines attached and accumulator in the background. C) Actuating mechanism at top of PCTB.

The upper and lower chambers are connected via hydraulic hoses so that equal pressures are maintained above and below the PCTB thus replicating the ID of the outer core barrel assembly.

A new pressure test console was prepared for the VFFPT. It incorporates the hydraulic pump, gauges, linear transducer readout, and a new hydraulic system to reliably and accurately control the rate of depressurization when simulating the wireline trip out of the hole. A pressure transducer is included to monitor the autoclave pressure in real time. An electronic A/D converter with USB computer output is available to make a computer record of the output of both the linear and pressure transducers. Digital Storage Tags (DST's) are placed within the autoclave and in the simulated annulus between the cap and the bottom of the PCTB to record those pressures as well.

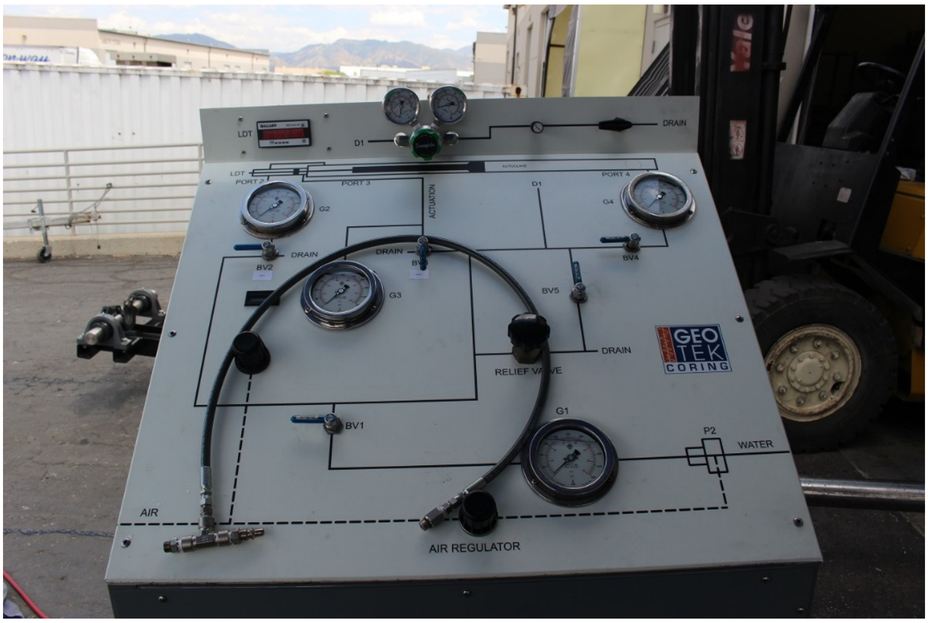
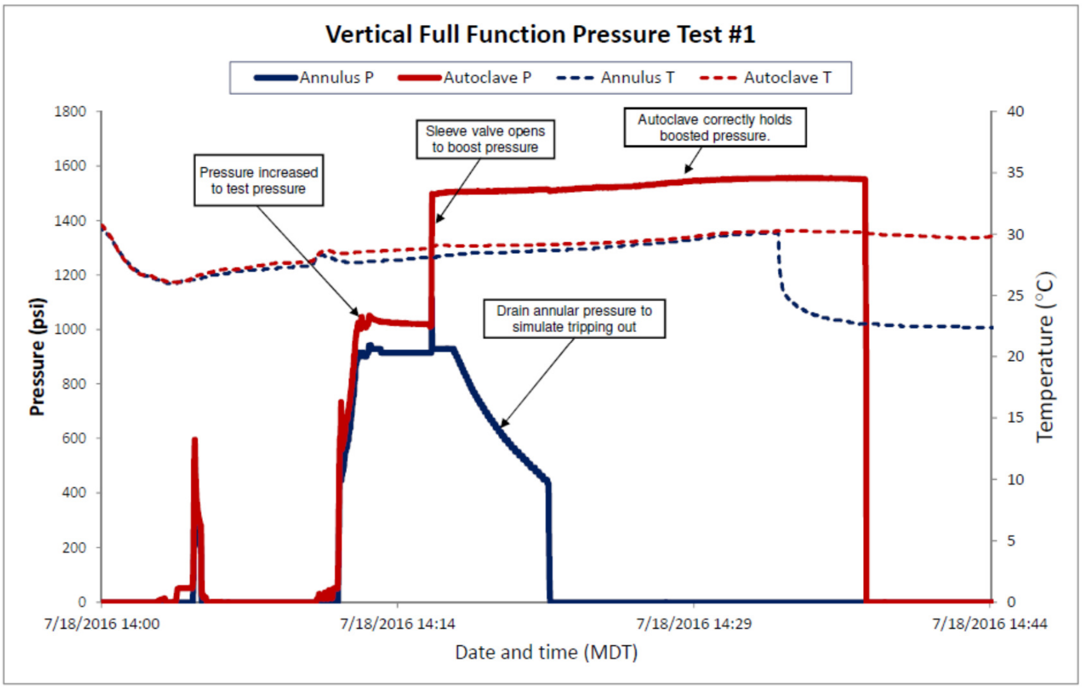


Figure 4, Pressure Test Console with linear transducer readout (top left) and new depressurization controls (top middle and right).

To conduct a VFFPT, the PCTB autoclave is assembled and hydraulically pressure tested as is normally done for an operation. The reservoir chamber in the pressure control section is filled with nitrogen and the regulator set to the desired boost pressure and function tested. The pressure control section is assembled to the autoclave. Then the upper balancing chamber and lower pressure test cap are installed. Hoses are used to connect the upper to lower chamber and to the new pressure test console and to an accumulator used to smooth out the pulses from the pump. The pressure transducer is attached to the port in the drive sub and the linear transducer is connected to its readout box. The PCTB is attached to the gimbaled lifting clamp and raised vertically using the forklift. The tool and the annulus are filled with water and pressure increased to the static test pressure (~1000 psi used for this series of tests) via the pump in the pressure test console. Pressure is applied to the actuator cylinder at the top of the assembly to simulate the pulling of the wireline to trigger ball valve closure and N2 boost from the pressure control section. After the pressure boost is observed, the pressure in the annular chambers is slowly lowered to simulate coming out of the hole. An example DST pressure chart shows correct operation.



2.3. HORIZONTAL SPACE OUT TEST

The horizontal space-out test is performed by assembling the bottom-hole assembly (BHA) horizontally and then sliding the complete PCTB inner barrel assembly into the BHA from the top. The BHA consisted of the cutting shoe bit, bit sub, outer core barrel, landing sub, top sub, and head sub. The PCTB III in the cutting shoe configuration was manoeuvred horizontally with a forklift and inserted into the top end of the BHA until the cutting shoe protruded from the bottom of the drill bit. Normally in a vertical orientation the tool would normally be suspended from the wireline allowing the dogs to retract and the tool to pass through the restriction in the head sub. In the horizontal position dogs in the upper part of the tool had to be manually covered and retracted to be inserted into the BHA. After the latch is locked in position, the cutting shoe is pushed up to check that the PCTB III is properly latched in the BHA. The pulling tool is then used to simulate pulling the tool after a coring run to check for proper PCTB III operation including ball closure and release from the BHA.

2.4. FLOW TEST

The purposes of the PCTB flow test is a) to characterize the pressure drops within the BHA and PCTB, b) to measure and compare the recorded flowing pressures between the standard PCTB and the modified PCTB III, and c) to test the PCTB III modifications designed to eliminate core liner and inner tube collapse.

An instrumented core liner was designed and fabricated. It replaces the standard core liner and inner tube during the flow tests. The instrumented core liner houses integral DST pressure recorders strategically located along its length to monitor and record the pressure between the core liner and the core tube as well as the outside of the core tube. The instrumented core liner would be installed in a standard PCTB and in a modified PCTB III for comparison of the pressure records. Incremental flow would be established with the BHA hanging just below the rotary table at rates from 100 gpm to a maximum of 500 gpm (or maximum capability of the pump) with the instrumented core liner in place recording the pressures.

The China flow tests were to be undertaken by Geotek with the cooperation of Fugro on a “best effort” basis, based on timely delivery of the instrumented core liner and modified PCTB III parts, as well as an appropriate opportunity arising during the China operations to perform the tests. It was planned that a Fugro PCTB would be used for the China flow test and updated with the DOE PCTB III parts. The tool is nearly identical to the DOE PCTB III except for the upper assembly being shorter and the smaller BHA ID at the upper end. Testing with the Fugro PCTB should provide nearly identical results to the DOE PCTB III. It was anticipated that the standpipe pressure at the surface may be higher in the Fugro test due to the smaller ID at the upper end of the Fugro BHA. Fugro also does not have a Face Bit Assembly so the tests could only be carried out using the Cutting Shoe Assembly.

3. TEST RESULTS

3.1. UPPER AUTOCLAVE SEAL SUB TEST

The original o-ring design and the newer lip seals were tested in the three Seal Sub configurations including the original 35° seal entry bevel, the radiused seal entry and a 10° seal entry bevel. This results in a matrix of six types of tests. Each test was repeated ten times. The average of the results are summarized in the table below. The chart shows the results with the tare weight of the suspended parts subtracted.

		Seal Sub Type		
		Original 35° Bevel	*Radiused*	*10° Bevel*
		Force (lbs)		
Seal Type	*O-ring*	133	55	19
	PolyPak	79	63	17

The forces measured during this test eliminate the possibility that this seal is not likely the reason for the tool hanging up in previous full function pressure tests or during operations. However, the results do show that's a significant reduction in the seal entry force can be obtained if the new 10° bevel is used.

3.2. VERTICAL FULL FUNCTION PRESSURE TEST (VFFPT)

The Geotek proposed testing procedures called for starting with the current steep angle seal sub and lip seal/o-ring combination. Since the current configured PCTB was deployed extensively during the land test and during horizontal full function bench testing prior to the land test, the decision was made by the UT/DoE representative not to repeat these tests and test only the modified configurations. Both the new 10° Bevel and Radiused Seal Subs were used during the VFFPT and the double lip seal was used as well as the full complement of PCTB III improvements were used in all the tests.

Note that for the VFFPT, only the autoclave, pressure section, and balancing actuation cylinder is used. The upper assembly is not used in these tests.

For all these tests the following nominal pressures were used.

Reservoir Pressure: 3,000 psi

Regulator Set (Boost) Pressure: 1,500 psi

Hydrostatic Pressure: 1,000 psi

Nine tests were conducted. A table of the results is in Appendix A. All tests except for three were completely successful. Two additional tests were partially successful and one failed. The following tests had problems.

Test 3 – The tool failed to fully stroke initially but finally fully stroked after several attempts to pull it using the actuation cylinder. The autoclave contained the fully boosted pressure and was ultimately successful. The maximum force applied by the actuator to the release rod was ~2,000 lbs. This force is well within the capabilities of a wireline unit in the field. Since the modified parts now prevent the PCTB from releasing from the BHA until it is fully stroked internally, should this particular hang up occurred in the field, the wireline operator would be able to work the wireline up and down and achieve the same results. In the event the PCTB fails to stroke in the field, it would be necessary to shear release pin in the pulling tool and pull it out of the hole. Then the emergency pulling tool, which engages only the PCTB upper latch, would have to be run in the hole to recover the PCTB. In this case the ball valve would likely remain open.

Upon disassembly, no definitive evidence was observed as to the cause of the hang up. However, one of the port covers was found to be slightly above flush with the OD of the tool and may have been the cause of the hang up.

Test 6 – This tool also failed to stroke but, this time repeated pulling did not free it. The tool was disassembled and it was discovered that the Disappearing Detent had not dropped into its groove. Some rough edges including a small lip on each tooth hadn't been deburred and this could have contributed to the problem. Detent was smoothed and replaced. However, this is considered an operator error. The assembler is supposed to rotate the inner assembly in an eccentric motion to check and make sure all of the Disappearing Detents are properly seated in their groove before final assembly. A trained operator can feel if a Disappearing Detent is not properly seated. This apparently was not properly done.

Test 7 – During this test the actuator was actuated and the PCTB only partially stroked. The actuator was worked up and down several times when both the annulus pressure and the autoclave pressure were observed to increase to ~1,125 psi and the PCTB could not be stroked further. The annular pressure was slowly bled off to zero as usual, simulating coming out of the hole on wireline. The autoclave held pressure but the pressure dropped from ~1,125 to ~1,070 psi and then remained there. The PCTB was rigged down for autopsy.

From visual observation of the pressure gauges, readouts and DST data, it appears the boost occurred before the autoclave was fully sealed, as indicated by both the annulus and the autoclave pressures increasing simultaneously while stroking the PCTB. Since the annular volume is connected to an accumulator during the test, the accumulator absorbed some of the boost pressure. Thus, only 125 psi was added to the system rather than the full 500 psi of the boost. This is indicated by a 1,175 psi spike in the autoclave pressure data before the system equalized at ~1,100 psi. Upon disassembly, the boost reservoir pressure was found to be below what is normally observed which would be consistent if the compensating piston in the pressure control section had travelled to the end of its chamber as it would if the boost pressure had escaped through an open ball.

As the annulus pressure was slowly bled off to simulate coming out of the hole, both the annulus pressure and autoclave pressure dropped together until the pressure reached ~1,025 psi at which point the autoclave pressure stopped dropping. This can happen if the ball valve closes too slowly and the boost from the pressure control section escapes. When there is no pressure boost or, if the pressure boost is lost, the ball moves upward to compensate for volume increase as the inner tube plug seal continues to move upward after ball valve closure. As the annular pressure is lowered coming out of the hole, the autoclave held the static pressure and did not necessarily leak. Similar response has been observed many times in the past both in the field and in lab tests when the boost pressure does not occur. The reason for the drop in pressure can be attributed to the ball moving back into the fully closed position as pressure is reduced which increases the autoclave volume and lowers the autoclave pressure until the ball is fully seated against the ball follower. It is unlikely but also possible that the ball did not close until some pressure had been bled off.

Upon disassembly of the ball valve, it was found to be closed in the normal position. The reset tool was installed to compress the ball valve spring for further disassembly. When the reset tool was removed, the seal carrier hung up inside the ball valve housing. A slight tap on the housing with a hammer freed the seal carrier and it slammed to the fully closed position driven by the compressed ball valve spring. The reset tool was installed again to compress the ball valve spring and again when the reset tool was removed the seal carrier hung up inside the ball valve housing. Further investigation revealed small raised areas at the top of the ball valve housing windows on the ID. These are caused by the ball moving too far upward and deforming the ID of the ball valve housing when the reset tool engaged and tightened too much. These dings prevent instantaneous travel of the seal carrier. The dings were ground off. Retesting using the ball resetting tool confirmed that the problem was fixed.

This again is considered operator error as the current procedure calls for the assembler to fire the ball several times during reassembly to verify correct operation. Seal carrier sticking or slow ball valve closure would have been observed and corrected had the assembler followed the procedure.

3.3. HORIZONTAL SPACE-OUT TEST

The Outer Core Barrel (OCB) was assembled and the 6-5/8 FH Modified connections were tightened as much as possible using a chain tong. The PCTB lower section was slid part way into the OCB using a fork lift. A lifting clamp was attached to the top of the lower section to keep it from sliding further, similar to how it is done in the field except for the PCTB being horizontal. The PCTB upper section was picked up and made up to the lower section horizontally. The lifting clamp was removed and the full PCTB assembly was slid into the OCB. Note, the running tool was not used since it would go too far inside the OCB to be released manually. Thus a piece of 4x4 lumber was used to drive the PCTB assembly into the OCB.

The PCTB stopped sliding about 12" above the landing point when the outer latch dogs contacted the head sub ID. Note, normally the outer latch dogs are retracted by the weight of the PCTB hanging on the running tool. The PCTB was pulled out of the OCB until the outer latch dogs were accessible. The running tool was installed in the PCTB to retract the outer latch dogs. A spare latch sleeve was slid over the outer latch dogs to keep them retracted. The running tool was manually released and removed. The PCTB was then slid back into the OCB as far as it would go while removing the spare latch sleeve once the outer latch dogs had entered the head sub ID.

It appeared that the PCTB was within 1/4" - 1/2" of latching but had not latched. To confirm that the PCTB was not latched, a sledge hammer was used to bump the PCTB out of the OCB by hammering on the cutting shoe. The PCTB continued to slide out of the OCB confirming that it was not latched.

Figure 5: Horizontal space-out test. A) The bottom hole assembly viewed from the bottom. B) The PCTB inserted into the head and top sub. C) The face bit with cutting shoe fully inserted.

The assemblies were double checked and found to be OK. The head sub was removed from the OCB to verify that the latch sleeve had not come lose and backed off. Note, removing the head sub allowed the outer latch dogs to expand inside the OCB and they cannot be retracted without engaging the pulling tool. The latch sleeve was found to be tight and the length verified to be correct. The head sub was made up to the OCB again and shouldered against the top sub. Since the outer latch dogs were locked in the expanded configuration and could not pass through the latch sleeve ID when the head sub was made up, the PCTB had to be latched in place. To verify the PCTB was latched into the OCB the cutting shoe was once again bumped with a sledge hammer and the PCTB would not move, indicating the PCTB was latched into the OCB.

The overall space out was checked and found to be correct. Thus, when the PCTB is made up with the new modified parts it will latch into the normal/standard PCTB BHA in the field.

The pulling tool was then inserted into the PCTB. A strap was connected between the pulling tool and the fork lift. The fork lift was used to pull the PCTB out of the OCB. Closing of the ball valve could be heard as the PCTB was stroked internally while pulling the PCTB out of the OCB. This further verified that the space out was correct and the internal stroking of the PCTB was occurring in the proper sequence.

The PCTB was removed from the OCB and disassembled. The OCB was then disassembled, ending the testing program.

Discussion:
The failure of the PCTB to latch on the first attempt was due to friction caused by performing the test horizontally. When the head sub was made up the second time, the latch sleeve was able to push against the outer latch dogs more evenly and with the power screw effect of the thread the PCTB was seated properly. This type of failure to latch is not likely to occur in the field where everything is done vertically.

3.4. FLOW TEST

The PCTB III upgrade parts, Fugro PCTB retrofit parts and instrumented core liner were completed on time and shipped to China for the planned flow test on the Fugro pressure coring operation. Unfortunately, customs delays in China and operations on board the drill ship prevented the Flow Test from being carried out.

It is recommended that this test be completed during the Marine Trial or sooner if another opportunity presents itself.

4. CONCLUSIONS AND RECOMMENDATIONS

- PCTB III tool improvements assemble and function properly.
- The double lip seal (PolyPak) autoclave inner tube plug seal configuration should be deployed in the future.
- The 10° Bevel Seal Sub should be deployed in the future.
- The PCTB space out, when configured with the new and modified parts, is compatible with the current PCTB BHA.
- The PCTB functioned quite well during the tests showing no signs of delayed boost and trapping the boost pressure during all of the tests but one.

APPENDICES

A. Seal Sub Test Data Sheet
B. Vertical Full Function Pressure Test Results Summary
C. Vertical Full Function Pressure Test Pressure Charts

Appendix A, Seal Sub Seal Test Data Sheet

Seal Sub Test						
UT/DOE Lab Testing 2016 - SOW Phase 2, Subtask 4.2						
Parameters: Pressure used to actuate the tool.						Tare/Equilibrium (psi):
Piston Area: 0.69 in²						180
Starting Displacement: -2.0						
Test #	Time	Displacement	Pressure at Seal Entry	Net Pressure	lb-f	Comments
1	13:51	109	383	203	140	35° Original Seal Sub with O-Ring
2	13:52	121	386	206	142	
3	13:54	125	361	181	125	
4	13:55	129	382	202	139	
5	13:56	137	395	215	148	
6	13:57	135	368	188	130	
7	13:57	132	359	179	124	
8	14:05	140	367	187	129	
9	14:07	134	367	187	129	
10	14:09	136	359	179	124	
AVG					133	
11	14:25	92	312	132	91	35° Original Seal Sub with Polypak
12	14:26	90	298	118	81	
13	14:30	98	295	115	79	
14	14:31	96	285	105	72	
15	14:32	96	281	101	70	
16	14:35	97	300	120	83	
17	14:36	97	297	117	81	
18	14:37	97	300	120	83	
19	14:38	96	296	116	80	
20	14:39	96	287	107	74	
AVG					79	
21	14:51	191	287	107	74	Radiused Seal Sub, Polypak
22	14:56	201	278	98	68	
23	15:00	196	270	90	62	
24	15:01	203	273	93	64	
25	15:04	209	271	91	63	
26	15:04	199	278	98	68	
27	15:05	198	261	81	56	
28	15:10	215	259	79	55	
29	15:14	207	263	83	57	
30	15:23	207	268	88	61	
AVG					63	

Seal Sub Test

UT/DOE Lab Testing 2016 - SOW Phase 2, Subtask 4.2

Parameters: Pressure used to actuate the tool.
Piston Area: 0.69 in²
Starting Displacement: -2.0

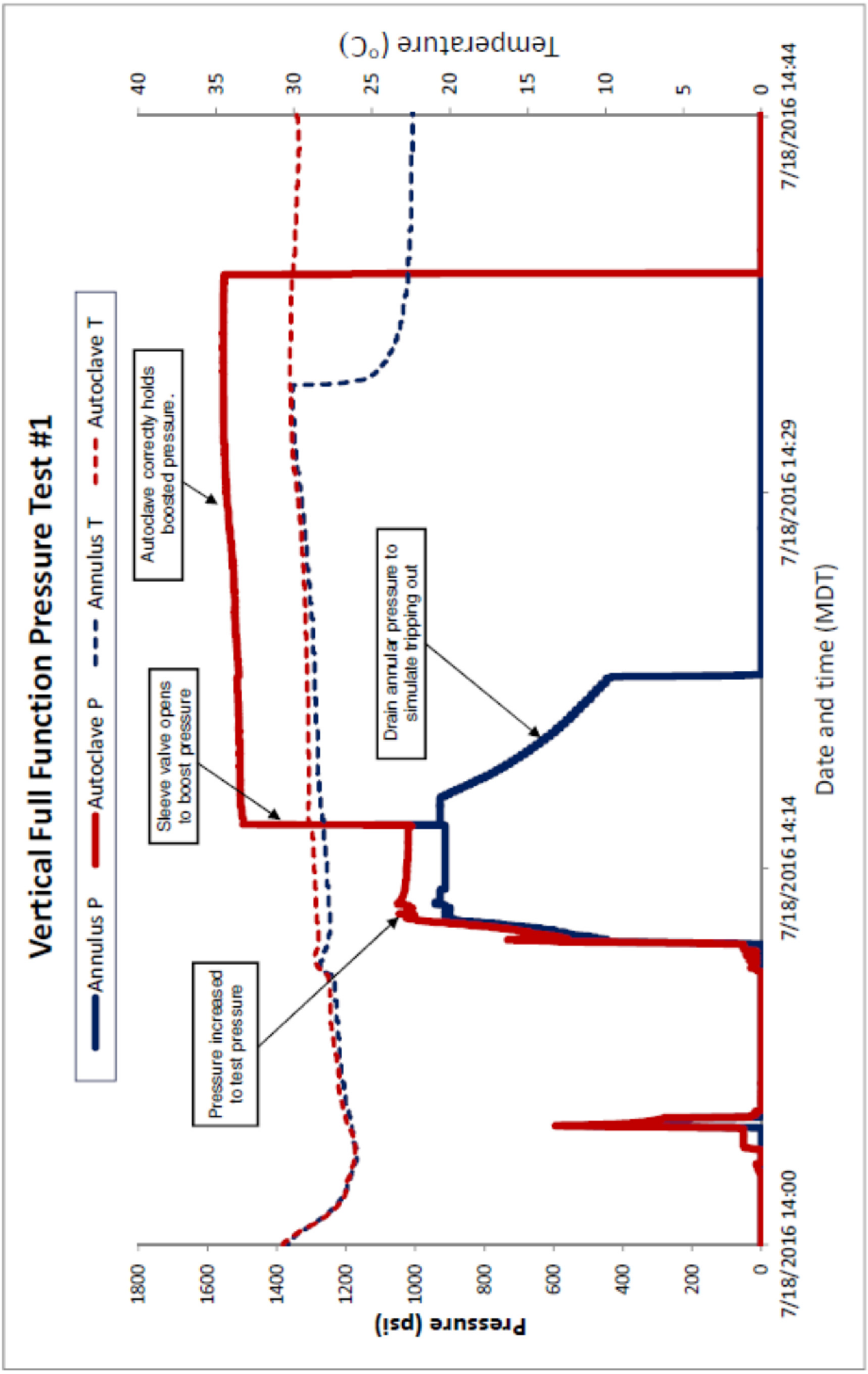
Tare/Equilibrium (psi): 180

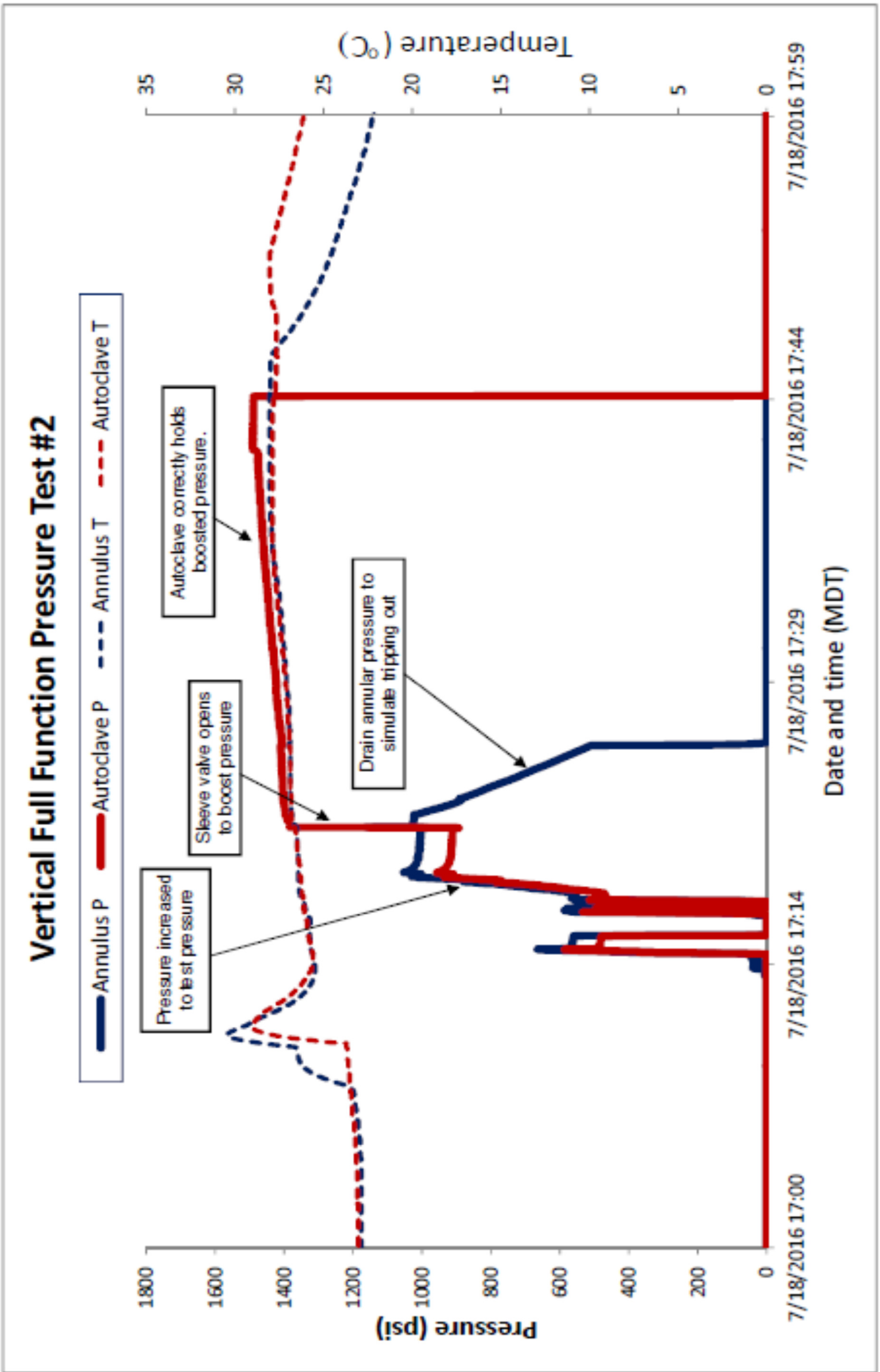
Test #	Time	Displacement	Pressure at Seal Entry	Net Pressure	lb-f	Comments
31	15:27	195	268	88	61	Radiused Seal Sub, O-Ring
32	15:28	206	256	76	52	
33	15:30	198	268	88	61	
34	15:32	208	264	84	58	
35	15:34	203	261	81	56	
36	15:35	196	263	83	57	
37	15:36	199	253	73	50	
38	15:38	196	262	82	57	
39	15:39	198	257	77	53	
40	15:41	198	249	69	48	
AVG					55	
41	15:57	28	224	44	30	10° Beveled Seal Sub, O-Ring
42	16:00	28	210	30	21	
43	16:01	48	219	39	27	
44	16:05	40	207	27	19	
45	16:06	35	212	32	22	
46	16:09	39	193	13	9	
47	16:10	35	193	13	9	
48	16:11	41	213	33	23	
49	16:13	41	204	24	17	
50	16:15	42	207	27	19	
AVG					19	
51	16:17	29	215	35	24	10° Beveled Seal Sub, Polypak
52	16:19	27	216	36	25	
53	16:21	25	214	34	23	
54	16:23	25	204	24	17	
55	16:24	26	205	25	17	
56	16:25	24	201	21	14	
57	16:27	25	209	29	20	
58	16:28	21	197	17	12	
59	16:29	24	195	15	10	
60	16:29	27	191	11	8	

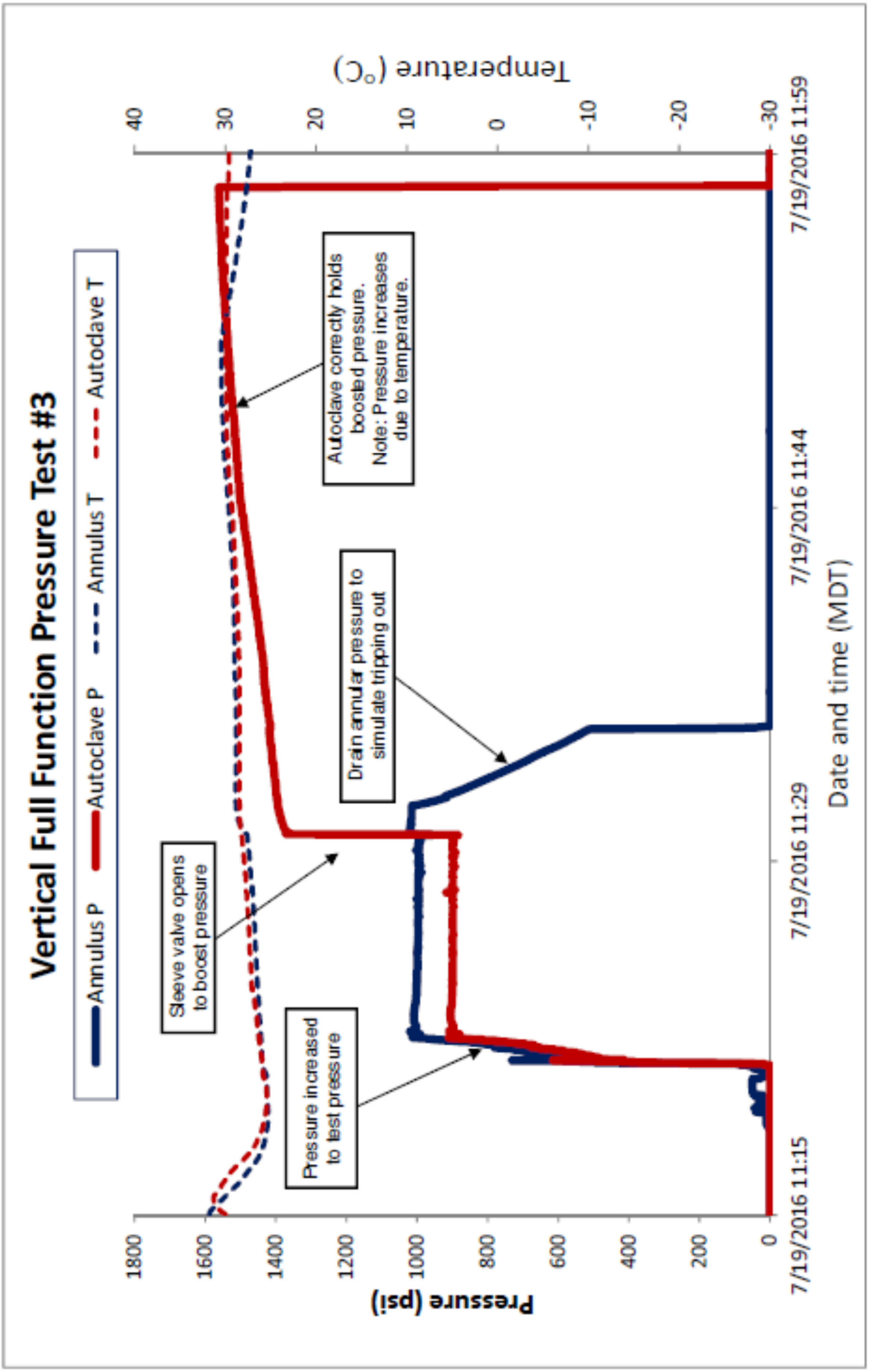
Appendix B, Vertical Full Function Pressure Test Summary Sheet

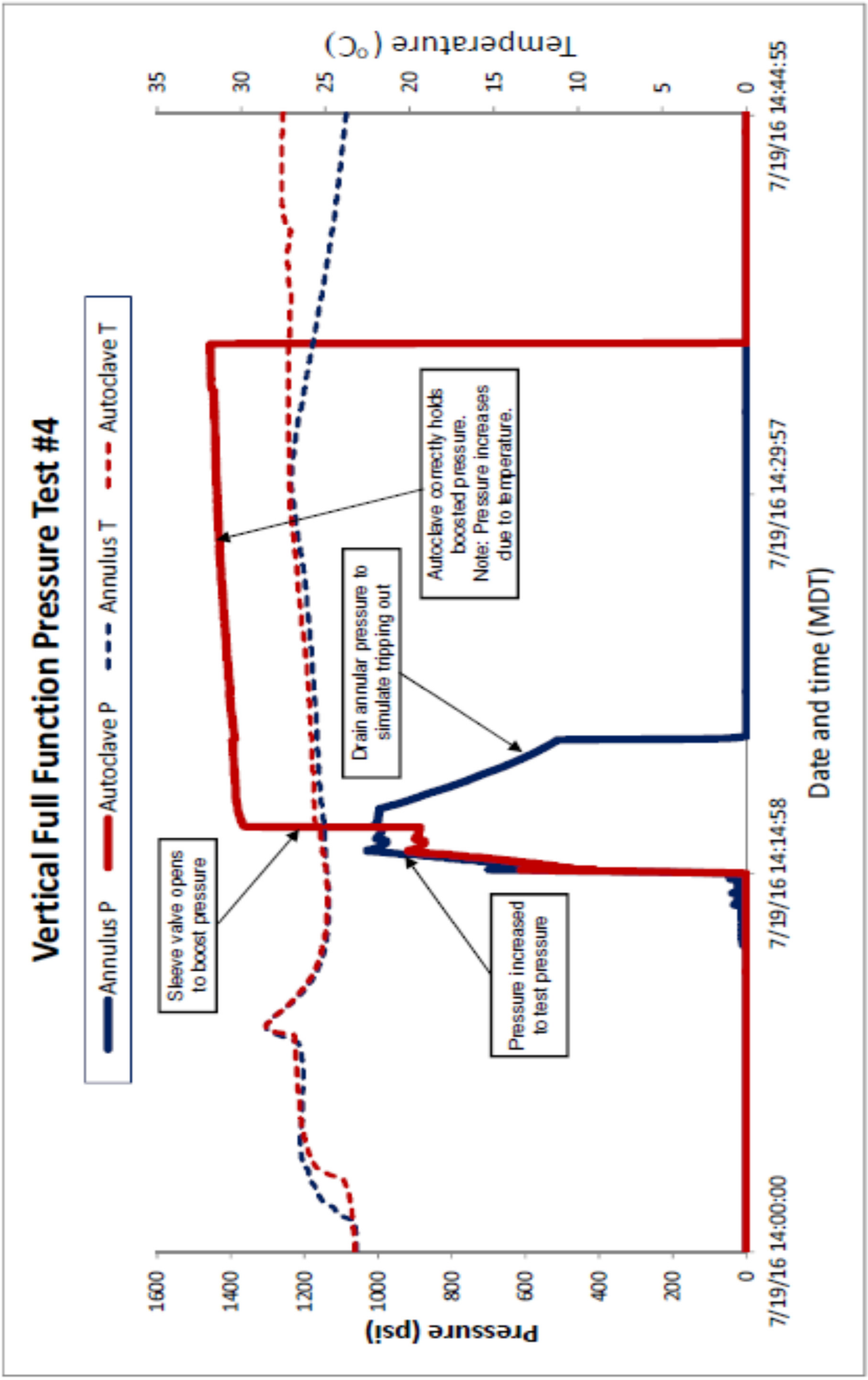
Test Attempt	Test No.	Date	Seal Sub Type (B) 10° Bevel (R) Radius	DST Autoclave	DST Annulus	Reservoir Pressure	Set Pressure	Annulus Before Closure	Annulus After Closure	Autoclave Pressure After Closure	Autoclave Pressure after POOH	Sleeve Valve Travel	Comment
				Run No.	Run No.	psi	psi	psi	psi	psi	psi	in	
1		7/18/2016	B	23C7068	20C7066	3049	1520	1000	1025	1497	1550	0.43	Good test.
2		7/18/2016	B	21C7066	24C7068	3006	1510	1006	1011	1400	1525		Good test.
3		7/19/2016	B	22C7066	25C7068	3009	1515	1000	1008	1383	1562	0.43	Jammed on first pull. Pulled and released 10-15 times and it came free. Good test after that. No definitive reason for the jamming was identified during disassembly.
4		7/19/2016	B	24C7066	26C7068	3030	1512	1284	1284	1383	1457	0.43	Good test.
5		7/19/2016	R	25C7066	27C7068	3015	1506	913	928	1498	1553	0.47	Good test.
6		7/20/2016	R	26C7066	28C7068	3040	1508	1000	NA	NA	NA	0.47	Moved 3/4" and stopped. Pulled a few times and decided to disassemble and inspect. Found one collapsing detent was not in its groove but pinched between the IT Release Sleeve and the Lower IT Plug.
7		7/20/2016	R	29C7068	27C7066	3010	1510	1000	1125	1125	1070	0.46	Boost occurred before the ball valve was completely closed. This pressured up the annulus as well during the pressure boost. However, the ball valve sealed during depressurization indicating it has closed late. Burrs were discovered on the ball valve housing causing the seal carrier to hang up delaying ball valve closure.
8		7/21/2016	R	28C7066	30C7068	3005	1501	990	1010	1375	1410	0.46	Good test.
9		7/21/2016	R	28C7066	30C7068	3004	1512	990		1470	1490		Good test. However, the annulus DST migrated from the annulus chamber below the ball into the autoclave and also recorded the autoclave pressure. As a result, no annular pressures were recorded.

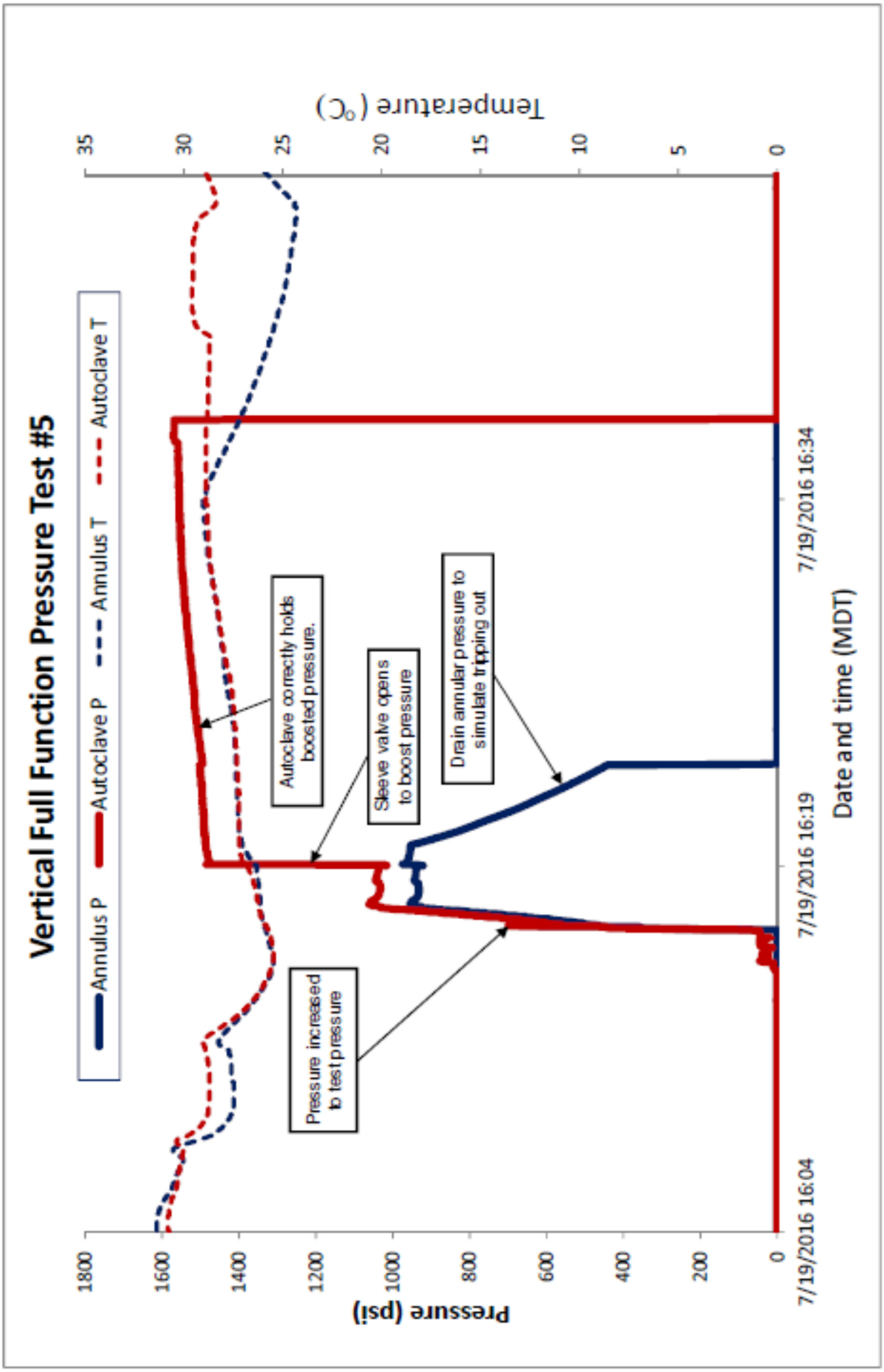
Appendix C, Vertical Full Function Pressure Test Pressure Charts

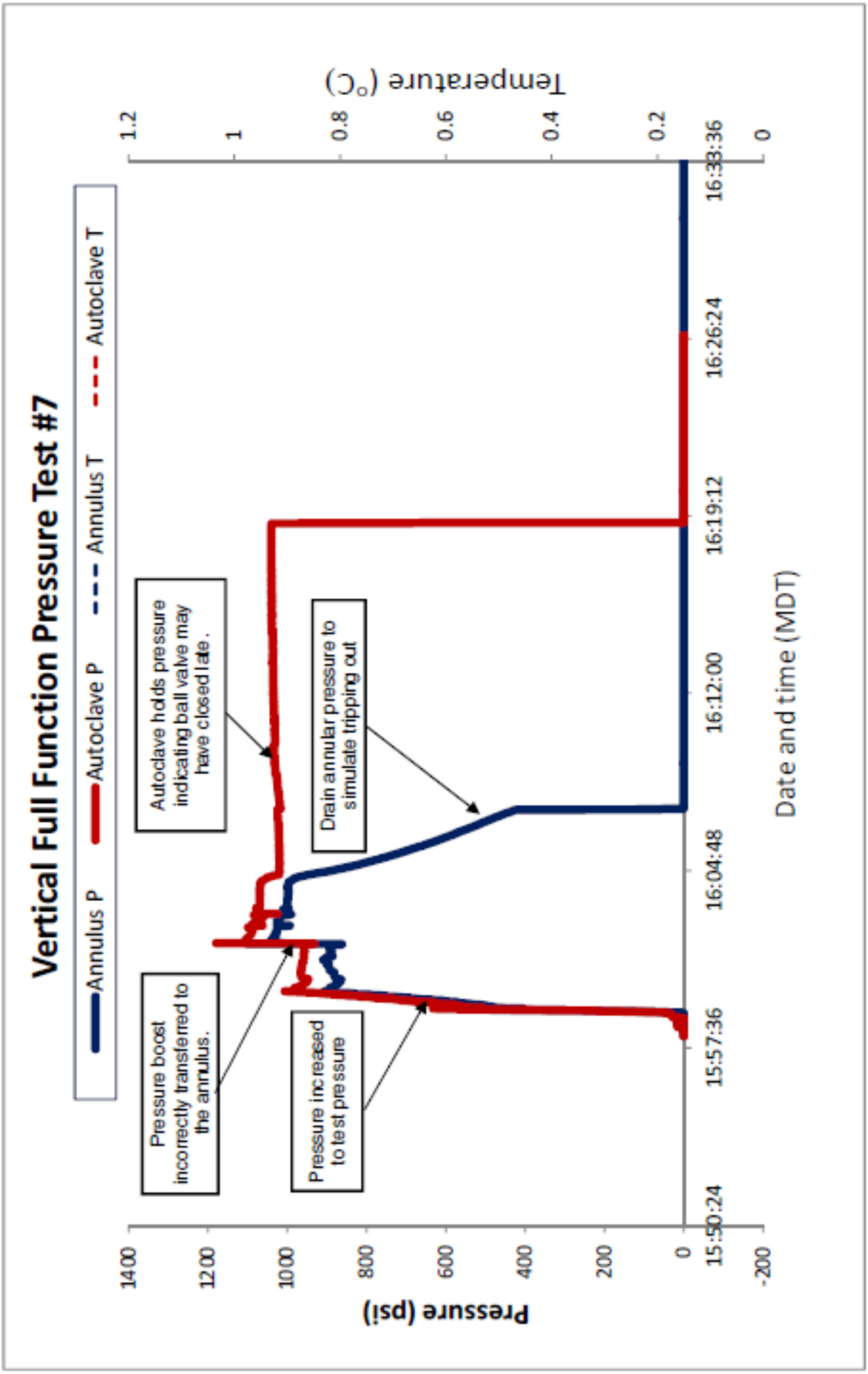


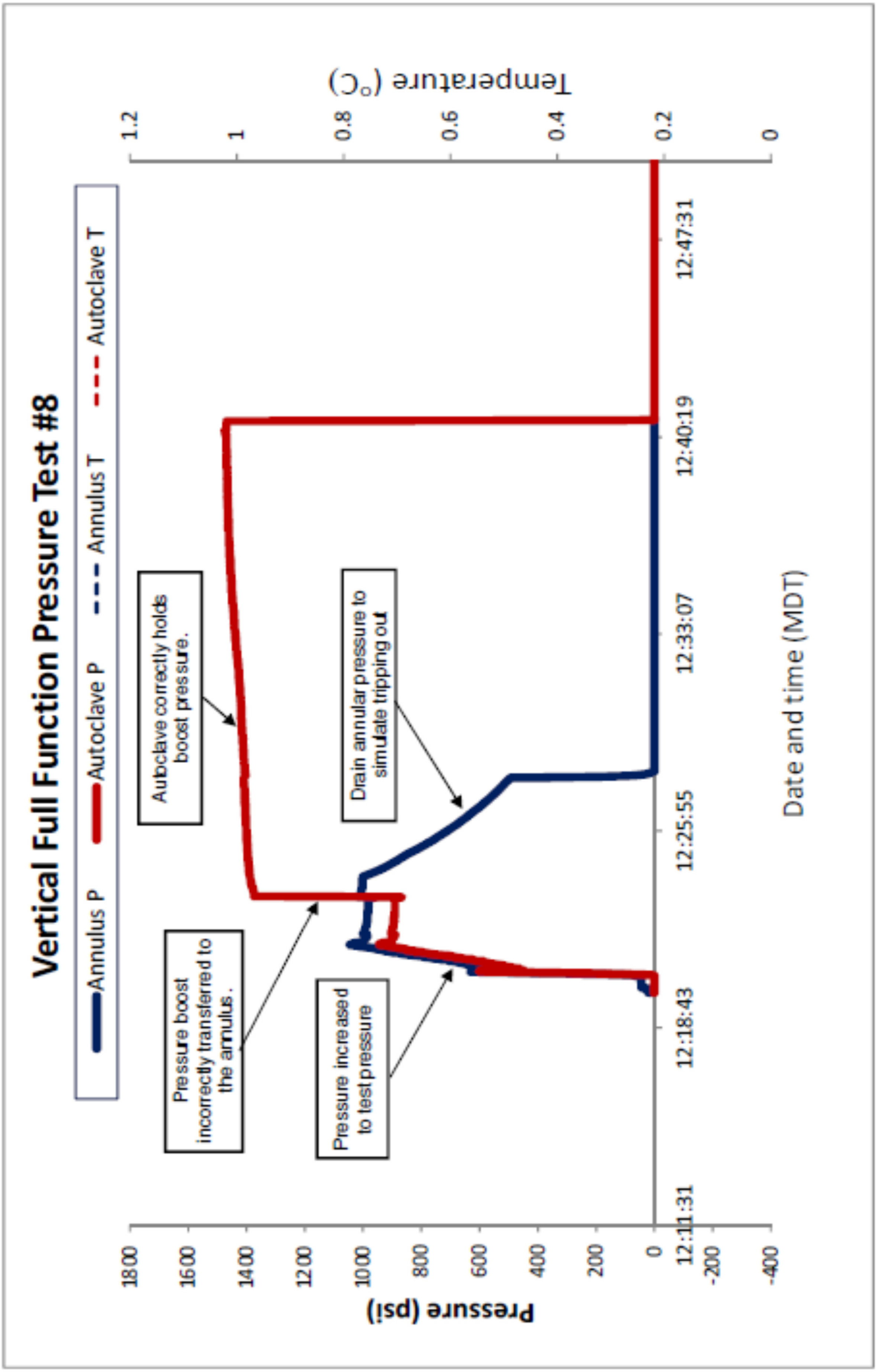

Vertical Full Function Pressure Test #2
Annulus P
Autoclave P
Annulus T
Autoclave T
Pressure increased to test pressure
Sleeve valve opens to boost pressure
Autoclave correctly holds boosted pressure.
Drain annular pressure to simulate tripping out
Pressure (psi)
1800
1600
1400
1200
1000
800
600
400
200
0
Temperature (°C)
35
30
25
20
15
10
5
0
7/18/2016 17:00
7/18/2016 17:14
7/18/2016 17:29
7/18/2016 17:44
7/18/2016 17:59
Date and time (MDT)

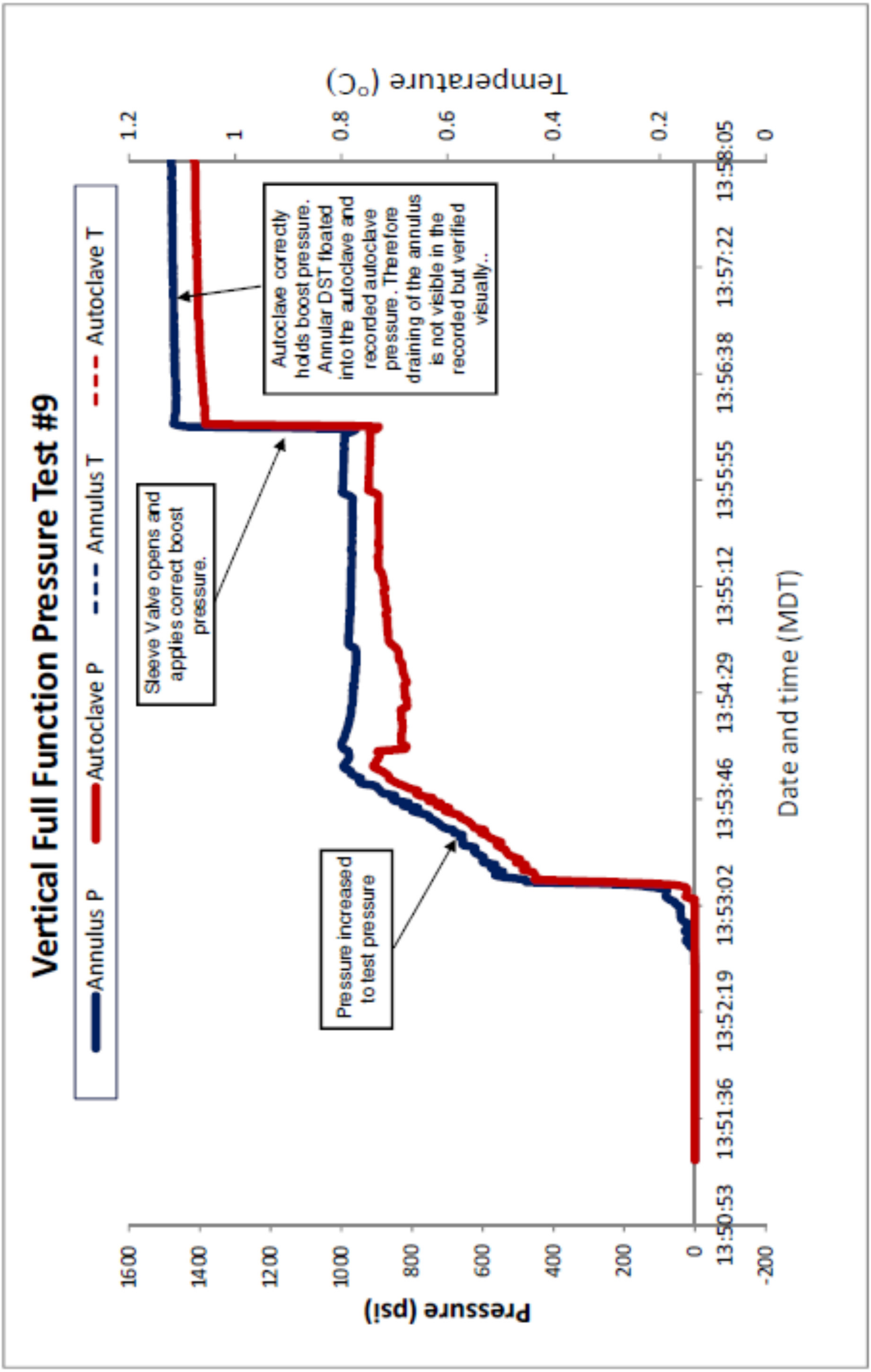

Vertical Full Function Pressure Test #3
Annulus P
Autoclave P
Annulus T
Autoclave T
Pressure (psi)
Temperature (°C)
Date and time (MDT)
7/19/2016 11:15
7/19/2016 11:29
7/19/2016 11:44
7/19/2016 11:59
Pressure increased to test pressure
Sleeve valve opens to boost pressure
Drain annular pressure to simulate tripping out
Autoclave correctly holds boosted pressure. Note: Pressure increases due to temperature.
0
200
400
600
800
1000
1200
1400
1600
1800
-30
-20
-10
0
10
20
30
40


Vertical Full Function Pressure Test #4
Annulus P
Autoclave P
Annulus T
Autoclave T
Pressure (psi)
1600
1400
1200
1000
800
600
400
200
0
Temperature (°C)
35
30
25
20
15
10
5
0
7/19/16 14:00:00
7/19/16 14:14:58
7/19/16 14:29:57
7/19/16 14:44:55
Date and time (MDT)
Sleeve valve opens to boost pressure
Pressure increased to test pressure
Drain annular pressure to simulate tripping out
Autoclave correctly holds boosted pressure. Note: Pressure increases due to temperature.


Vertical Full Function Pressure Test #5
Annulus P
Autoclave P
Annulus T
Autoclave T
Pressure increased to test pressure
Sleeve valve opens to boost pressure
Autoclave correctly holds boosted pressure.
Drain annular pressure to simulate tripping out
Pressure (psi)
Temperature (°C)
Date and time (MDT)
7/19/2016 16:04
7/19/2016 16:19
7/19/2016 16:34
1800
1600
1400
1200
1000
800
600
400
200
0
35
30
25
20
15
10
5
0


Vertical Full Function Pressure Test #7
Annulus P
Autoclave P
Annulus T
Autoclave T
Autoclave holds pressure indicating ball valve may have closed late.
Drain annular pressure to simulate tripping out
Pressure boost incorrectly transferred to the annulus.
Pressure increased to test pressure
Pressure (psi)
Temperature (°C)
Date and time (MDT)
1400
1200
1000
800
600
400
200
0
-200
1.2
1
0.8
0.6
0.4
0.2
0
15:50:24
15:57:36
16:04:48
16:12:00
16:19:12
16:26:24
16:33:36


Vertical Full Function Pressure Test #8
Annulus P
Autoclave P
Annulus T
Autoclave T
Autoclave correctly holds boost pressure.
Drain annular pressure to simulate tripping out
Pressure boost incorrectly transferred to the annulus.
Pressure increased to test pressure
Pressure (psi)
1800
1600
1400
1200
1000
800
600
400
200
0
-200
-400
Temperature (°C)
1.2
1
0.8
0.6
0.4
0.2
0
12:11:31
12:18:43
12:25:55
12:33:07
12:40:19
12:47:31
Date and time (MDT)


Vertical Full Function Pressure Test #9
Annulus P
Autoclave P
Annulus T
Autoclave T
Pressure increased to test pressure
Sleeve Valve opens and applies correct boost pressure.
Autoclave correctly holds boost pressure. Annular DST floated into the autoclave and recorded autoclave pressure. Therefore draining of the annulus is not visible in the recorded but verified visually..
Pressure (psi)
Temperature (°C)
Date and time (MDT)
1600
1400
1200
1000
800
600
400
200
0
-200
1.2
1
0.8
0.6
0.4
0.2
0
13:50:53
13:51:36
13:52:19
13:53:02
13:53:46
13:54:29
13:55:12
13:55:55
13:56:38
13:57:22
13:58:05

APPENDIX E

UT-GOM2-1
HYDRATE PRESSURE CORING EXPEDITION

CHAPTER 1. EXPEDITION SUMMARY

UT-GOM2-1 Hydrate Pressure Coring Expedition

Chapter 1. Expedition Summary[1]

[1]Flemings, P.B., Phillips, S.C, Collett, T., Cook, A., Boswell, R., and the UT-GOM2-1 Expedition Scientists, 2018. UT-GOM2-1 Hydrate Pressure Coring Expedition Summary. In Flemings, P.B., Phillips, S.C, Collett, T., Cook, A., Boswell, R., and the UT-GOM2-1 Expedition Scientists, UT-GOM2-1 Hydrate Pressure Coring Expedition Report: Austin, TX (University of Texas Institute for Geophysics, TX). https://ig.utexas.edu/energy/genesis-of-methane-hydrate-in-coarse-grained-systems/expedition-ut-gom2-1/reports/

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Chapter 1. Expedition Summary

Abstract

From 2-May-2017 to 22-May-2017, the UT-GOM2-1 Hydrate Pressure Coring Expedition drilled two wells in Green Canyon Block 955 (GC 955) in the deepwater Gulf of Mexico: Hole GC 955 H002 (H002) and Hole GC 955 H005 (H005). 21 10 ft (3.05 m) pressure cores were attempted in and near the methane hydrate reservoir. In the first hole, H002, 1 of the 8 cores were recovered under pressure and there was 34% recovery of sediment (both pressurized and depressurized). In the second hole, H005, 12 of the 13 cores were recovered under pressure and there was 72% recovery of sediment. The pressure cores were imaged and logged under pressure. Samples were quantitatively degassed either on-board or on-shore to determine the hydrate concentration and the gas composition. Pore water analyses were performed on depressurized samples, and sediment samples were collected to enable characterization of the microbial community. 21 3.3 ft (1 m) vessels containing pressure core sections were returned to the University of Texas for storage, distribution, and further analysis. These cores will provide a foundation for scientific exploration by the greater hydrate research community.

1.1 Background and Objectives

1.1.1 Expedition Background

The UT-GOM2-1 Hydrate Pressure Coring Expedition is part of the Deepwater Methane Hydrate Characterization & Scientific Assessment project DE-FE0023919, funded by the Department of Energy and advised by the United States Geological Survey (USGS) and the Bureau of Ocean Energy Management (BOEM). It was designed to evaluate the ability of the DOE pressure coring tool with ball valve (PCTB) to effectively and consistently capture, collect, and recover hydrate-bearing coarse-grained sediment pressure core, under hydrate-stable conditions, to the drilling vessel deck. This test was also designed to demonstrate the ability to perform preliminary characterization of pressure cores and transfer the cores to pressurized storage devices in a manner that will enable the cores to be stored and analyzed onshore after the conclusion of the deep stratigraphic tests. The successful transportation of pressure core samples would demonstrate the capability of the UT Pressure Core Center (PCC) to receive, store, and analyze pressure core and provide opportunity for scientific exploration by UT and the greater hydrate community through access to the PCC and/or through recovered cores. The expedition was also designed to complement prior logging while drilling (LWD) data acquisition with sediment, gas and water samples that could enable further evaluation of the nature and genesis of the GC 955 hydrate accumulation.

1.1.2 Expedition Objectives

The primary objective of UT-GOM2-1 was to demonstrate the engineering capability of the PCTB to effectively and consistently capture, collect, and recover hydrate-bearing sand sediment pressure core. These tests were in preparation for more extensive expeditions in the Gulf of Mexico. The PCTB has a cutting shoe (PCTB-CS) and a face bit (PCTB-FB) configuration. In 2015, both the PCTB-CS and the PCTB-FB were tested on land in lithologies not typical of hydrate-bearing systems. However, while versions of the PCTB-CS have been used for hydrate pressure coring, the PCTB-FB has not. The PCTB arose from tools described as the Hybrid Pressure Coring System. It was initially deployed with the cutting-shoe configuration in the Nankai Trough (Yamamoto et al., 2012) and versions of this tool were subsequently deployed in the South China Sea (Yang et al., 2017; Yang et al., 2015), the Japan Sea (Matsumoto et al., 2017), and offshore India (Kumar et al., 2016).

UT-GOM2-1 was primarily an engineering test. However, the underlying goal of this effort was to increase our understanding of the production potential of hydrate-bearing sands. Logging while drilling has documented the occurrence and estimated the concentration of hydrate-bearing sands in the Gulf of Mexico. To better understand the production potential of these reservoirs, samples need to be recovered and petrophysical analyses performed. We wish to illuminate questions that range from what is the compressibility and permeability of both the reservoir and its bounding units to what is the concentration and chemistry of the hydrate and the pore water (Boswell and Collett, 2016). Drilling studies have only recently begun to focus on hydrate bearing reservoirs in sands to address these issues. Examples include efforts in offshore japan (Suzuki et al., 2015) and offshore India (Kumar et al., 2016).

To achieve these scientific objectives, UT-GOM2-1 planned to demonstrate the ability to (1) acquire, log and image pressure cores, (2) subsample pressure cores and store subsamples in pressure vessels, (3) obtain geochemical and petrophysical data from pressure cores; and (4) transport these cores to shore-based laboratories. The specific steps to achieve these goals included the following.

1. Physically locate the 2009 JIP well drilled in approximately 6670 ft (2033 m) of water in the offshore Gulf of Mexico in Green Canyon Block 955
2. Drill/core two vertical wells within 200 ft of the previously drilled Hole GC 955 H001 (H001).
3. Take ten, 10 ft (~3.0 m) long, pressure cores in each hole (20 total cores) using the PCTB-CS in the first hole and the PCTB-FB in the second hole.
4. Wireline log the PCTB-CS hole.
5. Use the Pressure Core Analysis and Transfer System (PCATS) from Geotek Limited to characterize cores and transfer the samples to pressurized storage devices while on the drilling vessel or on land.
6. Use PCATS to:
    - Collect 2D, 100 um resolution, X-ray imaging under pressure
    - Collect P-wave Velocity and bulk density logging under pressure
    - Perform controlled degassing experiments
    - Subsample cores and store them in pressure chambers to shore-based laboratories
    - Pull, cut and transport PCs from the PCTB autoclaves into temporary storage chambers, degassing chambers, or storage chambers for shipping
    - Collect released gas and liquid during quantitative degassing (2 manifolds)
7. Transport and store up to twenty 3.3 to 3.9 ft (1.0 to 1.2 m) in length and 2.0 inches (5.08 cm) in diameter subsamples of pressure cores by road transport to the UT Pressure Core Center (PCC) for storage, further analysis, and distribution.
8. Transfer depressurized pressure cores and other samples to external R&D partners for transport institutions for further analysis.

1.2 UT-GOM2-1 Expedition: Pre-Drill Operational Planning

1.2.1 Project Development and Structure

In spring 2014, the U. S. Department of Energy Office of Fossil Energy National Energy Technology Laboratory released Funding Opportunity Number DE-FOA-0001023, which included a targeted Technical Topic Area requesting applications to investigate the occurrence and nature of methane hydrates on the U.S. Outer Continental Shelf to better characterize naturally-occurring gas hydrate deposits via multi-site deepwater marine drilling, logging, and/or sampling program. The University of Texas, in combination with partners from Ohio State University, Columbia University, and the Consortium for Ocean Leadership responded to this Funding Opportunity Announcement. The UT application was selected for funding and a Cooperative Agreement project was initiated in October of 2014. The project is titled "DE-FE0023919: Deepwater Methane Hydrate Characterization and Scientific Assessment." A three-phase (6 year) program was designed. In Phase 1, technology would be developed and tested, and the offshore engineering test planned. In Phase 2, the engineering test and its associated science would be executed and the 2nd research expedition planned. The second expedition would be executed in Phase 3.

This report describes the planning, execution, and results of the offshore Marine Test entitled "Expedition UT-GOM2-1." UT-GOM2-1 targeted sand-rich deposits containing high concentrations of methane hydrate (as interpreted from existing logging-while-drilling data) in Green Canyon Block 955 in Hole GC 955 H001 (H001) of the Chevron Joint Industry Project in 2009. The report is modeled after ocean drilling program expedition reports and includes 4 chapters: 1) Expedition Summary, 2) Methods, 3) Site H002 results and 4) Site H005 results.

1.2.2 GC 955 Site Characterization and Selection

Geologic Conditions

Green Canyon 955 (GC 955) is located 232 kilometers south of Port Fourchon, Louisiana, USA, at the base of the Sigsbee Escarpment in the northern Gulf of Mexico abyssal plain, in approximately 2 km water depth (Figure 1.2.1 A). Nearby, Green Knoll shows the expression of salt rising toward the seafloor. GC 955 is at the mouth of Green Canyon, where sediment transported across the continental shelf and slope enters the abyssal plain (Figure 1.2.1 B). Due to the rapid change in slope at the base of the Sigsbee escarpment, extensive turbidite and mass transport deposits are common in and near GC 955. Mass wasting is common, and the seafloor morphology indicates recent sediment transport.

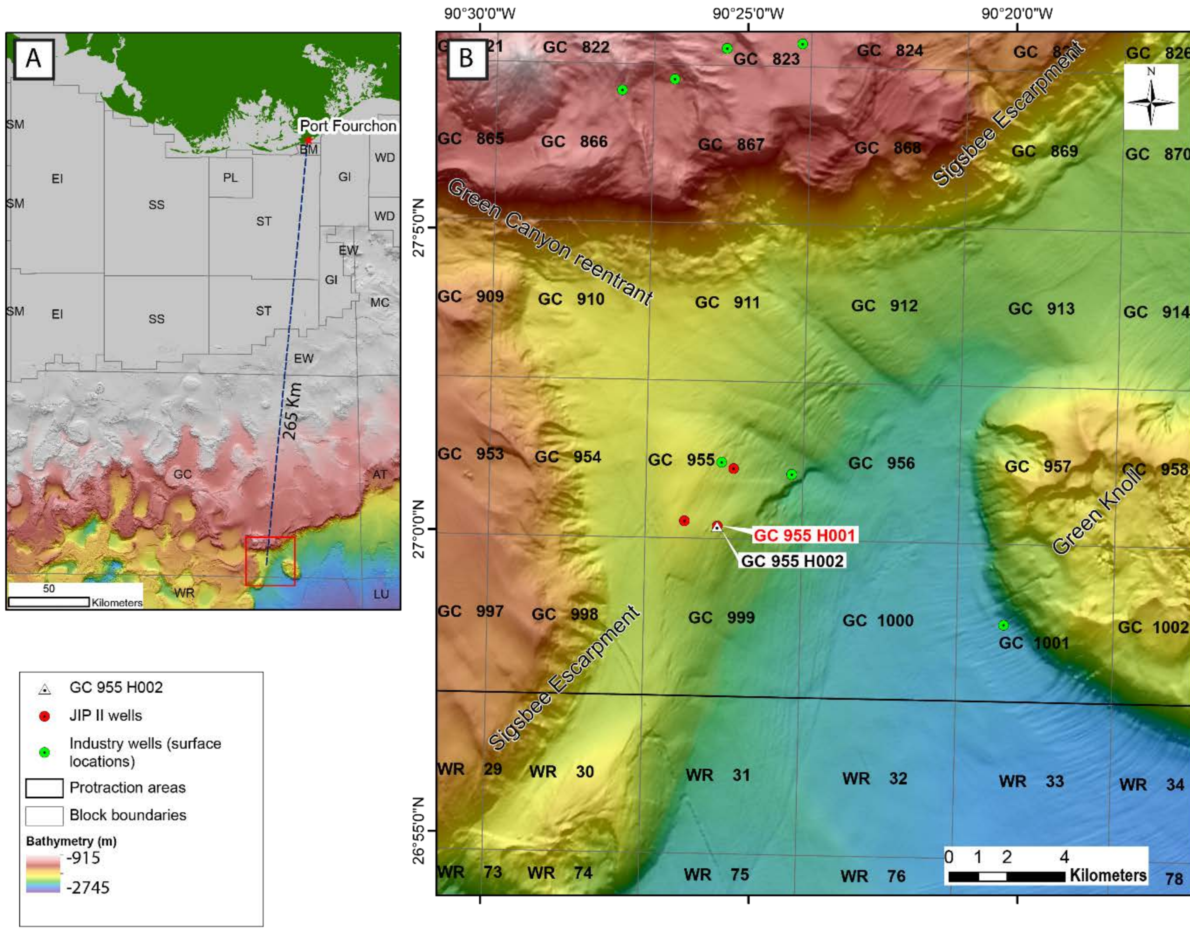

Figure 1.2.1 GC 955 Location. (A) GC 955 is located 232 km south-south-west of Port Fourchon, LA., at the foot of the Sigsbee Escarpment. (B) The UT-GOM2-1 Expedition drilled 2 holes at Green Canyon 955 within 30 meters of the previously drilled Hole GC 955 H001. GC Block 955 is at the toe of the Sigsbee Escarpment adjacent to the Green Canyon reentrant. Bathymetry data from the BOEM Northern Gulf Of Mexico Deepwater Bathymetry Grid (https://www.boem.gov/Gulf-of-Mexico-Deepwater-Bathymetry/).

The Green Canyon 955 region has been study area for methane hydrates since it was first described by McConnell (2000) and Heggland (2004). These studies described geophysical indications for gas sourcing, gas migration pathways into the shallow sediments afforded by extensive faulting, and the presence of thick sand reservoirs associated with a large and persistent Pleistocene channel-levee complex (McConnell et al., 2010). McConnell et al. (2010) review the GC-955 location and summarize the geophysical and geological evidence for methane hydrate at this location. They describe the erratic occurrence of strong positive and negative polarity reflections within the structural crest.

Based on these positive indicators for the presence of methane hydrates, the Chevron Joint Industry Project II (JIP II), drilled H001, I001, and Q001 at GC 955 (Figure 1.2.2) using LWD technology. The presence of hydrate was confirmed at each location. A range of publications describe the operations

(Collett et al., 2009), the geological context (Boswell et al., 2012a; Boswell et al., 2012b; McConnell et al., 2010) and the specific logging results (Collett et al., 2012; Cook et al., 2012).

The methane hydrates inferred to be present at Block GC 955 overlie a salt-cored anticline that is seaward of the Sigsbee Escarpment. The anticline is cut by numerous faults that generally do not reach the seafloor (Figure 1.2.3). Some faults extend to the underlying salt. Bright amplitudes are present at the crest of the anticline. Muted imaging beneath these amplitudes may record the presence of gas.

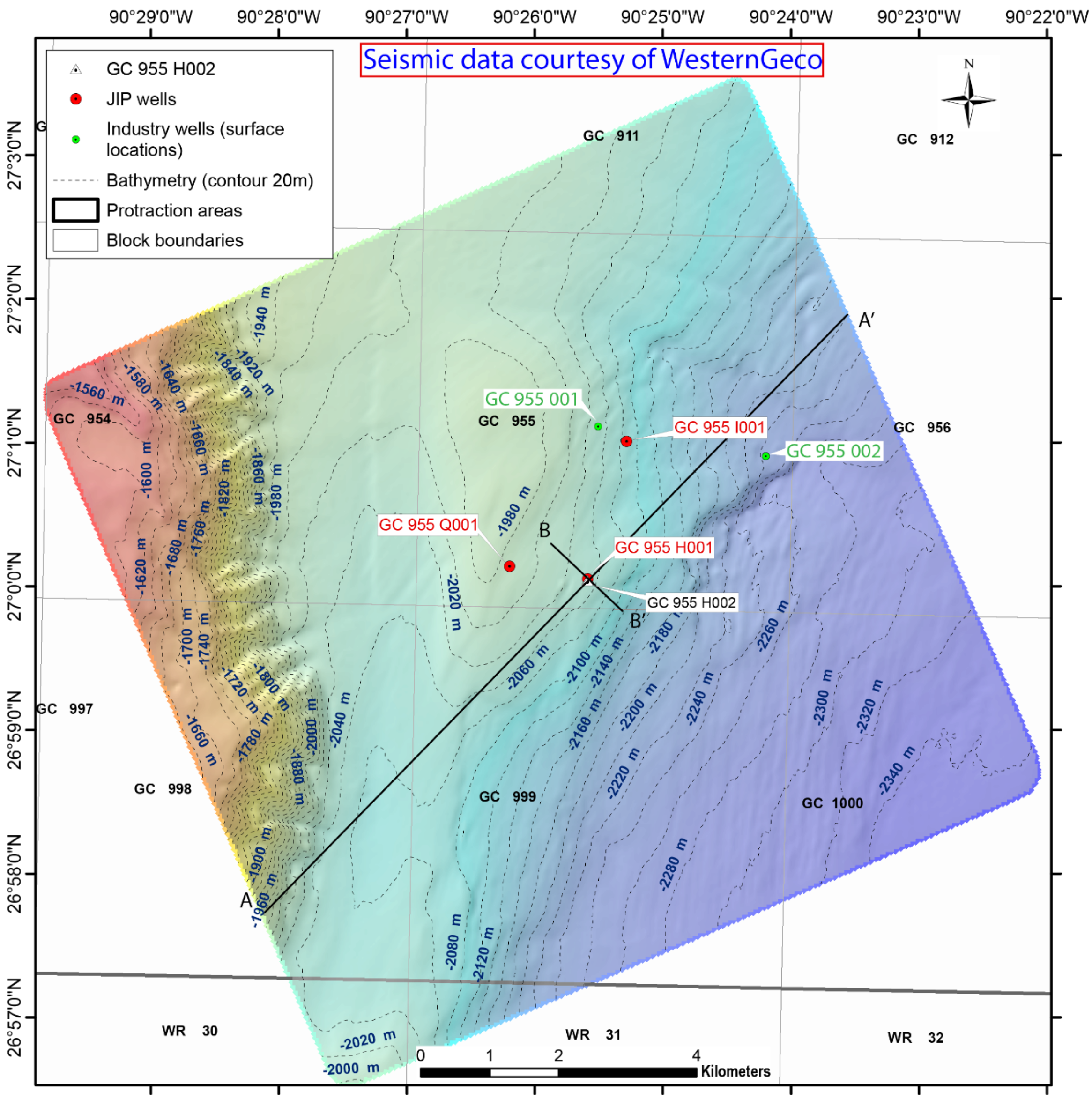

Figure 1.2.2 Bathymetry data from the BOEM Northern Gulf Of Mexico Deepwater Bathymetry Grid over Green Canyon Block 955. The Gas Hydrates JIP Leg II LWD program drilled H001, I001, and Q001 in 2009. Two industry wells (green dots) are located by their API #: the 60811402710000 well was drilled in 1999, and the 60811404770000 well (and its sidetrack) was drilled in 2006-2007. During Expedition UT-GOM2, H002 and H005 were drilled adjacent to H001. Seismic data courtesy of WesternGeco.

We mapped seven seismic horizons (Horizon 100 through Horizon 600 and the seafloor) across this structure (Figure 1.2.3, Figure 1.2.4). Horizon 100 and Horizon 300 bound a stacked channel-levee complex oriented NNW to SSE that is just to the east of the anticline (Figure 1.2.3). H001, lies on the western levee of this channel system (Figure 1.2.3). At the reservoir level, there is a strong peak-over-trough amplitude (black over red) present (Figure 1.2.4). In H001, the peak correlates to the top of a high resistivity and high velocity section at 414 mbsf that is inferred to record a sand-rich reservoir with methane hydrate in the pore space (Figure 1.2.5, Figure 1.2.6).

At H001, the section is mud-prone to a depth of 1270 feet below seafloor (fbsf) or 387 meters below seafloor (mbsf) (Figure 1.2.5). A 330 ft (101 m) thick sand or silt-rich interval lies between 1270 and 1600 fbsf (387 to 488 mbsf) based on the interpretation of the gamma ray, caliper, and resistivity data (Figure 1.2.5, Figure 1.2.6). The upper 50 ft (15 m) of this interval may become more mud prone upward because the gamma ray values increase upward as the borehole washout decreases. Within this 330 ft (101 m) sand-rich interval, there are three zones of high resistivity and high velocity where hydrate is interpreted to be present (green in Lithologic Units, Figure 1.2.6). The uppermost zone is 86 ft (26 m) thick and 63 ft of gas hydrate-bearing units thinly interbedded with mud-rich units. Where hydrate is not present in this sand-rich interval, significant borehole washout is present as is indicated from the enlarged borehole (caliper) and low density values. Based on the review of the 2012 LWD data (Boswell et al., 2012a; Boswell et al., 2012b; Collett et al., 2012), the entire 330 ft (101 m) sand-rich interval is composed of interbedded sand/silt and mud; the gas hydrate most likely occurs as pore-fill within thin-bedded sands within this sequence (Figure 1.2.6).

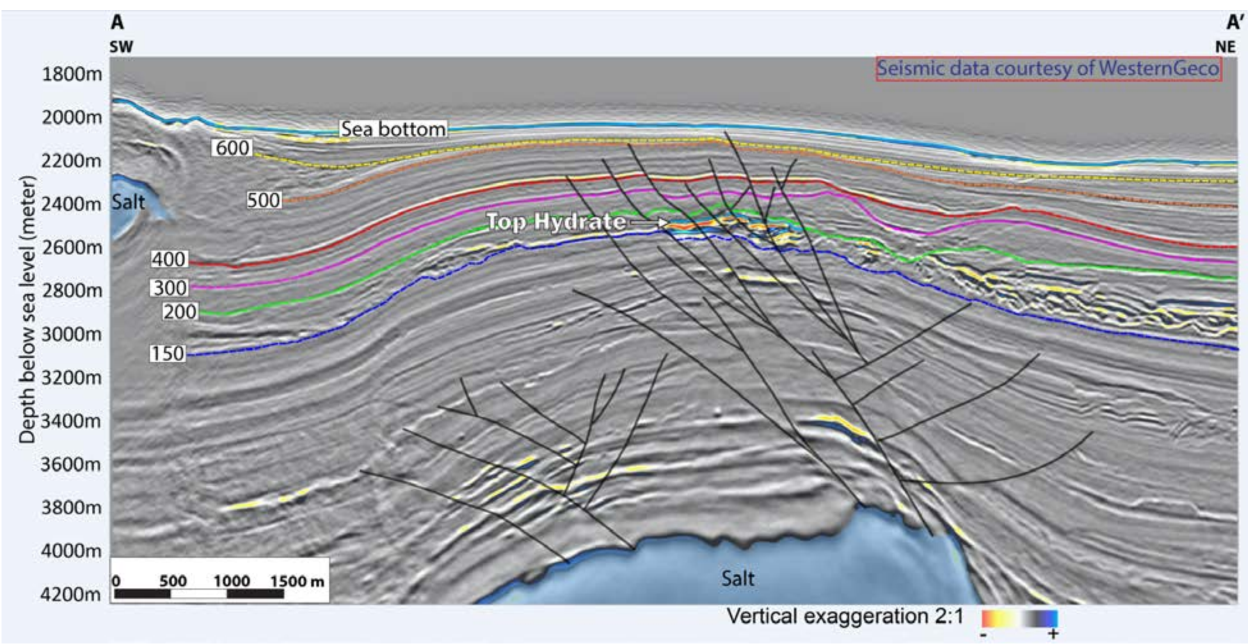

Figure 1.2.3 Interpreted seismic cross sections of the GC 955 area. Image courtesy of WesternGeco. The A-A' cross section is shown in Figure 1.2.2.

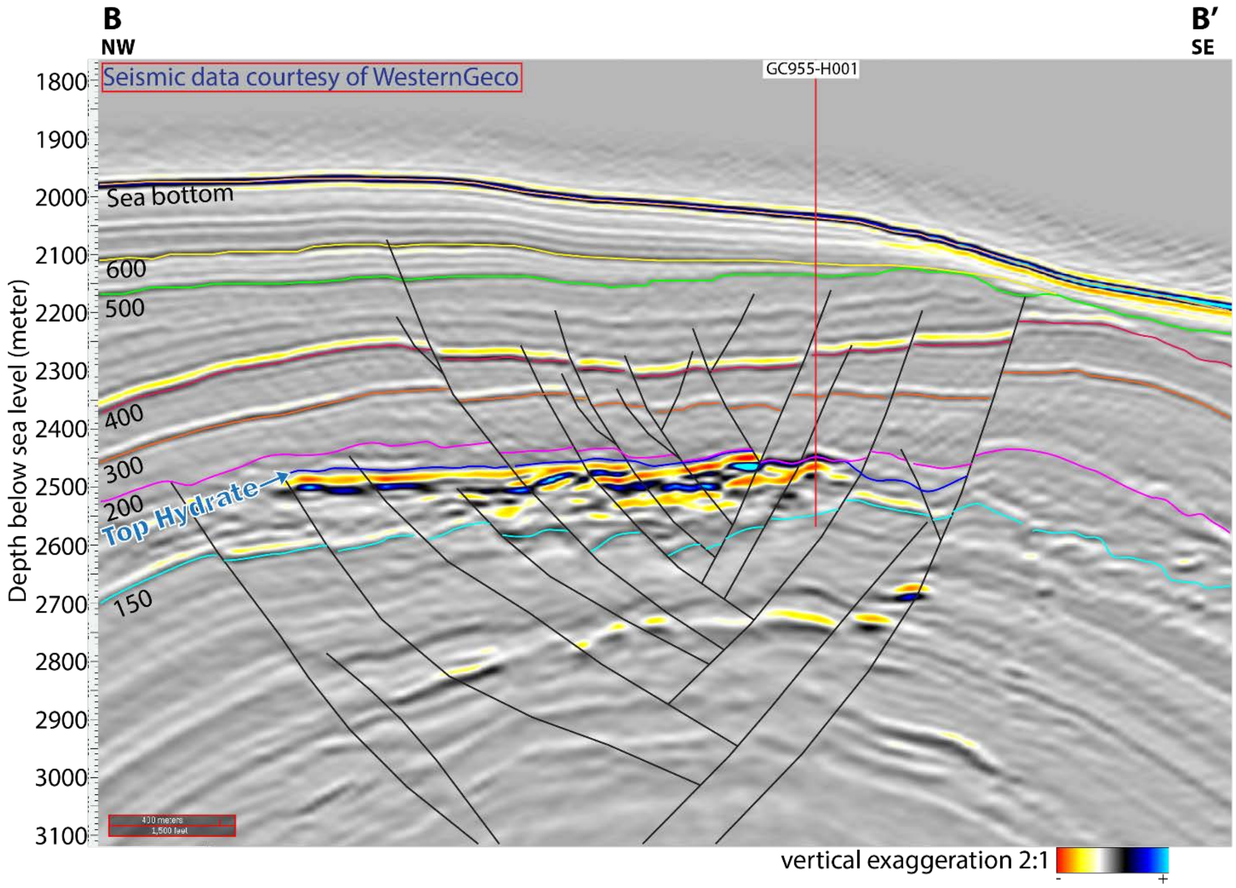

Figure 1.2.4 Expanded view of Hole GC 955 H001 location. Image courtesy of WesternGeco. The B-B' cross section is shown in Figure. 1.2.2.

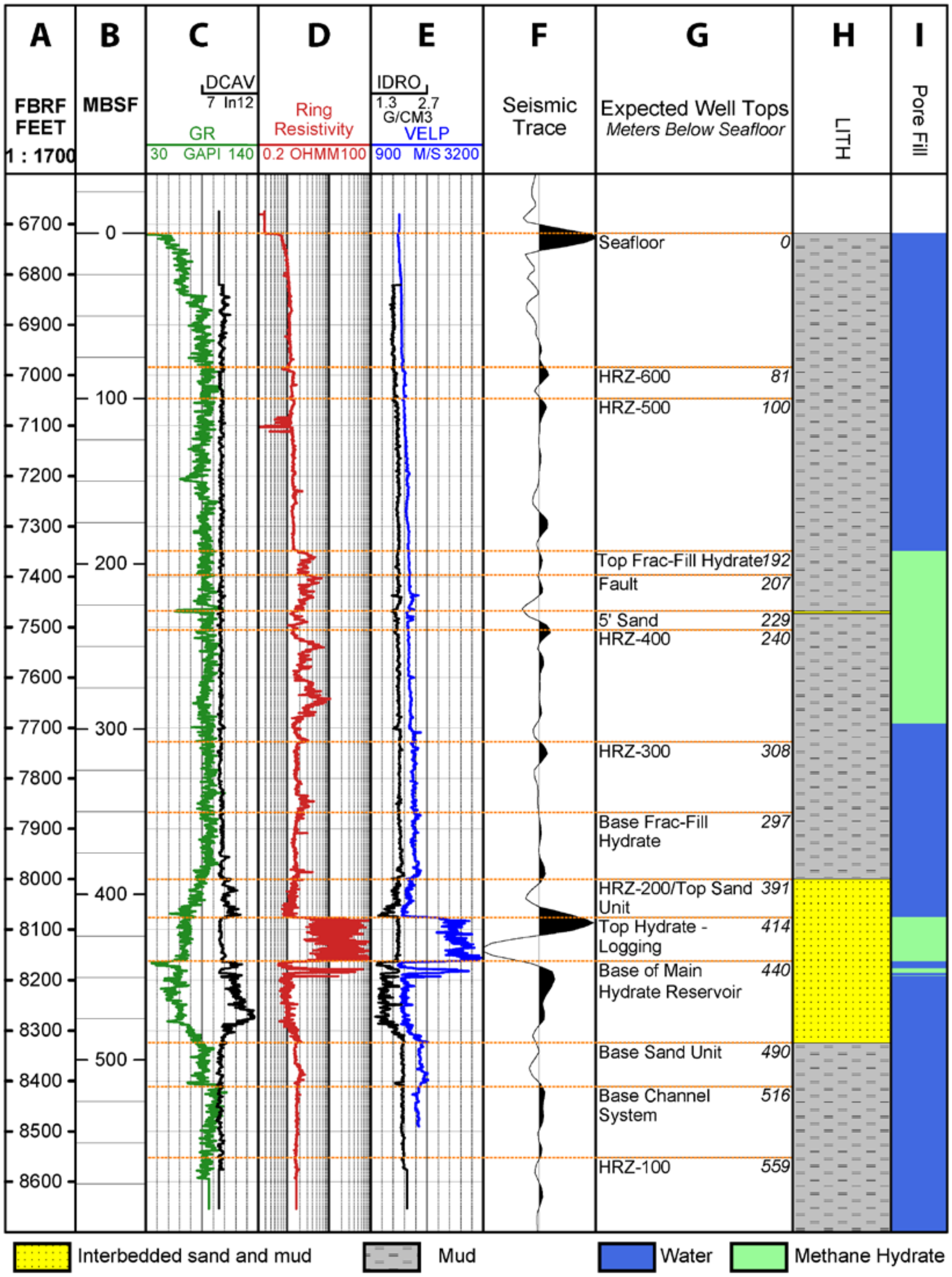

Figure 1.2.5 Columns C, D, and E illustrate logging while drilling (LWD) data for Hole GC 955 H001. GR-Gamma Ray, DCAV-calipers, IDRHO-bulk density, VELP-compressional velocity. F) Seismic trace at the GC 955 location (courtesy of WesternGeco). G) Interpreted stratigraphic surfaces. H) Interpreted Lithology. I) Pore Fill documents whether the rock is 100% water saturated (blue) or contains hydrate (green). H001 results have been discussed in detail (Boswell et al., 2012a; Collett et al., 2010; Collett et al., 2012).

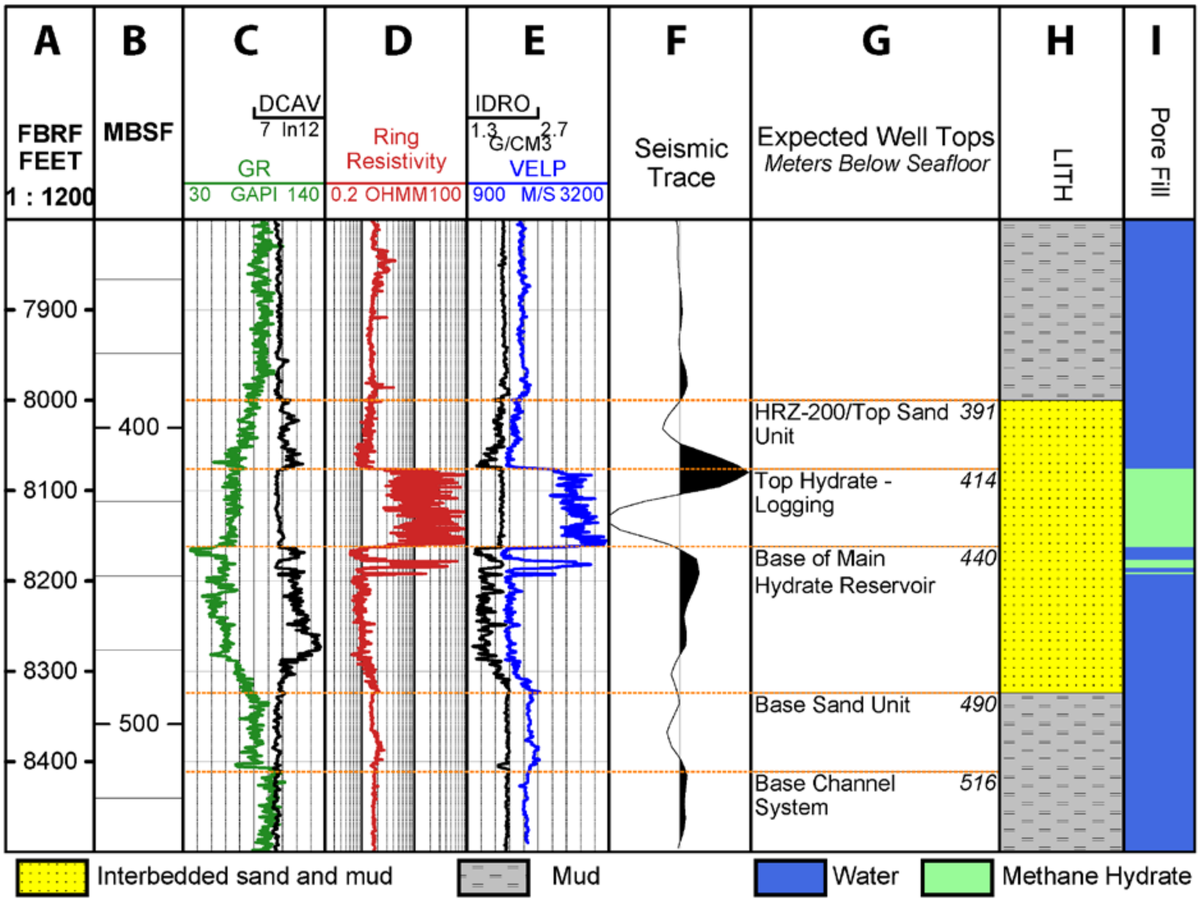

Figure 1.2.6 Expanded view of the hydrate-bearing section in Hole GC 955 H001. Columns C, D, and E illustrate LWD data for H001. GR-Gamma Ray, DCAV-calipers, IDRHO-bulk density, VELP-compressional velocity. F) Seismic trace at the GC 955 location (courtesy of WesternGeco). G) Interpreted stratigraphic surfaces. H) Interpreted Lithology. I) Pore Fill documents whether the rock is 100% water saturated (blue) or contains hydrate (green). H001 results have been discussed in detail previously (Boswell et al., 2012a; Collett et al., 2010; Collett et al., 2012).

Event	Depth below Rig Floor	Depth below Sea Level	Depth Below Seafloor	Seismic Reference Depth
unit	fbrf	fbsl	fbsf	ft
Sea floor	6,718	6,667	-	6,672
Top Fracture Filling Hydrates	7,349	7,298	631	7,303
Fault	7,396	7,345	678	7,350
5' thick sand	7,468	7,417	750	7,422
Base Fracture Filling Hydrates	7,692	7,641	974	7,646
Top Sand - rich section	8,000	7,949	1,282	7,954
Top Hydrate - Log based	8,076	8,025	1,358	8,030
Top Hydrate- Seismic Peak	8,081	8,030	1,363	8,035
Base of Main Hydrate Reservoir - Log Response	8,162	8,111	1,444	8,116
Base of Sand Unit	8,324	8,273	1,606	8,278
Base of Channel System	8,411	8,360	1,693	8,365

Table 1.2.1 Mapped horizons at H001. H001 distance from the rig floor to the sea level was 51 ft.

Geothermal Gradient and Thermodynamic Conditions

No direct temperature measurements exist at GC 955 to determine the temperature gradient. Therefore, a theoretical approach was applied, based on the thermodynamic properties of gas hydrate. The water depth is 6667 fbsl (2032.1 mbsl) at H001 (Table 1.2.1). The base of the methane hydrate stability zone was interpreted from 2- and 3-D seismic data to lie at 8202 fbsl (467.9 mbsf). The deepest occurrence of hydrate within the main reservoir was interpreted from H001 LWD data to lie at approximately 8162 fbrf (440 mbsf).

We estimate the three-phase equilibrium curve for pure methane hydrates employing the model developed by Flemings and Liu (2007). The three-phase equilibrium condition is obtained from the intersection of two pressure-temperature-salinity dependent methane solubility curves: 1) methane solubility in water when methane hydrate and water phases are in equilibrium, described by the model of (Henry et al., 1999); and 2) methane solubility in water when methane gas and water phases are in equilibrium, described by the model of (Duan et al., 1992). Seawater salinity (3.5 wt%) and hydrostatic pressure were assumed. At the depth of BSR (1535 fbsf, 467.9 mbsf), the water pressure is 3661 psi (25.24 MPA). A bottom water temperature 4.2 °C (NODC, 2013) was assumed. The temperature should be 20.4 ^{o}C to achieve three-phase conditions at the observed BSR.

With these conditions, the geothermal gradient equals 34.7 °C/km (Figure 1.2.7). The base of the sand rich hydrate bearing section lies at the inferred base of the hydrate stability zone (green line, Figure 1.2.7). In a pressure versus temperature plot, the base of the sand-rich hydrate bearing zone lies exactly at the stability boundary for seawater salinity (green line, Figure 1.2.8).

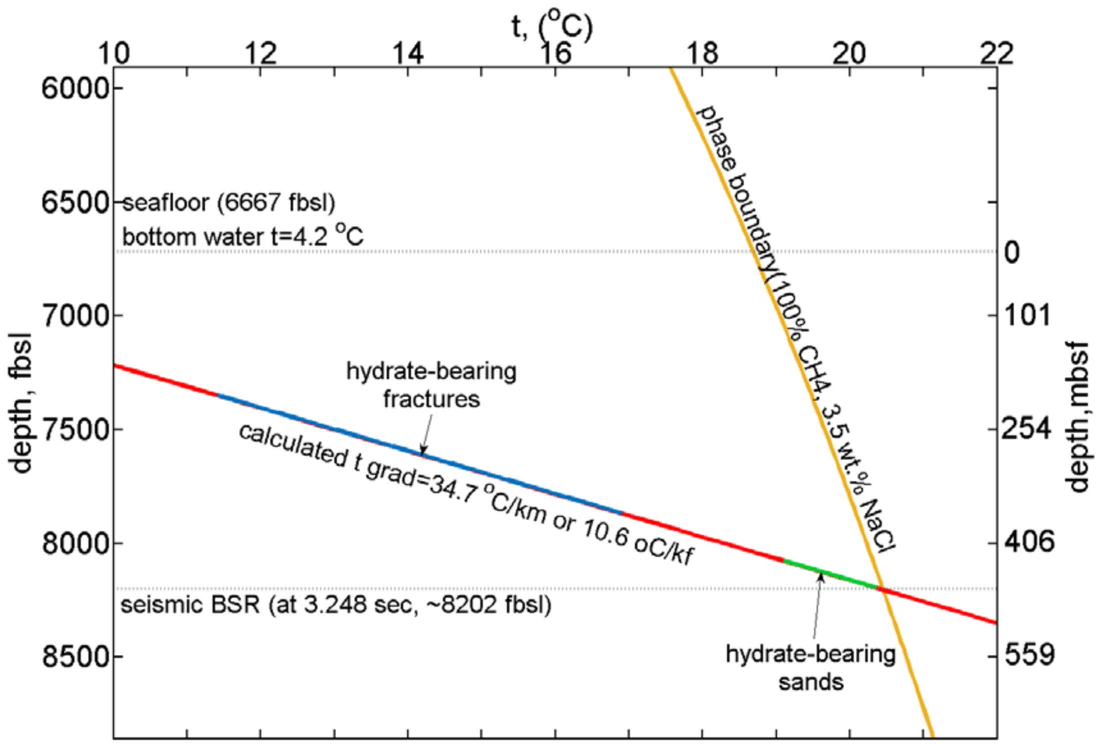

Figure 1.2.7 Temperature-depth diagram, showing gas hydrate phase boundary within the study area. Seismic BSR was used as a reference for GHSZ lower boundary in temperature gradient calculation experiment.

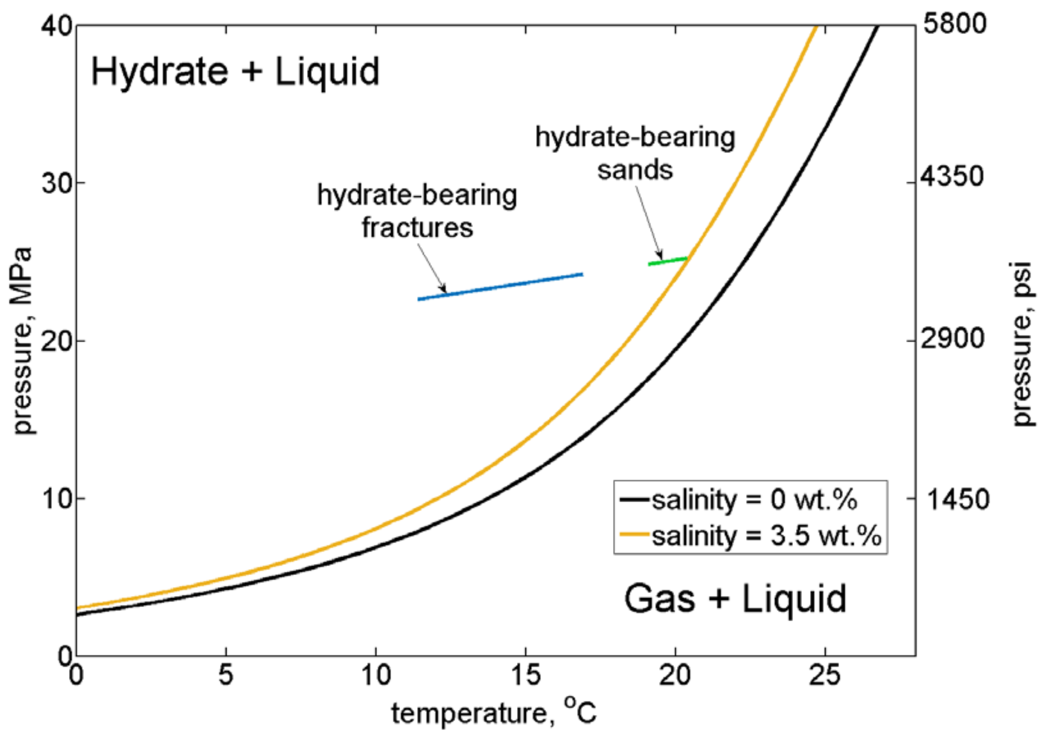

Figure 1.2.8 Pressure vs. temperature diagram for hydrate-bearing intervals at H001.

Gas Hazards

GC 955 has a high concentration of shallow gassy sediments over the faulted structure, especially in the southwestern quadrant of the block (Boswell et al., 2012b). The upward migration of the gas is interpreted to be hindered by gas hydrate formation at and above the base of the methane hydrate stability zone. Seismic and well data record the presence of only hydrate at H001 (Boswell et al., 2012b), but free gas is likely at GC 955 Q. McConnell et al., (2012) assess the occurrence of free gas associated with gas hydrate in the area.

Based on offset observations at the previously drilled H001 and Q001 wells, the following gas flow risks were interpreted. First, there is a low risk for gas flow due to dissociation of hydrate cuttings while drilling the hydrate bearing-interval (1363-1449 fbsf or 415-442 mbsf). Second, beneath the hydrate-bearing zone, there is a low risk for gas flow in sands and silts due to the observed lack of free gas in H001. Although penetration of a permeable gas-rich zone beneath the hydrate could result in a continuous gas flow if not hydrostatically controlled, free gas is not expected at H002 based on drilling H001. The free-gas risk was mitigated by careful review of seismic data to ensure that the two wells were drilled within the same fault block as H001.

H001 was drilled and completed without any significant problems and without any special measures other than the precautionary use of drilling fluid effective cuttings removal and wellbore stability (Collett et al., 2009). However, high amplitudes and, particularly, the strong positive reflector that is regionally present, may record the base of a gas cap beneath the hydrate in some locations (other fault blocks than were targeted with the GOM-Expedition-1 program). In Q001 (Figure 1.2.2), a gas bubble was observed at 1,516 fbsf during a connection. The hole was displaced with 13 ppg mud and observed for an hour with no flow. While pulling the string out of the hole, a small, continous flow was observed. The flow was possibly due to borehole swabbing while pulling out of the hole or the use of heavy mud may have fractured sedients at the bottom of the hole into a fee-gas zone below the gas-bearing hydrate zone (Hutchinson et al., 2010). The well was ultimately plugged with a 16 ppg cement.

The following lessons were learned from drilling the Q well. It is important to follow good drilling practices to prevent swabbing or fracturing the formation. To minimize the likelihood for swabbing, the mud properties should be maintained throughout the drilling to minimize bit and bottom hole assembly (BHA) balling. Prior to starting out of the hole, a bottoms-up circulation should be completed to provide a clean annulus. Prior to starting out of the hole an extended flow check should be performed. When pulling out of the hole, keep the drill string full of weighted mud to maintain the drill pipe-to-annulus U-tube effect. Pull the drill string at a slow rate and monitor for evidence of overpull or changes in string weight. If swabbing is suspected, run the drill string back to bottom and the circulate at least a hole volume and observe for flow. If flow persists after circulating, pump kill mud in increasingly heavier weights to control the well. To avoid fracturing the formation, increase the kill mud weight in no-more-than 0.5 ppg stages and perform flow checks in between each stage. The maximum kill mud weight should not exceed fracture gradient.

Observations made during the Chevron JIP drilling indicate that when drilling highly concentrated gas hydrate sections, hydrate cuttings and perhaps gas can be released as the formation is cut. The size and intensity of the cut-gas release can be controlled to some extent by reducing the rate of penetration, but gas should be expected in the annular fluid; much as it is when drilling through other gas-ladened formations.

Worst Case Discharge

As part of the permitting process, a worst-case discharge analysis was performed. The H001 well encountered one zone of methane-hydrate bearing sandstone, did not encounter any free gas, and did not flow gas or water. Based on extrapolation of seismic data the short distance to the proposed well bores, a similar stratigraphy was expected at H005 and H002. Thus, we did not predict that we would encounter any free gas for the H005 or H002 wells. Despite the fact that no gas was predicted, we constructed two worst case scenarios. In Scenario 1, we estimated the largest potential volume of gas that could be trapped within the GC-955 anticlinal structure beneath the base of the hydrate stability zone and above a regional gas-water contact that was imaged with seismic data. This gas-water contact was not present at the H001, H005, or H002 locations. In Scenario 2, we estimated the total volume of methane trapped within the hydrate based on the presence of a strong positive reflection above and an assumed reservoir thickness of 100 feet.

The maximum volume of gas that could be released from trapped gas (Scenario 1) is about 20 times greater than that released from hydrate destabilization (Scenario 2). This is because the mapped volume of possible free gas is larger than the mapped volume of possible hydrate. The maximum volume of gas that could flow from the trapped gas (Scenario 1) is estimated to be 2.79×10^6 ft^3. The release would occur over 20 days for a 1 Darcy reservoir and over 50 years for a 1 mD reservoir (the time scale is linearly proportional to the permeability). No logical reason was found for the hydrate to destabilize (Scenario 2) because temperatures and pressures expected in the well would keep the hydrate as a stable (solid) phase throughout the drilling and coring program. None the less, if all of the hydrate dissociated, 1.25×10^5 ft^3 of gas would be released over 2 days for a 1D reservoir and 2000 days for a 1 mD reservoir.

Shallow Water Flow

There are only two sand-prone zones: 1) a 5 ft (1.5 m) sand at 750 fbsf (229 mbsf) (brine) and the 325 ft (99 m) thick sand-rich interval within which hydrate is present (Figure 1.2.6). The risk for shallow water flow was assessed as low in these two intervals and negligible risk was inferred for the remainder of the section. There was no evidence of any shallow water flow in H001 (Collett et al., 2009). A water flow was observed at Hole GC 955 I001 (I001) well after the drill string was pulled out of the hole from a total depth of 9,027 fbrf with 10.5 ppg mud in the hole (Collett et al., 2009). A cement plug was placed in that well.

Human Obstructions

The nearest existing wells are three wells that were drilled at this location during the 2009 Gas Hydrates JIP Leg II LWD program (GC 955 I001, Q001, and H001) and two industry wells (OSC-G 20114 #1 and OCS-G 20114 #2). No other man-made features or other potentially hazardous seafloor conditions are identified in the vicinity of the proposed well site.

Pore Pressure & Fracture Gradient

We generated pore pressure and fracture gradient plots (Figure 1.2.9) and pressure/stress plot (and Figure 1.2.10) for H002 and H005.

H002 and H005 were drilled riserless without casing. The plots are based on the following assumptions. 1) The overburden curve was generated by integrating the density log from the LWD data acquired in H001. In zones where there were washouts and the density values recorded values near the density of water, density values were interpolated from the overlying and underlying zones to more effectively determine the overburden. 2) Pore pressure was assumed to be hydrostatic because there was no evidence of any elevated pore pressures during previous drilling of H001. Hydrostatic pore pressures are expressed with a pore pressure gradient of 8.3 ppg, or seawater gradient of 0.46 psi/ft. 3) The least principle stress (σ_{hmin}) was calculated using the following equation:

$$\sigma_{hmin} = K_0 * (\sigma_v - u_h) + u_h. \qquad \text{Eq. x}$$

u_h is the hydrostatic pressure. Eaton (1969) and Matthews and Kelly (Matthews and Kelly, 1967) suggest K_0 = ~0.4 within the first 1,000 fbsf. However, these estimates were based on either wells on land or in very shallow water. In contrast, it is commonly observed in deepwater wells that in the shallow section (e.g. 1,000 feet below mud line), K_0 values are much higher and can approach 1.0. An upper bound of K_0 = 0.9 and a lower bound of K_0 = 0.7 was assumed.

The program called for increasing the mud weight to 10.5 ppg at the depth of the hydrate-bearing interval (~1350 fbsf). When the mud weight is increased, this will expose the upper part of the borehole to elevated pressures. The program considered an 11.5 ppg mud at the completion of drilling, as illustrated.

Based on seismic interpretation and offset well information from H001, formations penetrated at the proposed location are expected to be normally pressured. There is a possible gas cap beneath the hydrate in the region (although not interpreted to be present at H001), the pressure associated with the gas cap is illustrated with the red solid line (Figure 1.2.9 and Figure 1.2.10).

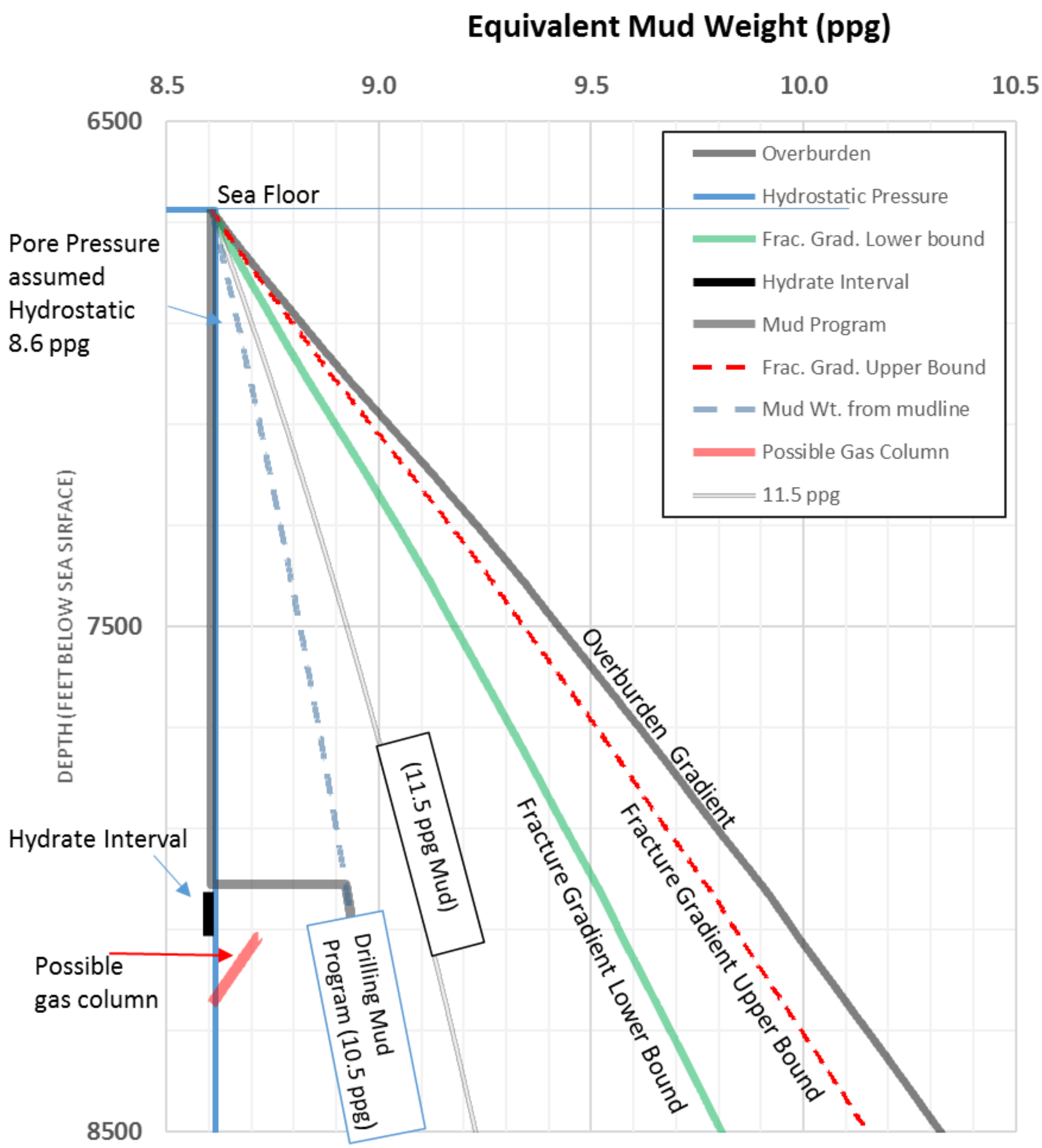

Figure 1.2.9 Pore pressure and fracture gradient plot for H001. See text for discussion. This well will be drilled without a riser. An upper bound and lower bound fracture gradient are shown. The current drilling plan is to increase the mud weight to 10.5 ppg 15 feet above the hydrate-bearing interval as shown by the thick grey line. This will expose the upper part of the borehole to elevated pressures as illustrated with the light blue dotted line. At the completion of the drilling, an 11.5 ppg pad mud will be placed in the well. There is a possible gas column beneath the hydrate layer. The possible gas pressure is shown with the red line.

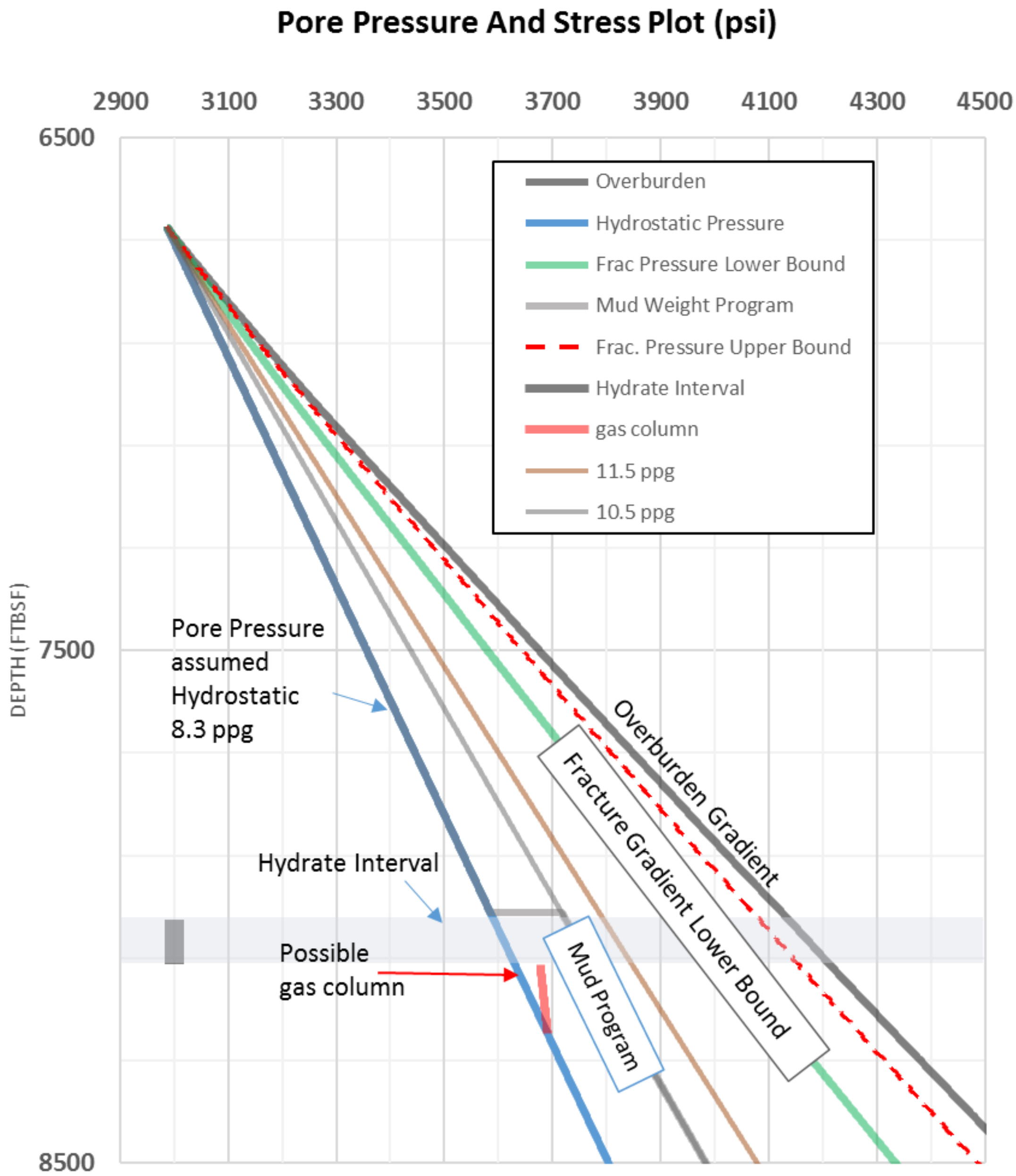

Figure 1.2.10 Total Pore pressure and least principal stress plot, measured from the sea surface, proposed for the proposed H002 and H005 wells. See text for discussion. This well will be drilled without a riser. Thus, the pore pressure and stress increase from the hydrostatic pressure at the seafloor. The current drilling plan is to increase the mud weight to 10.5 ppg 15 feet above the depth of the hydrate-bearing interval.

1.2.3 Drilling Platform Review and Selection

Vessel Selection - Bidding & Evaluation Process

A high-level statement-of-requirements was developed and requests for proposals were sent to prospective vessel contractors. In December 2015, returned proposals were pre-screened to ensure the offered vessel was capable of meeting equipment requirements. A number of follow-up clarification meetings were held, as well as requests made for additional information. The details of the proposals and each vessel's capability were documented in a summary spreadsheet for ease of comparison. Each vessel and company capability was evaluated vs. project requirements. A scorecard was developed, weighted to reflect perceived importance of individual items on overall success of the project. The scorecard included a combination of rig equipment capability and soft issues such as coring/drilling experience; plans for management of subcontractors, logistics, and mobilization; cost; risk exposure; vessel availability within the operating window; and client space. Each proposal was evaluated and scored by a panel consisting of geological, operational, and management expertise. In April 2016, after scoring and discussion, the deepwater well intervention vessel Helix D/V Q4000 was unanimously selected.

Vessel contracting strategy

Due to the complexities of setting-up and managing University contracts, the vessel contractor was asked to contract and to manage logistical support and all third-party contractors (excluding coring) as part of the vessel contract. Environmental compliance oversight was managed by the third-party drilling fluid provider. Third-party services ultimately provided for UT-GOM2-1 and sub-contracted by the vessel contractor included: mud, cement, slickline, electric-line logging, gyro survey tools, drill pipe rental, PE certification of the P&A design, drilling-parameter recorder system, enhanced communication system, ROVs, installation of grating for single-elevation work surfaces, and full logistical support (helicopters, crew boat, and supply boats).

Contracting of a US-flagged intervention vessel which routinely operates in deepwater Gulf of Mexico, simplified project planning and execution for the University. The University was able to take advantage of procedures, systems, and third-party alliances already established and provided by the contractor. Most notable, was the ability for the University to operate under the vessel contractor's Safety and Environmental Management System (SEMS). Additionally, requirements for vessels operating in the Gulf of Mexico had already been addressed by the contractor and thus, not a work front to be managed by the University (i.e. USCG Certificate of Inspection, Certificate of Class, vessel Oil Spill Response Plan, US Certificate of Financial Responsibility, vessel NPDES permit, etc.).

1.2.4 Liability Obligations

Regulatory Liability

To assure that the University was able to meet the financial obligations to cover the liabilities outlined by the federal regulations (Title 30 CFR 250, 251, 550, and 551), the University was required to qualify as an operator in the Gulf of Mexico. Because of the uniqueness of being a public academic institution, the University had to work closely with the BOEM - Adjudication Section to modify the established qualification process. Ultimately, the following documents were provided for review:

1. Certificate of Formation – Letter stating that the University is a public entity created under Texas Constitution of 1876 and an excerpt from the Texas Higher Education Coordinating Board - “Education Code Title 3 - Higher Education, Subtitle C - The University of Texas System, Chapter 65 - Administration of the University of Texas System, Subchapter A - General Provisions, Subchapter B – Administrative Provisions, and Subchapter C - Powers and Duties of Board” which includes discussion of the powers related to the issuance of bonds and notes.
2. Resolution Certification - Certificate issued by a member of the Board of Regents of The University of Texas that the University is authorized to hold mineral leases, permits and rights-of-way on the Outer Continental Shelf.
3. Incumbency Certification – Authority from the Board of Regents that the named delegate is empowered to bind the University and enter into contracts and other documents, including those related to Federal lands or minerals, use of land for research, permits, rights-of-use-and-easement, financial assurance, bonds, and applications.

On 3/21/2017, the University was recognized as qualified to bid and acquire leases at a BOEM lease sale, to receive and hold leases (including record title interest or operating rights), as a leasee, to be designated operator of a lease or portion of a lease, and to receive and hold pipeline rights-of-way and rights-of-use and easement on the OCS. The qualification was applicable to the entire OCS.

Determination of Liability, Indemnification, and Insurance – Between Contracted Parties

During contract negotiations, the determination and acceptance of various liabilities was risk-based and project specific. A full understanding of the well control aspects of the formations to be penetrated and methane-hydrate behavior, as well as a recognition of which party controlled various aspects of the activity, drove the mutual agreement of liability between primary parties.

A knock-for-knock indemnification was agreed to the extent authorized by the constitution and laws of the state of Texas.

Each party carried Insurance to cover agreed liability and associated financial responsibility. The primary parties named each other as additional insureds where appropriate. The University carried the following additional insurance during project execution: Maritime Employers’ Liability Insurance, Control of Well, Commercial General Liability, Excess Liability, and Lost-in-Hole Downhole Equipment Coverage.

1.2.5 Permit and Reporting Requirements

As an operator in the Gulf of Mexico, the University of Texas was required to comply with all applicable permitting and reporting requirements promulgated by state and federal regulatory agencies, including the United States Environmental Protection Agency (US EPA), Bureau of Ocean Energy Management (BOEM), and Bureau of Safety and Environmental Enforcement (BSEE) and Louisiana Department of Natural Resources (LDNR).

A summary of the permits that the University of Texas was required to obtain is presented as Table 1.2.2; a summary of the regulatory reporting and notification requirements that the University of Texas was obligated to fulfill is presented as Table 1.2.3.

Permits and Approvals	Regulatory Agency	Reference No.	Date Approved
NEPA Environmental Questionnaire /Categorical Exclusion Designation	DOE-NETL	DE-FE0023919	03/06/17
Qualified Operator Status for OCS Right-of-Use-and-Easement	BOEM	GoM Operator # 3487	03/21/17
Exploration Plan	BOEM	N-9978	04/28/17
Right of Use and Easement	BOEM	RUE OCS-G 30344	04/28/17
Permit for Geological Exploration for Mineral Resources or Scientific Research on the Outer Continental Shelf	BOEM	L17-001	05/05/17
Coastal Zone Management Federal Consistency Determination	LDNR	C20170064	04/21/17
CZM public comment waiver	LDNR	C20170064	04/20/17
Application for Permit to Drill – H002	BSEE	API # 608114068600	05/05/2017
Application for Permit to Drill – H005	BSEE	API # 608114068700	05/05/2017
Application for Permit to Modify (P&A) – H002 & H005	BSEE		05/17/2017 05/20/2017 05/23/2017
USCG Letter of Determination for foreign nationals	USCG	160881 160971	02/13/17 04/14/17
NPDES General Permit for New & Existing Sources and New Discharges in the Offshore Subcategory of the Oil & Gas Extraction Point Source Category for the Western Portion of the Outer Continental Shelf of the Gulf of Mexico - Notice of Intent	US EPA	GMG290609	05/02/17

Table 1.2.2 UT-GOM2-1 related regulatory permits and approvals.

Regulatory, Reports, & Notifications	Regulatory Agency	Form	Date Submitted
Notification of Commencement – BOEM Resource Evaluation.	BOEM	Email Comm.	05/07/17
Notification of Commencement – BOEM G&G Permitting	BOEM	Email Comm.	05/08/17
Notification of Completion (use of RUE has ceased)	BOEM	Email Comm.	05/26/17
Monthly records of annual fuel consumption	BOEM	Email comm.	Feb 1, Annually
Rig Move Notification – Arrival on location	BSEE	BSEE-0144	05/04/17
Rig Move Notification – From H002 to H005	BSEE	BSEE-0144	05/14/17
Rig Move Notification – Departure from location	BSEE	BSEE-0144	05/21/17
Dropped Rigging Notification (NSS # 750191)	BSEE	E-Mail Comm.	05/7/17
Open Hole Data Report – H002	BSEE	BSEE-0133S	05/12/17
Open Hole Data Report – H002	BSEE	BSEE-0133S	05/17/17
Open Hole Data Report – H005	BSEE	BSEE-0133S	05/24/17
Well Activity Report – H002	BSEE	BSEE-0133	05/12/17
Well Activity Report (Final) – H002	BSEE	BSEE-0133	05/17/17
Well Activity Report (Final) – H005	BSEE	BSEE-0133	05/24/17
Well Activity Report (Final) – H005 (Rev.)	BSEE	BSEE-0133	07/27/17
Notification APM: Site Clearance – H002	BSEE	BSEE-0124	05/31/17
Notification APM: Site Clearance – H005	BSEE	BSEE-0124	05/31/17
End of Operations Report – H002	BSEE	BSEE-0125	05/31/17
End of Operations Report – H005	BSEE	BSEE-0125	05/31/17
Notification of ROV As-found Survey results – H002	BSEE	Email Comm.	05/08/17
Notification of ROV As-found Survey results – H005	BSEE	Email Comm.	05/08/17
Site Clearance ROV dive video – H002/H005	BSEE	Electronic	07/24/17
As-Found & As-Left Survey Reports – H002	BSEE	12817-GC-WOP-PR	05/23/17
As-Found & As-Left Survey Reports – H005	BSEE	12817-GC-WOP-PR	05/23/17
Directional survey data – H002/H005	BSEE	Courier	08/09/17
Well Log data	BSEE	Courier	08/24/17
Notice of Intent for US EPA Region 6 Offshore General Permit	US EPA	Electronic	05/02/17
Discharge Monitoring Report (Period ending 6/30/17)	US EPA	Electronic	07/06/17
Discharge Monitoring Report (Period ending 9/30/17)	US EPA	Electronic	07/06/17
NPDES Notice of Termination	US EPA	Electronic	07/31/17

Table 1.2.3 UT-GOM2-1 related regulatory planning documents, reports, and notifications.

1.3 UT-GOM2-1 Expedition: Operational Overview

Expedition UT-GOM2-01 is divided into five phases: (1) Planning; (2) Mobilization; (3) Execution; (4) Demobilization; and (5) Shore-Based Science (Table 1.3.1).

Date	Activity	Planning	Mobilization	Execution	Demobilization	Dockside Analysis
9/7/2016	Kick-off Contractor Meeting					
4/15/2017	Mobilization					
5/11/2017	Execution					
5/23/2017	Begin Demobilization					
5/24/2017	Scientists leave vessel					
5/26/2017	Establish shore-based Lab, Port Fourchon					
6/3/2017	Complete Dockside Analysis					

Table 1.3.1 Phases of Planning and Execution for UT-GOM2-01 Expedition.

Planning accelerated with the kick-off contractor meeting in October-2016. This is, perhaps, the first time that an academic institution has acted as an Operator for drilling deepwater wells. Preparing for this endeavor included a myriad of tasks including the following: (1) performing basic geology and geophysics studies to optimize drilling location; (2) contracting a drilling vessel; (3) establishing appropriate project insurance; (4) developing a safe drilling program and a plug and abandonment program; (5) Applying for permits to meet regulatory requirements. These operator responsibilities were in addition to the tasks that are more common to a university including the development of a detailed scientific program.

The *D/V Q4000* was in dry-dock in Brownsville, Texas prior to the project. Mobilization included delivery of equipment to Port Fourchon, Louisiana, for delivery by boat and delivery to Brownsville to onboard equipment directly. Mobilization began with the first movement of equipment on 25-April-2017. Operations in Brownsville included boarding Geotek equipment, the sand-line, Geotek personnel, and part of the science team. The *D/V Q4000* sailed from Brownsville on 01-May-2017. Mobilization continued after the *D/V Q-4000* left dock in Brownsville. It included bringing the service vans online, making up the BHA, and flow testing of the PCTB within the water column prior to the spudding.

Project execution formally began on 11-May-2017 with the spudding of H002. The execution phase lasted only 12 days during which H002 and H005 were drilled (Table 1.3.2 and Table 1.3.3). When the BHA was pulled from the hole on 23-May-2017, demobilization began. Scientists were offloaded by helicopter to Houma, Louisiana on 24-May-2017. The pressure cores were transported by boat to Port

Fourchon, LA. Other activities included cleaning the mud pits on the vessel, and ultimately cleaning the tanks on the mud boat.

Synchronous with demobilization was a shore-based core analysis phase. In our planning phase, it was determined that there would not be enough time to process cores taken during the latter half of the execution phase while on the vessel. To properly analyze the core, Geotek's PCATS and UT's sampling lab were re-established on shore at the InterMoor yard in Port Fourchon, LA.

The UT-GOM2-1 Post-Drill Operation Report and Daily Log (executed activities, drilling and coring statistics, and an event drilling-log) can be found in Appendix A. Post-Drill Operation Report and Daily Log of this report, which includes a listing of completed operational activities during UT-GOM2-1 and a daily log of the major project activities.

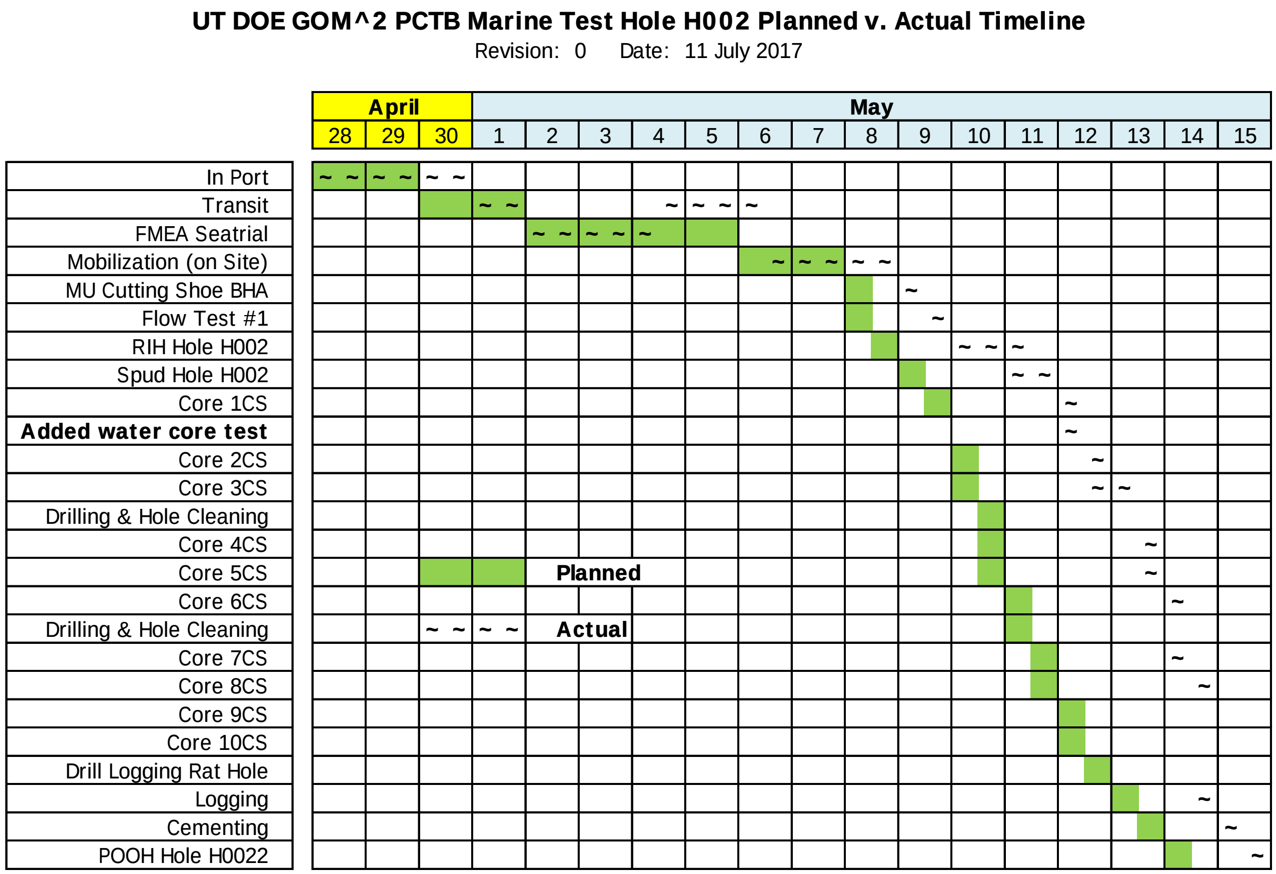

Table 1.3.2 Operational flow chart of H002 planned and actual UT-GOM2-01 drilling and coring operations.

UT DOE GOM^2 PCTB Marine Test Hole H005 Planned v. Actual Timeline

Revision: 0 Date: 11 July 2017

	May																	
	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
MU Face Bit BHA			~															
Flow Test #1			~						Planned									
RIH Hole B			~															
Spud Hole B & 1,000 ft Survey				~			~ ~	~ ~	Actual									
Core 11FB				~	~													
Core 12FB					~													
Core 13FB					~													
Drilling & Hole Cleaning					~													
Core 14FB						~												
Core 15FB						~												
Core 16FB						~												
Drilling & Hole Cleaning						~												
Core 17FB						~												
Core 18FB						~												
Core 19FB							~											
Core 20FB							~											
Core 21FB							~											
Core 22FB							~											
Core 23FB								~										
Survey								~										
Cementing								~										
Waiting on Cement									~ ~									
Cementing #2									~									
Waiting on BSEE										~								
POOH Hole B										~								
Demob											~ ~							

Table 1.3.3 Operational flow chart of H005 planned and actual UT-GOM2-01 drilling and coring operations.

1.3.1 Mobilization

Before mobilization, the PCTB underwent testing and modification. Ownership of the PCTB was transferred from DOE to the University of Texas Austin. UT Austin then contracted with Aumann Engineering to test and modify this tool to prepare it for use in the offshore. Over two years, UT worked with Aumann Engineering (in 2016, Aumann Engineering was purchased by Geotek Limited and it is now termed Geotek Coring, USA) to perform and test engineering modifications. Throughout this phase, two configurations of the tool were developed: the face bit configuration and the cutting shoe configuration. The cutting shoe configuration is compatible with other Integrated Ocean Discovery Program (IODP) coring tools. However the face bit configuration was thought to have the potential to minimize core disturbance. New parts for the tool were machined and the configurations were successfully tested at Geotek Coring in Salt Lake City and at Schlumberger's Cameron, TX testing facility. After field testing at Cameron, modifications to the tool were made to implement a flow diverter to reduce the pressure on the coring liner during coring and minimize the possibility of casing collapse. It was intended to test this capability on a vessel of opportunity prior to Expedition UT-GOM2-1. However, further testing was not accomplished prior to UT-GOM2-1.

Extensive planning for core acquisition, core analysis, and sample transport was also conducted during this time. Invitations were sent out to members of the science team and a first pass look at sample and data requests from the members of the greater hydrate community was used in the identification and gathering of supplies to support the science goals beyond the test of the coring tools.

Mobilization, not including Helix subcontractor mobilization, was worked by UT with Geotek Ltd., Geotek Coring, Prolog, and Tiger Rentals. Five service vans/containers and three baskets of heavy equipment were delivered to Keppel AmFELS, Brownsville for loading onto the *D/V Q-4000*. Geotek containers purposefully arrived several days ahead of transfer to the rig in order to set up test equipment after the trip overseas. Mobilization of equipment began in the US with the first movement of equipment on 25-April-2017. The *D/V Q-4000* set sail from Brownsville on 01-May-2017.

During transit to the drill site, Geotek brought the service vans online connecting them to air, water, and power. Make-up of the BHA and flow testing of the PCTB within the water column were completed prior to spudding H002.

A final container, specially modified for depressurized core sampling operations on the rig, was delivered to InterMoor Port Fourchon. This container along with other Helix sub-contractor supplies were then transferred by supply ship to the *D/V Q-4000* at the drill site.

Mobilization of personnel also occurred in two waves. About half of the members of the University group including all of the members from Geotek completed final boarding of the *D/V Q-4000* on April 30. The remainder of the personnel including members of the science and videography teams boarded the D/V *Q-4000* by helicopter from Houma, LA on 09-May-2017.

Several crew changes occurred during operations, one by personnel boat from Brownsville and rest by helicopter from Houma, LA.

During drilling and coring operations supply boats brought additional needed equipment and consumables including a second delivery of mud.

1.3.2 Execution

Project execution occurred from 5/11/2017 to 5/23/2017. During this time, H002 and H005 were drilled, cored, plugged and abandoned. In addition, wireline logging was performed at H002. A summary of the timing of major events is provided in Table 1.3.4. Detailed descriptions are given in Daily Reports (Appendix B.) and the UT-GOM2-1 Post-Drill Operation Report and Daily Log (Appendix A., mentioned above).

The UT-GOM2-1 Pre-Drill Operation Report and Daily Log (executed activities, drilling and coring statistics, and an event drilling-log) can be found in Appendix C. of this report, which includes a listing of proposed operational activities during UT-GOM2-1.

Event	Time	Date
Spud H002	08:53	11-May-17
Begin Coring H002	07:30	12-May-17
End Coring H002	14:00	14-May-17
Begin Logging H002	16:30	14-May-17
End Logging	01:30	15-May-17
Begin P&A	01:30	15-May-17
End P&A	12:30	15-May-17
Spud H005	02:30	17-May-17
Begin Coring H005	22:30	17-May-17
End Coring H005	02:20	21-May-17
Begin logging H005	03:50	21-May-17
End Logging H005	08:00	21-May-17
Begin P&A	08:00	21-May-17
End P&A	03:45	23-May-17
End Execution	00:00	25-May-17

Table 1.3.4 Major Events during Execution of UT-GOM2-01.

Hole Locations

When the *D/V Q4000* arrived at location, the remotely operated underwater vehicles (ROVs) were deployed and H001 was identified. H001 was extraordinarily preserved 8 years after it had been drilled (Figure 1.3.1). The position of the hole was identified through the WinFrog system on the vessel by locating the position of the ROV while sitting over H001. The position of H001 ('as found') was not exactly the published position of H001 (Table 1.3.5, Figure 1.3.2). This difference is interpreted to be due to the limited accuracy of both positioning systems, which was estimated to be 14 m. H002 and H005 were located relative to the as found location of H001.

Name	Latitude WGS84 (decimal min.)	Longitude WGS84 (decimal min.)
GC 955 H005	27° 0.04665' N	-90° 25.59125' W
GC 955 H002	27° 0.04154' N	-90° 25.58715' W
GC 955 H001-as found	27° 0.05126' N	-90° 25.58367' W
GC 955 H001-published	27° 0.05166' N	-90° 25.58759' W

Table 1.3.5 Location information for the H wells drilled at GC-955.
H001 is shown as found during this drilling expedition and as published previously by BOEM.

Figure 1.3.1 Hole GC 955 H001, drilled in 2009 during the Chevron JIP was found at the start of the UT-GOM2-01 Expedition.

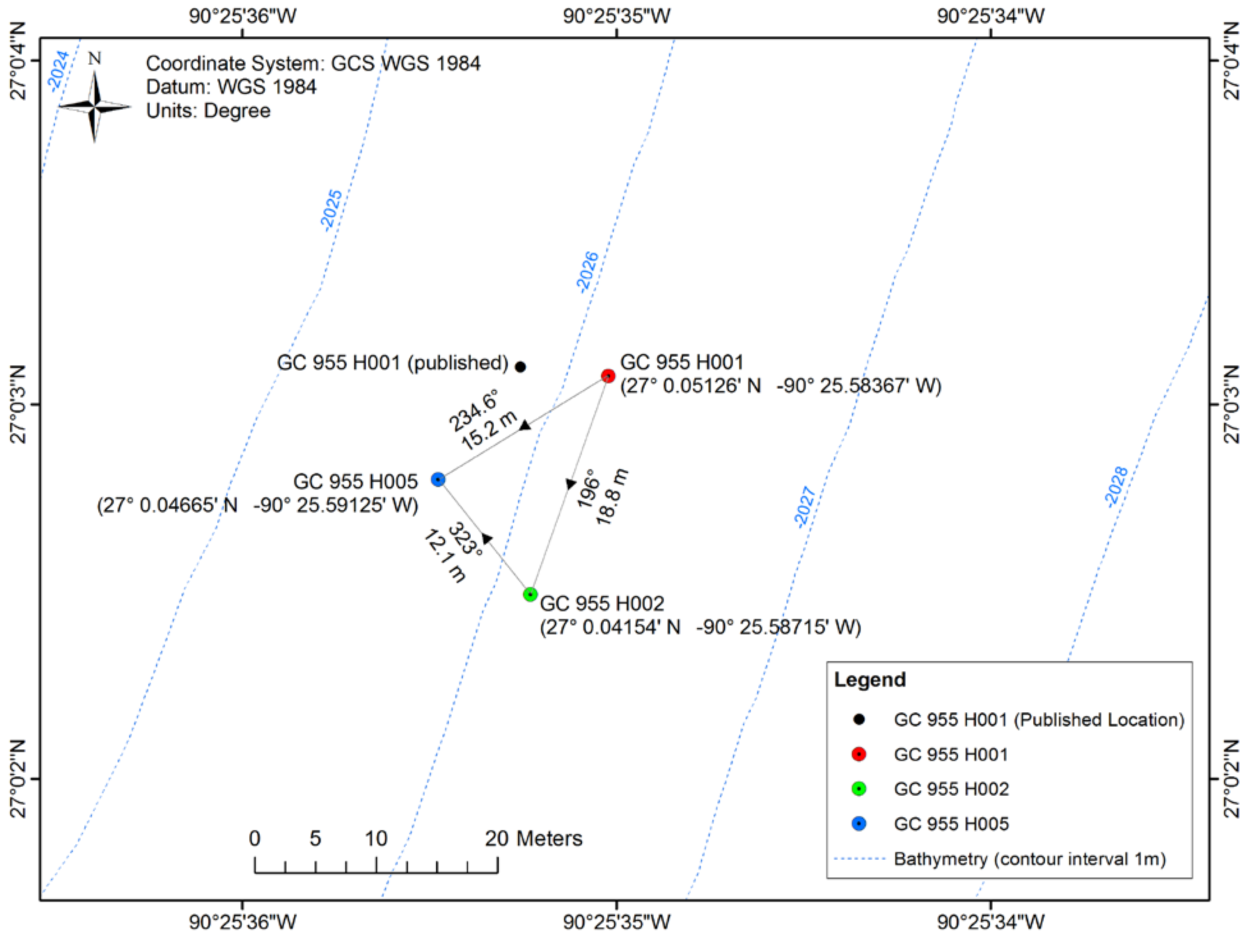

Figure 1.3.2 The locations, distances, and azimuths between GC 955 H Holes. H001 as located by BOEM (published location), the position of H001 as found in Expedition UT-GOM2-1 (as found), and H002. The locations of the wells relative to each other is very accurate because it was measured by the ROV. However, the absolute position of any of these wells is limited to the accuracy of the shipboard navigation system used for both drilling programs, which is a 14m radius circle.

	Seafloor fbrf	Water Depth (ft)	Water Depth (m)
H001	6718	6667	2032.1
H002	6719	6667	2032.1
H005	6718	6666	2031.8

Table 1.3.6 Depth of seafloor for three GC 955 site H holes.

The seafloor depth at H002 and H005 was determined through observation of the ROV as to when the BHA tagged seafloor with a drill pipe measured depth of 6719 fbrf (Table 1.3.6). H005 was spudded at 6666.0 ft (6718.0 fbrf). H001 tag depth was estimated from the depth on the LWD log where there was a shift in the ring resistivity recording the seafloor.

Pre-drill calculated top of the hydrate-bearing sand interval for H002, and H005, and logged top in H001.

Well	fbrf[1] (ft)	fbsl[1] (ft)	fbsf[1] (ft)	SRD[3] (ft)
H001	8076	8025	1358	8030
H002	8077	8025	1358	8027
H005	8076	8024	1358	8030

Table 1.3.7 Estimated depth to the top of the hydrate-bearing interval. fbrf = feet below rig floor, fbsl = feet below sea level, fbsf = feet below seafloor, SRD = seismic reference depth. Please see Chapter 2 Methods, Section 2.1.3 Depth References for more information.

The depth of the top of the hydrate-bearing interval was determined from the seismic data given the known seafloor depth (Table 1.3.7). The peak seismic reflection was mapped at the top of the hydrate-bearing interval to H002 and H005. Because these holes were drilled so close (closer than horizontal sampling in seismic data) to each other, it was assumed that the top of hydrate at H002 and H005 would be at the same depth below the seafloor as that in H001. The discrepancy in predicted depths of reservoir below SRD and below sea level (fbsl in Table 1.3.7) is the result of the difference between the depth of sea floor predicted from seismic and that observed by the ROV at each hole location.

H002 and H005 Coring Operations and Recovery

One 1.4 m (4.6 ft) of pressure core (Core H002-4CS) was recovered within the methane hydrate stability zone at H002. 16.1 m (69.9 ft) of pressure core where the material has stayed within the methane hydrate stability zone are available and in storage vessels from H005 (Cores H005-1FB, -6FB, -9FB and -12FB have been excluded). In addition, 4.2 m of pressure core from H005 that likely temporarily left methane hydrate stability during recovery and processing are available. All but one of the cores (H005-1FB) are from the sand-bearing hydrate reservoir. Little core was acquired from the material that bounds the reservoir and none of this material was recovered under pressure; it is unclear whether Core H005-13FB penetrates material below the hydrate reservoir. The poor recovery was interpreted to mean that the material above and below the reservoir is so poorly consolidated that they could not be readily recovered during coring.

Hole GC 955 H002

Figure 1.3.3 shows the coring intervals and core recovered from H002 compared to the ring resistivity log acquired at H001. Only one core from H002 was recovered at pressure. Seven cores were recovered at atmospheric pressure after the coring tool ball valve failed to close properly before the core was pulled out of the methane hydrate stability zone. These cores were sampled for interstitial water, microbiology, physical property, and head space gas samples with additional core sections remaining for archive and later description and sampling. A single pressure core, H002-04CS, was recovered at pressure and was cut into two sections for degassing and one section was transferred to a storage chamber and transported to the UT Pressure Core Center.

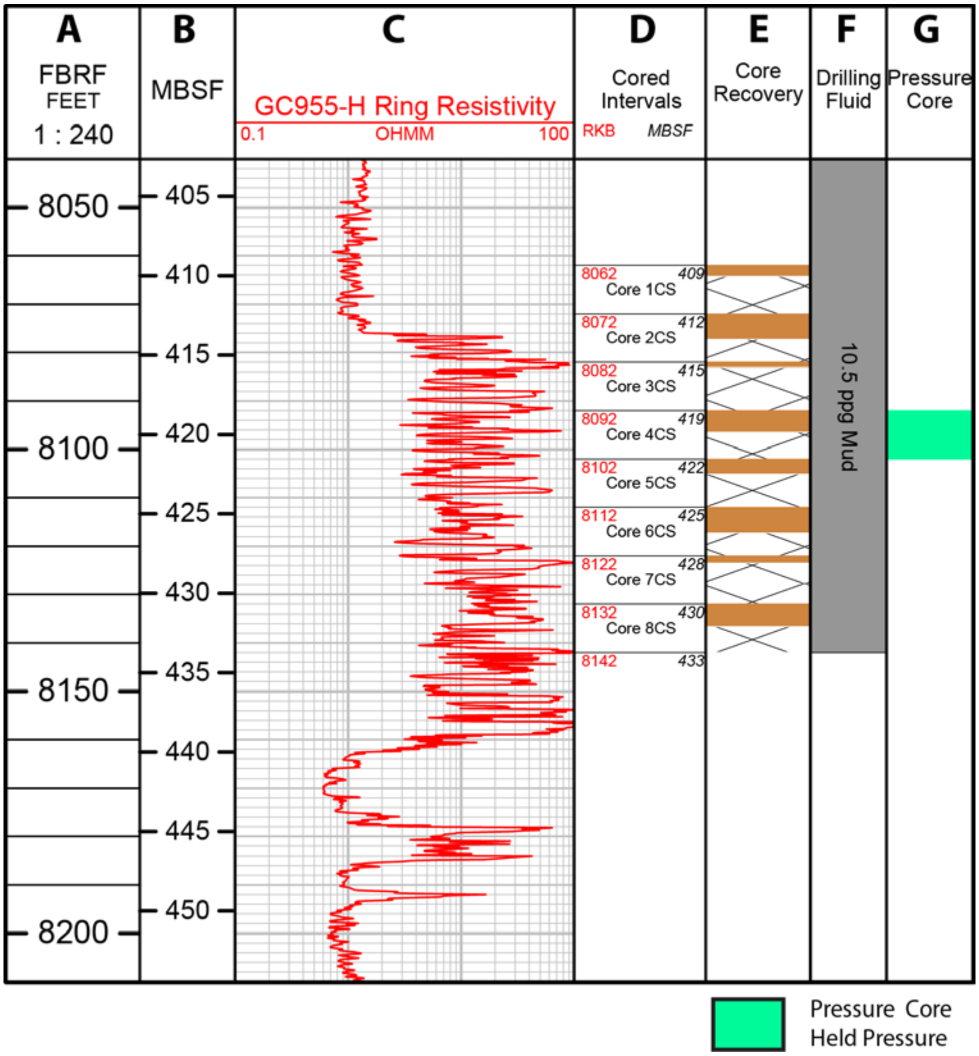

Figure 1.3.3 Cored intervals and core recovery from H002 compared to H001 LWD resistivity log.

Hole GC 955 H005

Figure 1.3.4 and Figure 1.3.5 show the cored intervals and the core recovered from H005 compared to H001 resistivity log. 11 cores (Cores H005-1FB to -8FB, H005-10FB to -11FB, and H005-13FB) were recovered at pressure and without leaving the methane hydrate stability zone. H005-9FB was recovered at pressure but left the methane hydrate stability zone and began to dissociate, creating voids filled with gas. Data storage tag (DST) data from within the PCTB suggest that the tool may have barely touched the phase boundary during coring runs H005-2FB, -3FB, and -4FB, however, the excellent core quality suggests the core material remained at hydrate stable conditions. H005-12FB was recovered at atmospheric pressure after the coring tool ball valve failed to close properly. Cores H005-1FB Section 3 and all of -6FB, while recovered within the methane hydrate stability zone, lost pressure temporarily during cutting due to seal problems in PCATS (purple zone Figure 1.3.4 and Figure 1.3.5).

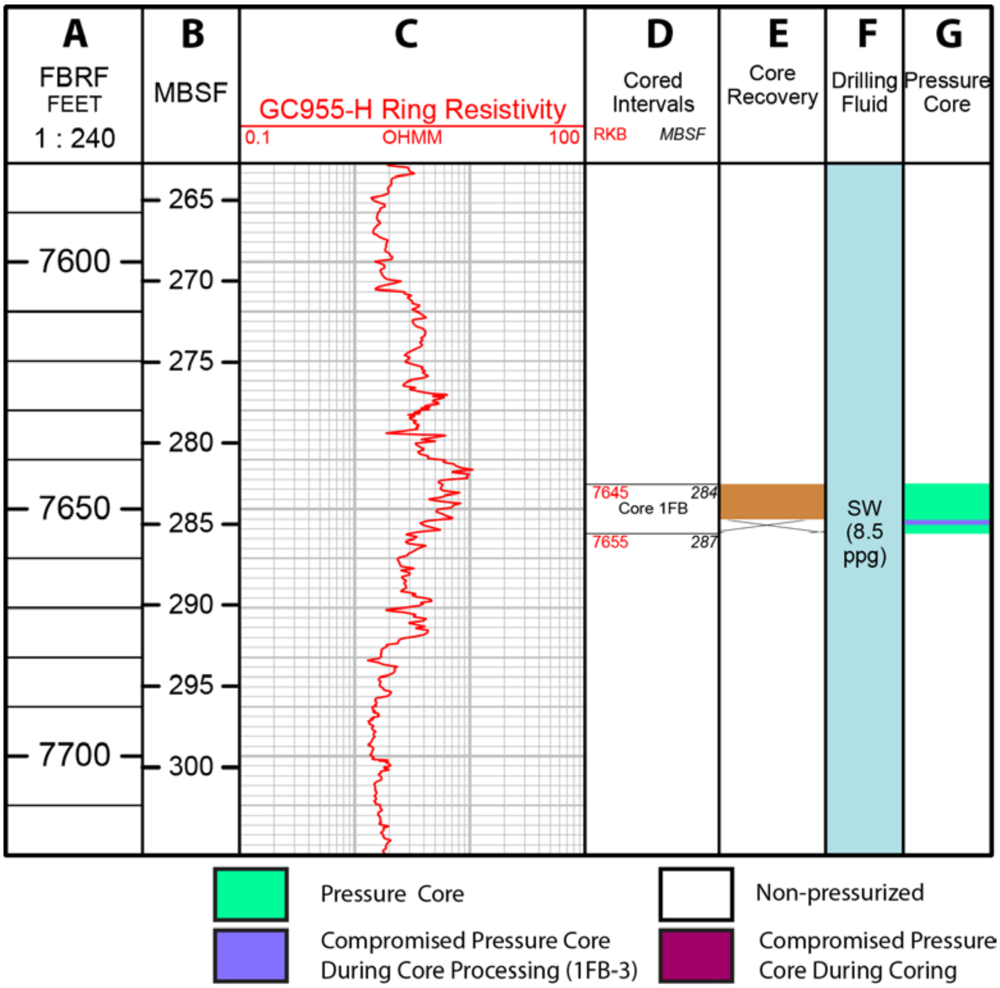

Figure 1.3.4 Cored intervals and core recovery from H005 compared to H001 LWD resistivity log. The amount of recovered material is indicated by the brown box.

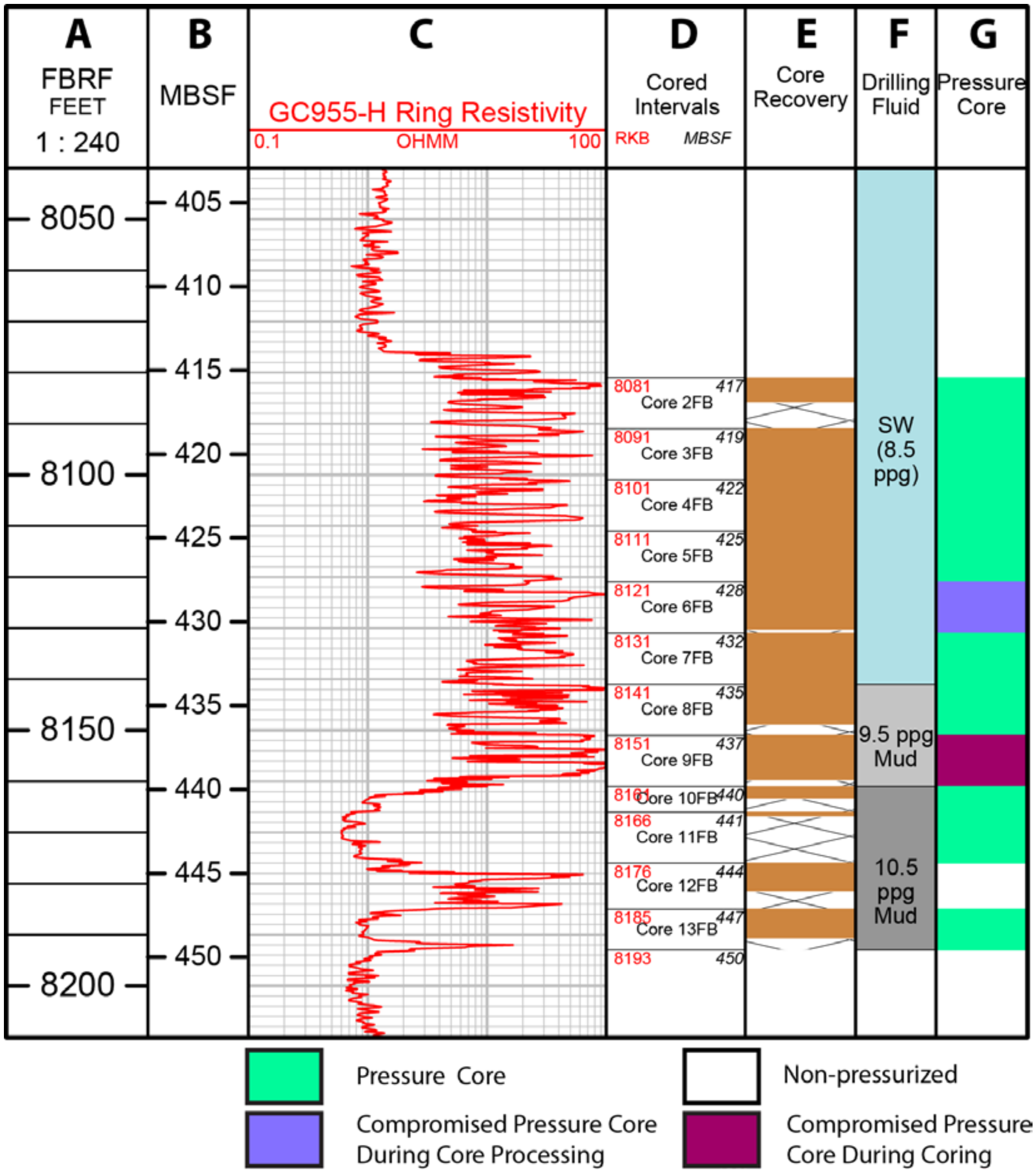

Figure 1.3.5 Cored intervals and core recovery from H005 compared to H001 resistivity log. The recovery is indicated by the brown box. Cores 2-7 were drilled with seawater, cores 8-9 were drilled with 9.5 ppg mud, and cores 10-13 were drilled with 10.5 ppg mud.

Pressure Coring Performance

At H002, 8 pressure cores were attempted but only one pressure core was recovered to the rig floor at a pressure and temperature that was within the methane hydrate stability zone (Figure 1.3.3). A single root cause was not identified for the failed pressure cores. However, a number of problems were identified that contributed to the lack of pressure in the 7 unsuccessful pressure cores (Figure 1.3.6). After Core 01CS, it was recognized that there was a design oversight that caused a hydraulic lock to occur as a result of a metal to metal seal. This metal-on-metal seal resulted from modifications made to the tool to incorporate a flow-diverter. The flow-diverter reduces the pressure differential between the inside and the outside of the core liner during coring. This pressure differential had previously caused liners to sometimes collapse at high pump rates. The change in flow path also avoids problems with clogging the upper valve from pipe scale and other debris during pumping. Unfortunately, there was no opportunity to field test these design changes prior to this expedition and hence the oversight was only recognized at this point.

To address this while in the midst of coring H002, the seals that allow the flow diverter to operate were removed, which eliminated the possibility of a hydraulic lock. However, as illustrated in Figure 1.3.6, 6 more pressure cores were taken in H002 and only one of them retained pressure. A number of problems caused these other failures including the following: 1) displacement of the ball valve seal; 2) the ball valve not firing correctly; 3) the inner tool barrel failing to unlatch within the BHA (with the result that an emergency retrieval tool had to be deployed which necessarily resulted in pressure not being retained); and 4) the seal at the top of the autoclave failing.

While plugging and abandoning H002 and while drilling to the coring depth at H005, several modifications were made to the PCTB. First, to reinstate the flow diverter function but eliminate the possibility of a hydraulic lock, grooves were ground into a component that restricted flow of high pressure fluid and the flow diverter seal itself was replaced. Second, to reduce the likelihood of seal displacement during ball valve closure, the ball valve seal was replaced with a newer seal to achieve a better fit after the ball valve snapped shut. Third, small tabs were welded onto the ball release sleeve collets, ensuring the sleeve was always correctly connected to the operating mechanics higher up in the tool thus ensuring the ball valve closing mechanism was triggered more reliably.

In addition, two new procedures were implemented during pressure coring at H005. First, while retrieving the tool from core point depth, the tool was held for approximately 15 minutes at the seafloor to allow time for pressure to equilibrate inside the tool. This was done to ensure that any delays moving components would be allowed the time to actuate. This approach was implemented during coring runs H005--06FB, -07FB, -08FB, -09FB, -11FB, -12FB & -13FB.

Second, the set pressure on the regulator of the core tool accumulator was reduced to a value below the in situ pressure for cores H005-7FB, -8FB, -10FB, -11FB, and -12FB. This change was made as a strategy to ensure that the autoclave sealed and core remained at a pressure well inside the methane hydrate stability zone, even if it was not at in situ pressure or above. The normal operation is to have the set pressure at a value greater than the in situ pressure such that when the initial closure of the ball valve is complete, the pressure is released as a fast boost. Fluid is forced via the set pressure into the autoclave to help seat the seals (especially the ball valve), preventing leakage and pressure loss during recovery. Because this function was not working correctly, with the result that the fast boost fluid injection was being lost (presumably because the ball valve was not fully sealed when it was applied), a change in strategy was deemed appropriate.

Setting the regulator to a lower pressure than the in situ pressure enables fluid from the core tool accumulator to be forced into the autoclave as a slow boost. In this case, if the autoclave does not seal at in situ pressure at the base of the hole, then the as the tool is raised and the borehole pressure reduced to the set pressure, the slow boost will initiate. If the slow boost is activated, then the recovery pressure will be less than the in situ pressure. If on examination of the DST records, the autoclave appears to seal at a value above the set pressure then one concludes that the system sealed on initial activation of the tool and that the slow boost mechanism was not required. If, on examination of the DST records, the autoclave appears to seal at or just below the set pressure, then one concludes that the system failed to seal on initial activation of the tool and that the slow boost mechanism was applied. From an examination of the DST records it was concluded that the slow boost occurred for cores H005-7FB, -8FB and possibly -11B. Core H005-10FB sealed close to the in situ pressure and hence it was concluded that it sealed during or soon after the tool was retracted from the BHA.

Pressure coring at H005 was much more successful than at H002. 11 cores were recovered on the rig floor at pressures and temperatures within the methane hydrate stability zone as interpreted from the rabbit DST records (Figure 1.3.7). However, during recovery, cores 2FB and 9FB left the methane hydrate stability zone for several minutes and cores 3FB and 4FB approached the methane hydrate stability boundary very briefly (e.g. seconds). X-ray scans of 9FB showed that voids had formed, possibly formed by dissociation and gas expansion when the core left the methane hydrate stability zone. In addition, P-wave velocities are relatively low, and no lithofacies were discernable in 9FB, consistent with disturbance of the recovered sediments due to dissociation of hydrate. No voids were observed in X-ray images from 2FB, 3FB, or 4FB. High P-wave velocities and interbedded lithofacies were observed in Cores 2FB, 3FB, and 4FB, suggesting that any hydrate dissociation was not severe enough to alter the physical properties.

Although more successful, the PCTB-FB did not seal at the depth that the core was acquired in every case except Cores 1FB and 6FB (Figure 1.3.7, where red triangle overlies the blue circle). The depth where the pressure in the autoclave begins to differ from the borehole pressure (recorded in the pulling tool) is used to determine at what depth the autoclave sealed (red triangles, Figure 1.3.6 and Figure 1.3.7).

We qualitatively compared images of the single pressure core recovered at H002 with those recovered at H005 (Figure 1.3.8). Core biscuits represent coherent sections of the core that lie between zones where there was rotation of one part of the core relative to the other. The coherent sections of core at H002 average ~5cm length. In contrast, the PCTB-FB has many much larger lengths of undisturbed core. In fact, one of the striking successes at H005 was the extraordinary length of coherent sections of the core. The 40 cm length of perfectly intact core illustrated in Figure 1.3.8 is not uncommon. Because only one pressure core was recovered with the PCTB-CS, it is challenging to do a rigorous comparison of tool performance. Nonetheless, the quality of the core recovered by the PCTB-FB are remarkable and generally less deformed than those recovered by the PCTB-CS.

The difference in core quality may be due to the fact that here is a fundamental difference in how the cores are cut between the PCTB-CS and the PCTB-FB. In the PCTB-CS, the inner core barrel is locked in the BHA to provide the rotation of the cutting shoe itself whereas the liner inside the inner barrel is free to not rotate during the coring process. In contrast, in the PCTB-FB, neither the inner core barrel nor the liner are locked to the rotation of the BHA. Biscuits and spiral gouges created by the core catcher record rotation of the core, which is not desirable. Qualitative evidence suggests that more biscuits and more spiral gouges are present in the PCTB-CS than in the PCTB-FB. We interpret that there may be more friction in the PCTB-CS than in the PCTB-FB and thus the core is more likely to rotate with the BHA with the PCTB-CS. The PCTB_FB was also more successful at recovering core at pressure than the PCTB-CS at our land test in Cameron (Flemings et al.)The potential for increased performance of the PCTB-FB relative to the PCTB-CS must be weighed against the fact that the PCTB-CS has the operational advantage that it can be used with other downhole tools during drilling without removing the BHA. For example, conventional corers and wireline logging devices can be used with the PCTB-CS but not with the current version of the PCTB-FB.

Ultimately, the difference in pressure coring performance between H002 and H005 reflect a combination of incremental improvements in design and process over the evolution of the expedition and, perhaps, differences between the PCTB-CS used in H002 and PCTB-FB used in H005. It is challenging to determine the relative role of these factors. H002 was drilled first with the PCTB-CS and H005 was drilled second with the PCTB-FB. None of the failure modes encountered in either well are related specifically to the unique components of the separate tool designs. For example, the problem with the hydraulic lock discovered early in H002 in the CS configuration would have equally limited the face bit deployment; furthermore, all of the iterative changes made between H002 and H005 would have contributed to the performance at H005. In addition, the drilling rig (and its newly installed equipment) and pump gear were being commissioned and optimized during Hole H002 and some of H005. Thus, the rig began operating more smoothly and the PCTB coring team was far more experienced when they cored H005. While it is difficult to untangle the factors that contributed to the PCTB-FB and PCTB-CS performance, the very limited data suggest that the core quality is higher in the face bit than in the cutting shoe. This is primarily due to the reduced internal core deformation demonstrated with the FB design.

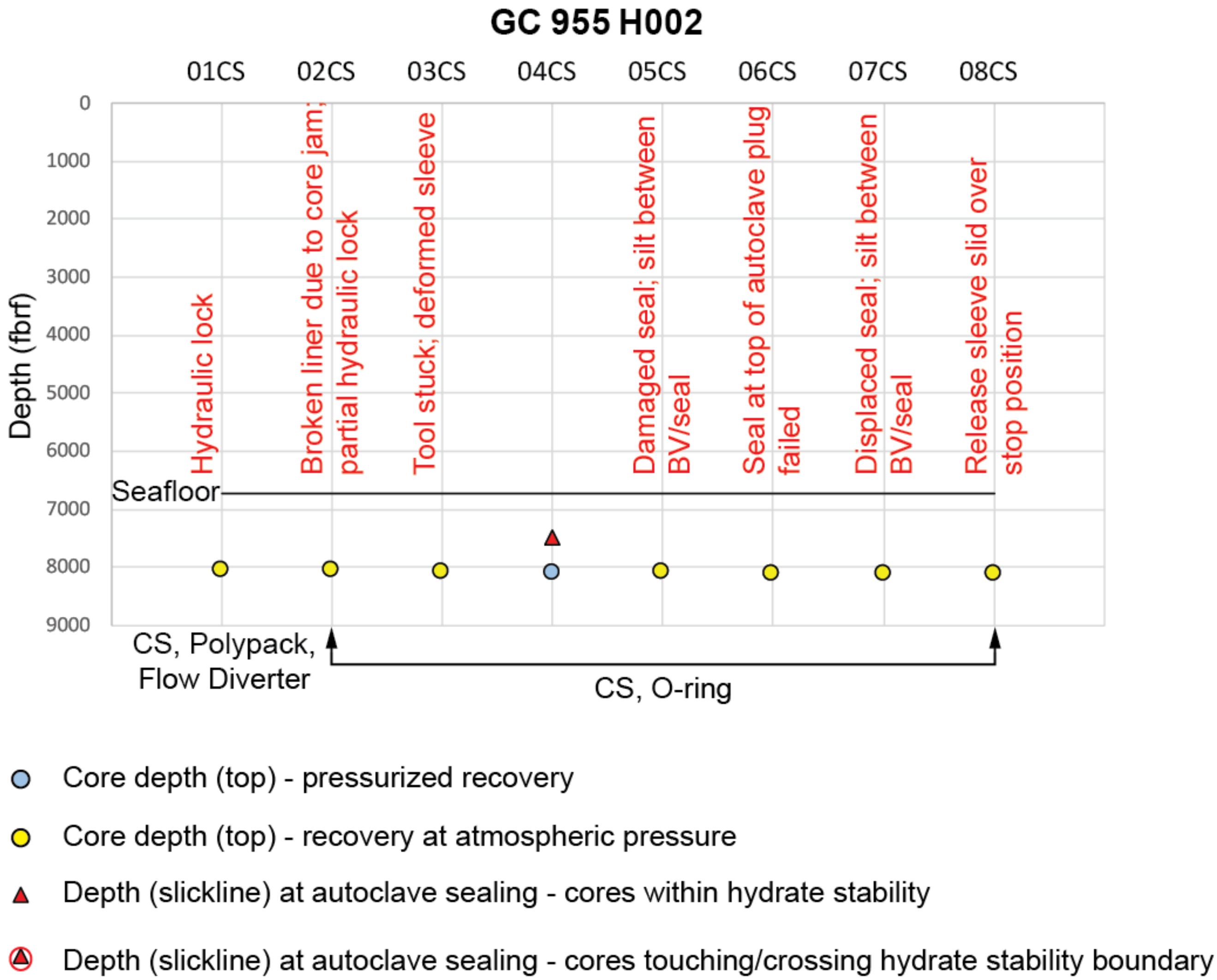

Figure 1.3.6 Tool configuration and failure mechanism for pressure cores at H002. 8 pressure cores were taken. Only one pressure core held pressure.

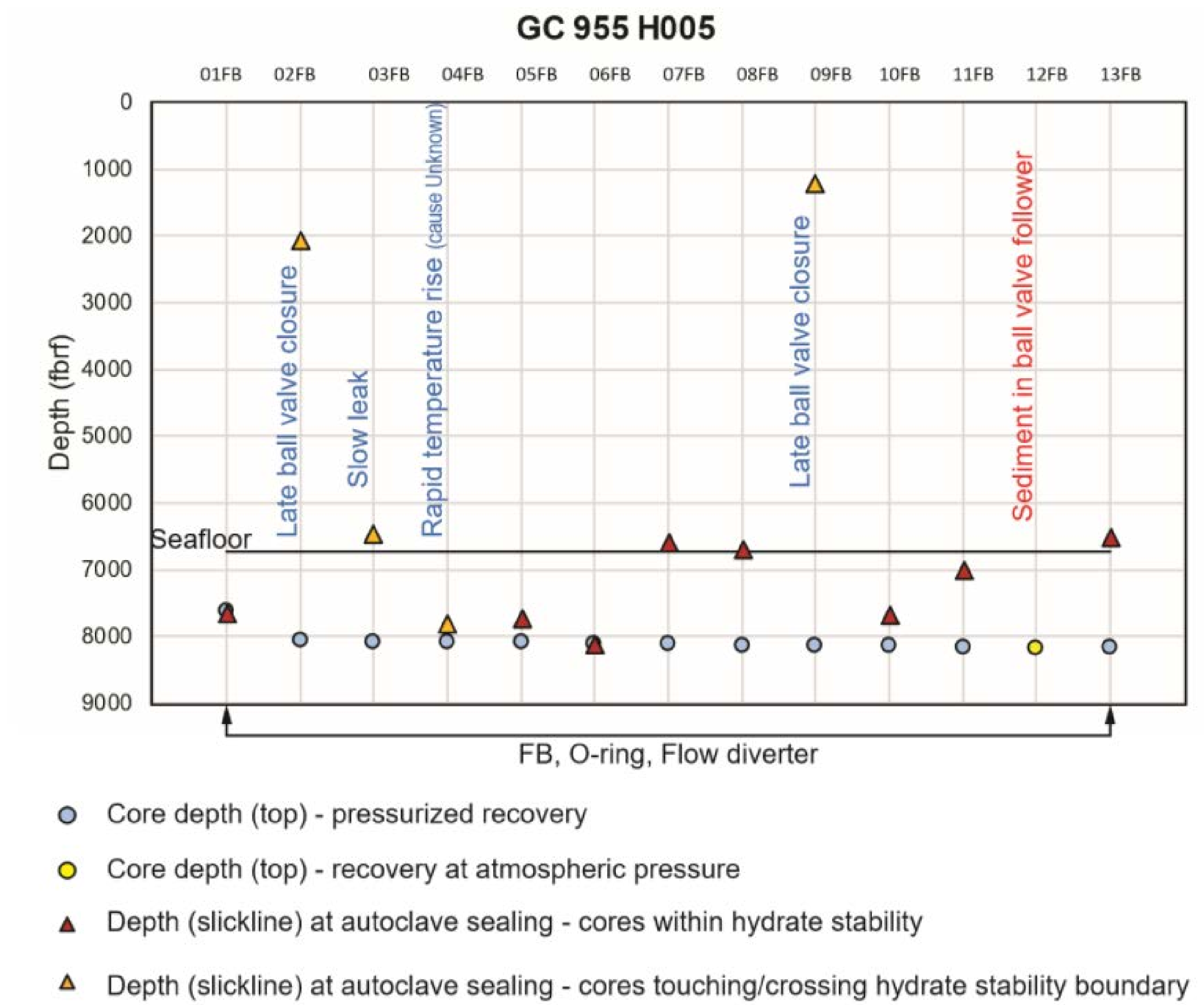

Figure 1.3.7 Tool configuration and failure mechanism for pressure cores at H005. 13 pressure cores were taken.

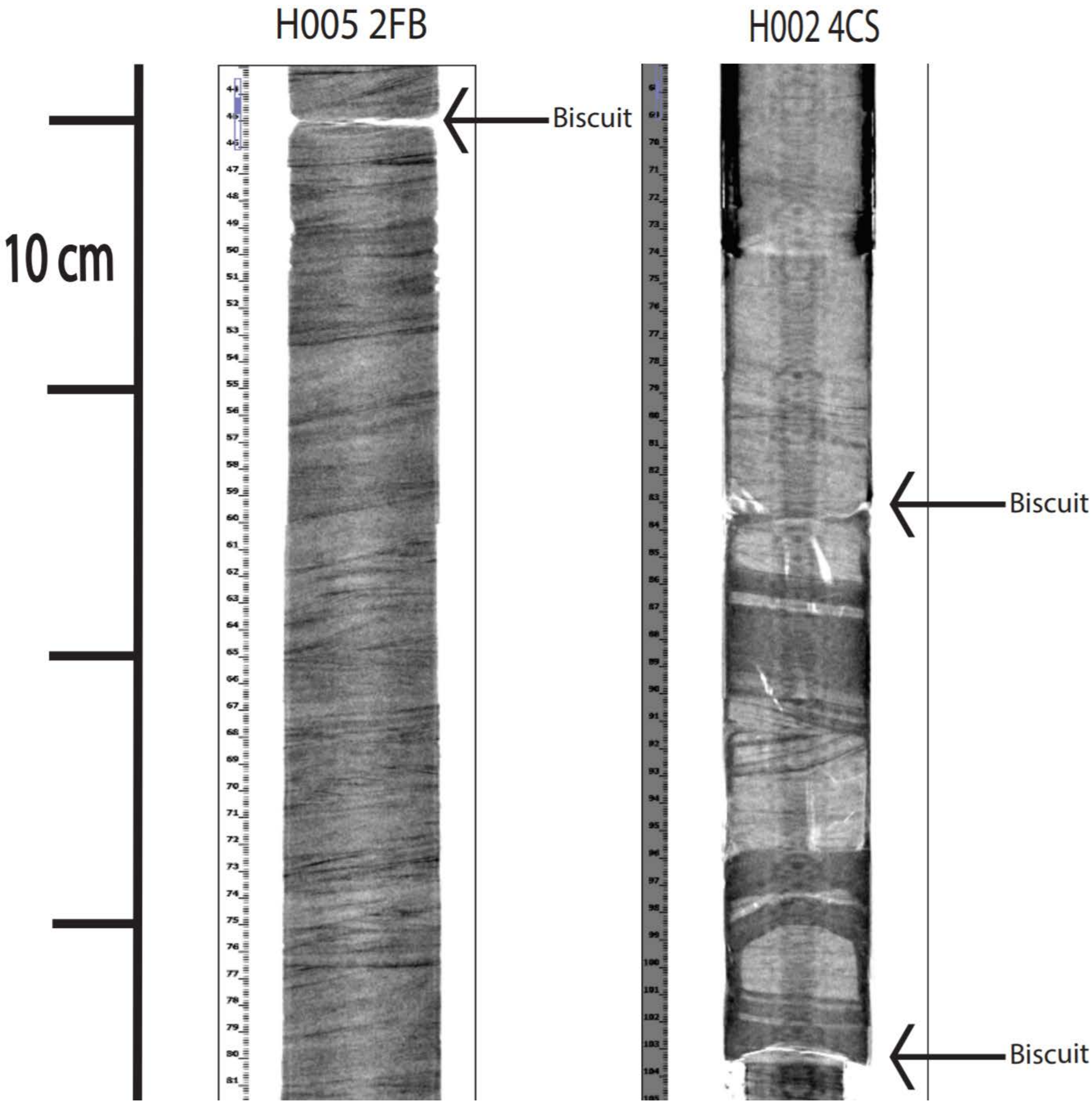

Figure 1.3.8 X-ray image of face bit core (left) and cutting shoe core (right). The cutting shoe core shows more severe disturbance with shearing and spiral cutting.

1.3.3 Demobilization

Demobilization occurred in phases. First, demobilization occurred from the vessel while simultaneously establishing analysis capabilities at Port Fourchon, LA. Then the Port Fourchon facilities were demobilized at the completion of shore-based activities.

After drilling and coring operations were completed on 23-May-2017, container baskets were repacked with heavy service items and extra supplies packed in service vans and containers for transport. Service vans were decommissioned and prepped for transport using special protocols to ensure that all core samples were kept cold. Power was disconnected on the *D/V Q-4000* in a specific order and the power outage minimized before the vans were reconnected on the supply boat. All containers, vans, and baskets were transported in a single supply boat, modified to provide power to the vans, to InterMoor Port Fourchon were the second mobilization, or recommissioning, of the core analysis equipment began.

All members of the University group were transported off the *D/V Q-4000* by helicopter to Houma, LA. Members of the group participating in the shore-based core analysis operation left Houma for Port-Fourchon where several new members of the science party joined them.

From the supply vessel, Geotek and UT containers were unloaded using a special protocol to ensure the depressurized and pressure cores were kept cold. Air compressors, generators, and fuel bowsers were brought in while InterMoor provided water hook-up. The service vans and containers were arranged to minimize/optimize movement of the long pressure cores. The service vans were connected to air, power, and water and the equipment retested before core analysis and cutting was restarted.

Sections of pressure core were identified, cut, placed in storage chambers, and then transported over land to the UT Pressure Core Center. Three trips were made in all with a Geotek specially designed, Department of Transportation approved, overpack system inside a refrigerated van. Also, the PCTB service was cleaned and all parts prepped for long-term storage at UT.

Once operations were complete at InterMoor, all depressurized core, gas samples, and water samples were packed and shipped using dry ice and other methods as necessary. All equipment and service vans were decommissioned and picked up for transport over land and sea and all rented equipment was picked up and returned.

The PCTB service van and the three baskets of heavy parts were brought to UT for long-term storage. The baskets were unloaded and returned to Tiger Rentals. The Geotek service vans were shipped back to the UK. The mud lab for core processing was returned to Prolog. All pressure cores arrived at UT and are currently being stored under a high-pressure maintenance and relief system in a room controlled to 4°C. All depressurized core, as well as gas and water samples, were shipped to their designated destinations.

1.4 UT-GOM2-1 Expedition: Scientific Results

1.4.1 Lithostratigraphy and Physical Properties:

Three lithofacies were identified at the cm-scale using PCATS P-wave velocity, gamma density, and 2D X-ray bulk property data and confirmed by grain size measurements. Lithofacies 1 was only recovered in Core H005-1FB and is characterized by high density (2-2.1 g/cm^3) and low P-wave velocity (~1500-1700 m/s). Lithofacies 2 and 3 are interbedded in the hydrate-bearing interval (Figure 1.4.1). Lithofacies 2 is composed of low density (1.7 to 1.9 g/ cm^3) and high velocity (3000-3250 m/s) beds. Ripple laminations and/or cross-laminations were observed in X-ray images (Figure 1.4.2). Lithofacies 2 contains the most continuous un-deformed samples. Lithofacies 3 is composed of high density (~1.9-2.1g/ cm^3) and low velocity (~1700 m/s) beds. In X-ray images, it is generally more deformed than lithofacies 2. It was noted that this section is very finely-interbedded and that each designated lithofacies incorporates a mix of lithologies. As a result, the characteristics described above are the bulk properties averaged over larger intervals (cm to tens of cm scale) that may contain multiple individual lithologies.

Core H005-1FB contains lithofacies 1, while cores H002-4CS, H005-2FB to -11FB, and H005- 13FB contain lithofacies 2 and 3. Preliminary grain size analyses by laser diffraction indicate distinct differences between each lithofacies (Figure 1.4.3). Lithofacies 1 is the finest, composed of silty clay and is from the section well above the hydrate reservoir. Lithofacies 2 is coarsest with a bulk composition of sandy silt. The bulk composition of lithofacies 3 is clayey silt, although it may be composed of both mudstone and siltstone layers (e.g. Figure 1.4.1, beneath 422.5 mbsf). Because lithofacies 3 may be composed of interbedded lithologies, the average (bulk) properties (density or P-wave velocity) may not record the properties at the scale of the finer beds. During the expedition, we did not differentiate lithofacies at a finer scale. Furthermore, logging tools may not be able to resolve the very thin beds observed at the core scale.

Lithofacies 2 is generally less disturbed and provides longer, more intact sections within the liner with only minor biscuiting, rotation, and barreling (Figure 1.4.2). Lithofacies 3 is generally more disturbed with more frequent shearing and often flows around adjacent sections of lithofacies 2.

A summary of the grain size results from laser diffraction are shown in Figure 1.4.4.

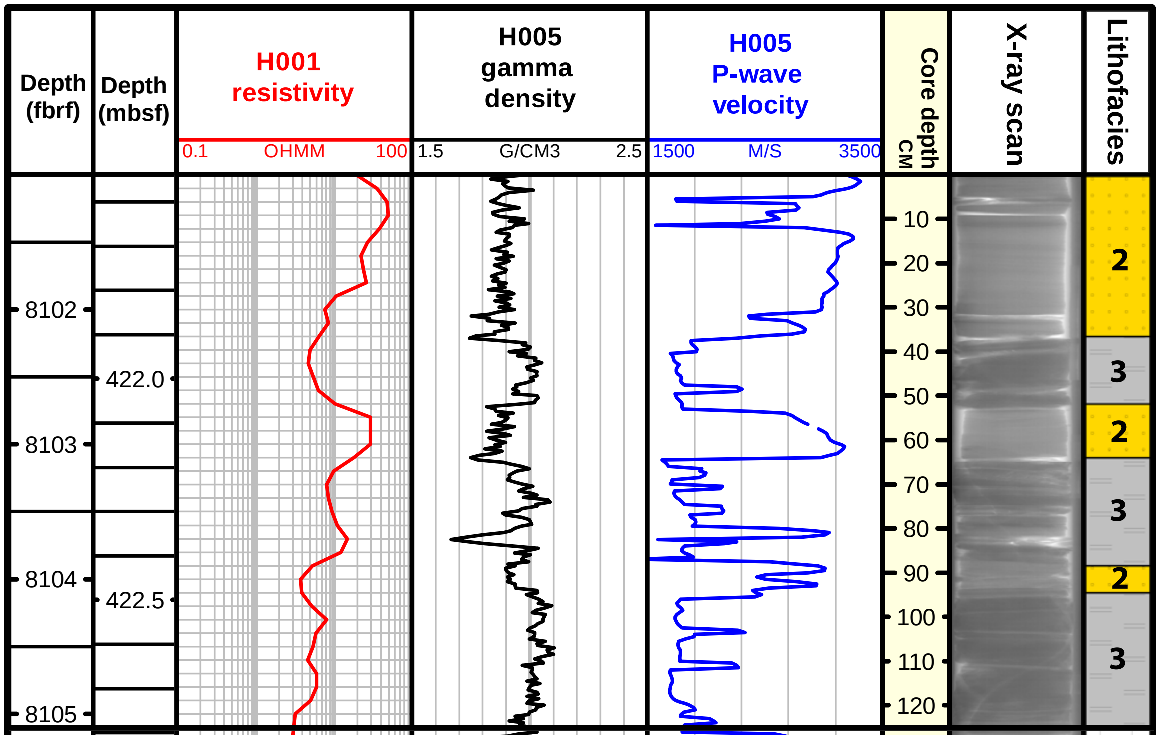

Figure 1.4.1 Example of interbedded lithofacies 2 and 3 from Core UT-GOM2-1-H005-4FB. The data shown here are downhole ring resistivity from GC955-H compared to the gamma density, P-wave velocity, and 2D X-ray scan from PCATS. Interpreted lithofacies on the right. Lighter intervals in the X-ray correspond to lower density and higher P-wave velocity. See Chapters 3 and 4, Section 2 Physical Properties and Core Transfer and Section 6 Lithostratigraphy for more information.

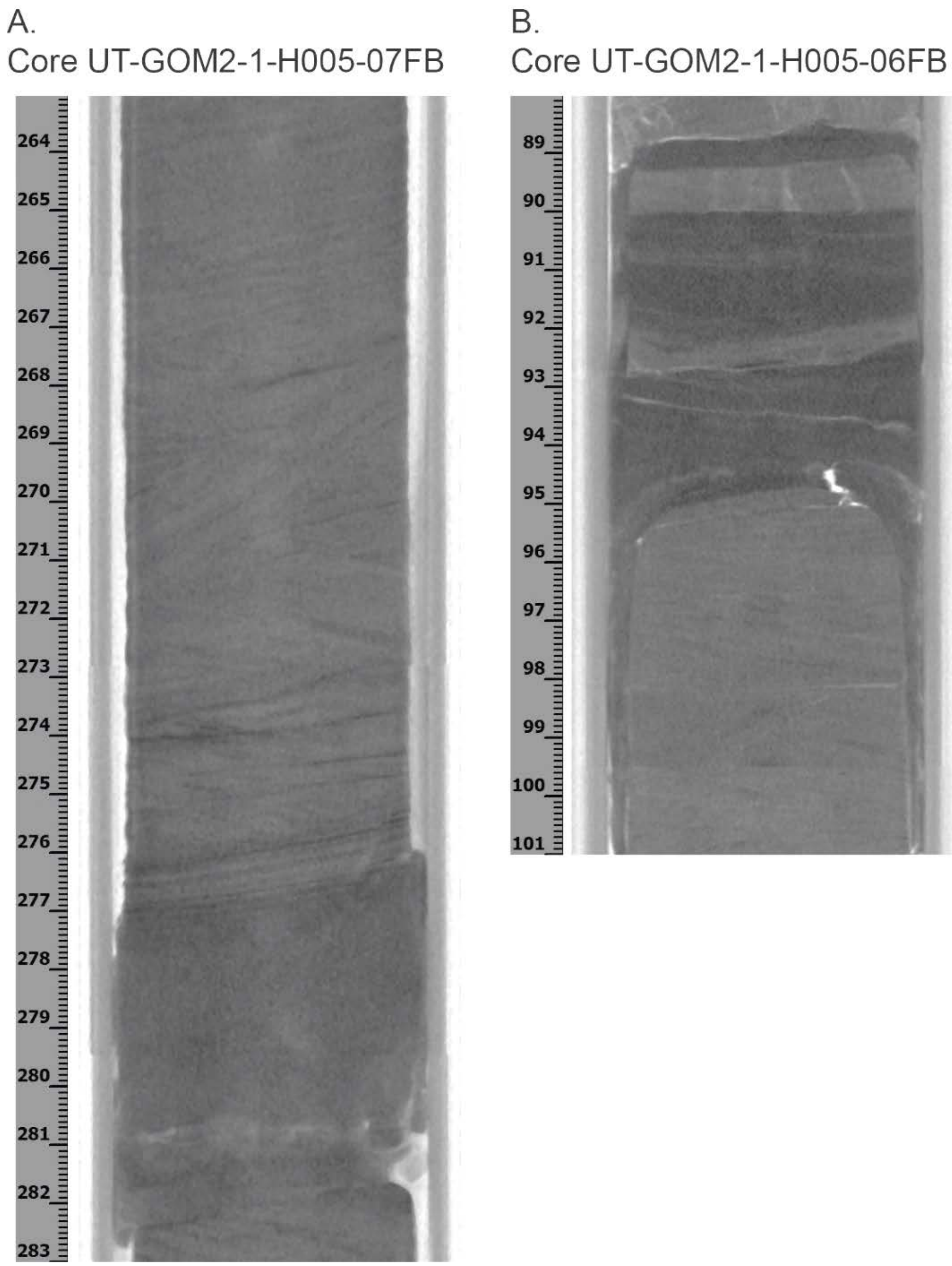

Figure 1.4.2 Two X-ray CT slab images from PCATS logging. A: Core UT-GOM2-1-H005-7FB showing lithofacies 2 (263-276 cm) with rippled cross-laminations and lithofacies 3 (276-283 cm). B: Core UT-GOM2-1-H005-6FB showing interbedded lithofacies 2 and 3. Lithofacies 2 shows a crisp cut of the formation with often a slight gap between the core and core liner, while lithofacies 3 often fills the entire core liner and flows around the edges of adjacent lithofacies 2 intervals. See Chapters 3 and 4, Section 2 Physical Properties and Core Transfer for more information. All H005 CT data can be found in the expedition data directory under H005 / Physical Properties.

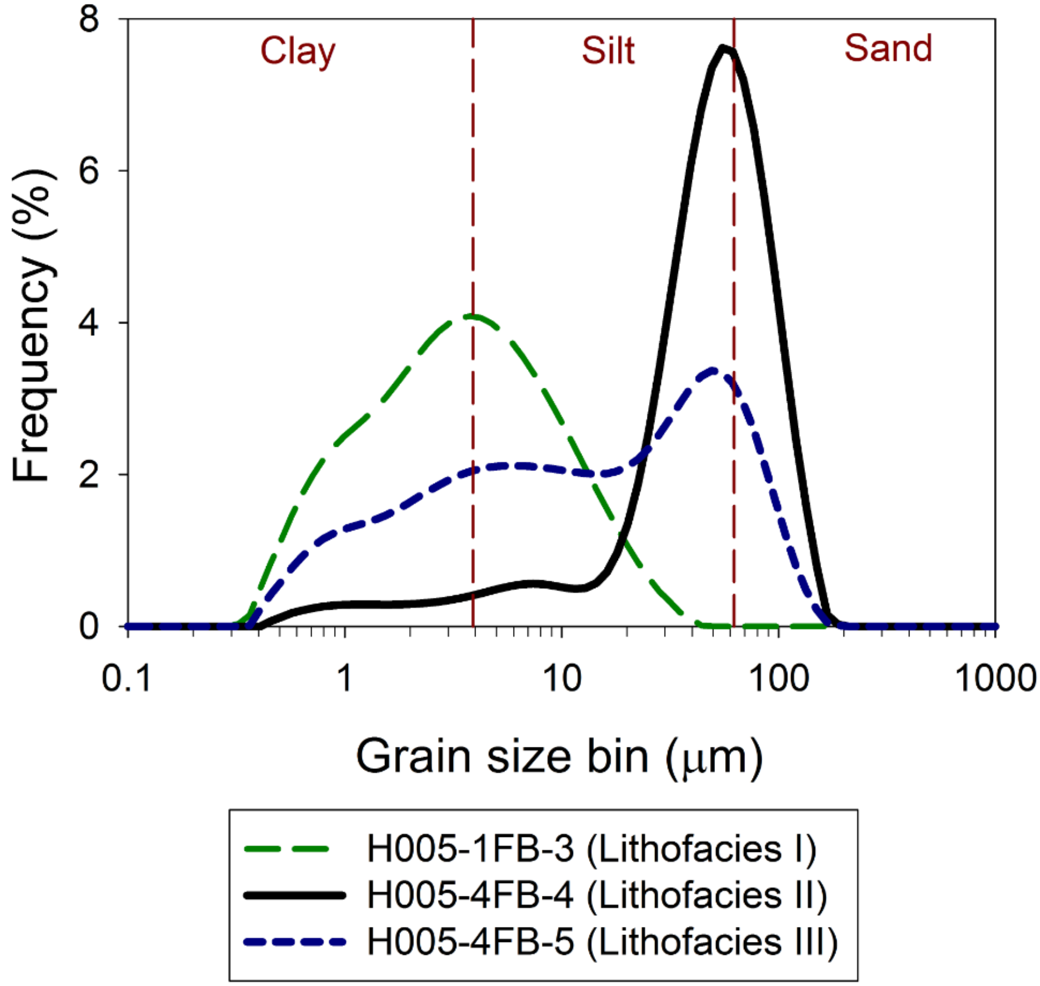

Figure 1.4.3 Grain size distributions analyzed with laser particle size analysis from samples from lithofacies 1, 2, and 3. See Chapters 3 and 4, Section 6 Lithostratigraphy for more information. All H005 Laser Diffraction Particle size data can be found in the expedition data directory under H005 / Lithostratigraphy / Grain size.

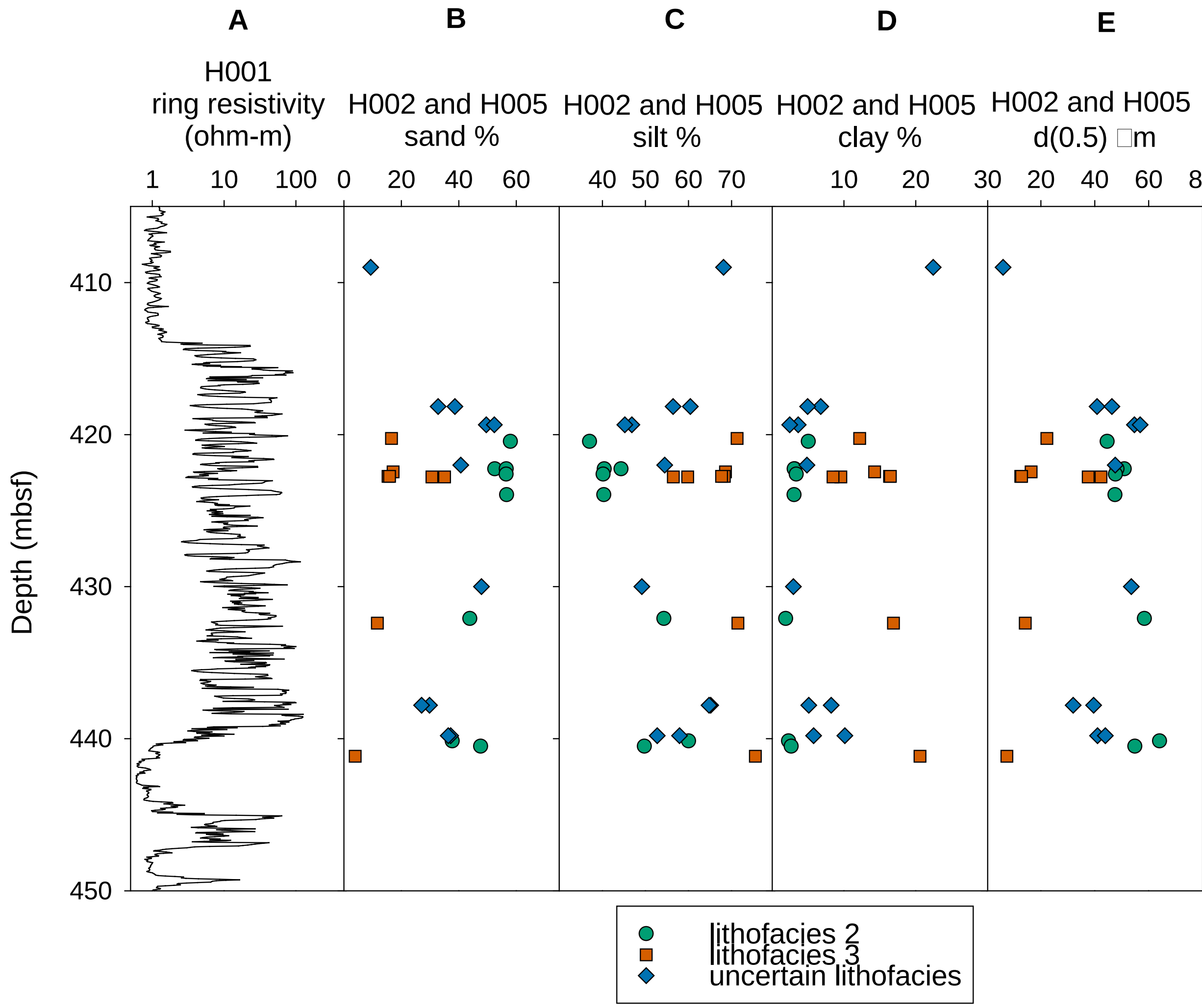

Figure 1.4.4 Grain size results from laser diffraction analysis in the hydrate-bearing interval at holes H002 and H005. Data from lithofacies 2, lithofacies 3, and unknown lithofacies samples. A) resistivity from H001 showing the hydrate-bearing interval, B) sand %, C) silt %, D) clay %, and E) median grain size d (0.5). See Chapters 3 and 4, Section 6 Lithostratigraphy for more information. All H005 Laser Diffraction Particle size data can be found in the expedition data directory under H002 / Lithostratigraphy / Grain size and H005 / Lithostratigraphy / Grain size.

1.4.2 Quantitative Degassing

Quantitative degassing experiments were performed separately on samples containing lithofacies 1, 2, and 3 (11 to 27 cm sections), as well as sections that contained mixtures of these lithofacies (10 to 120 cm sections). The total amount of gas and liquid released was recorded and the pressure continuously monitored. Between 0.3 and 123 L of gas was recovered during individual degassing experiments (Figure 1.4.5). Gas samples were analyzed over the course of each experiment and were composed of primarily methane with an average of 94 ppm ethane and detectable, but not quantifiable propane (< 10 ppm).

Hydrate saturations were calculated from the methane content, an assumption of 40% porosity based on LWD data (Collett et al., 2012), and an assumption that the core volume equals the internal volume of the core liner. Lithofacies 1 contains very low to no bulk hydrate saturation (<3%), lithofacies 2 contains very high bulk hydrate saturation (66-87%), and Lithofacies 3 contains moderately low hydrate bulk saturation (0.5-30%) (Figure 1.4.6 and Figure 1.4.7). As discussed, lithofacies 3 may contain interbedded thin sands/silts and muds. Thus, the local saturations in lithofacies 3 may differ from the bulk saturation. In particular, the sand/silt layers may contain a higher hydrate saturation and the mudstone may contain a lower (or no) hydrate saturation than the bulk saturation. Other degassing experiments contained multiple lithofacies (within cores UT-GOM2-1-H005-7FB, and -10FB) or uncertain facies (cores UT-GOM2-1-H005-9FB and -11FB). These mixed or uncertain lithofacies sections exhibit high hydrate saturations (47-77%).

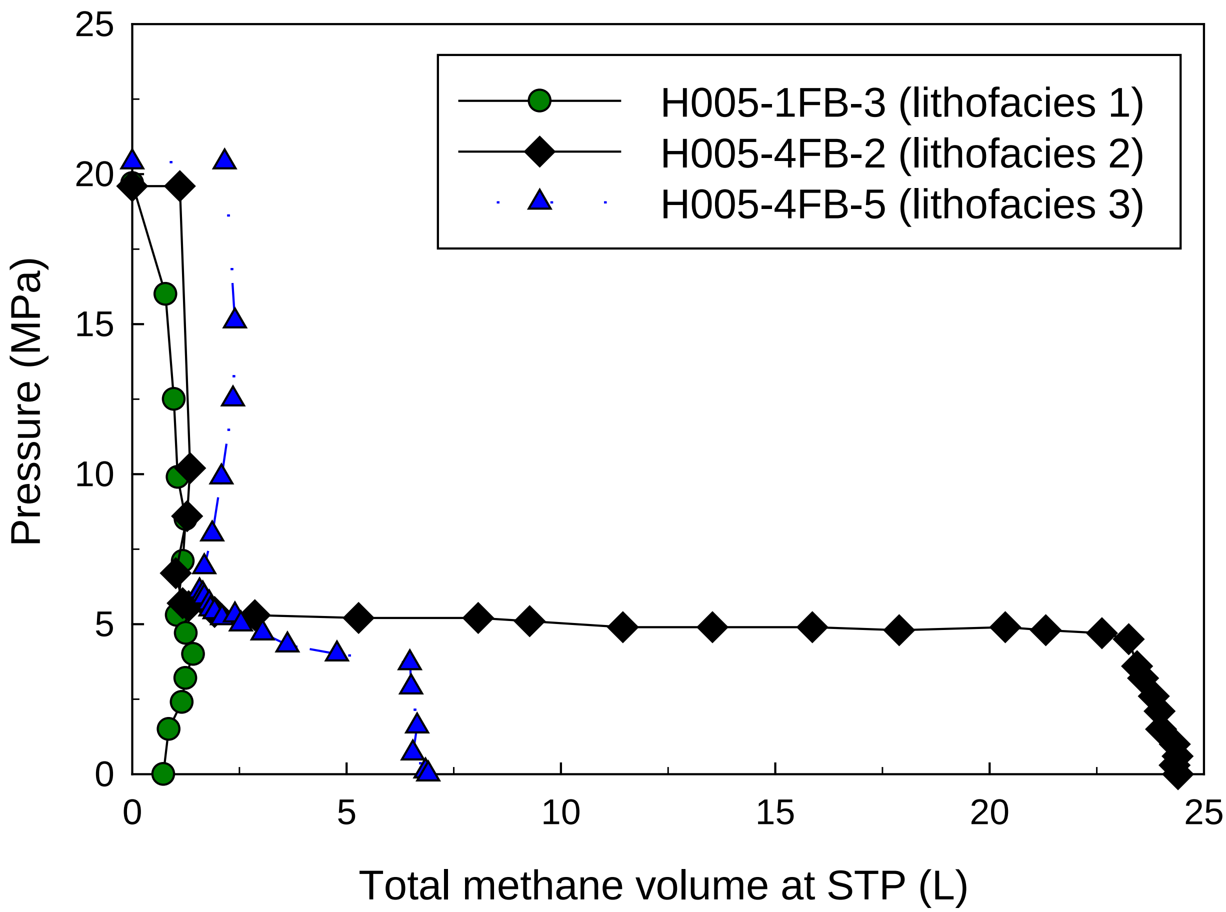

Figure 1.4.5 Example of methane volume versus pressure from three quantitative degassing experiments, each representing lithofacies 1, 2, and 3. Lithofacies 2 generally produced the most gas, followed by lithofacies 3, and the least in lithofacies 1. See Chapters 3 and 4, Section 5 Quantitative Degassing for more information. All H005 Quantitative Degassing data can be found in the expedition data directory under H005 / Quantitative Degassing.

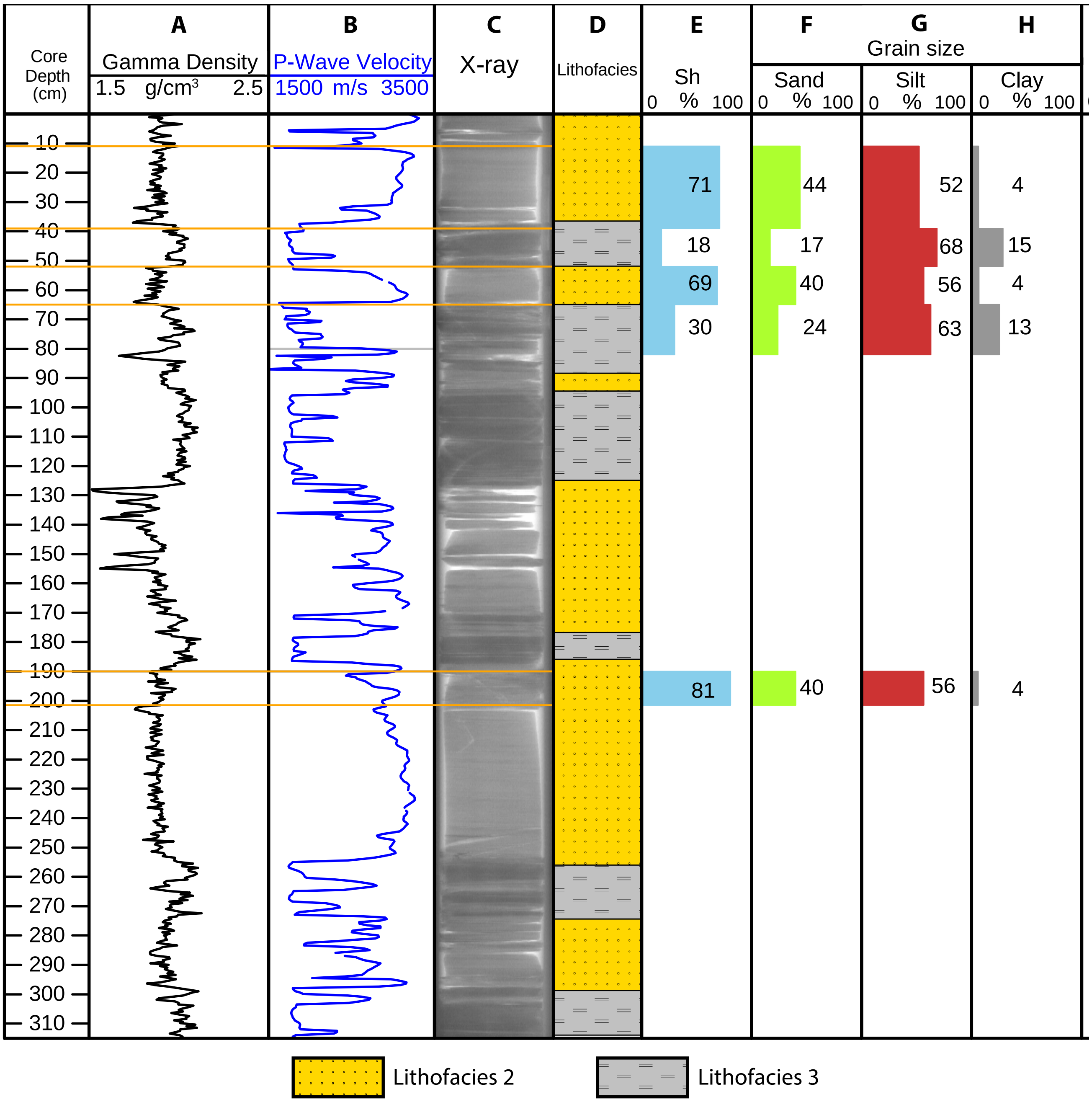

Figure 1.4.6 PCATS results with lithofacies-specific hydrate saturation (S_h) for core UT-GOM2-1-H005-4FB. See Chapters 3 and 4, Section 2 Physical Properties and Core Transfer and Section 6 Lithostratigraphy for more information. All H005 Physical property data can be found in the expedition data directory under H005 / Physical Properties.

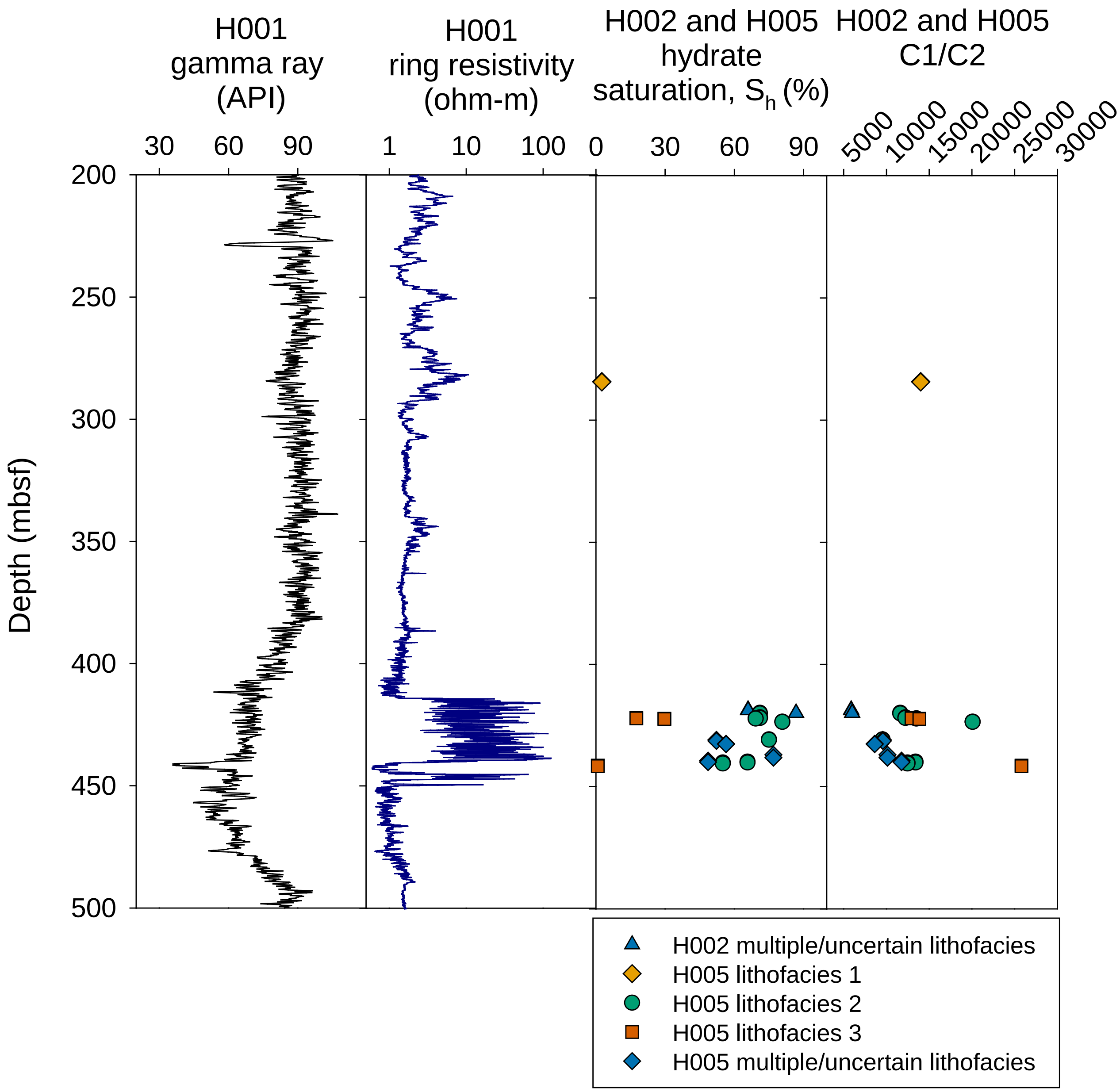

Figure 1.4.7 Down core variation in methane hydrate saturation (S_h) and the methane:ethane ratio (C1/C2) from H002 and H005 along with the gamma ray and ring resistivity data from H001 indicating the depth of the hydrate-bearing interval (Collett et al., 2012; Boswell et al., 2012). See Chapters 3 and 4 Section 5 Quantitative Degassing and Section 7 Geochemistry and Microbiology for more information. All H005 Gas Analysis data can be found in the expedition data directory under H005 / Geochemistry / Gas.

1.4.3 Geochemistry and Microbiology

Gases generated during quantitative degassing experiments were measured for C1 to C5 hydrocarbons. Methane was the primary hydrocarbon in all samples, with an average of 84 ppm ethane and detectable, but not quantifiable, propane. The amount of ethane in each sample varies as demonstrated by down core variation in the methane:ethane ratio (C1/C2) (Figure 1.4.7). Each sample contained on average 2.5 and 0.5% nitrogen and oxygen respectively from atmospheric contamination. Additional gas samples were collected for on shore stable isotopic and noble gas analysis.

Ten whole round core samples were collected for pore water chemistry and microbiological analyses. The pore water samples have been measured for salinity and major anions. Additional major and minor ions, water $\delta^{18}O$ and δD, ammonia, and dissolved organic carbon will be later analyzed. The microbial community will be characterized via 16S rRNA and DNA analyses. Drilling fluid and PCATS water samples were collected to characterize potential contamination. PCATS fluid was spiked with 10 ppm Cs to trace contamination from samples processed in PCATS and stored in storage vessels.

Within the main hydrate-bearing interval, the measured salinity is 8 to 54% of seawater, and chlorinity is similarly below seawater values (Figure 1.4.8). The presence of sulfate (11 to 42% of seawater) in pore waters from the main hydrate-bearing interval, at depths likely far below the sulfate-methane transition zone, suggests a moderate amount of contamination from the seawater-based drilling fluids in the silt-rich sediments (Figure 1.4.8). Salinity and chlorinity are closer to seawater values (80 and 92% respectively) in a pore water sample from lithofacies 1 sediments well above the hydrate-bearing interval (Figure 1.4.8). Sulfate in this sample is much lower (<2% of seawater) suggesting minimal drilling fluid contamination in these fine-grained sediments.

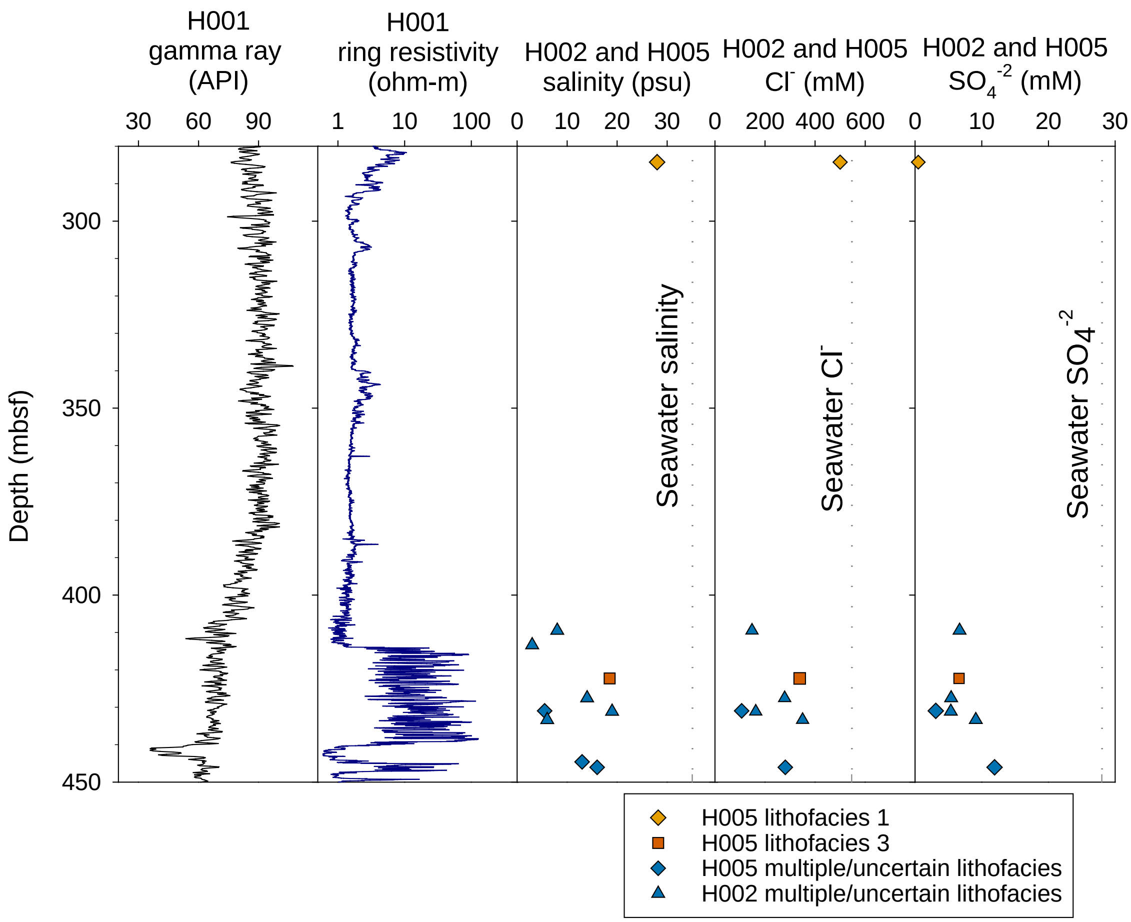

Figure 1.4.8 Down core variation in salinity, chloride concentration, and sulfate concentration from H002 and H005 along with the gamma ray and ring resistivity data from H001 indicating the depth of the hydrate-bearing interval See Chapters 3 and 4, Section 7 Geochemistry and Microbiology, for more information. All H005 Gas Analysis data can be found in the expedition data directory under H005 / Geochemistry / Gas.

1.4.4 Wireline logging

H002 was logged from 7680 to 8057 fbrf. Gamma ray and resistivity logs were generated for the logged interval. A potential bridge in the hole prevented logging below 8057 fbrf and therefore no logs were acquired through the hydrate-bearing coarse-grained section.

1.5 UT-GOM2-1 Expedition: Reporting

1.5.1 On-board Contractor and Scientific Daily Reports

Daily on-board contractor reporting during UT-GOM2-1 consisted of (1) Helix Drilling Reports, (2) *D/V Q4000* Bridge Reports – including POB report, (3) Weatherford Drilling/Coring Performance Reports, (4) Geotek Coring Reports, (5) Swaco Daily Drilling Fluids Report, (6) Schlumberger Services Completions (cementing) Report, (7) Schlumberger Wireline Services Daily Report, and the (8) UT Daily Operational and Science Reports (Appendix C.).

1.5.2 UT-GOM2-1 Expedition Report

UT-GOM2-1 participants have prepared additional chapters of this expedition report (Methods, H002, and H005) that have been released to the UT-GOM2-1 science party and will be released to the general public after the end of the moratorium on Oct 1, 2018. The chapters will include details on pressure coring, physical properties, quantitative degassing, Lithostratigraphy, geochemistry and wireline logging for each of the two holes. Additional findings are anticipated to be published together in a special journal of peer-reviewed papers as feasible.

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Appendix A. Post-Drill Operation Report and Daily Log

UT / DOE GOM^2 Marine Test Daily Log

Revision: 0 Date: 6 June 2017

Date	Time	Activity Description	Daily Log
20-Apr-17		UT representative arrives at Keppel AmFELS Shipyard in Brownsville, TX.	Shipyard work continued on the vessel (Q4000) in dry dock. Tom Pettigrew (Pettigrew Engineering/UT), Quentin Huggett (Geotek), Sally Huggett (Geotek, not sailing), Mike Mimitz (Geotek), Allan Bakken (Geotek), and Matt Selman (Geotek) arrived at the Kepple AmFELS shipyard in Brownsville, Texas. A shipyard briefing was given and then identification and gangway passes were issued. Vish Subramani (Helix) escorted the group to the Q4000 where a shipboard safety briefing was given as well as a tour of the vessel. Positions for the Geotek PCATS containers were laid out on deck. Electrical and air connections were located. Water connections are yet to be defined. Required lengths of utility hoses and cables was measured. The rig floor was inspected as well as the mouse hole locations, tuggers, etc. While sitting on the dock, the PCTB service van was opened and inspected, all was found to be as shipped. The DNV frame was located in another part of the shipyard and requested to be moved dockside.
21-Apr-17		Q4000 in dry dock, shipyard work continues.	Shipyard work continued on the vessel in dry dock. No shipments were received.
22-Apr-17		PCATS, PCTB, BHA components arrive dockside in Brownsville, TX	Shipyard work continued on the vessel in dry dock. All of the Geotek Pressure Core Analysis and Transfer System (PCATS) containers and all three lifting baskets, one from Austin and two from Houston arrived and were offloaded from their trucks to dockside. Helix requested a change in the PCATS container layout on deck. Geotek personnel boarded the Q4000 to confer on the changes.
23-Apr-17		Chillers, cold shuck arrive dockside in Brownsville, TX, chillers installed in DNV frame.	Shipyard work continued on the vessel in dry dock. Lifting basket contents were inventoried and required tubulars and subs were present. The chillers arrived late afternoon and were offload from the truck dockside.
24-Apr-17		Q4000 moved out of dry dock and tied up dockside.	Shipyard work continued on the vessel in dry dock. The chillers were installed in the DNV frame. Nitrogen bottles were secured in a rack. The revised deck layout for the PCATS containers was approved by both Helix and Geotek. At 0930 hrs. the dry dock began flooding in preparations for moving the Q4000 alongside the dock. The Q4000 was tied up dockside at 1700 hrs.
25-Apr-17		Q4000 shipyard work continues.	Shipyard work continued on the vessel dock side. Loading of the Geotek and UT equipment was discussed with Rig Superintendent.
26-Apr-17		Q4000 shipyard work continues.	Shipyard work continued on the vessel dock side.
27-Apr-17		Q4000 shipyard work continues.	Shipyard work continued on the vessel dock side. All Geotek personnel completed the SafeGulf course. Peter Polito (University of Texas at Austin (UT)), Steve Phillips (UT), Kevin Meazell (UT), and Tiannong Dong (UT) arrived.
28-Apr-17		Q4000 shipyard work continues.	Shipyard work continued on the vessel dock side. Additional UT personnel that arrived Thursday were given the shipyard safety briefing and issued identification and gangway passes. Peter Flemings (UT) arrived.
29-Apr-17		UT personnel board Q4000.	Shipyard work continued on the vessel dock side. Peter Flemings was given the shipyard safety briefing and issued identification and a gangway pass. All Geotek PCATS containers were loaded on board and positioned on deck. The lifting baskets from Houston were unloaded dockside and the contents loaded onboard the Q4000. All UT personnel move on board the Q4000 at 1600 hrs. and given the shipboard safety briefing.
30-Apr-17		Geotek personnel board Q4000.	UT and Geotek staff boarded the Q4000. All Geotek containers were loaded onto the vessel. Phone and internet connected to company man and the 3rd party offices. Representatives from UT, Geotek, Helix, Schlumberger, and Weatherford met to discuss the status/plans for rig floor and container operations going forward. These plans include utility connections to Geotek containers, grating installation, Schlumberger wireline rig up through the top drive, Weatherford instrumentation, and mouse-hole installation/modification. The current priority is for Helix to finish loading and load-testing before the above operations can continue.
1-May-17	0750	Begin transit to FMEA site.	At 0750hr the Q4000 left the dock at Brownsville, TX and was guided by the harbor pilot through the channel towards South Padre Island. At 1020hr the vessel entered the Gulf of Mexico, and continued offshore at 1105hr after the pilot disembarked. At 1300hr conducted fire drill. Geotek Coring gained access to clean freshwater for their core lab containers. Helix began required vessel sea trials by 2200hr.
	2200	Arrive FMEA site.	
2-May-17		Conduct sea trials, FMEA.	Helix continued to conduct required vessel sea trials. Geotek-Coring continued to prepare core lab containers (PCATS) for operations.
		Assemble and test PCATS.	
3-May-17		Conduct sea trials, FMEA.	Helix continued to conduct required vessel sea trials. Geotek-Coring continued to prepare core lab containers (PCATS) for operations.
		Assemble and test PCATS.	
4-May-17	1800	1 nmi off FMEA site, begin transit and lump sum mobilization.	Helix completed a crew change through the morning and afternoon with three helicopter flights. After transfers were complete, the Q4000 was de-ballasted and began to transit towards GC955. Helix began installing the grating around Geotek-Coring (PCATS) containers. Geotek-Coring continued to prepare core lab containers (PCATS) for operations.
		Rig Movement Notification submitted.	
		Geotek continued to organize and inventory their equipment.	
5-May-17		Underway for H002 site.	The Q4000 continued transit towards GC955 throughout the day. Grating was installed around Geotek Coring (PCATS) containers. UT, Helix, Geotek-Coring and all third parties participated in a pre-spud meeting to discuss the expedition objectives and the operational plan. Schlumberger and Helix worked on rigging up the wireline equipment through the top drive.
		Pre-spud meeting held.	
		Grating installed around Geotek's containers.	
		Geotek continuing to set up their equipment.	
		Rig up wireline equipment to/through top drive.	

6-May-17	1600	1 nmi off operations site.	The Q4000 arrived within 1 nmi of location of the GC955-H001 well at 1600hr after a 307 nmi transit. Schlumberger and Helix complete the rigging up the wireline equipment through the top drive. Geotek-Coring continued to prepare Geotek Coring (PCATS) containers and PCTB pressure core systems. The ROV was launched at 2040he to deploy four Compact transponders and survey the site area. The GC955-H001 well was found at 2247hr at a location of 27° 00.05126' N, 090° 25.58367' W in a WGS84 coordinate system. The borehole well head at the seafloor was intact and in good condition.
		Geotek continued to prepare their equipment.	
		Launch ROV, deploy transponders, conduct as-found survey.	
		Locate Hole H001 at 27° 00.05126' N, 090° 25.58367' W (WGS84).	
7-May-17	0230	M/V HOS Crockett arrived on site with equipment and mud from Fourchon, LA, begin offload.	Helix conducted a partial crew change via three helicopter flights. The supply boat *M/V HOS Crockett* was offloaded over most of the day; drilling mud, gel, and the mud lab were brought on board. The as-found ROV survey of the seafloor was completed. Geotek-Coring conducted trial PCTB core system runs in the Geotek Coring (PCATS) labs. Helix worked on installing the HVAC system for the mud pumps. Weatherford installed a new interface and software to monitor and record drilling and coring parameters.
		Crew change occurred via three helicopter flights.	
		Mud lab offloaded.	
		Completed as-found survey with the ROV.	
		Weatherford installed interface and software to record drilling parameters.	
8-May-17	1227	The M/V HOS Crockett departed.	Conducted fire/abandon ship drill at 0819hr. The supply boat M/V HOS Crockett materials transfer was completed and departed at 1227hr. The UT mud lab was placed into location on the deck of the Q4000 and hooked up to utilities. Helix finished installing the duct work for the mud pumps. Made up ~2300 ft of drill pipe between 1400-1930hr and then between 1940-2200hr pilled up and laid down pipe in doubles. Starting at 2015hr, Weatherford software began logging top drive data; allowing for the recording of all drilling parameters, except the stroke counter on the mud pumps. Helix performed pressure testing of the upper and lower IBOP valves and the wireline night cap starting at 2315hr.
		Spot mud lab, connect utilities.	
	1400-2200	Make up ~2300 ft of drill pipe and lay out in doubles.	
	2315	Begin pressure testing upper and lower IBOP valves and wireline night cap.	
9-May-17	0800	Complete pressure testing upper and lower IBOP valves and wireline night cap.	Conducted a series of three Shallow Flow Tests of the PCTB-CS pressure core system with the BHA hanging just below the sea surface. Preliminary analysis of data from Geotek instrumented core liner shows only small pressure differentials across the core liner during each of the three Shallow Flow Tests of the PCTB-CS. The instrumented core liner upon visual inspection did not exhibit any damage or deformation. The PCTB-CS Surface Pump Test revealed a potential problem associated with the use of the shipboard Hex mud pumps in that the pumps could not effectively work below a flow rate of about 125 GPM. It has been shown in the past that high mudflow rates, exceeding about 30 GPM, can cause severe borehole washouts and adversely affect core recovery. A decision was made to also test the use of the Schlumberger cement pumps to determine if lower mud pump rates could be established and maintained. As shown above, the cement pumps used during Surface Pump Test 3 was able to establish and maintain low flow rates in the range of 21-40 GPM. The current operational plan has been modified to include the use of the onboard cement pumps during planned pressure coring operations. There were three helicopter flights for crew change, and the remainder of the UT Science Party arrived at 1445hr and went through the safety orientation.
	0800	MU PCTB-CS OCBA for flow test.	
	1145	UT personnel board via helicopter from Houma, LA.	
	1230-1300	Space out with PCTB and instrumented core barrel	
	1621-1646 hr	Surface Pump Test 1 PCTB-CS	
	1653-1710 hr	Surface Pump Test 2 PCTB-CS	
	1953-2022 hr	Surface Pump Test 3 (cement pump) PCTB-CS	
	2130-2400	Space out cementing liner, center bit and PCTB-CS.	
10-May-17	0000-0215	MU PCTB-CS BHA.	Made-up and ran to the seafloor the BHA with drill collars and pipe reaching near the seafloor (6716 ft MD) at 2110hr and the Geotek instrumented core barrel was deployed in preparation for conducting a series of seafloor level flow tests. The first attempted Deep Flow Test was not completed because of an electrical problem associated with one of the ship's mud pumps. However, two additional seafloor pump tests were completed without any concerns. The flow tests also allowed for the analysis of the performance of all three pump units on the platform (i.e., Hex Pumps 1 and 2; and the Schlumberger cement pump). Analysis of data obtained from both the sea surface and seafloor flow tests documented only small pressure differentials across the core liner for all of the completed tests. In addition, the instrumented core liner was not damaged during any of the completed pump test. Modifications to the drilling fluid flow paths through the PCTB-CS appear to have significantly reduced the internal pressure conditions that have in the past resulted in the collapse of core liners within the PCTB-CS system. The pump tests also represented an excellent opportunity for Geotek-Coring and the Q4000 rig crew to become more familiar with operations and handling of the PCTB-CS pressure core system as deployed on this expedition.
	0215-1630	RIH w/ bit on drill pipe.	
	1630-1930	Change bails on TDS, stage PCTB-CS, RU wireline.	
	1930-2110	RIH w/ instrumented core barrel.	
	2110-2230	Seafloor Pump Test X PCTB-CS (incomplete test)	
		Using Hex Pump 2 switched to Hex Pump 1 (circulating seawater)	
	2230-2315	Seafloor Pump Test 1 PCTB-CS	
	2315-2400	Seafloor Pump Test 2 (cement pump) PCTB-CS	
	0912-1647	USCG inspection.	
11-May-17	0000-0100	Complete Seafloor Pump Test 2 (cement pump) PCTB-CS	At 0830hr spudded Hole UT-GOM2-1-H002 at 6667.0 ft (6719.0 ft RKB) and advanced hole to a depth of 8032.0 ft RKB (1313.0 fbsf) by midnight without any significant problems. Geotek-Coring completed preparations for coring operations and developed plans for simulated core runs to be conducted before reaching core point as planned for the morning of 12-May-17. The UT Scientific Party refined and finalized the Hole UT-GOM2-1-H002 core plan. The UT Scientific Party also continued to develop the core handling and processing plan. Based on (1) lateral correlation with seismic data from Hole GC955-H as drilled under the Gulf of Mexico Gas Hydrate Joint Industry Project Leg II (GOM JIP Leg II) in 2009 to the Hole UT-GOM2-1-H002 and (2) the seafloor depth at UT-GOM2-1-H002, the first pressure core point (Core UT-GOM2-1-H002-01) was set at 8062.0 ft RKB (1343.0 fbsf).
	0100-0500	POOH w/ instrumented core barrel.	
		RIH w/ center bit.	
	0500-0530	Test wireline night cap on TDS to 5000 psi	
	0530-0600	Held Spud meeting with all personnel involved	
	0600-0830	RIH w/ bit.	
	0630-0730	Move rig over H002 location.	
	0730-0830	Tag mudline at 6719.0 ft.	
	0830-2300	Spud Hole H002.	
		Drill 6719.0 ft to 8032.0 ft.	
	0856-1215	BSEE inspection (Inspectors Campo, Boudreaux, Fry, Shedd)	
	2300-2400	Circulate hole clean with 8.6 ppg mud	

12-May-17	0000-0030	Fill hole w/ 10.5 ppg WBM.	Performed a series of three simulated coring drill downs with the bit just off the bottom of the hole. Hole UT-GOM2-1-H002 was advanced from 8062 ft MD to 8092 ft MD with 3 PCTB-CS pressure cores (Core UT-GOM2-1-H002-01-CS, Core UT-GOM2-1-H002-02-CS, and Core UT-GOM2-1-H002-02-CS). **Conducted core run: Core UT-GOM2-1-H002-01CS.** Core barrel recovered on deck with ball valve closed but with little to no pressure in the autoclave. Core UT-GOM2-1-H002-01CS, which was the first core acquired during this expedition, recovered 2.3 ft (69 cm) of core in poor condition and failed to retain pressure. The deployment, cutting, and recovery of the core appeared to be conducted without any problems. We did not see any trouble with the latching of the tool or it's deployment in the pipe. But it took more than 6,000 lbs of pull to unlatch the tool from the BHA. The cutting of the core on bottom also appeared to be good with somewhat variable penetration rates and weight on bit. Upon recovery, the ball valve was closed but the pressure boost appeared not to have pressurized the autoclave below the new flow diverter set above the upper autoclave seal (polypack seals). Two additional PCTB-CS operational tests were conducted in the open drillpipe (while not in contact with the sediment) that appeared to confirm that there was some form of pressure block in the tool. **Conducted core run: Core UT-GOM2-1-H002-02CS.** When the tool was recovered on deck the ball valve was not closed; core liner visible through ball valve (no pressure). Core did not retract into the autoclave. The upper threaded connection of the liner to the top of the core plug was broken and the core catcher was damage indicating that the core likely jammed, which caused core milling and the breaking of the liner. It also took about a 6000 lb pull to unlatch the inner core barrel from with the BHA during the recovery of the core. A total of 5.3 ft (162 cm) of sediment was recovered. **Conducted core run: Core UT-GOM2-1-H002-03CS.** Upon recovery this core failed to hold pressure; however, it did return core to the surface. This failure of the core system to retain pressure was attributed to the fact that the retrieval of the inner core-barrel required a special procedure to release it form the latches in the BHA. We did not see any trouble with the deployment and latching of the tool before coring. The actual core cut event appeared to be good with somewhat variable penetration rates and weight on bit. However, at the end of the test the inner core-barrel was stuck in the BHA. The rig crew and Geotek staff core team managers worked with the Schlumberger wireline engineer for nearly four hours to unlatch the core barrel from the BHA. Eventually, the decision was made to use a special emergency release procedure that was successful but also prevents the ball-valve on the tool from closing. A total of 1.1 ft (33 cm) was recovered. The 'conventionalized' core material from each core was transferred to the UT mud lab whole rounds were subsampled and preserved for shore-based geochemistry, microbiology, and physical properties. Head space gas samples were sampled for shore-based analyses.
	0030-0230	Performed coring simulations drilling down: 8032 ft - 8042 ft, 8042 ft - 8052 ft, 8052 ft - 8062 ft.	
	0230-0330	Circulate hole clean.	
	0330-0730	POOH w/ center bit.	
		RIH w/ PCTB-CS.	
	0730-0900	Core H002-01, F/ 8062 ft T/ 8072 ft.	
	0900-0930	POOH w/ PCTB-CS (recovered 2.3 ft, 0 psi).	
	0930-1010	RIH w/ PCTB-CS for water core test 1.	
		POOH PCTB-CS (0 psi, boost failed).	
	1010-1230	RIH w/ PCTB-CS for water core test 2.	
		POOH w/ PCTB-CS (0 psi, boost failed).	
	1230-1830	RIH w/ PCTB-CS.	
		Circulate hole clean.	
	1830-1900	Core H002-02, F/ 8072 ft T/ 8082 ft.	
	1900-1945	POOH w/ PCTB-CS (recovered 5.3 ft, 0 psi) (liner did not retract preventing ball valve from closing.	
	1945-2230	RIH w/ PCTB-CS.	
		Circulate hole clean.	
	2230-2330	Core H002-03, F/ 8082 ft T/ 8092 ft.	
	2330-2400	RIH w/ pulling tool.	
13-May-17	0000-0400	PCTB-CS would not unlatch from the BHA.	Hole UT-GOM2-1-H002 was advanced from 8092 ft MD to 8112 ft MD with 2 PCTB-CS pressure cores (Core UT-GOM2-1-H002-04CS and Core UT-GOM2-1-H002-05CS). **Conducted core run: Core UT-GOM2-1-H002-04CS.** Core UT-GOM2-1-H002-04CS was recovered on deck with ball valve closed and at an internal autoclave pressure of 3372 psi, which was the first core acquired during this expedition at pressure. The deployment and recovery of the PCTB-CS core barrel was conducted without any problems. The cutting of the core at the bottom of the hole also appeared to be good with almost constant core penetration rates and weight on bit. Upon recovery, the PCTB-CS core barrel was placed in the vertical ice-shuck on the rig floor. The internal pressure of the PCTB-CS autoclave when received in the Geotech Coring Service Van measured 3372 psi, which is slightly less than the expected hydrostatic pressure at the depth of the cored reservoir section at this site. In the PCATS lab, an X-ray scan of the PCTB-CS autoclave revealed 4.6 ft (140 cm) section of sediment core and 4.0 ft (123 cm) sediment fill above the core rabbit, which indicates that formation sediment had been fluidized during coring and flowed up into the core liner through the small ports in the rabbit. **Conducted core run: Core UT-GOM2-1-H002-05CS.** For Core UT-GOM2-1-H002-05, the ball-valve failed to close or hold pressure; however, it did return core to the surface. For Core UT-GOM2-1-H002-05CS the tool was recovered to the rig floor with the ball-valve closed but not sealed. Silt and sand was found packed between the ball valve and seal; and the seal appeared to be damaged. We also had significant trouble unlatching this tool from the BHA during recovery, which may also have been caused by the impact of silt/sand on the operation of the latch system within the PCTB-CS BHA. Core UT-GOM2-1-H002-05CS did recover 3.1 ft (94 cm) of non-pressurized core that was transferred and processed through the onboard UT core processing lab.
		Pumped numerous mud sweeps and worked SLB slickline.	
		POOH w/ pulling tool, RIH w/ emergency pulling tool.	
	0345	POOH w/ PCTB-CS (recovered 1.1 ft, 0 psi).	
	0400-0630	RIH w/ PCTB-CS.	
	0630-0900	Pulling tool shear released PCTB.	
		POOH w/ pulling tool, RIH w/ emergency pulling tool.	
		POOH w/ PCTB-CS.	
	0900-1300	RIH w/ PCTB-CS.	
	1300-1330	Core H002-04, F/ 8092 ft T/ 8102 ft. MD: Recovered 4.6 ft, 3372 psi	
	1330-1530	POOH w/ PCTB-CS (recovered 4.6 ft, 3372 psi)	
	1530-1930	RIH w/ PCTB-CS.	
	1930-2000	Core H002-05, F/ 8102 ft T/ 8112 ft. MD: Recovered 3.1 ft, 0 psi	
	2000-2400	POOH w/ PCTB-CS (recovered 3.1 ft, 0 psi)	
	0540-1130	M/V Mr Steven arrive/departed location.	

14-May-17	0000-0200	RIH w/ PCTB-CS.	Hole UT-GOM2-1-H002 was advanced from 8112 ft RKB to 8142 ft RKB with 3 PCTB-CS pressure cores (Core UT-GOM2-1-H002-06CS, Core UT-GOM2-1-H002-07CS, Core UT-GOM2-1-H002-08CS). All three of the recovered PCTB-CS cores failed to hold pressure. **Conducted core run: Core UT-GOM2-1-H002-06CS**. For Core UT-GOM2-1-H002-06CS, the ball-valve closed, seal at top end of autoclave plug failed; however, it did return core to the surface. For Core UT-GOM2-1-H002-06 the tool was recovered to the rig floor with the ball-valve partially closed (not sealed). Silt and sand was found packed between the ball valve and seal. Core UT-GOM2-1-H002-06 recovered 5.2 ft (158 cm) of non-pressurized core that was transferred and processed through the onboard UT core processing lab. **Conducted core run: Core UT-GOM2-1-H002-07CS.** For Core UT-GOM2-1-H002-07CS, the ball-valve failed to close or hold pressure (displaced BV seal); however, it did return core to the surface. For Core UT-GOM2-1-H002-07 the tool was recovered to the rig floor with the ball-valve partially closed (not sealed). Silt and sand was found packed between the ball valve and seal. In addition, sediment was also found above the core rabbit in the PCTB-CS autoclave, indicating that formation sediment had been fluidized during coring and flowed up into the core liner through the small ports in the rabbit. Core UT-GOM2-1-H002-07 did recover 1.5 ft (46 cm) of non-pressurized core that was transferred and processed through the onboard UT core processing lab. **Conducted core run: Core UT-GOM2-1-H002-08CS.** For Core UT-GOM2-1-H002-08CS, the ball-valve failed to actuate or hold pressure. The ball-valve release sleeve (collett) failed by sliding over stop position, which resulted in the failure of the ball-valve to actuate. Core UT-GOM2-1-H002-08 did recover 4.6 ft (140 cm) of non-pressurized core that was transferred and processed through the onboard UT core processing lab. Hole UT-GOM2-1-H002 reached a TD of 8142 ft RKB (1423 fbsf) at 1630 hr with the recovery of Core UT-GOM2-1-H002-08, after which the hole was swept with 280 bbls of 10.5 ppg water-based mud in preparation for downhole wireline logging. The wireline logging tool string (including EDTC-HRLA-GPIT) was lowered to bottom of the hole, and two up hole log runs from 8045 ft RKB to 7680 ft RKB (Main Pass and Repeat Pass) were acquired without any problems. Because of borehole blockages, the wireline logging tool string could not pass below 8045 ft RKB and the BHA had been set back to a depth of 7680 ft RKB. **Wireline Logs: EDTC-HRLA-GPIT F/ 7680 ft RKB T/ 8045 ft RKB (Main Pass)**
	0200-0230	Core H002-06, F/ 8112 ft T/ 8122 ft. MD: Recovered 5.2 ft, 0 psi	
	0230-0315	POOH w/ PCTB-CS (recovered 5.2 ft, 0 psi).	
	0315-0730	RIH w/ PCTB-CS.	
	0730-0830	Core H002-07, F/ 8122 ft T/ 8132 ft. MD: Recovered 1.5 ft, 0	
	0830-0920	POOH w/ PCTB-CS (recovered 1.5 ft, 0 psi).	
	0920-1330	RIH w/ PCTB-CS.	
	1330-1400	Core H002-08, F/ 8132 ft T/ 8142 ft.	
	1400-1530	POOH w/ PCTB-CS (recovered 4.6 ft, 0 psi) (ball valve did not actuate).	
	1530-1630	Decision made to TD Hole H002 at 8142 ft.	
		Pumped 280 bbls of 10.5 ppg to sweep hole clean.	
	1630-1730	Rig up logging sheaves.	
	1730-1830	POOH w/ bit F/ 8142 ft T/ 7680 ft.	
	1830-2040	RU logging wireline through travel block and TDS	
		MU logging wireline packoff in TD	
		Terminate logging wireline cable head	
		MU logging tool string.	
	2040-2400	RIH w/ EDTC-HRLA-GPIT (logging tool string includes Induction Inclinometer).	
		Unable to pass 8045 ft.	
		Log up F/ 8045 ft T/ 7680 ft.	
		RIH w/ EDTC-HRLA-GPIT F/ 7680 ft T/ 8045 ft.	
		Log up F/ 8045 ft T/ 7680 ft.	
		Continue up hole log run to obtain seafloor log depth at 6704 ft.	
		POOH w/ logging tool string.	
15-May-17	0000-0130	Continue POOH w/ logging tool string.	Logging program in Hole UT-GOM2-1-H002 was completed with the acquisition of a main pass and repeat pass surveys (EDTC-HRLA-GPIT) over the depth interval from 7680 ft RKB to 8045 ft RKB. Hole UT-GOM2-1-H002 was abandoned with the emplacement of a 500 ft cement plug that was set above the hydrate interval to avoid any potential problem associated with hydrate dissociation that may be caused by the heat generated by cement hydration. The last half of the day dealt with preparations to move onto the location of Hole UT-GOM2-1-H005. Prepared and set cement plug in Hole UT-GOM2-1-H002 from a depth of 7900 ft RKB to 7400 ft RKB. Recovered PCTB-CS BHA to the ship and prepared to run the PCTB-FB version of the PCTB pressure core system.
		RD logging tools, wireline, and wireline sheaves	
	0130-0430	RIH w/ bit F/ 7680 ft T/ 8142 ft.	
		Spot 25 bbls 11.5 ppg Gel pad mud.	
		POOH w/ bit BHA F/ 8142 ft T/ 7900 ft.	
		Pump 200 bbls of 10.5 ppg WBM.	
		Drop cementing liner.	
	0430-1230	Pump 17 bbls gel spacer.	
		Drop Nerf ball, pump 3 bbls of 10.5 ppg spacer.	
		Pump 77 bbls 16.4 ppg cement.	
		Pump 17 bbls of gel spacer.	
		Displace drill string w/ 171 bbls of seawater.	
		POOH w/ bit F/ 7900 ft T/ 6611 ft.	
		Flush drill string w/ 350 bbls seawater and 2 nerf balls.	
		POOH w/ cementing liner.	
		Flush DS w/ 245 bbls of seawater.	
	1230-1825	POOH w/ bit	
		BO BHA (5 drill collars, 2 stabilizers, bit sub, bit) inspect for residual cement.	
	1825-2400	MU face bit OCBA.	
		Space out center bit, PCTB-FB, cementing liner.	
	2132	M/V Gerry Bordelon on location.	
16-May-17	0000-0330	Complete space out center bit, PCTB-FB, cementing liner.	Conducted three full function (water) tool tests of the PCTB-FB in the drill pipe as it was being deployed in preparation for drilling the next test hole in the project (Hole UT-GOM2-1-H005). To further test the engineering capability of the "face-bit" version of the PCTB pressure-coring tool, it was tested in three successive tests in which the configuration of the tool was not changed between each tests and the coring and core handling procedures were conducted in a similar fashion in each test. The tools as tested were all the face-bit cutting version of the PCTB, which is also known as the PCTB-FB. In each case the "flow diverter" in the pressure core barrel was sealed with an O-ring. These tests were all full function tests in that the PCTB-FB inner barrel was lowered into drill pipe on a slick line wire, (2) the PCTB-FB inner barrel was locked into the BHA, (3) the wireline "running in" tool was used to deploy the PCTB-FB inner barrel and the wireline "pulling" tool was used to recover the PCTB-FB inner barrel to the deck of the ship. Under normal operations, the pulling tool is deployed and latches into the PCTB-FB inner barrel in the BHA and when pulled by the slick line the ball-valve at the bottom of the PCTB-FB inner barrel closes, the upper valve on the tool closes, the entire inner core barrel unlatches from the BHA, and the onboard pressure boost system activates to maintain internal tool pressures during recovery.
	0210	Begin transferring 881 bbls 16.0 ppg WBM from M/V Gerry Bordelon.	
	0719	M/V Gerry Bordelon depart location.	
	0330-0800	MU PCTB-FB BHA	
		RIH w/ bit T/ 1090 ft.	
	0800-1000	RIH w/ PCTB-FB for water core test 3.	
		Circulate seawater at 2 bpm using Hex Pump 2	
		POOH w/ PCTB-FB.	
	1000-1200	RIH w/PCTB-FB for water core test 4.	
		Circulate seawater at 2 bpm using Hex Pump 2	
		POOH w/ PCTB-FB.	
	1200-1630	RIH w/ PCTB-FB for water core test 5.	
		Circulate seawater at 1.75 bpm using Hex Pump 2	
		POOH w/ PCTB-FB.	
	1630-1800	RIH w/ center bit.	
	1800-2400	RIH w/ bit F/ 1090 ft T/ 6700 (18 ft above sea floor).	
		Backload equipment to M/V Gerry Bordelon.	

17-May-17	0000-0124	Move rig over Hole H002.	Re-entered Hole UT-GOM2-1-H002 to tag and test cement plug, tagged top of cement plug at 6839 ft RKB. Set down 11000lbs on top of cement plug. D/S Q4000 was moved over proposed location of Hole UT-GOM2-1-H005. Hole UT-GOM2-1-H005 was spud at 6666.0 ft (6718.0 ft RKB) at 0230hr and advanced to the first core point at 7645 ft RKB. Acquired pressure core from a known fracture dominated hydrate-bearing section that overlies the hydrate-bearing sand-rich reservoir section that is the primary coring target at the Green Canyon 955 test site. **Conducted core run: Core UT-GOM2-1-H005-01FB.** The core throw for the 01 core was 10ft, but from drilling performance data it appeared that the core only cut about 5-6 ft of formation. On recovery, the ball valve was closed and the autoclave was conditioned in the cold shuck for 20 minutes before a pressure of 4115 psi was measured in the service van, indicating that the pressure boost had been retained. The autoclave was moved to PCATS for core handling and processing. The target depth for Core UT-GOM2-1-H005-01 was specifically selected to test the impact of mud-rich sediments on the PCTB-FB core system. A total of 7.1 ft (217 cm) of sediment was recovered.
		Reenter Hole H002.	
		RIH w/ bit, tag top of cement at 6839 ft, apply 11,000 lb WOB.	
		POOH w/ bit F/ 6839 ft T/ 6690 ft.	
		Weekly activity report end submitted.	
	0124-0230	Move rig over proposed Hole H005 location.	
		RIH w/ bit, tag mudline at 6718.0 ft.	
	0230-1330	Spud Hole H005.	
		Drill to 7654 ft.	
	1330-2230	POOH w/ center bit.	
		RIH w/ PCTB-FB.	
		PCTB-FB failed to land in BHA.	
		POOH w/PCTB-FB.	
		RIH w/ PCTB-FB.	
	2230-2330	Core H005-01, F/ 7645 ft T/ 7655 ft.	
		POOH w/ PCTB-FB (recovered 7.1 ft, 4115 psi).	
	2330-2400	RIH w/ center bit.	
18-May-17	0000-0625	Drill F/ 7655 ft T/ 8081 ft, w/ seawater and Hi vis sweeps every 2 doubles.	Continued drilling Hole UT-GOM2-1-H005 from 7655 ft RKB to 8081 ft RKB the depth of the next core point in the hole. Acquired and logged in PCATS Core UT-GOM2-1-H005-02FB and Core UT-GOM2-1-H005-03FB. These scans indicated high P-wave velocities consistent with hydrate at high-saturations. C**onducted core run: Core UT-GOM2-1-H005-02FB.** Successful coring run with clean pick up from BHA. On recovery the ball valve was closed and the autoclave was left in the cold shuck for 45 mins before a pressure of 2834 psi was measured in the service van, indicating that there was a very slight leak which was located around the ball valve. The autoclave pressure was increased to 4000 psi before being transferred to PCATS. A total of 4.9 ft (150 cm) of sediment was recovered. **Conducted core run: Core UT-GOM2-1-H005-03FB.** Another good coring run with clean pick up from BHA. On recovery the ball valve was closed and the autoclave was left in the cold shuck for 45 mins before a pressure of 1780 psi was measured in the service van indicating that there might be a slow leak. The autoclave was transferred to PCATS where pressure was increased to 4000 psi before core handling and processing. DST record showed that autoclave had fully sealed during recovery. A total of 10.0 ft (304 cm) of sediment was recovered.
	0625-1130	POOH w/ center bit.	
	1130-1200	RIH w/ PCTB-FB.	
	1200-1240	Core H005-02, F/ 8081 ft T/ 8091 ft.	
		POOH w/ PCTB-FB (recovered 4.9 ft, 2834 psi).	
	1240-1545	RIH w/ PCTB-FB.	
		Tag fill at 8086 ft.	
		POOH w/ PCTB-FB.	
	1545-1700	Pump 25 bbls gel sweep followed by 280 bbls seawater.	
	1700-1930	RIH with core barrel.	
	1930-2120	Core H005-03, F/ 8091 ft T/ 8101 ft.	
		POOH w/ PCTB-FB (recovered 10 ft, 1780 psi).	
	2120-2230	Circulated 25 bbls gel sweep followed by 128 bbls seawater.	
	2230-2400	Prepare to take core UT-GOM2-1-H005-04	
19-May-17	0000-0130	RIH w/ PCTB-FB.	Advanced Hole UT-GOM2-1-H005 from 8101 ft RKB to 8151 ft RKB with the acquisition of five pressure cores. **Conducted core run: Core UT-GOM2-1-H005-04FB.** On recovery the ball valve was closed and the autoclave was left in the cold shuck for 43 mins before a pressure of 3477 psi was measured in the service van indicating that the autoclave had sealed at in situ pressures. The autoclave was transferred to PCATS for core handling and processing. DST record showed that autoclave had fully sealed as it was lifted from the BHA. Core recovery 10.5 ft (321 cm) as measured by X-ray image in PCATS. **Conducted core run: Core UT-GOM2-1-H005-05FB.** On recovery the ball valve was closed and the autoclave was left in the cold shuck for 35 mins before a pressure of 3242 psi was measured in the service van indicating that the autoclave had sealed around the in situ pressure. The autoclave was transferred to PCATS for core handling and processing. Core recovery was 9.7 ft (296 cm) as measured by X-ray image in PCATS. **Conducted core run: Core UT-GOM2-1-H005-06FB.** Good coring run with clean pick up from BHA and a sea floor 'cooling stop' for 15 mins. On recovery the ball valve was closed and the autoclave was left in the cold shuck for 35 mins before a pressure of 3250 psi was measured in the service van indicating that the autoclave had sealed around the in situ pressure. The autoclave was transferred to PCATS for core handling and processing. Core recovery was 9.4 ft (286 cm) as measured by X-ray image in PCATS. **Conducted core run: Core UT-GOM2-1-H005-07FB.** Good coring run with clean pick up from BHA and a sea floor 'cooling stop' for 15 mins. On recovery the ball valve was closed and the autoclave was left in the cold shuck for 46 mins before a pressure of 3164 psi was measured in the service van indicating that the autoclave had sealed around the in situ pressure. The set pressure for this deployment was made at 3000 psi and consequently there was no boost. The autoclave was transferred to PCATS for core handling and processing. Core recovery was 10.5 ft (321 cm) as measured by X-ray image in PCATS. **Conducted core run: Core UT-GOM2-1-H005-08FB.** Switched from drilling with seawater to drilling with 9.5 lb/gal mud. Good coring run but the pick up from BHA took multiple efforts before it cane free. The tool was stopped at the sea floor (cooling stop) for 15 mins. On recovery the ball valve was closed and the autoclave was left in the cold shuck for 77 mins before a pressure of 3016 psi was measured in the service van indicating that the autoclave had sealed around the set pressure indicating that the accumulator boost may have assisted sealing the autoclave. The autoclave was transferred to PCATS for core handling and processing. Core recovery was 8.2 ft (250 cm) as measured by X-ray image in PCATS.
	0130-0330	Core H005-04, F/ 8101 ft T/ 8111 ft.	
		POOH w/ PCTB-FB (recovered 10.5 ft, 3477 psi).	
	0330-0400	Gel sweep followed by seawater.	
	0400-0630	RIH w/ PCTB-FB.	
	0630-0800	Core H005-05, F/ 8111 ft T/ 8121 ft.	
		POOH w/ PCTB-FB (recovered 9.7 ft, 3242 psi).	
	0800-0900	Gel sweep followed by seawater	
	0900-1100	RIH w/ PCTB-FB.	
	1100-1230	Core H005-06, F/ 8121 ft T/ 8131 ft.	
		POOH w/ PCTB-FB (recovered 9.4 ft, 3250 psi).	
	1230-1300	Gel sweep followed by seawater	
	1300-1500	RIH w/ PCTB-FB.	
	1500-1700	Core H005-07, F/ 8131 ft T/ 8141 ft.	
		POOH w/ PCTB-FB (recovered 10.5 ft, 3164 psi).	
	1700-1830	Displaced hole w/ 9.5 ppg WBM, begin pump and dump w/ 9.5 ppg WBM.	
	1830-2000	RIH w/ PCTB-FB.	
	2000-2400	Core H005-08, F/ 8141 ft T/ 8151 ft.	
		POOH w/ PCTB-FB (recovered 8.2 ft, 3016 psi).	

20-May-17	0000-0230	Re-headed slick line.	Advanced Hole UT-GOM2-1-H005 from 8151 ft RKB to 8185 ft RKB with the acquisition of four pressure cores. **Conducted core run: Core UT-GOM2-1-H005-09FB.** Good coring run with a clean pick-up from the BHA with a 15 minutes autoclave cooling stop at the sea bed to experiment with further cooling of the autoclave. On recovery the ball valve was closed and the autoclave was left in the cold shuck for 55 minutes before a pressure of only 746 psi was measured in the service van. On this occasion the set pressure was 4015 psi and hence the boost did not function as expected and there was no accumulator function. The pressure was pumped up to 3250 psi before being transferred to PCATS. The DST recordings showed that autoclave did not seal until it close at the surface and was probably aided by at least partial dissociation of gas hydrates. Core recovery was 8.9 ft (270 cm) as measured by the X-ray image in PCATS (includes a number of voids). **Conducted core run: Core UT-GOM2-1-H005-10FB.** During the coring the cement pumps (mud pumps) stopped temporarily (~30 sec). At approximately 5 ft into formation bit reached very high torque (as much as 30 klbs) and released, causing the drill string to spin in reverse momentarily. Coring was discontinued immediately at this point. On recovery, the ball valve was closed but there was an indication there may be a slight leak (which proved to be wrong) and hence the tool was moved quickly out of the cold shuck to the service van where the pressure was found to be 3255 psi. It was then placed in the cold bath before being transferred to PCATS. A total of 1.4 ft (44 cm) of sediment was recovered. **Conducted core run: Core UT-GOM2-1-H005-11FB.** After the difficulties experienced during the last coring run, the main objective of Core UT-GOM2-1-H005-11FB was to advance through what is interpreted on the logs as a water bearing zone before another short gas hydrate interval beneath it. Consequently the pump rates were increased significantly at the expense of the core quality to ensure that a clean hole was developed for the next core (Core UT-GOM2-1-H005-12FB) which is back in a gas hydrate interval. The tool was deployed in the BHA before a core was cut using the 10.5 lb/gal mud. After picking up from BHA and retrieving to the rig floor the ball valve was closed and the autoclave was left in the cold shuck for 45 minutes before a pressure of 3002 psi was measured in the service van. The autoclave was placed in the cold bath while PCATS was being prepared. A total of 0.9 ft (26 cm) of sediment was recovered. **Conducted core run: Core UT-GOM2-1-H005-12FB.** The tool was deployed in the BHA before a core was cut using the 10.5 lb/gal mud. Weight and torque came on bit 1 ft early (above core point) hence the run was stopped after a 9 ft advance. Generally a good coring run with clean a pick up from BHA, however on recovery the ball valve was only half closed trapping sediment in the ball follower and hence having zero pressure. Core barrel was over-filled, with rabbit against top plug and core material across the ball valve. Recovery was 5.4 ft (165 cm).
		RIH w/ PCTB-FB.	
	0230-0630	Core H005-09, F/ 8151 ft T/ 8161 ft.	
		POOH w/ PCTB-FB (recovered 8.9 ft, 746 psi).	
		Fill/sweep hole with 10.5 ppg mud, begin pump and dump w/ 10.5 ppg WBM.	
	0630-1030	RIH w/ PCTB-FB.	
		Failed to latch in BHA.	
		POOH w/ PCTB-FB, remove broken latch pin.	
		RIH w/ PCTB-FB.	
	1030-1200	Core H005-010, F/ 8161 ft T/ 8166 ft.	
		POOH w/ PCTB-FB (recovered 1.4 ft, 3255 psi).	
		Sweep hole with 10.5 ppg mud.	
	1501-1811	M/V Mr Steven arrive/departed location.	
	1200-1600	RIH w/ PCTB-FB.	
	1600-1730	Core H005-011, F/ 8166 ft T/ 8176 ft.	
		POOH w/ PCTB-FB (recovered 0.9 ft, 3002 psi).	
		Sweep hole with 10.5 ppg WBM.	
	1730-2000	RIH w/ PCTB-FB.	
	2000-2400	Core H005-012, F/ 8176 ft T/ 8185 ft (partial core to accommodate for fill).	
		POOH w/ PCTB-FB (recovered 5.4 ft, 0 psi).	
		Sweep hole with 10.5 ppg WBM.	
21-May-17	0000-0030	RIH w/ PCTB-FB.	Advanced Hole UT-GOM2-1-H005 to the total depth of the hole at 8193 ft with the acquisition of pressure core Core UT-GOM2-1-H005-13-FB. **Conducted core run: Core UT-GOM2-1-H005-13FB.** Before the deployment of the PCTB-FB inner core barrel, a 3/8 inch hole was drilled in the middle barrel and the set boost pressure was raised above the in situ pressure to ~4000 psi. This modification was designed to test whether the additional flow path would help create a boost pressure. Good coring run with a clean pick-up from the BHA with a 15 minutes autoclave cooling stop at the sea bed to experiment with further cooling of the autoclave. After picking up from BHA and retrieving to the rig floor the ball valve was closed and an autoclave pressure of 2806 psi was measured in the service van. The autoclave was placed in the cold bath while PCATS was being prepared. Core recovery was 5.8 ft (175 cm) as measured by the X-ray image in PCATS. Conduct two uphole directional gyroscopic surveys from the 8100 ft RKB to the seafloor. **Wireline Log: Gyroscopic directional survey F/ 8100 ft RKB T/ surface (Run-1)** **Wireline Log: Gyroscopic directional survey F/ 8100 ft RKB T/ surface (Run-2)** Hole UT-GOM2-1-H005 was abandoned with the emplacement of a 500 ft cement plug that was set above the hydrate interval to avoid any potential problem associated with hydrate dissociation. Prepared and set cement plug in Hole UT-GOM2-1-H005 from a depth of 7900 ft RKB to 7400 ft RKB.
	0030-0230	Core H005-013FB, F/ 8185 ft T/ 8193 ft (partial core to accommodate for fill).	
		POOH w/ PCTB-FB (recovered 5.8 ft, 2806 psi).	
	0230-0800	RIH w/ gyroscopic survey tool.	
		Conduct up hole survey F/ 8100 ft T/ seafloor.	
		POOH w/ gyroscopic survey tool.	
		Review data, determine 2nd run required.	
		RIH w/ gyroscopic survey tool.	
		Conduct up hole survey F/8100 ft T/ seafloor.	
		POOH w/ gyroscopic survey tool.	
	0800-0930	Spot 28 bbls 11.5 ppg high-viscosity pad mud in bottom of hole.	
		POOH w/ bit T/ 7900 ft.	
	0930-1230	Pump 17 bbls of 10.5 ppg gel spacer.	
		BO cement head and load nerf ball.	
		Pump 3 bbl of 10.5 ppg spacer.	
		Pump 54.7 bbls of 16.4 ppg cement.	
		Pump 6.7 bbl of 10.5 ppg gel spacer.	
		Displace drill string with 180.7 bbls of seawater.	
	1230-1830	POOH w/ bit F/ 7900 ft T/ 6600 ft.	
		Flush drill string w/ 350 bbls of seawater and 2 nerf balls.	
		Waiting on cement.	
	1830-2230	RIH w/ bit T/ 7621 ft, unable to tag cement.	
	2230-2400	POOH w/ bit T/ 6800 ft.	
		Waiting on cement	
		Rig Movement Notification submitted.	
22-May-17	0000-0900	POOH w/ bit T/ 6600 ft (above mudline).	Re-entered Hole UT-GOM2-1-H005 to tag and test cement plug, tagged top of cement plug at 7691 ft RKB. Set down 15000lbs on top of cement plug. Began to backload project equipment to the supply vessel *HOS Red Rock.* Decision was made to set additional cement ontop of existing cement plug in Hole UT-GOM2-1-H005; with BHA at 1691 ft RKB, pumped 58 bbls cement slurry and bbls tail spacer.
		Waiting on cement	
		Flush DP with 250 bbls of seawater.	
	0900-1100	RIH w/ bit, tag top of cement at 7691 ft, apply 15,000 lbs WOB.	
	1004	M/V Red Rock on location.	
	1100-1200	POOH w/ bit T/ 7172 ft.	
	1200-1230	POOH w/ bit T/ 6868 ft.	
	1230-1330	Circulate 300 bbls 10.5 ppg WBM.	
	1330-1600	Backload project equipment to HOS Red Rock	
	1600-1730	RIH w/ bit T/ 7691 ft, tag cement, POOH to 7686 ft.	
	1730-2130	Backload project equipment to HOS Red Rock	
	2130-2400	Pump 96 bbls of 10.5 ppg WBM.	
		Pump 17 bbls of 10.5 ppg spacer.	
		Drop Nerf ball, pump 3 bbls of 10.5 ppg spacer.	
		Pump 58 bbls 16.4 ppg cement.	
		Pump 17 bbls 10.5 ppg spacer.	

23-May-17	0000-0100	Continue pumping spacer.	Demobilization operations continued throughout the day with the transferee of equipment to to the supply vessel *HOS Red Rock.* Borehole cementing operations in Hole UT-GOM2-1-H005 was completed and the drill string was was recovered and laid down as singles.
	0100-0345	POOH w/ bit to 5976 ft.	
		Flush drill string w/ 400 bbls seawater.	
	0345-1140	RIH w/ bit to 6674 ft.	
		Waiting on approval from BSEE to abandoned hole w/o tagging cement.	
		Transfer 340 bbls of 16.0 ppg WBM to M/V Red Rock.	
		Backload equipment to M/V Red Rock.	
		Receive approval.	
	1200-1300	POOH w/ bit to 6100 ft laying down singles.	
	1300-1330	WOW (lightning in area).	
	1330-2400	POOH to BHA laying down singles.	
		Break down BHA.	
		Conduct as-left site survey w/ ROV.	
24-May-17	0000-1200	Continue breaking down BHA.	Demobilization operations continued throughout the day with the transferee of equipment to to the supply vessel HOS Red Rock, which departed location 2337hr. The drill string was was recovered and laid down as singles. Geotek personnel and UT representative depart rig via helicopter. Q4000 Rig moved 1 nmi off location by midnight, end of lump sum demobilization.
		Backload BHA and DP.	
	0730	UT personnel depart rig via helicopter.	
	1200-2200	Backload project equipment.	
		Recover transponders.	
	1330	Geotek personnel and UT representative depart rig via helicopter.	
	2200-2400	Rig 1 nmi off location, end of lump sum demobilization.	
	2337	M/V HOS Red Rock departed location.	
25-May-17	0000-1230	M/V HOS Red Rock transiting from GG955 to Port of Fourchon, LA.	In the last 24 hours, completed UT-GOM2-1 demobilization operations with the arrival and offloading of the *M/V HOS Red Rock* in the Port of Fourchon, LA (Intermoor facilities). The pressure core storage van was offloaded by 1500 hr. From power disconnect to power hookhoop the transfer of the pressure core sample van took only 15 minutes. Also today, the UT and Geotek technical team meant to review and finalize the pressure core-cut, sampling, and degassing plans to be conducted at the PCATS/UT labs in Fourchon.
	1230-1300	M/V HOS Red Rock arrives InterMoor dock/facilities.	
	1300-1500	Offload project equipment.	
		PCATS system transfer, with pressure cores.	
		UT core processing lab transfer.	
	1500-2400	Setup PCATS and UT core labs.	
		Weekly activity report submitted.	
26-May-17	0000-1100	Setup PCATS and UT core labs.	Setup of Geotek and UT labs at Intermoor were completed. UT continued to work on the expedition report, planning degassing activities, and preparing to ship geochemistry and microbiology samples. Geotek began PCATS scanning and cutting of Core UT-GOM2-1-H005-10FB.
	1100-2400	PCATS operation.	
27-May-17	0000-2400	PCATS and degassing operations.	Geotek worked on scanning and cutting of Cores UT-GOM2-1-H005-11FB and 04FB. Geotek/UT began quantitative degassing of two sections from Core UT-GOM2-1-H005-10FB.
	1000	Delivery of over pack container.	
28-May-17	0000-2400	PCATS and degassing operations	Geotek worked on scanning and cutting of Core UT-GOM2-1-H005-4FB and Core UT-GOM2-1-H005-5FB. Geotek worked on preparing the overpack unit for the first shipment of 1.2 m storage vessels to UT. UT finished quantitative degassing of two sections from Core UT-GOM2-1-H005-10FB and began quantitative degassing of 5 sections from Core UT-GOM2-1-H005-4FB, and completed one of these sections. Gases were sampled for post-cruise analysis and the remaining sediment after degassing was processed through the mud lab.
29-May-17	0000-2400	PCATS and degassing operations	Geotek worked on scanning and cutting of Core Core UT-GOM2-1-H005-5FB. It was determined that seals need to be purchased and replaced in PCATS and PCATS operation was paused. Geotek worked on preparing the overpack unit for the first of three shipments of storage vessels to Austin. The truck arrived and began transport with an expected arrival the next day 30 May 2017. UT finished quantitative degassing of two sections from Core UT-GOM2-1-H005-4FB and continued degassing two additional sections. Gases were sampled for post-cruise analysis and remaining sediment after degassing was processed through the mud lab.
	0000-1100	Preparation of over pack for shipping	
	1115	Over pack departure	
	1115-2400	PCATS and degassing operations	
30-May-17			
31-May-17		H002 and H005 end of operations reports submitted.	

Appendix B. UT Daily Operational and Science Reports

Daily Operational and Science Report
UT-GOM2-1: Hydrate Pressure Coring Expedition

1. DATE: 30-May-2017, 0000-2400hr

2. LOCATION:
0000-2400
Intermoor, Port Fourchon
540 Dudley Bernard Road
Fourchon, LA 70357

3. DESCRIPTION OF OPERATIONS:
0600-1200 Locate seals for PCATS in New Orleans
1400-1800 Replace seals in PCATS
1800-2400 PCATS operations
0000-2400 Ongoing degassing experiments

4. OPERATIONAL PLAN (Next 24 Hours):
Continue PCATS and degassing activities. Visit of DOE and UT personnel.

5. DOWNHOLE LOGGING OPERATIONS:
No additional log data were acquired over the last 24 hr.

6. CORE DATA:
No additional cores were acquired over the last 24 hr.

7. Science Activities
Geotek worked on obtaining and replacing seals for PCATS. UT continued quantitative degassing of two core sections UT-GOM2-1-H005-4FB-3 and -4, and began to measure samples for grain size analysis. UT continued to work on the expedition report. Back at UT, the first batch of pressure core storage vessels arrived at the UT Pressure Core Center at 0800 hr.

Daily Operational and Science Report
UT-GOM2-1: Hydrate Pressure Coring Expedition

1. DATE: 31-May-2017, 0000-2400hr

2. LOCATION:

0000-2400
Intermoor, Port Fourchon
540 Dudley Bernard Road
Fourchon, LA 70357

3. DESCRIPTION OF OPERATIONS:

0000-2400 PCATS and degassing operations

4. OPERATIONAL PLAN (Next 24 Hours):

Continue PCATS and degassing activities. Loading and departure of the second batch of pressure core storage vessels.

5. DOWNHOLE LOGGING OPERATIONS:

No additional log data were acquired over the last 24 hr.

6. CORE DATA:

No additional cores were acquired over the last 24 hr.

7. Science Activities

Geotek worked on scanning and cutting of Cores UT-GOM2-1-H005-7FB and -8FB. The overpack unit was returned to Fouchon from Austin after the first delivery of cores. Geotek worked on preparing the overpack unit for the second of three shipments of storage vessels to Austin. UT continued quantitative degassing of core sections UT-GOM2-1-H005-4FB-3 and -4, and made additional grain size measurements. UT continued to work on the expedition report. DOE and UT personnel arrived today for a tour of the labs and a discussion of expedition results. Junbong Jang from the USGS arrived and joined the science party.

Daily Operational and Science Report
UT-GOM2-1: Hydrate Pressure Coring Expedition

1. DATE: 23-May-2017, 0000-2400hr

2. LOCATION:

0000 – 2400 hr, 23-May-2017
Hole UT-GOM2-1-H005
Location: Lat: 27° 00.04665', Long: -90° 25.59125' (WGS 84)
Water depth: 6666.0 ft (6718.0 ft RKB)
Per Datum: RKB 52.0 ft above SL

3. DESCRIPTION OF OPERATIONS:

0000-0100	At Hole UT-GOM2-1-H005 Continue borehole cementing operations Cementer continued pumping 171.4 bbl of seawater
0100-0345	Cement in place ETOC 7391 ft RKB POOH F/7685 ft RKB T/5976 ft RKB BHA clear of seafloor Flushed drillstring with 400 bbls seawater
0345-11:39	RIH BHA F/5976 ft RKB T/6674 ft RKB Standby at 6674 ft RKB waiting on BSEE approval
11:39	Received BSEE approval to abandon Site 005 without tagging cement as per revised APM.
1200-1300	JSA with personnel involved in POOH POOH F/6674 ft RKB T/6100 ft RKB
1300-1330	Waiting on weather due to lightning
1330-2400	POOH F/6100 ft RKB T/203 ft RKB JSA for personnel involved in breaking down the BHA Continue to breakdown BHA

4. OPERATIONAL PLAN (Next 24 Hours):

Continue demobilization of project equipment and people from *D/V Q4000.*

5. DOWNHOLE LOGGING OPERATIONS:

No additional log data were acquired over the last 24 hr.

6. CORE DATA:

No additional cores were acquired over the last 24 hr.

7. Science Activities

Demobilization operations continued throughout the last 24 hours with the transfer of equipment to the *HOS Red Rock.* Borehole cementing operations in Hole UT-GOM2-1-H005 was completed.

Daily Operational and Science Report
UT-GOM2-1: Hydrate Pressure Coring Expedition

1. DATE: 24-May-2017, 0000-2400hr

2. LOCATION:

0000 – 2400 hr, 24-May-2017
Hole UT-GOM2-1-H005
Location: Lat: 27° 00.04665', Long: -90° 25.59125' (WGS 84)
Water depth: 6666.0 ft (6718.0 ft RKB)
Per Datum: RKB 52.0 ft above SL

3. DESCRIPTION OF OPERATIONS:

0000-1200	At Hole UT-GOM2-1-H005 JSA for personnel involved in breaking down the BHA Continue to breakdown BHA Backload BHA and DP
1200-2200	Backload project equipment to the *M/V HOS Red Rock* Recover compatts
2200-2400	D/V Q4000 moved to one mile off location *M/V HOS Red Rock* depart location **2400 hrs - End of Lump sum demobilization**

4. OPERATIONAL PLAN (Next 24 Hours):

Transfer project equipment and cores to the Port of Fourchon, LA via *M/V Red Rock*, ETA 1430 hrs on 5/25/17

5. DOWNHOLE LOGGING OPERATIONS:

No additional log data were acquired over the last 24 hr.

6. CORE DATA:

No additional cores were acquired over the last 24 hr.

7. Science Activities

Demobilization operations continued throughout the last 24 hours with the transfer of equipment to the *HOS Red Rock*, which departed location 2337hr.

Daily Operational and Science Report
UT-GOM2-1: Hydrate Pressure Coring Expedition

1. DATE: 25-May-2017, 0000-2400hr

2. LOCATION:
0000 – 1330 hr, 25-May-2017
***M/V HOS Red Rock* transiting from GG985 to the Port of Fourchon, LA**
1330 – 2400 hr, 25-May-2017
Intermoor, Port of Fourchon
540 Dudley Bernard Road
Fourchon, LA 70357

3. DESCRIPTION OF OPERATIONS:

0000-1230	*M/V HOS Red Rock* transiting from GG985 to Port of Fourchon, LA
1230-1300	Arrive Intermoor dock/facilities
1300-1500	Offload project equipment PCATS system transfer, with pressure cores UT core processing lab transfer
1500-2400	Setup PCATS and UT core labs

4. OPERATIONAL PLAN (Next 24 Hours):
Complete setup and PCATS/UT lab setup at Intermoor, begin processing pressure cores by about 1300 hr. Complete offloading of HOS Red Rock mud boat. Move HOS Red Rock to Francis Drilling Fluids (FDF) to offload the excess mud & cement followed by tank cleaning operations.

5. DOWNHOLE LOGGING OPERATIONS:
No additional log data were acquired over the last 24 hr.

6. CORE DATA:
No additional cores were acquired over the last 24 hr.

7. Science Activities
In the last 24 hours, completed UT-GOM2-1 demobilization operations with the arrival and offloading of the *M/V HOS Red Rock* in the Port of Fourchon, LA (Intermoor facilities). The pressure core storage van was offloaded by 1500 hr. From power disconnect to power hookhoop the transfer of the pressure core sample van took only 15 minutes. Also today, the UT and Geotek technical team met to review and finalize the pressure core cut, sampling, and degassing plans to be conducted at the PCATS/UT labs in Fourchon.

Daily Operational and Science Report
UT-GOM2-1: Hydrate Pressure Coring Expedition

1. DATE: 26-May-2017, 0000-2400hr

2. LOCATION:
0000-2400
Intermoor, Port of Fourchon
540 Dudley Bernard Road
Fourchon, LA 70357

3. DESCRIPTION OF OPERATIONS:
0000-1100 Setup PCATS and UT core labs
1100-2400 PCATS operation

4. OPERATIONAL PLAN (Next 24 Hours):
Continue PCATS and degassing activities.

5. DOWNHOLE LOGGING OPERATIONS:
No additional log data were acquired over the last 24 hr.

6. CORE DATA:
No additional cores were acquired over the last 24 hr.

7. Science Activities
Setup of Geotek and UT labs at Intermoor were completed. UT continued to work on the expedition report, planning degassing activities, and preparing to ship geochemistry and microbiology samples. Geotek began PCATS scanning and cutting of Core UT-GOM2-1-H005-10FB.

Daily Operational and Science Report
UT-GOM2-1: Hydrate Pressure Coring Expedition

1. DATE: 27-May-2017, 0000-2400hr

2. LOCATION:
0000-2400
Intermoor, Port of Fourchon
540 Dudley Bernard Road
Fourchon, LA 70357

3. DESCRIPTION OF OPERATIONS:
0000-2400 PCATS and degassing operations
1000 Delivery of overpack container

4. OPERATIONAL PLAN (Next 24 Hours):
Continue PCATS and degassing activities.

5. DOWNHOLE LOGGING OPERATIONS:
No additional log data were acquired over the last 24 hr.

6. CORE DATA:
No additional cores were acquired over the last 24 hr.

7. Science Activities
Geotek worked on scanning and cutting of Cores UT-GOM2-1-H005-11FB and 04FB. Geotek/UT began quantitative degassing of two sections from Core UT-GOM2-1-H005-10FB. UT continued to work on the expedition report.

Daily Operational and Science Report
UT-GOM2-1: Hydrate Pressure Coring Expedition

1. DATE: 28-May-2017, 0000-2400hr

2. LOCATION:
0000-2400
Intermoor, Port Fourchon
540 Dudley Bernard Road
Fourchon, LA 70357

3. DESCRIPTION OF OPERATIONS:
0000-2400 PCATS and degassing operations

4. OPERATIONAL PLAN (Next 24 Hours):
Continue PCATS and degassing activities.

5. DOWNHOLE LOGGING OPERATIONS:
No additional log data were acquired over the last 24 hr.

6. CORE DATA:
No additional cores were acquired over the last 24 hr.

7. Science Activities
Geotek worked on scanning and cutting of Cores UT-GOM2-1-H005-4FB and -5FB. Geotek worked on preparing the overpack unit for the first shipment of 1.2 m storage vessels to UT. UT finished quantitative degassing of core sections UT-GOM2-1-H005-10FB-2 and -3, and began quantitative degassing core sections UT-GOM2-1-H005-4FB-2, -3, -4, -5, and -7, completing section UT-GOM2-1-H005-4FB-5. Gases were sampled for post-cruise analysis and the remaining sediment after degassing was processed through the mud lab. UT continued to work on the expedition report.

Daily Operational and Science Report
UT-GOM2-1: Hydrate Pressure Coring Expedition

1. DATE: 29-May-2017, 0000-2400hr

2. LOCATION:

0000-2400
Intermoor, Port Fourchon
540 Dudley Bernard Road
Fourchon, LA 70357

3. DESCRIPTION OF OPERATIONS:

0000-2400 PCATS and degassing operations
0000-1100 Preparation of overpack for shipping
1115 Overpack departure

4. OPERATIONAL PLAN (Next 24 Hours):

Continue PCATS and degassing activities.

5. DOWNHOLE LOGGING OPERATIONS:

No additional log data were acquired over the last 24 hr.

6. CORE DATA:

No additional cores were acquired over the last 24 hr.

7. Science Activities

Geotek worked on scanning and cutting of Core UT-GOM2-1-H005-5FB. It was determined that seals need to be purchased and replaced in PCATS and PCATS operation was paused. Geotek worked on preparing the overpack unit for the first of three shipments of storage vessels to Austin. The truck arrived in Fourchon and began transport with an expected arrival in Austin the next day 30 May 2017. UT finished quantitative degassing of core sections UT-GOM2-1-H005-4FB-2 and -7, while continuing to degas core sections UT-GOM2-1-H005-4FB-3 and -4. Gases were sampled for post-cruise analysis and remaining sediment after degassing was processed through the mud lab. UT continued to work on the expedition report.

2230-2400 POOH BHA F/7621 ft RKB T/6800 ft RKB
Waiting on cement

4. OPERATIONAL PLAN (Next 24 Hours):

Complete P&A operations in Hole UT-GOM2-1-H005. Begin demobilization of project equipment and people from *D/V Q4000.*

5. DOWNHOLE LOGGING OPERATIONS:

Wireline Log: Gyroscopic directional survey F/8100 ft RKB T/surface (Run-1)
Wireline Log: Gyroscopic directional survey F/8100 ft RKB T/surface (Run-2)

6. CORE DATA:

PCTB-FB Coring (pressure coring) Totals: 1 core, 8 ft cored; 5.8 ft recovery.

Core UT-GOM2-1-H005-13FB
F/8185 ft RKB T/8193 ft RKB: Recovered: 5.8 ft, 2806 psi
Performed coring operations F/8185 ft RKB T/8193 ft RKB
Drilling/Coring Parameters: 60 RPM w/2-5 K lb torque and Cement Pump circulating 10.5 ppg WBM at 61-105 gpm, ROP 34 ft/hr, WOB 4 tons, with O-ring seals in the diverter.

Before the deployment of the PCTB-FB inner core barrel, a 3/8 inch hole was drilled in the middle barrel and the set boost pressure was raised above the in situ pressure to ~4000 psi. This modification was designed to test whether the additional flow path would help create a boost pressure. Good coring run with a clean pick-up from the BHA with a 15 minutes autoclave cooling stop at the sea bed to experiment with further cooling of the autoclave. After picking up from BHA and retrieving to the rig floor the ball valve was closed and an autoclave pressure of 2806 psi was measured in the service van. The autoclave was placed in the cold bath while PCATS was being prepared. Core recovery was 5.8 ft (177 cm) as measured by the X-ray image in PCATS.

7. Science Activities

The onboard Scientific Party continued to process data and write reports from Holes UT-GOM2-1-H002 and UT-GOM2-1-H005. In the Geotek degassing lab, the controlled degassing of Sections 1 and 3 from Core UT-GOM2-1-H005-09FB were completed, chambers were emptied and cleaned, and the sediment residues were provided to UT for curation. Conventionalized core from UT-GOM2-1H005-12FB was sampled by UT for geochemistry, microbiology, and physical properties. After the early difficulties extracting Core UT-GOM2-1-H005-10FB from the autoclave in PCATS, a core 'fishing tool' was manufactured and the core was recovered with a length of 2.4 ft (72 cm). This included 2 pieces of core which are interpreted as gas hydrate rich with P-wave velocities over 3000 m/s; this sample was stored in a storage chamber. Core UT-GOM2-1-H005-13FB, after waiting for a while in the cold bath, the core was extracted in PCATS where the recorded recovery was 5.8 ft (176 cm); this core also produced some high quality samples consisting of what is interpreted as interbedded gas hydrate saturated sandy intervals with P-wave velocities up to 3300 m/s. PCATS scans of Core UT-GOM2-1-H005-11FB revealed only 0.9

(27 cm) of washed sediments, which is not a surprise considering the high pump rates required to safely penetrate this apparent unconsolidated water-wet stratigraphic section.

Daily Operational and Science Report
UT-GOM2-1: Hydrate Pressure Coring Expedition

1. DATE: 22-May-2017, 0000-2400hr

2. LOCATION:

0000 – 2400 hr, 22-May-2017
Hole UT-GOM2-1-H005
Location: Lat: 27° 00.04665', Long: -90° 25.59125' (WGS 84)
Water depth: 6666.0 ft (6718.0 ft RKB)
Per Datum: RKB 52.0 ft above SL

3. DESCRIPTION OF OPERATIONS:

0000-0900	At Hole UT-GOM2-1-H005 Continue borehole cementing operation POOH BHA above mudline F/6800 ft RKB T/6600 ft RKB Waiting on cement Flush DP with 250 bbls of seawater
0900-1100	RIH BHA F/6600 ft RKB T/7691 ft RKB Tagged Top of Cement and set down at 15K WOB
1100-1200	POOH BHA F/7691 ft RKB T/7172 ft RKB
1200-1230	POOH BHA F/7172 ft RKB T/6868 ft RKB
1230-1330	Circulate 10.5 ppg WBM – 300 bbls
1330-1600	Backload project equipment to HOS Red Rock
1600-1730	RIH BHA F/6868 ft RKB T/7691 ft RKB Tagged Top of Cement and PU 5 ft
1730-2130	Backload project equipment to HOS Red Rock
2130-2200	JSA with personnel involved with performing cement job
2200-2400	Pumped 96 bbls of 10.5 ppg WBM Cementer performed pressure test of deck iron to 3,000 psi visual Cementer pumped 17 bbls of 10.5 ppg spacer at 4 bpm Nerf ball in DP and cementer pumped 3 bbls of 10.5 ppg spacer Cementer cleaned cement unit and caught mix water Cementer mixed 16.4 ppg class H cement Cementer pumped 58 bbls cement slurry Cementer pumped 17 bbls tail spacer

4. OPERATIONAL PLAN (Next 24 Hours):

Complete P&A operations in Hole UT-GOM2-1-H005. Continue demobilization of project equipment and people from *D/V Q4000.*

5. DOWNHOLE LOGGING OPERATIONS:

No additional log data were acquired over the last 24 hr.

6. CORE DATA:

No additional cores were acquired over the last 24 hr.

7. Science Activities

The boarding of University of Texas scientists on the *D/V Q4000* more than 23 days ago in Brownsville, Texas not only marked the start of the "UT-GOM2-1: Hydrate Pressure Coring Expedition," it also represented a critical milestone in the engineering and scientific research needed to understanding the role that gas hydrates map play as a potential energy resource, as a geohazard, or as an agent of climate change. The primary goal of UT-GOM2-1 expedition is to conduct a systematic and rigorous field marine test of the DOE Pressure Coring Tool with Ball Valve (PCTB) system. The UT-GOM2-1 expedition has featured the test of two unique designs of the PCTB system, often referred to the cutting shoe (CS) and face bit (FB) versions. Hole UT-GOM2-1-H002, which was spud on 11-May-17 and completed on 17-May-17, featured the test of the PCTB-CS tool through a series of flow and full-function tests in the drill pipe as it was suspended from the drilling vessel. PCTB-CS tool was also deployed a total of 8 times with only one of the deployments returning a pressurized core to the ship. However, all 8 of the PCTB-CS deployments recovered sediment cores (see below the composite well log and core recovery display for Hole UT-GOM2-1-H002). Hole UT-GOM2-1-H005, which was spud on 17-May-17 and completed on 23-May-17, featured the test of the PCTB-FB tool. The testing plan for Hole UT-GOM2-1-H005 also included a series of full-function tests of the PCTB-FB tool in the drill pipe. The PCTB-FB was deployed a total of 13 times and returned to the ship 12 cores under pressurized conditions. As shown below in the composite well log and core recovery displays for Hole UT-GOM2-1-H005, the core recovery for most of the runs was very high and for the most part the entire gas hydrate-bearing reservoir section was sampled with the PCTB-FB pressure core system.

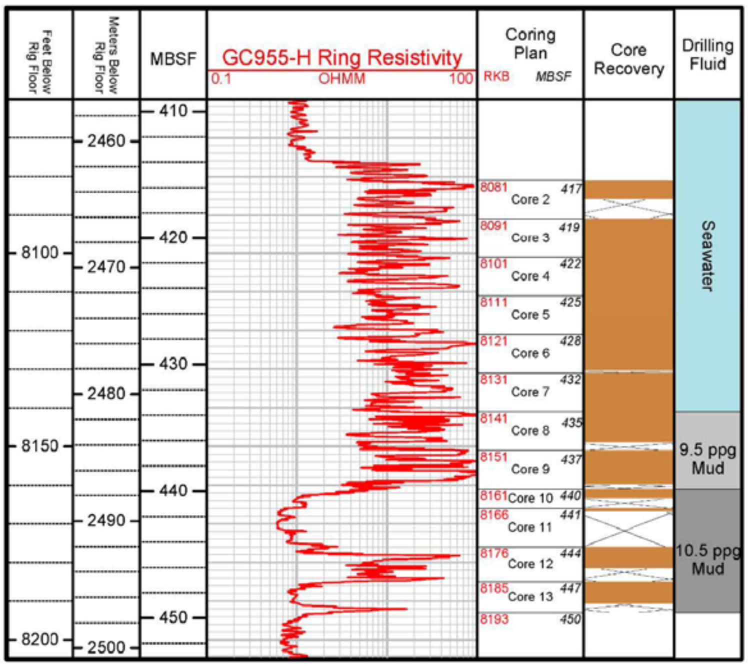
All of the cores recovered at pressure during UT-GOM2 have been processed through the onboard Geotek Pressure Core Analysis and Transfer System (PCATS) lab to perform a preliminary characterization of the cores. These core studies have included core logging of physical properties and X-ray imaging of the recovered cores. The PCATS has also been used to subsample a portion of the recovered pressure cores under conditions where hydrates are stable. The PCATS system has also been used to transfer some number of samples to pressurized storage chambers. A limited number of subsamples have undergone quantitative degassing to determine hydrate concentrations.

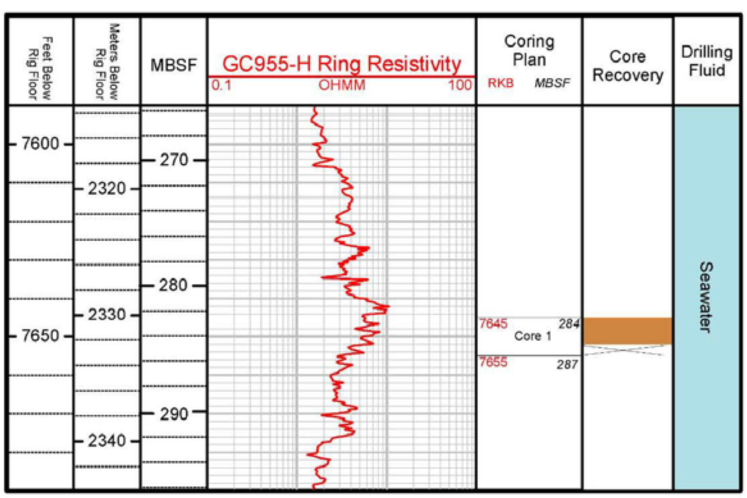
With the approaching end of the UT-GOM2-1 expedition, we now see the transition to the next and equally challenging stage of this project with the transfer of recovered and preserved pressure core samples to the UT shore-based pressure core laboratory that will be established in the Port Fourchon, Louisiana. PCATS data is now being interpreted in preparation for generating core cut plans for the work at the port. It is expected that the pressure core processing laboratory in Port Fourchon will be operational for about two weeks, after which approximately 20 (1.2-m-long) pressure core samples and an unprecedented number of conventionalized core samples will be transferred to University of Texas at Austin (UT). We will analyze these cores at the UT Pressure Core Center (PCC) and distribute them to the USGS Woods Hole, the National Energy Technology Laboratory, and others. Additional CT scans and quantitative degassing experiments are planned for Port

Fourchon. Depressurized (conventionalized) cores will be shipped to Ohio State University, University of Washington, Oregon State University, ExxonMobil, USGS Woods Hole, UT and other institutions.

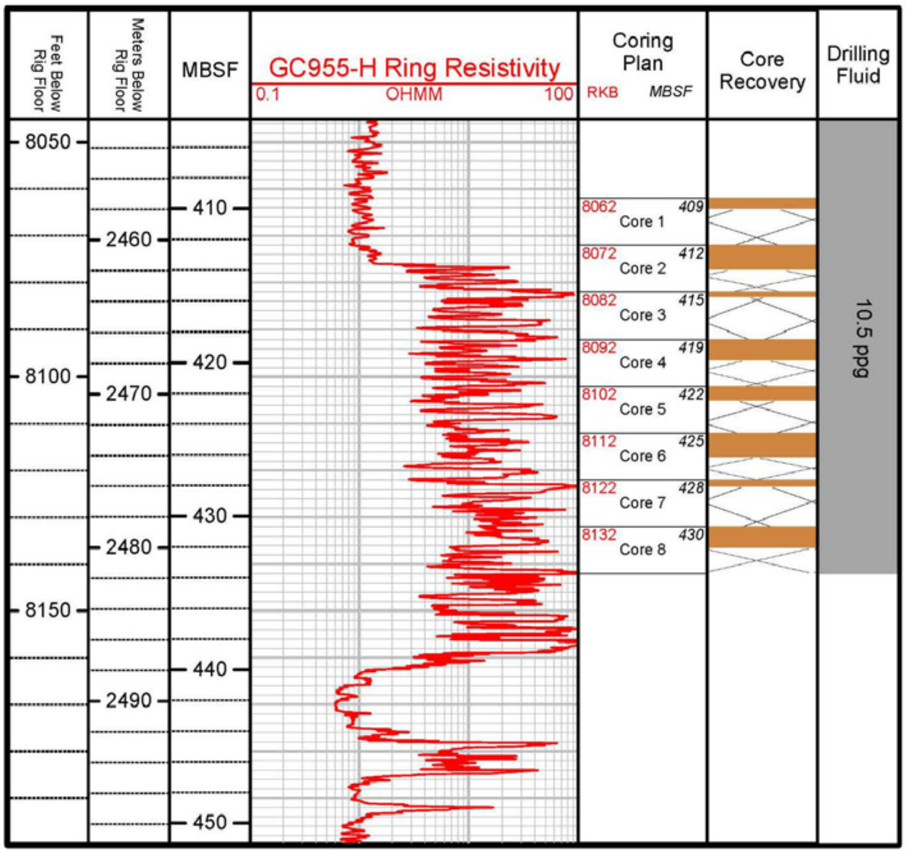
Special thanks are extended to the crew of the Helix *D/V Q4000* for their unyielding support of this project and for their commitment to running a safe and efficient scientific expedition.

Hole UT-GOM2-1-H005





Hole UT-GOM2-1-H002



Daily Operational and Science Report
UT-GOM2-1: Hydrate Pressure Coring Expedition

1. DATE: 20-May-2017, 0000-2400hr

2. LOCATION:

0000 – 2400 hr, 20-May-2017
Hole UT-GOM2-1-H005
Location: Lat: 27° 00.04665', Long: -90° 25.59125' (WGS 84)
Water depth: 6666.0 ft (6718.0 ft RKB)
Per Datum: RKB 52.0 ft above SL

3. DESCRIPTION OF OPERATIONS:

0000-0230	At Hole UT-GOM2-1-H005 Prepare for coring operations Core UT-GOM2-1-H005-09 Re-headed slick line MU PCTB-FB core barrel RIH with core barrel POOH running tool RIH pulling tool
0230-0630	**Core UT-GOM2-1-H005-09, F/8151 T/8161 ft MD: Recovered 10.5 ft, 746 psi** POOH pulling tool with PCTB-FB inner barrel Upon recovery stabbed into vertical cold shuck Upon inspection of core barrel was confirmed to be pressurized (low pressure) Sweep hole with 10.5 ppg mud using Hex Pump 2
0630-1030	Prepare for coring operations Core UT-GOM2-1-H005-10 Change out PCTB pressure control system MU PCTB-FB core barrel RIH with core barrel Unable to latch PCTB-FB inner core barrel in BHA POOH PCTB-FB inner core barrel Remove broken latch pin RIH with core barrel POOH running tool RIH pulling tool
1030-1200	**Core UT-GOM2-1-H005-010, F/8161 T/8166 ft MD: Recovered NA ft, 3255 psi** BHA experienced high torque, stalled, and limited spring-back rotation POOH pulling tool with PCTB-FB inner barrel Upon recovery stabbed into vertical cold shuck Upon inspection of core barrel was confirmed to be pressurized Sweep hole with 10.5 ppg mud using Hex Pump 2
1200-1600	Prepare for coring operations Core UT-GOM2-1-H005-11 MU PCTB-FB core barrel RIH with core barrel POOH running tool RIH pulling tool

1600-1730 **Core UT-GOM2-1-H005-011, F/8166 T/8176 ft MD: Recovered NA ft, 3002 psi**
POOH pulling tool with PCTB-FB inner barrel
Upon recovery stabbed into vertical cold shuck
Upon inspection of core barrel was confirmed to be pressurized
Sweep hole with 10.5 ppg mud using Hex Pump 2

1730-2000 Prepare for coring operations Core UT-GOM2-1-H005-12
MU PCTB-FB core barrel
RIH with core barrel
POOH running tool
RIH pulling tool

2000-2400 **Core UT-GOM2-1-H005-012, F/8176 T/8185ft MD: Recovered 5.7 ft, 0 psi**
Partial core throw to accommodate for borehole fill
POOH pulling tool with PCTB-FB inner barrel
Upon recovery stabbed into vertical cold shuck
Upon inspection of core barrel was confirmed not to be pressurized
Sweep hole with 10.5 ppg mud using Hex Pump 2

4. OPERATIONAL PLAN (Next 24 Hours):

Continue coring to the next core point at 8185 ft RKB and ultimately acquire up to 13 cores to the bottom of Hole UT-GOM2-1-H005. Complete directional survey and P&A Hole UT-GOM2-1-H005.

5. DOWNHOLE LOGGING OPERATIONS:

No additional log data acquired over the last 24 hr.

6. CORE DATA:

PCTB-FB Coring (pressure coring) Totals: 4 cores, 39 ft cored; [pending] ft recovery.

Core UT-GOM2-1-H005-09FB
F/8151 ft RKB T/8161 ft RKB: Recovered: 10.5 ft, 746 psi
Performed coring operations F/8151 ft MD T/8161 ft MD
Drilling/Coring Parameters: 60 RPM w/5-6 K lb torque and Cement Pump circulating 9.5 ppg WBM at 84 gpm, ROP 40 ft/hr, WOB 5 tons, with O-ring seals in the diverter.
Good coring run with a clean pick-up from the BHA with a 15 minutes autoclave cooling stop at the sea bed to experiment with further cooling of the autoclave. On recovery the ball valve was closed and the autoclave was left in the cold shuck for 55 minutes before a pressure of only 746 psi was measured in the service van. On this occasion the set pressure was 4015 psi and hence the boost did not function as expected and there was no accumulator function. The pressure was pumped up to 3250 psi before being transferred to PCATS. The DST recordings showed that autoclave did not seal until it close at the surface and was probably aided by at least partial dissociation of gas hydrates. Core recovery was 321 cm as measured by the X-ray image in PCATS (includes a number of voids).

Core UT-GOM2-1-H005-10FB
F/8161 ft RKB T/8166 ft RKB: Recovered: [pending] ft, 3255 psi
Performed coring operations F/8161 ft MD T/8166 ft MD
Drilling/Coring Parameters: 60 RPM w/2-5 K lb torque and Cement Pump circulating 10.5 ppg WBM at 42-80 gpm, ROP 33 ft/hr, WOB 10 tons, with O-ring seals in the diverter.

During the coring the cement pumps (mud pumps) stopped temporarily (~30 sec). At approximately 5 ft into formation bit reached very high torque (as much as 30 klbs) and released, causing the drill string to spin in reverse momentarily. Coring was discontinued immediately at this point. On recovery, the ball valve was closed but there was an indication there may be a slight leak (which proved to be wrong) and hence the tool was moved quickly out of the cold shuck to the service van where the pressure was found to be 3255 psi. It was then placed in the cold bath before being transferred to PCATS.

Core UT-GOM2-1-H005-11FB
F/8166 ft RKB T/8176 ft RKB: Recovered: Recovered [pending] ft, 3002 psi
Performed coring operations F/8166 ft MD T/8176 ft MD
Drilling/Coring Parameters: 60 RPM w/2-5 K lb torque and Cement Pump circulating 10.5 ppg WBM at 210 gpm, ROP 22-46 ft/hr, WOB 5 tons, with O-ring seals in the diverter.

After the difficulties experience during the last core the main objective of Core UT-GOM2-1-H005-11FB was to advance through what is interpreted on the logs as a water bearing zone before another short gas hydrate interval beneath it. Consequently the pump rates were increased significantly at the expense of the core quality to ensure that a clean hole was developed for the next core (Core UT-GOM2-1-H005-12FB) which is back in a gas hydrate interval. The tool was deployed in the BHA before a core was cut using the 10.5 lb/gal mud. After picking up from BHA and retrieving to the rig floor the ball valve was closed and the autoclave was left in the cold shuck for 45 minutes before a pressure of 3002 psi was measured in the service van. The autoclave was placed in the cold bath while PCATS was being prepared.

Core UT-GOM2-1-H005-12FB
F/8176 ft RKB T/8185 ft RKB: Recovered: Recovered 5.7 ft, 0 psi
Performed coring operations F/8176 ft MD T/8185 ft MD
Drilling/Coring Parameters: 60 RPM w/2-5 K lb torque and Cement Pump circulating 10.5 ppg WBM at 61-122 gpm, ROP 22 ft/hr, WOB 5 tons, with O-ring seals in the diverter.

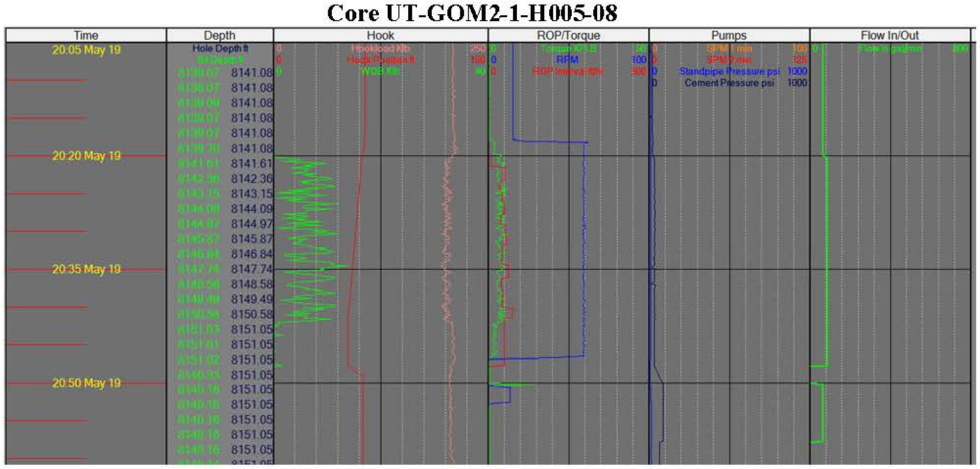
The tool was deployed in the BHA before a core was cut using the 10.5 lb/gal mud. Weight and torque came on bit 1 ft early (above core point) hence the run was stopped after a 9 ft advance. Generally a good coring run with clean a pick up from BHA, however on recovery the ball valve was only half closed trapping sediment in the ball follower and hence having zero pressure. Core barrel was over-filled, with rabbit against top plug and core material across the ball valve. Recovery was 1.75 m.

7. Science Activities

The onboard Scientific Party continued to process data and write reports from Holes UT-GOM2-1-H002 and UT-GOM2-1-H005. Conventionalized core samples from Core UT-GOM2-1-H005-12FB were transferred to the onboard UT core lab for processing and subsampling. Core UT-GOM2-1-H005-09FB was logged in PCATS at a total length 321 cm but including voids created during partial gas hydrate dissociation. This core was cut into 4 sections with one transferred to a 1.2 m storage chamber. Sections 2 and 4 were put on degassing manifolds and Section 3 was kept for long term storage as a possible experimental core for transport to UT. Despite partial dissociation, the degassing experiments have produced large volumes of gas, and gas samples have been collected for onboard and onshore analyses. PCATS and drilling fluid samples have continued to be collected for contamination control.

Rotary coring is accomplished by the manipulation of numerous drilling parameters that are designed to maintain safe operations and to yield in this expedition high quality pressure cores. To help visualize how the rotary core process works, the computer capture of the "real-time" Weatherford generated drillers displays of the acquisition of the Core UT-GOM2-1-H005-08 (cored from 8141 to 8151 ft MD, yielded a 8.2 ft long core at a pressure of 3016 psi) has been shown below in this report. As shown the core cutting event started at about 2020 hr ended about 23 minutes later at about 2043 hr. In this case, the flow rate of the drilling fluid (which was sea water) being pumped down the drill pipe was set at 65 gpm. The driller, by regulating the amount of weight that is applied to the drill bit (WOB) at the bottom of hole and the drilling fluid (mud) flow rate they can control rate of which the hole is advanced (ROP) and how much torque the formation transfers back onto the drill bit. In the example below we see a relatively uniform ROP and weight on bit that generally will yield a high quality core.

Core UT-GOM2-1-H005-08



Daily Operational and Science Report
UT-GOM2-1: Hydrate Pressure Coring Expedition

1. DATE: 21-May-2017, 0000-2400hr

2. LOCATION:

0000 – 2400 hr, 21-May-2017
Hole UT-GOM2-1-H005
Location: Lat: 27° 00.04665', Long: -90° 25.59125' (WGS 84)
Water depth: 6666.0 ft (6718.0 ft RKB)
Per Datum: RKB 52.0 ft above SL

3. DESCRIPTION OF OPERATIONS:

0000-0030	At Hole UT-GOM2-1-H005
	Prepare for coring operations for Core UT-GOM2-1-H005-13FB
	MU PCTB-FB core barrel
	RIH with core barrel
	POOH running tool
	RIH pulling tool
0030-0230	**Core UT-GOM2-1-H005-013FB, F/8185 T/8193ft RKB: Recovered 5.8 ft, 2806 psi**
	Partial core throw to accommodate for borehole fill
	POOH pulling tool with PCTB-FB inner barrel
	Upon recovery stabbed into vertical cold shuck
	Upon inspection of core barrel was confirmed to be pressurized
0230-0800	MU gyroscopic directional survey logging tool
	RIH gyroscopic survey tool F/6718 ft RKB T/8100 ft RKB (in DP)
	Conduct uphole gyroscopic survey F/8100 ft RKB T/surface (Run-1)
	RIH gyroscopic survey tool F/6718 ft RKB T/8100 ft RKB
	Conduct uphole gyroscopic survey F/8100 ft RKB T/surface (Run-2)
	RD slickline
0800-0930	Prepare to set cement plug in Hole UT-GOM2-1-H005
	Pump and spot 11.5 ppg high-viscosity mud at bottom of hole
	POOH BHA F/8193 ft RKB T/7900 ft RKB
	JSA with personnel involved in performing cement job
0930-1230	Set cement plug in Hole UT-GOM2-1-H005
	Conduct pressure test of surface equipment
	Pump 17 bbls of 10.5 ppg gel spacer
	BO cement head and load nerf ball
	Pump 3 bbl of 10.5 ppg spacer
	Mix and pump 54.7 bbls of 16.4 ppg cement
	Set cement plug F/7400 ft RKB T/7900 ft RKB
	Pump 6.7 bbl of 10.5 ppg gel spacer
	Pump 180.7 bbls of seawater
1230-1830	POOH BHA F/7900 ft RKB T/6600 ft RKB
	Flush DP with 350 bbls of seawater and 2 nerf balls
1830-2230	RIH BHA F/6600 ft RKB T/7621 ft RKB unable to tag cement

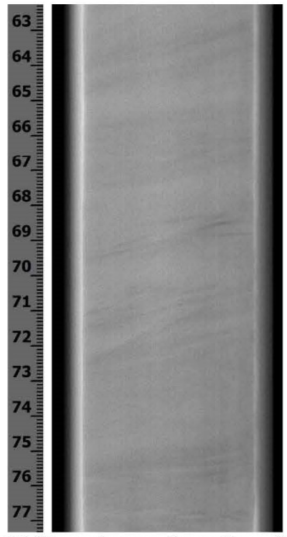


Figure 1. Example PCATS X-ray image from Core UT-GOM2-1-H005-2FB.

Daily Operational and Science Report
UT-GOM2-1: Hydrate Pressure Coring Expedition

1. DATE: 19-May-2017, 0000-2400hr

2. LOCATION:

0000 – 2400 hr, 19-May-2017
Hole UT-GOM2-1-H005
Location: Lat: 27° 00.04665', Long: -90° 25.59125' (WGS 84)
Water depth: 6666.0 ft (6718.0 ft RKB)
Per Datum: RKB 52.0 ft above SL

3. DESCRIPTION OF OPERATIONS:

0000-0130 Prepare for coring operations UT-GOM2-1-H005-04
MU PCTB-FB core barrel
RIH with core barrel
RIH with pulling tool
0130-0330 **Core UT-GOM2-1-H005-04, F/8101 T/8111 ft MD: Recovered 10.5 ft, 3477 psi**
Upon recovery stabbed into vertical cold shuck
Upon inspection of core barrel was confirmed to be pressurized
0330-0400 Gel sweep followed by seawater
0400-0630 Prepare for coring operations UT-GOM2-1-H005-05
MU PCTB-FB core barrel
RIH with core barrel
RIH with pulling tool
0630-0800 **Core UT-GOM2-1-H005-05, F/8111 T/8121 ft MD: Recovered 9.7 ft, 3242 psi**
Upon recovery stabbed into vertical cold shuck
Upon inspection of core barrel was confirmed to be pressurized
0800-0900 Gel sweep followed by seawater
0900-1100 Prepare for coring operations UT-GOM2-1-H005-06
MU PCTB-FB core barrel
RIH with core barrel
RIH with pulling tool
1100-1230 **Core UT-GOM2-1-H005-06, F/8121 T/8131 ft MD: Recovered 9.4 ft, 3250 psi**
Upon recovery stabbed into vertical cold shuck
Upon inspection of core barrel was confirmed to be pressurized
1230-1300 Gel sweep followed by seawater
1300-1500 Prepare for coring operations UT-GOM2-1-H005-07
MU PCTB-FB core barrel
RIH with core barrel
RIH with pulling tool
1500-1700 **Core UT-GOM2-1-H005-07, F/8131 T/8141 ft MD: Recovered 10.5 ft, 3164 psi**
Upon recovery stabbed into vertical cold shuck
Upon inspection of core barrel was confirmed to be pressurized
1700-1830 Displaced well to 9.5 ppg WBM
1830-2000 Prepare for coring operations UT-GOM2-1-H005-08

MU PCTB-FB core barrel
RIH with core barrel
RIH with pulling tool

2000-2300 **Core UT-GOM2-1-H005-08, F/8141 T/8151 ft MD: Recovered 8.2 ft, 3016 psi**
Upon recovery stabbed into vertical cold shuck
Upon inspection of core barrel was confirmed to be pressurized

2300-2400 Prepare for coring operations UT-GOM2-1-H005-09
MU PCTB-FB core barrel

4. OPERATIONAL PLAN (Next 24 Hours):

Continue coring to the next core point at 8161 ft RKB and ultimately acquire up to 13 cores to the bottom of Hole UT-GOM2-1-H005.

5. DOWNHOLE LOGGING OPERATIONS:

No additional log data acquired over the last 24 hr.

6. CORE DATA:

PCTB-FB Coring (pressure coring) Totals: 5 cores, 50.0 ft cored; 48.4 ft recovery.

Core UT-GOM2-1-H005-04FB
F/8101 ft RKB T/8111 ft RKB: Recovered: 10.5 ft, 3477 psi
Performed coring operations F/8101 ft MD T/8111 ft MD
Drilling/Coring Parameters: 60 RPM w/2-5 K lb torque and Cement Pump circulating sea water at 80 gpm, ROP 50 ft/hr, WOB 2.5-5 tons, with O-ring seals in the diverter.
Good coring run with clean pick up from BHA. On recovery the ball valve was closed and the autoclave was left in the cold shuck for 43 mins before a pressure of 3477 psi was measured in the service van indicating that the autoclave had sealed at in situ pressures. The autoclave was transferred to PCATS for core handling and processing. DST record showed that autoclave had fully sealed as it was lifted from the BHA. Core recovery 321 cm as measured by X-ray image in PCATS

Core UT-GOM2-1-H005-05FB
F/8111 ft RKB T/8121 ft RKB: Recovered: 9.7 ft, 3242 psi
Performed coring operations F/8111 ft MD T/8121 ft MD
Drilling/Coring Parameters: 60 RPM w/2-5 K lb torque and Cement Pump circulating sea water at 80 gpm, ROP 60 ft/hr, WOB 5 tons, with O-ring seals in the diverter.
Clean pick up from BHA. On recovery the ball valve was closed and the autoclave was left in the cold shuck for 35 mins before a pressure of 3242 psi was measured in the service van indicating that the autoclave had sealed around the in situ pressure. The autoclave was transferred to PCATS for core handling and processing. Core recovery was 296 cm as measured by X-ray image in PCATS.

Core UT-GOM2-1-H005-06FB
F/8121 ft RKB T/8131 ft RKB: Recovered: Recovered 9.4 ft, 3250 psi
Performed coring operations F/8121 ft MD T/8131 ft MD
Drilling/Coring Parameters: 60 RPM w/2-5 K lb torque and Cement Pump circulating sea water at 80 gpm, ROP 55 ft/hr, WOB 8 tons, with O-ring seals in the diverter.
Good coring run with clean pick up from BHA and a sea floor 'cooling stop' for 15 mins. On recovery the ball valve was closed and the autoclave was left in the cold shuck for 35 mins before a pressure of 3250 psi was measured in the service van indicating that the autoclave had sealed around the in situ pressure. The autoclave was transferred to PCATS for core handling and processing. Core recovery was 286 cm as measured by X-ray image in PCATS.

Core UT-GOM2-1-H005-07FB
F/8131 ft RKB T/8141 ft RKB: Recovered: Recovered 10.5 ft, 3164 psi
Performed coring operations F/8131 ft MD T/8141 ft MD
Drilling/Coring Parameters: 60 RPM w/2-5 K lb torque and Cement Pump circulating sea water at 70-80 gpm, ROP 27 ft/hr, WOB 10 tons, with O-ring seals in the diverter.
General coring parameters: ROP=27 ft/hr, 60 RPM, WOB=10 tons, SW flow rate = 70-80 gpm. Good coring run with clean pick up from BHA and a sea floor 'cooling stop' for 15 mins. On recovery the ball valve was closed and the autoclave was left in the cold shuck for 46 mins before a pressure of 3164 psi was measured in the service van indicating that the autoclave had sealed around the in situ pressure. The set pressure for this deployment was made at 3000 psi and consequently there was no boost. The autoclave was transferred to PCATS for core handling and processing. Core recovery was 321 cm as measured by X-ray image in PCATS.

Core UT-GOM2-1-H005-08FB
F/8141 ft RKB T/8151 ft RKB: Recovered: Recovered 8.2 ft, 3016 psi
Performed coring operations F/8141 ft MD T/8151 ft MD
Drilling/Coring Parameters: 60 RPM w/2-5 K lb torque and Cement Pump circulating sea water at 65 gpm, ROP 26 ft/hr, WOB 5 tons, with O-ring seals in the diverter.
Switched from drilling with seawater to drilling with 9.5 lb/gal mud. Good coring run but the pick up from BHA took multiple efforts before it cane free. The tool was stopped at the sea floor (cooling stop) for 15 mins. On recovery the ball valve was closed and the autoclave was left in the cold shuck for 77 mins before a pressure of 3016 psi was measured in the service van indicating that the autoclave had sealed around the set pressure indicating that the accumulator boost may have assisted sealing the autoclave. The autoclave was transferred to PCATS for core handling and processing. Core recovery was 250 cm as measured by X-ray image in PCATS.

7. Science Activities

Core UT-GOM2-1-H005-04FB, -05FB, 06FB, 07FB, and 08FB were logged in PCATS. These scans indicated interbedded intervals with high P-wave velocities (up to 3500 m/s) consistent with hydrate at high-saturations and produced X-ray images clearly revealing bedding and sedimentary structures (see Figure 1 below). The Scientific Party continued to process data and write reports from Holes UT-GOM2-1-H002 and UT-GOM2-1-H005.

Sediment from the last degassing experiment from UT-GOM2-1-H002-4CS was collected from the storage chamber.

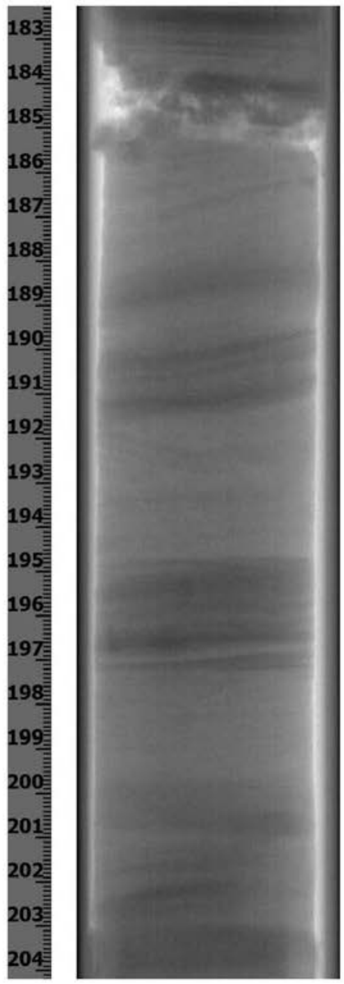


Figure 1. Example PCATS X-ray image from Core UT-GOM2-1-H005-05FB.

Daily Operational and Science Report
UT-GOM2-1: Hydrate Pressure Coring Expedition

1. DATE: 17-May-2017, 0000-2400 hr

2. LOCATION:
0000 - 2400 hr, 17-May-2017
Green Canyon 955

Location from 0000 – 0338 hr
Hole UT-GOM2-1-H002
Corrected Location: Lat: 27° 00.04154', Long: -90° 25.58715' (WGS 84)
Water depth: 6667.0 ft (6719.0 ft RKB)
Per Datum: RKB 52.0 ft above SL

Location from 0338 – 2400 hr
Hole UT-GOM2-1-H005
Corrected Location: Lat: 27° 00.04665', Long: -90° 25.59125' (WGS 84)
Water depth: 6666.0 ft (6718.0 ft RKB)
Per Datum: RKB 52.0 ft above SL

3. DESCRIPTION OF OPERATIONS:

0000-0124 At Hole UT-GOM2-1-H002
Re-enter Hole UT-GOM2-1-H002 to tag and test cement plug
Move *D/V Q4000* over Hole UT-GOM2-1-H002
Stab drillstring into H002
RIH F/6700 ft RKB and tag top of cement plug at 6839 ft RKB
Set down 5000lbs on top of cement plug
POOH F/6839 ft RKB T/6690 ft RKB

0124-0230 Prepare to spud Hole UT-GOM2-1-H005
D/S Q4000 DP moved over proposed drill site, ROV used to position DS
RIH and tagged mudline at 6718.0 ft RKB
Pull clear of mudline a reset data loggers
Held shallow gas well control drill
Held spud meeting

0230-0338 Spud Hole UT-GOM2-1-H005 at 6666.0 ft (6718.0 ft RKB).
Advance hole F/6718 ft RKB T/6778 ft RKB

0338-1330 Advance hole F/6778 ft RKB T/7645 ft RKB

1330-2230 Prepare to acquire Core UT-GOM2-1-H005-01
JSA to review wireline operations
RU slick line for coring operations
MU PCTB-FB inner core barrel at surface
RIH PCTB-FB inner core barrel F/surface T/7665 ft RKB
Unsuccessful core barrel failed to land in the BHA
POOH PCTB-FB inner core barrel F/7665 ft RKB T/surface
RD upper section of the PCTB-FB core barrel and move to Geotek Service Van

	Geotek clean and repair upper section of PCTB-FB core barrel
	MU PCTB-FB core barrel
	RIH PCTB-FB core barrel F/surface T/7663 ft RKB
2230-2330	**Core UT-GOM2-1-H005-01, F/7645 T/7655 ft MD: Recovered 6.7 ft, 4115 psi**
	POOH PCTB-FB core barrel F/7655 ft RKB T/surface
	Move recovered core sample to chiller for 20 minutes
2330-2400	RIH PCTB-FM center bit F/surface T/7665 ft RKB

4. OPERATIONAL PLAN (Next 24 Hours):

Continue to advance hole by drilling to second core point at 8081 ft RKB and acquire up to 9 cores to the bottom of the hole. The table below contains a detailed listing of the proposed core plan for Hole UT-GOM2-1-H005.

5. DOWNHOLE LOGGING OPERATIONS:

No additional log data acquired over the last 24 hr.

6. CORE DATA:

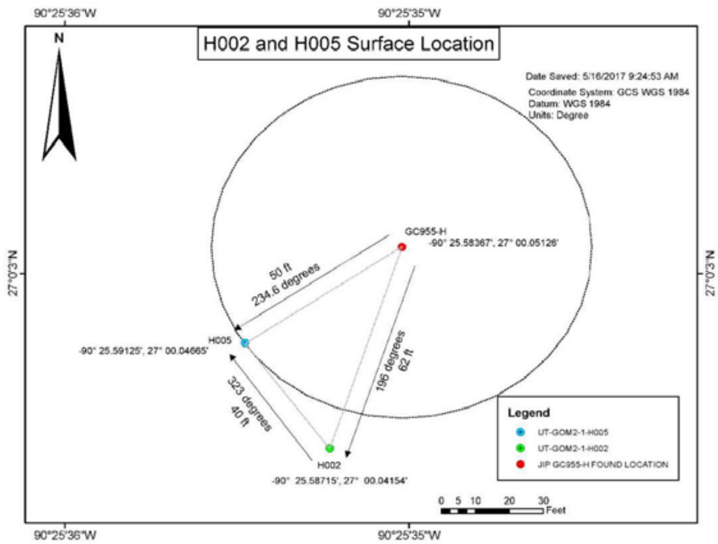
PCTB-FB Coring (pressure coring) Totals: 1 core, 10.0 ft cored; 6.7 ft recovery

Core UT-GOM2-1-H005-01
F/7645 ft RKB T/7655 ft RKB: Recovered 6.7 ft, 4115 psi
Performed coring operations F/7645 ft MD T/7655 ft MD
Drilling/Coring Parameters: 60 RPM w/4.6 K lb torque and Cement Pump circulating sea water at 85 gpm and standpipe pressure of 12 psi, ROP 67 ft/hr, WOB 5 tons, with O-ring seals in the diverter.

The UT-GOM2-1-H005-01 coring run was possibly compromised because of a depth discrepency between the driller-calculated tag depth and the Weatherford sensor-derived well depths. It was determined that the driller-calculated tag depth was accurate and Core UT-GOM2-1-H005-01 was acquired assuming a core point depth of 7645 ft MD. The core throw for the 01 core was 10ft, but from drilling performance data it appeared that the core only cut about 5-6 ft of formation. The slick line deployment and retrieval of Core UT-GOM2-1-H005-01 was completed without any problems. On recovery, the ball valve was closed and the autoclave was conditioned in the cold shuck for 20 minutes before a pressure of 4115 psi was measured in the service van, indicating that the pressure boost had been retained. The autoclave was moved to PCATS for core handling and processing.

7. Science Activities

Operations and science activities over the last 24-hours featured the abandonment of Hole UT-GOM2-1-H002 and the spudding of Hole UT-GOM2-1-H005 along with the acquisition of a successful pressure core from a known fracture dominated hydrate-bearing section that overlies the hydrate-bearing sand-rich reservoir section that is the primary coring target at the Green Canyon 955 test site. The map below shows the location of the two holes drilled and cored during this expedition, along with the location of the JIP Leg II GC955-H hole that was LWD logged on 2009. The target depth for Core UT-GOM2-1-H005-01 was specifically selected to test the impact of mud-rich sediments on the PCTB-FB core system.



The UT Scientific Party also continued to develop the core plan for Hole UT-GOM2-1-H005, which is posted below in this report. The pressure core from Hole UT-GOM2-1-H002 (Core 4) and the conventionalized core material from other cores collected from Hole UT-GOM2-1-H002, obtained from earlier in the expedition, are being processed through their respective labs on the ship. Quantitative pressure core degassing experiments have been completed on one of the two sections from Core UT-GOM2-1-H005-4CS selected for degassing. The other section continues to be degassed, producing large volumes of methane. Additional gas samples were collected for onshore analysis.

Hole UT-GOM2-1-H005 Core Plan

GC955H-005 Coring Plan	
Water Depth (tvdss)	6666
Rig Floor elevation above sl. (ft)	52
Mud line depth RKB	6718
Hydrate Top (fbsf)	1358
Hydrate top (RKB)	8076
Core length (ft)	10

Core #	Top (fbsf)	Bottom (fbsf)	Top (RKB)	Bottom (RKB)
1	927	937	7645	7655
2	1363	1373	8081	8091
3	1373	1383	8091	8101
4	1383	1393	8101	8111
5	1393	1403	8111	8121
6	1403	1413	8121	8131
7	1413	1423	8131	8141
8	1423	1433	8141	8151
9	1433	1443	8151	8161
10	1443	1453	8161	8171

Daily Operational and Science Report
UT-GOM2-1: Hydrate Pressure Coring Expedition

1. DATE: 18-May-2017, 0000-2400hr

2. LOCATION:

0000 – 2400 hr, 18-May-2017
Hole UT-GOM2-1-H005
Location: Lat: 27° 00.04665', Long: -90° 25.59125' (WGS 84)
Water depth: 6666.0 ft (6718.0 ft RKB)
Per Datum: RKB 52.0 ft above SL

3. DESCRIPTION OF OPERATIONS:

0000-0625 At Hole UT-GOM2-1-H005
Continued drilling hole F/7655 ft RKB T/8081 ft RKB at 110 RPM, 12 - 20 klbs WOB, 3-5 K torque, 150 - 250 fph ROP while pumping 8.6 ppg S/W w/ HEX #2 @ 336 gpm w/340 psi. Pumping 25 bbl Hi vis sweeps every 2 doubles drilled.

0625-1130 POOH PCTB-FB center bit
JSA for RU slickline and recovering center bit from BHA
RU slickline and recover center bit

1130-1200 Prepare for coring operations UT-GOM2-1-H005-02
MU PCTB-FB core barrel
RIH with core barrel
RIH with pulling tool

1200-1240 **Core UT-GOM2-1-H005-02, F/8081 T/8091 ft MD: Recovered 4.9 ft, 2834 psi**
ROP 29 ft/hr, 60 RPM, WOB 3-7 tons, flow rate 40-90 GPM
Upon recovery stabbed into vertical cold shuck
Upon inspection of core barrel was confirmed to be pressurized

1240-1545 Prepare to take core UT-GOM2-1-H005-03
MU PCTB-FB core barrel
RIH with core barrel
DS tagged bottom of the hole at 8086 ft RKB – borehole fill
POOH PCTB-FB and inspect core barrel
Fall in material recovered in liner and saved

1545-1700 Pump 25 bbls gel sweep followed by 280 bbls seawater using HEX Pump 2

1700-1930 Prepare to take core UT-GOM2-1-H005-03
Tagged bottom of the hole confirming no fill
M/U PCTB-FB core barrel
RIH with core barrel

1930-2120 **Core UT-GOM2-1-H005-03, F/8091 T/8101 ft MD: Recovered 10 ft, 1780 psi**
ROP 12 ft/hr, 60 RPM, WOB 2.5-5 tons, flow rate 70-120 Gpm
Upon recovery stabbed into vertical cold shuck
Upon inspection core barrel confirmed to be pressurized, possible slow leak

2120-2230 Circulated 25 bbls gel sweep followed by 128 bbls seawater spotting sweep in drill string using HEX #2 at 220 gpm w/ 53 psi.

2230-2400 Prepare to take core UT-GOM2-1-H005-04

4. OPERATIONAL PLAN (Next 24 Hours):

Continue coring to the next core point at 8111 ft RKB and ultimately acquire up to 13 cores to the bottom of Hole UT-GOM2-1-H005.

5. DOWNHOLE LOGGING OPERATIONS:

No additional log data acquired over the last 24 hr.

6. CORE DATA:

PCTB-FB Coring (pressure coring) Totals: 2 cores, 8.0 ft cored; 14.9 ft recovery.

Core UT-GOM2-1-H005-02
F/8081 ft RKB T/8091 ft RKB: Recovered: 4.9 ft, 2834 psi
Performed coring operations F/8081 ft MD T/8091 ft MD
Drilling/Coring Parameters: 60 RPM w/4.6 K lb torque and Cement Pump circulating sea water at 40-90 gpm, ROP 29 ft/hr, WOB 3-7 tons, with O-ring seals in the diverter.
Successful coring run with clean pick up from BHA. On recovery the ball valve was closed and the autoclave was left in the cold shuck for 45 mins before a pressure of 2834 psi was measured in the service van, indicating that there was a very slight leak which was located around the ball valve. The autoclave pressure was increased to 4000 psi before being transferred to PCATS.

Core UT-GOM2-1-H005-03
F/8091 ft RKB T/8101 ft RKB: Recovered: 10.0 ft, 1780 psi
Performed coring operations F/8091 ft MD T/8101 ft MD
Drilling/Coring Parameters: 60 RPM w/4.6 K lb torque and Cement Pump circulating sea water at 70-120 gpm, ROP 12 ft/hr, WOB 2.5-5 tons, with O-ring seals in the diverter.
Another good coring run with clean pick up from BHA. On recovery the ball valve was closed and the autoclave was left in the cold shuck for 45 mins before a pressure of 1780 psi was measured in the service van indicating that there might be a slow leak. The autoclave was transferred to PCATS where pressure was increased to 4000 psi before core handling and processing. DST record showed that autoclave had fully sealed during recovery.

7. Science Activities

Core UT-GOM2-1-H005-2 and Core UT-GOM2-1-H005-3 were logged in PCATS. These scans indicated high P-wave velocities consistent with hydrate at high-saturations and produced X-ray images clearly revealing sedimentary structures (see Figure 1 below). Drilling mud and PCATS water samples were collected for contamination control. The second quantitative core degassing from Core UT-GOM2-1-H002-4 was completed, producing a large volume of methane indicating high gas hydrate saturations. The Scientific Party continued to process data and write reports from Hole UT-GOM2-1-H002.

Core UT-GOM2-1-H002-07
F/8122 ft RKB T/8132 ft RKB: Recovered 1.5 ft, 0 psi
Performed coring operations F/8122 ft RKB T/8132 ft RKB
Drilling/Coring Parameters: 60 RPM w/3-4 Kflb torque and Hex Pump 2 circulating 10.5 ppg WBM at 50-100 gpm and standpipe pressure of 20 psi, ROP 10-25 ft/hr, WOB 5 tons, with no seals in the diverter
Core start time 0727 hr; Core end time 0815 hr; Core on deck at 0855 hr
For Core UT-GOM2-1-H002-07, the ball-valve failed to close or hold pressure (displaced BV seal); however, it did return core to the surface. For Core UT-GOM2-1-H002-07 the tool was recovered to the rig floor with the ball-valve partially closed (not sealed). Silt and sand was found packed between the ball valve and seal. In addition, sediment was also found above the core rabbit in the PCTB-CS autoclave, indicating that formation sediment had been fluidized during coring and flowed up into the core liner through the small ports in the rabbit. Core UT-GOM2-1-H002-07 did recover 1.5 ft (46 cm) of non-pressurized core that was transferred and processed through the onboard UT core processing lab.

Core UT-GOM2-1-H002-08
F/8132 ft RKB T/8142 ft RKB: Recovered 4.6 ft, 0 psi
Performed coring operations F/8132 ft RKB T/8142 ft RKB
Drilling/Coring Parameters: 60 RPM w/2-4 Kflb torque and Cement Pump circulating 10.5 ppg WBM at 210 gpm and standpipe pressure of 20 psi, ROP 20 ft/hr, WOB 5-8 tons, with no seals in the diverter
Core start time 1310 hr; Core end time 1350 hr; Core on deck at 1440 hr
For Core UT-GOM2-1-H002-08, the ball-valve failed to actuate or hold pressure. The ball-valve release sleeve (collett) failed by sliding over stop position, which resulted in the failure of the ball-valve to actuate. Core UT-GOM2-1-H002-08 did recover 4.6 ft (140 cm) of non-pressurized core that was transferred and processed through the onboard UT core processing lab.

7. Science Activities

In the last 24 hours, Hole UT-GOM2-1-H002 was advanced from 8112 ft RKB to 8142 ft RKB with 3 PCTB-CS pressure cores (Core UT-GOM2-1-H002-06, Core UT-GOM2-1-H002-07, Core UT-GOM2-1-H002-08). All three of the recovered PCTB-CS cores failed to hold pressure. The failure of the first two core runs have been attributed to problems associated with sand and silt interfering with the operations of the ball-valve in the PCTB-CS core system that could be linked to an internal core tool flow problem that is being currently evaluated.

The 'conventionalized' core material from cores Core UT-GOM2-1-H002-06, Core UT-GOM2-1-H002-07, and Core UT-GOM2-1-H002-08 was transferred to the UT mud lab and whole rounds were subsampled and preserved for shore-based microbiological, geochemical, physical property measurements. Head space gas samples were also acquired for post expedition analysis. A total of 3.25 ft (99 cm) was sampled as whole rounds and the remaining 8.0 ft (244 cm) was archived for shore-based analysis. Based on a quick description of core ends, the primary lithology in these cores ranges from sandy silt to silty, fine sand. A sample of drilling fluid was collected and preserved to characterize potential core contamination in support of the geochemistry and microbiological analyses. Geotek finished logging Core UT-GOM2-1-H002-04 in PCATS (139 cm) including full CT. Draft pressure core cutting plan provided to UT science team. In total, 27.5 ft of sediment was recovered from Hole UT-GOM2-1-H002 (34% recovery), with 4.5 ft under pressure.

Hole UT-GOM2-1-H002 reached a TD of 8142 ft RKB (1423 fbsf) at 1630 hr with the recovery of Core UT-GOM2-1-H002-08, after which the hole was swept with 280 bbls of 10.5 ppg water-based mud in preparation for downhole wireline logging. The wireline logging tool string (including EDTC-HRLA-GPIT) was lowered to bottom of the hole, and two up hole log runs from 8045 ft RKB to 7680 ft RKB (Main Pass and Repeat Pass) were acquired without any problems. Because of borehole blockages, the wireline logging tool string could not pass below 8045 ft RKB and the BHA had been set back to a depth of 7680 ft RKB.

Daily Operational and Science Report
UT-GOM2-1: Hydrate Pressure Coring Expedition

1. DATE: 15-May-2017, 0000-2400 hr

2. LOCATION:
0000 - 2400 hr, 15-May-2017
Green Canyon 955
Hole UT-GOM2-1-H002
Corrected Location: Lat: 27° 00.04154', Long: -90° 25.58715' (WGS 84)
Water depth: 6667.0 ft (6719.0 ft RKB)
Per Datum: RKB 52.0 ft above SL

3. DESCRIPTION OF OPERATIONS:

0000-0130 At Hole UT-GOM2-1-H002
Continue downhole logging operations
POOH logging tool string F/5000 ft RKB to T/Surface ft RKB
JSA for the personnel involved in wireline logging program
RD logging tools, wireline, and wireline sheaves

0130-0430 Prepare to set cement plug in Hole UT-GOM2-1-H002
RIH BHA F/7680 ft RKB T/8142 ft RKB (bottom of the hole)
Spot 25 bbls of 11.5 ppg Gel pad followed by 200 bbls of 10.5 ppg WBM
POOH BHA F/8142 ft RKB T/7900 ft RKB
Deploy Geotek cement barrel, free-fall to BHA
Build cement

0430-1230 JSA for the personnel involved in setting cement plug
Cementer pumped 20 bbls gel spacer
Cementer mixed and pumped 77 bbls 16.4 ppg cement
Place 500 ft cement plug F/7400 ft RKB T/7900 ft RKB
Cementer pumped 17 bbls of gel spacer
Cementer pumped 171 bbls of seawater
POOH BHA F/7900 ft RKB T/6611 ft RKB
Flushed DS and cement barrel W/seawater
Pumped 2 nerf balls and 350 bbls of seawater
Recover Geotek cement barrel on slickline
Flushed DS with 245 bbls of seawater

1230-1825 POOH BHA F/6611 ft RKB T/Surface
BO BHA (5 drill collars, 2 stabilizers, bit sub, bit)

1825-2400 Prepare to run PCTB-FB pressure core BHA
MU face bit and bit sub to outer core barrel
MU landing saver sub, top sub, head sub
Geotek performed space out on center bit core barrel
Geotek performed space out core barrel in outer core barrel
Geotek performed space out cementing barrel in outer core barrel

4. OPERATIONAL PLAN (Next 24 Hours):

Conduct series of full function (water) tool test of the PCTB-FB in DP. Move onto location of Hole UT-GOM2-1-H005, RIH, and spud hole.

5. DOWNHOLE LOGGING OPERATIONS:

No additional log data acquired over the last 24 hr.

6. CORE DATA:

No additional cores acquired over the last 24 hr.

7. Science Activities

In the last 24 hours, the downhole logging program in Hole UT-GOM2-1-H002 was completed with the acquisition of a main pass and repeat pass surveys (EDTC-HRLA-GPIT) over the depth interval from 7680 ft RKB to 8045 ft RKB. Hole UT-GOM2-1-H002 was abandoned with the emplacement of a 500 ft cement plug that was set above the hydrate interval to avoid any potential problem associated with hydrate dissociation that may be caused by the heat generated by cement hydration. The last half of the day dealt with preparations to move onto the location of Hole UT-GOM2-1-H005.

The technical objectives of the Hole UT-GOM2-1-H005 drilling and coring program include (1) demonstrate the engineering capability of the "face-bit" version of the PCTB pressure-coring tool to effectively and consistently capture, collect, and recover hydrate-bearing sand sediments, (2) test the coring efficiency of the cutting shoe BHA, and (3) obtain up to 13 pressure cores in the methane-hydrate-bearing sand and adjacent interfaces.

The pressurized core from Hole UT-GOM2-1-H002 (Core 4) and the conventionalized core material from other cores collected from Hole UT-GOM2-1-H002 continued to be processed through their respective labs on the ship. A cut plan for Hole UT-GOM2-1-H002 was finalized and two sections were selected for quantitative degassing, and one section transferred to a storage vessel for shipment to UT. Head space gas samples obtained from degassing experiments of subsamples from Core UT-GOM2-1-H002-04 have yielded significant volumes of mostly methane gas.

The drilling, wireline, and core pressure/temperature data were integrated for analyzing the performance of each pressure core run. The core pressure/temperature data indicate that several cores that failed to hold pressure experienced substantial cooling due to hydrate dissociation during retrieval.

Daily Operational and Science Report
UT-GOM2-1: Hydrate Pressure Coring Expedition

1. DATE: 16-May-2017, 0000-2400 hr

2. LOCATION:
0000 - 2400 hr, 16-May-2017
Green Canyon 955
Hole UT-GOM2-1-H002
Corrected Location: Lat: 27° 00.04154', Long: -90° 25.58715' (WGS 84)
Water depth: 6667.0 ft (6719.0 ft RKB)
Per Datum: RKB 52.0 ft above SL

3. DESCRIPTION OF OPERATIONS:

0000-0330	At Hole UT-GOM2-1-H002
	Continue operations in support of the "PCTB-FB BHA Water Test 3"
	Geotek completed space out test of the PCTB-FB core system
0330-0800	JSA for the personnel involved deployment of BHA
	MU PCTB-FB BHA
	RIH PCTB-FB BHA F/surface T/1090 ft RKB
	Fill DP with seawater every 10 connections
0800-1000	**Conduct PCTB-FB BHA Water Test 3**
	JSA for the personnel involved with slick line and RU PCTB-FB
	RU slick line in TDS
	MU PCTB-FB core barrel (with O-ring seal in diverter)
	RIH CTB-FB F/surface T/1038 ft RKB; POOH running tool
	RIH slick line with CTB-FB pulling tool F/surface T/1038 ft RKB
	Circulate seawater at 2 bpm using Hex Pump 2
	Shutdown Hex Pump 2, latch pulling tool
	POOH CTB-FB core barrel F/1038 ft RKB T/surface
1000-1200	**Conduct PCTB-FB BHA Water Test 4**
	MU PCTB-FB core barrel (with O-ring seal in diverter)
	RIH CTB-FB F/surface T/1040 ft RKB; POOH running tool
	RIH slick line with CTB-FB pulling tool F/surface T/1038 ft RKB
	Circulate seawater at 2 bpm using Hex Pump 2
	Shutdown Hex Pump 2, latch pulling tool
	POOH CTB-FB core barrel F/1038 ft RKB T/surface
1200-1630	**Conduct PCTB-FB BHA Water Test 5**
	MU PCTB-FB core barrel (with O-ring seal in divereer)
	RIH CTB-FB F/surface T/1035 ft RKB; POOH running tool
	RIH slick line with CTB-FB pulling tool F/surface T/1035 ft RKB
	Circulate seawater at 1.75 bpm using Hex Pump 2
	Shutdown Hex Pump 2, latch pulling tool
	POOH CTB-FB core barrel F/1035 ft RKB T/surface
1630-1800	MU PCTB-FB center bit assembly to slick line
	RIH PCTB-FB center bit assembly F/surface T/1034 ft RKB

JSA for the personnel involved rigging down slick line
Rig down slick line
1800-2400 RIH CTB-FB BHA F/1090 ft RKB T/6700 (18 ft above sea floor)

4. OPERATIONAL PLAN (Next 24 Hours):

Re-enter Hole UT-GOM2-1-H002 with PCTB-FB BHA tag and test cement plug. Spud Hole UT-GOM2-1-H005 and advance to first core point at 7645 ft RKB.

5. DOWNHOLE LOGGING OPERATIONS:

No additional log data acquired over the last 24 hr.

6. CORE DATA:

No additional cores acquired over the last 24 hr. However, we conducted a series of full function (water) tool tests of the PCTB-FB in DP. The results of these tests have been described below in this report.

7. Science Activities

Operations and science activities over the last 24-hours focused mostly on reviewing the performance of the PCTB-CS core runs and the various tool "pump" and "water" tests that were conducted over the last six days of this field test. Also, a total of three full function (water) tool tests of the PCTB-FB were conducted today in the drill pipe as it was being deployed in preparation for drilling the next test hole in the project (Hole UT-GOM2-1-H005).

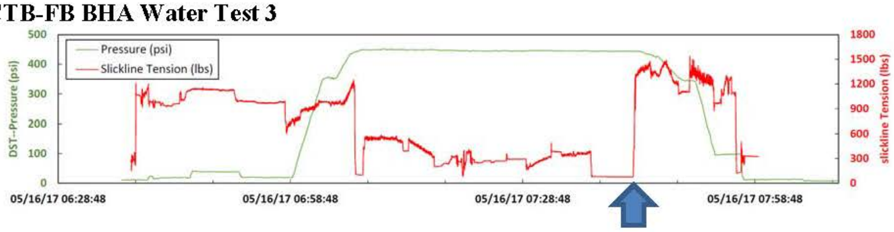
The Geotek and onboard UT-technical staff along with support from Weatherford, who are maintaining the systems that monitor shipboard drilling/coring parameters and performance, have been accessing, compiling, and analyzing the large number of drilling/coring data sets that have been generated during each tool test and core run over the last six days. These data include pressure and temperature data recorded in each core barrel when deployed in the borehole, data on the performance of the wireline system that deploys and recovers the pressure core barrels during each core run, information on drilling performance and drilling fluids (including drilling fluid pressures, temperature, bit penetration rates, weight on bit, drilling mud flow rates, rate of bit rotation, etc.) and many other important performance measurements.

To further test and demonstrate the engineering capability of the "face-bit" version of the PCTB pressure-coring tool, it was tested today in three successive tests in which the configuration of the tool was not changed between each tests and the coring and core handling procedures were conducted in a similar fashion in each test. The tools as tested were all the face-bit cutting version of the PCTB, which is also known as the PCTB-FB. In each case the "flow diverter" in the pressure core barrel was sealed with an O-ring. These tests were all full function tests in that the PCTB-FB inner barrel was lowered into drill pipe on a slick line wire, (2) the PCTB-FB inner barrel was locked into the BHA, (3) the wireline "running in" tool was used to deploy the PCTB-FB inner barrel and the wireline "pulling" tool was used to recover the PCTB-FB inner barrel to the deck of the ship. Under normal operations, the pulling tool is deployed and latches into the PCTB-FB inner barrel in the

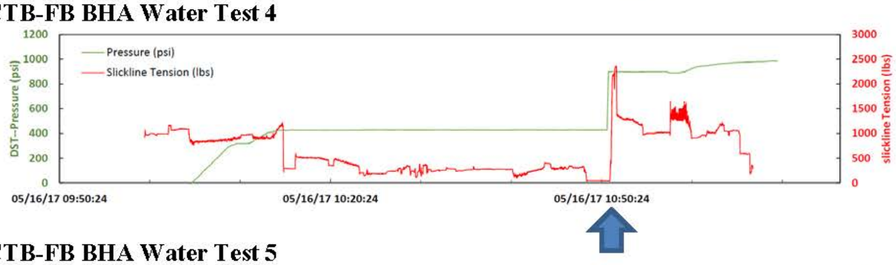
BHA and when pulled by the slick line the ball-valve at the bottom of the PCTB-FB inner barrel closes, the upper valve on the tool closes, the entire inner core barrel unlatches from the BHA, and the onboard pressure boost system activates to maintain internal tool pressures during recovery.

In the plots of the PCTB-FB BHA Water Test 4 and PCTB-FB BHA Water Test 5 we see good examples of the expected pressure boost as the PCTB-FB inner barrel is unlatched from the BHA; and the PCTB-FB was recovered sealed and at pressure for both of these tests (the large blue arrow in each plot marks the time the PCTB-FB inner barrel unlatches from the BHA). For Test 4 the autoclave pressure was measured at 1015 psi and for Test 5 the autoclave pressure was measured at 1113 psi. The PCTB-FB BHA Water Test 3, however, does not show the expected pressure boost and in this case the autoclave was not sealed.

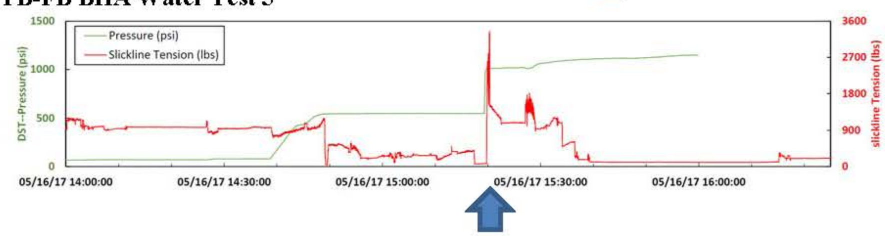
PCTB-FB BHA Water Test 3



PCTB-FB BHA Water Test 4



PCTB-FB BHA Water Test 5



The pressurized core from Hole UT-GOM2-1-H002 (Core 4) and the conventionalized core material from other cores collected from Hole UT-GOM2-1-H002 continued to be processed through their respective labs on the ship. Quantitative pressure core degassing experiments have continued on two sections from Core 4. Head space gas samples obtained from degassing experiments of subsamples from Core UT-GOM2-1-H002-04 have continued to yield significant volumes of mostly methane gas that suggest high methane hydrate saturation in this core. Additional gas samples have been collected for shore-based gas analyses.

Helix also conducted a large crew change today with a total of four helicopter flights. The UT led science team on the *D/V Q4000* also saw the departure of Yongkoo Seol, Gilles Guerin, Anton Caputo, and Robert Andrew Ott.

Daily Operational and Science Report
UT-GOM2-1: Hydrate Pressure Coring Expedition

1. DATE: 13-May-2017, 0000-2400 hr

2. LOCATION:
0000 - 2400 hr, 13-May-2017
Green Canyon 955
Hole UT-GOM2-1-H002
Lat: 27° 00.04548', Long: -90° 25.59312' (WGS 84)
Water depth: 6667.0 ft (6719.0 ft RKB)
Per Datum: RKB 52.0 ft above SL

3. DESCRIPTION OF OPERATIONS:

0000-0400	At Hole UT-GOM2-1-H002 Core UT-GOM2-1-H002-03 core barrel would not unlatch from the BHA Pumped numerous mud sweeps and worked SLB slickline to free tool Deployed Geotech Coring -- Emergency Recovery Tool 0345 unlatch and recovered tool to the surface via SLB slickline
0400-0630	Prepare to acquire Core UT-GOM2-1-H002-04 Assemble new core barrel JSA to review coring and wireline operations RU and RIH PCTB-CS F/Surface T/8135 ft RKB
0630-0900	SLB slickline dropped core barrel off wireline Work and pull core barrel with Geotech Coring -- Emergency Recovery Tool POOH PCTB-CS F/8092 ft RKB T/Surface
0900-1300	Prepare to acquire Core UT-GOM2-1-H002-04 Assemble new core barrel RU and RIH PCTB-CS F/Surface T/8092 ft RKB
1300-1330	**Core UT-GOM2-1-H002-04, F/8092 ft T/8102 ft MD: Recovered 4.6 ft, 3372 psi**
1330-1530	Recover PCTB-CS inner core barrel Upon recovery stabbed into vertical cold shuck Upon inspection of core barrel was confirmed to be pressurized
1530-1930	Prepare to acquire Core UT-GOM2-1-H002-05 Rebuild upper and lower section of PCTB-CS RU and RIH PCTB-CS F/Surface T/8102 ft RKB
1930-2000	**Core UT-GOM2-1-H002-05, F/8102 ft T/8112 ft MD: Recovered 3.1 ft, 0 psi**
2000-2400	Recover PCTB-CS inner core barrel Difficulty unlatching PCTB-CS outer barrel Work and pull core barrel with SLB slickline Upon inspection of core barrel it was confirmed not to be pressurized

4. OPERATIONAL PLAN (Next 24 Hours):
Continue to advance Hole UT-GOM2-1-H002 with continuous pressure coring with the PCTB-CS system.

5. DOWNHOLE LOGGING OPERATIONS:

NA

6. CORE DATA:

PCTB-CS Coring (pressure coring) Totals: 2 core, 20.0 ft cored; 7.7 ft recovery

Core UT-GOM2-1-H002-04
F/8092 ft MD T/8102 ft MD: Recovered 4.6 ft, 3372 psi
Performed coring operations F/ 8092 ft MD T/ 8102 ft MD
Drilling/Coring Parameters: 60 RPM w/ 3-6 K torque and Hex Pump 2 circulating 10.5 ppg WBM at 280 gpm and standpipe pressure of 12 psi, ROP 20 ft/hr, WOB 2-6 tons, with no seals in the diverter.

Core UT-GOM2-1-H002-04 was recovered on deck with ball valve closed and at an internal autoclave pressure of 3372 psi, which was the first core acquired during this expedition at pressure. The deployment and recovery of the PCTB-CS core barrel was conducted without any problems. The cutting of the core at the bottom of the hole also appeared to be good with almost constant core penetration rates and weight on bit. Upon recovery, the PCTB-CS core barrel was placed in the vertical ice-shuck on the rig floor. The internal pressure of the PCTB-CS autoclave when received in the Geotech Coring Service Van measured 3372 psi, which is slightly less than the expected hydostatic pressure at the depth of the cored reservoir section at this site. In the PCATS lab, an X-ray scan of the PCTB-CS autoclave revealed 4.6 ft (140 cm) section of sediment core and 4.0 ft (123 cm) sediment fill above the core rabbit, which indicates that formation sediment had been fluidized during coring and flowed up into the core liner through the small ports in the rabbit. The Geotek PCATS X-ray image of the recovered core section, from below the core rabbit, measured a total thickness of 4.6 ft (140 cm) and the following characteristics with depth along the core: **00-53 cm** sheared and biscuited core section with an upward decreasing bulk denisty trend, with the upper 32.0 cm of this section characterized by peak P-wave velocites ranging from 2,500 to over 3,200 m/s indicating the pressence of a highly saturated gas hydrate-beaing sediments; **53-102 cm** is also characterized by an upward decreasing bulk density trend and several 10-25 cm thick intervals exhibiting velocities as high as 3,400 m/s also indicating the presence of gas hydrate ; **102-140 cm** is a third upward decreasing bulk density section with a relatively massively-bedded 23 cm thick high velocity likely hydrate bearing unit. The PCATS cut plan for this core is under review, but it is likely that most of this core will be preserved for post expedition analysis and some sections may be selected for quantitative degassing.

Core UT-GOM2-1-H002-05
F/8102 ft MD T/8112 ft MD: Recovered 3.1 ft, 0 psi
Performed coring operations F/8102 ft MD T/8112 ft MD
Drilling/Coring Parameters: 60 RPM w/ 4-8 K torque and Hex Pump 2 circulating 10.5 ppg WBM at 100-225 gpm and standpipe pressure of 12 psi, ROP 40-60 ft/hr, WOB 4-12 tons, with no seals in the diverter.
Core start time 1947 hr; Core end time 2000 hr; Core on deck at 2323 hr.

For Core UT-GOM2-1-H002-05, the ball-valve failed to close or hold pressure; however, it did return core to the surface. For Core UT-GOM2-1-H002-05 the tool was recovered to the rig floor with the ball-valve closed but not sealed. Silt and sand was found packed between the ball valve and seal; and the seal appeared to be damaged. We also had significant trouble unlatching this tool from the BHA during recovery, which may also have been caused by the impact of silt/sand on the operation of the latch system within the PCTB-CS BHA. Core UT-GOM2-1-H002-05 did recover 3.1 ft (94 cm) of non-pressurized core that was transferred and processed through the onboard UT core processing lab.

7. Science Activities

In the last 24 hours, Hole UT-GOM2-1-H002 was advanced from 8092 ft MD to 8112 ft MD with 2 PCTB-CS pressure cores (Core UT-GOM2-1-H002-04 and Core UT-GOM2-1-H002-05). Only Core UT-GOM2-1-H002-04 was recovered near its pre-set pressure, the other PCTB-CS failed to hold pressure. PCATS processing and scans yielded significant evidence (i.e., P-wave velocities) for the occurrence of gas hydrate at high concentrations in Core UT-GOM2-1-H002-04. The failure of Core UT-GOM2-1-H002-05 has been attributed to problems associated with sand and silt interfering with the operations of the ball-valve in the PCTB-CS core system.

The Core UT-GOM2-1-H002-05 'conventionalized' core material was transferred to the UT mud lab and a whole round was subsampled and preserved for shore-based physical property measurements. A head space gas sample was also acquired for post expedition analysis. A total of 0.17 ft (5 cm) was sampled as whole rounds and the remaining 2.93 ft (89 cm) was archived for shore-based analysis. Based on a quick description of core ends, the primary lithology in this core is sandy silt at the bottom and silty sand at the top. A sample of drilling fluid and a sample of PCATS water were collected and preserved to characterize potential core contamination in support of the geochemistry and microbiological analyses.

Daily Operational and Science Report
UT-GOM2-1: Hydrate Pressure Coring Expedition

1. DATE: 14-May-2017, 0000-2400 hr

2. LOCATION:

0000 - 2400 hr, 14-May-2017
Green Canyon 955
Hole UT-GOM2-1-H002
~~Lat: 27° 00.04548', Long: -90° 25.59312' (WGS 84)~~
Corrected Location: Lat: 27° 00.04154', Long: -90° 25.58715' (WGS 84)
Water depth: 6667.0 ft (6719.0 ft RKB)
Per Datum: RKB 52.0 ft above SL

3. DESCRIPTION OF OPERATIONS:

0000-0200	At Hole UT-GOM2-1-H002 Prepare to acquire Core UT-GOM2-1-H002-06 Rebuild upper and lower section of PCTB-CS RU and RIH PCTB-CS F/Surface T/8112 ft RKB
0200-0230	**Core UT-GOM2-1-H002-06, F/8112 ft T/8122 ft MD: Recovered 5.2 ft, 0 psi** Stop coring and monitor hole until returns stop
0230-0315	Recover PCTB-CS inner core barrel POOH PCTB-CS F/8122 ft RKB T/Surface Upon inspection of core barrel it was confirmed not to be pressurized
0315-0730	Prepare to acquire Core UT-GOM2-1-H002-07 Rebuild upper and lower section of PCTB-CS RU and RIH PCTB-CS F/Surface T/8122 ft RKB
0730-0830	**Core UT-GOM2-1-H002-07, F/8122 ft T/8132 ft MD: Recovered 1.5 ft, 0 psi** Stop coring and monitor hole until returns stop
0830-0920	Recover PCTB-CS inner core barrel POOH PCTB-CS F/8132 ft RKB T/Surface Upon inspection of core barrel it was confirmed not to be pressurized Noted cut O-ring on ball valve of core barrel
0920-1330	Prepare to acquire Core UT-GOM2-1-H002-08 Rebuild upper and lower section of PCTB-CS RU and RIH PCTB-CS F/Surface T/8132 ft RKB
1330-1400	**Core UT-GOM2-1-H002-08, F/8132 ft T/8142 ft MD: Recovered 4.6 ft, 0 psi** Stop coring and monitor hole until returns stop
1400-1530	Recover PCTB-CS inner core barrel POOH PCTB-CS F/8142 ft RKB T/Surface Upon inspection of core barrel it was confirmed not to be pressurized Noted ball-valve did not accurate
1530-1630	Hole UT-GOM2-1-H002 TD at 8142 ft RKB (1423 fbsf) Pumped 280 bbls of 10.5 ppg to sweep hole clean
1630-1730	Prepare for wireline logging operations JSA and TBT in support of logging program

Install wireline logging sheaves
1730-1830 POOH BHA F/8142 ft RKB (1423 fbsf) T/7680 ft RKB (961 fbsf) at 5min/90ft
1830-2040 **Conduct wireline logging operations in UT-GOM2-1-H002**
JSA and TBT in support of logging program
Move logging tools from moonpool to rig floor
RU logging wireline through travel block and TDS
MU logging wireline packoff in TD
Terminate logging wireline cable head
MU logging tools and build logging string in DP
2040-2400 RIH with EDTC-HRLA-GPIT, DP set at 7680 ft RKB (961 fbsf)
Logging tool string includes Induction Inclinometer
WL tools unable to pass 8045 ft RKB (1326 fbsf)
Obtain up hole log run from F/8045 ft RKB T/7680 ft RKB (Repeat Pass)
RIH with EDTC-HRLA-GPIT F/7680 ft RKB T/8045 ft RKB
Obtain up hole log run from F/8045 ft RKB T/7680 ft RKB (Main Pass)
Continue up hole log run to obtain seafloor log depth at 6704 ft RKB.
POOH logging tool string F/7680 ft RKB to T/5000 ft RKB

4. OPERATIONAL PLAN (Next 24 Hours):

Complete wireline logging program in Hole UT-GOM2-1-H002, set cement plug and abandon Hole UT-GOM2-1-H002, move to location of Hole UT-GOM2-1-H005, and MU BHA and RIH.

5. DOWNHOLE LOGGING OPERATIONS:

Wireline Logs: EDTC-HRLA-GPIT F/7680 ft RKB T/8045 ft RKB (Main Pass)
Wireline Logs: EDTC-HRLA-GPIT F/7680 ft RKB T/8045 ft RKB (Repeat Pass)

6. CORE DATA:

PCTB-CS Coring (pressure coring) Totals: 3 core, 30.0 ft cored; 11.3 ft recovery

Core UT-GOM2-1-H002-06
F/8112 ft T/8122 ft RKB: Recovered 5.2 ft, 0 psi
Performed coring operations F/8112 ft RKB T/8122 ft RKB
Drilling/Coring Parameters: 60 RPM w/2-5 Kflb torque and Hex Pump 2 circulating 10.5 ppg WBM at 100 gpm and standpipe pressure of 20 psi, ROP 20-50 ft/hr, WOB 6 tons, with no seals in the diverter.
Core start time 0155 hr; Core end time 0244 hr; Core on deck at 0355 hr.
For Core UT-GOM2-1-H002-06, the ball-valve closed, seal at top end of autoclave plug failed; however, it did return core to the surface. For Core UT-GOM2-1-H002-06 the tool was recovered to the rig floor with the ball-valve partially closed (not sealed). Silt and sand was found packed between the ball valve and seal. Core UT-GOM2-1-H002-06 recovered 5.2 ft (158 cm) of non-pressurized core that was transferred and processed through the onboard UT core processing lab.

7. Science Activities

In the last 24 hours, spudded and advanced Hole UT-GOM2-1-H002 to a depth of 8032.0 ft RKB (1313.0 fbsf) by midnight without any significant problems. Geotek completed preparations for coring operations and developed plans for simulated core runs to be conducted before reaching core point as planned for the morning of 12-May-17. The UT Scientific Party refined and finalized the Hole UT-GOM2-1-H002 core plan and continued to work on the "Methods Section" writing assignments in support of the expedition initial results volume. The UT Scientific Party also continued to develop the core handling and processing plan. Based on 1) lateral correlation with seismic data from Hole GC955-H as drilled under the Gulf of Mexico Gas Hydrate Joint Industry Project Leg II (GOM JIP Leg II) in 2009 to the Hole UT-GOM2-1-H002 and 2) the seafloor depth at UT-GOM2-1-H002, the first pressure core point (Core UT-GOM2-1-H002-01) was set at 8062.0 ft RKB (1343.0 fbsf). Posted below is the finalized core plan for Hole UT-GOM2-1-H002.

GC955 H002 Coring Plan	
Water Depth (tvdss)	6667
Rig Floor elevation above sl. (ft)	52
mud line depth RKB	6719
Hydrate Top (fbsf)	1358
Hydrate top (RKB)	8077
Hydrate Bottom (fbsf)	1444
core length (ft)	10
wash interval (ft)	10

Core #	Top (fbsf)	Bottom (fbsf)	Top (RKB)	Bottom (RKB)
1	1343	1353	8062	8072
2 (hydrate top in middle)	1353	1363	8072	8082
3	1363	1373	8082	8092
4	1373	1383	8092	8102
5	1383	1393	8102	8112
6	1393	1403	8112	8122
Drill/Wash	1403	1429	8122	8148
7	1429	1439	8148	8158
8 (hydrate base in middle)	1439	1449	8158	8168
9	1449	1459	8168	8178
10	1459	1469	8178	8188
Drill/Wash	1469	1719	8188	8438

Daily Operational and Science Report
UT-GOM2-1: Hydrate Pressure Coring Expedition

1. DATE: 12-May-2017, 0000-2400 hr

2. LOCATION:
0000 - 2400 hr, 12-May-2017
Green Canyon 955
Hole UT-GOM2-1-H002
Lat: 27° 00.04548', Long: -90° 25.59312' (WGS 84)
Water depth: 6667.0 ft (6719.0 ft RKB)
Per Datum: RKB 52.0 ft above SL

3. DESCRIPTION OF OPERATIONS:

0000-0030	At Hole UT-GOM2-1-H002 Continue to circulate hole clean and fill with F/8.6 ppg T/10.5 ppg mud
0030-0230	Performed coring simulations drilling down: F/ 8032 ft MD T/ 8042 ft MD F/ 8042 ft MD T/ 8052 ft MD F/ 8052 ft MD T/ 8062 ft MD
0230-0330	Circulate hole clean and fill with 10.5 ppg mud
0330-0730	Prepare to acquire Core UT-GOM2-1-H002-01 JSA to review wireline operations Transfer PCTB-CS tools to rig floor Recover PCTB-CS center bit RU and RIH PCTB-CS F/Surface T/8062 ft RKB Circulate hole clean and fill with 10.5 ppg mud
0730-0900	**Core UT-GOM2-1-H002-01, F/8062 T/8072 ft MD: Recovered 2.26 ft, 0 psi**
0900-0930	Recover PCTB-CS inner core barrel Upon recovery stab into vertical cold shuck Upon inspection of core barrel discovered sample was not pressurized Pressure boost failed to fully-charge the PCTB-CS autoclave
0930-1010	**Conduct PCTB-CS BHA Water Test 1** Standard PCTB-CS configuration (with polypack seals) RIH F/ Surface T/ 8072 ft RKB, lock tool into BHA POOH PCTB-CS with standard pulling tool Upon inspection (0 psi) pressure boost failed Pressure boost failed to charge PCTB-CS autoclave
1010-1230	**Conduct PCTB-CS BHA Water Test 2** Upper seal changed to a 0-ring to allow limited fluid transfer RIH F/ Surface T/ 8072 ft RKB, lock tool into BHA POOH PCTB-CS with standard pulling tool Upon inspection (0 psi) pressure boost failed Pressure boost failed to charge PCTB-CS autoclave

1230-1830 Prepare to acquire Core UT-GOM2-1-H002-02
JSA to review wireline operations
PU and RIH PCTB-CS F/Surface T/8072 ft RKB
Circulate hole clean and fill with 10.5 ppg mud
1830-1900 **Core UT-GOM2-1-H002-02, F/8072 T/8082 ft MD: Recovered 5.33 ft, 0 psi**
1900-1945 Recover PCTB-CS inner core barrel
Upon inspection the core did not retract and the ball valve did not close
1945-2230 Prepare to acquire Core UT-GOM2-1-H002-03
PU and RIH PCTB-CS F/Surface T/8082 ft RKB
Circulate hole clean and fill with 10.5 ppg mud
2230-2330 **Core UT-GOM2-1-H002-03, F/8082 T/8092 ft MD: Recovered 1.08 ft, 0 psi**
2330-2400 Recover PCTB-CS inner core barrel
Note from 13-May-2017 UT-GOM2-1 Daily Operational and Science Report: The PCTB-CS inner core barrel would not unlatch from the coring BHA using the standard recovery tool. After several hours of attempting to free the tool, the Geotek emergency release tool was used to successfully release the inner core barrel; however, the normal functioning of this tool will not activate the ball valve or other tool functions resulting in the depressurization of the core.

4. OPERATIONAL PLAN (Next 24 Hours):
Continue to advance Hole UT-GOM2-1-H002 with continuous pressure coring with the PCTB-CS system.

5. DOWNHOLE LOGGING OPERATIONS:
NA

6. CORE DATA:
PCTB-CS Coring (pressure coring) Totals: 3 core, 30.0 ft cored; 8.67 ft recovery

Core UT-GOM2-1-H002-01
F/8062 T/8072 ft MD: Recovered 2.26 ft, 0 psi
Performed coring operations F/ 8062 ft T/ 8072'
Drilling/Coring Parameters : 50 RPM w/ 3.5 K torque and cement unit circulating 10.5 ppg WBM at 125 gpm and standpipe pressure of 15 psi, ROP 5-15 ft/hr, WOB 2-6 tons, With polypack diverter seal.
Core start time 0745 hr; Core end time 0840 hr; Core on deck at 0917 hr.
Core barrel recovered on deck with ball valve closed but with little to no pressure in the autoclave. Core UT-GOM2-1-H002-01, which was the first core acquired during this expedition, recovered 2.26 ft of core in poor condition and failed to retain pressure. The deployment, cutting, and recovery of the core appeared to be conducted without any problems. We did not see any trouble with the latching of the tool or it's deployment in the pipe. But it took more than 6,000 lbs of pull to unlatch the tool from the BHA. The cutting of the core on bottom also appeared to be good with somewhat variable penetration rates and weight on bit. Upon recovery, the ball valve was closed but the pressure boost appeared not to have pressurized the autoclave below the new flow diverter set above the upper autoclave seal (polypack seals). It was speculated that the interaction of the new upper seal and flow diverter

had created a pressure seal (hydraulic lock) that did not allow the pressure charging of the autoclave. Two additional PCTB-CS operational tests were conducted in the open drillpipe (while not in contact with the sediment) that appeared to confirm that there was some form of pressure block in the tool. It is also important to add that the spring type core catcher was damaged upon recovery, showing evidence of inverted and twisted fingers.

Core UT-GOM2-1-H002-02
F/8072 T/8082 ft MD: Recovered 5.33 ft, 0 psi
Drilling/Coring Parameters : 60 RPM w/ 3.5 K torque and cement unit circulating 10.5 ppg WBM at 125 gpm and standpipe pressure of 15 psi, ROP 20-90 ft/hr, WOB 1-20 tons, With O-ring diverter seal.
Core start time 1840 hr; Core end time 1857 hr; Core on deck at 2430 hr.
Tool recovered on deck. Ball valve not closed; core liner visible through ball valve (no pressure). Core did not retract into the autoclave. The upper threaded connection of the liner to the top of the core plug was broken and the core catcher was damage indicating that the core likely jammed, which caused core milling and the breaking of the liner. It also took about a 6000 lb pull to unlatch the inner core barrel from with the BHA during the recovery of the core. We have concluded that the main factor affecting/limiting our core recovery, core quality and sometime creating tool damage (preventing recovery under pressure) is 'formation jamming'. This happens when the formation is forced up inside the cutting shoe, without the core having been correctly cut and the cuttings removed. This can happen as a result of ship's movement indicated by the rapid and significant changes to the weight on bit (WOB).

Core UT-GOM2-1-H002-03
F/8082 T/8092 ft MD: Recovered 1.08 ft, 0 psi
Drilling/Coring Parameters : 60 RPM w/ 3.5 K torque and cement unit circulating 10.5 ppg WBM at 125 gpm and standpipe pressure of 15 psi, ROP 7-24 ft/hr, WOB 5-15 tons, With O-ring diverter seal.
Core start time 2225 hr; Core end time 2315 hr; Core on deck at 0245 hr (13-May-17).
Core UT-GOM2-1-H002-03 failed to hold pressure; however, it did return core to the surface. This failure of the core system to retain pressure was attributed to the fact that the retrieval of the inner core-barrel required a special procedure to release it form the latches in the BHA. We did not see any trouble with the deployment and latching of the tool before coring. The actual core cut event appeared to be good with somewhat variable penetration rates and weight on bit. However, at the end of the test the inner core-barrel was stuck in the BHA. The rig crew and Geotek staff core team managers worked with the Schlumberger wireline engineer for nearly four hours to unlatch the core barrel from the BHA. Eventually, the decision was made to use a special emergency release procedure that was successful but also presents the ball-valve on the tool from closing.

7. Science Activities

The 'conventionalized' core material from each core was transferred to the UT mud lab whole rounds were subsampled and preserved for shore-based geochemistry, microbiology, and physical properties. Head space gas samples were sampled for shore-based analyses. A total of 2.65 ft was sampled as whole rounds and the remaining 6.02 ft was archived for shore-based splitting and description. Based on a quick description of core ends, the primary lithology in the recovered cores ranges from sandy silt with clay to silty sand with clay. A sample of drilling fluid was sampled and preserved to characterize potential contamination.

Daily Operational and Science Report
UT-GOM2-1: Hydrate Pressure Coring Expedition

1. DATE: 08 May 2017, 0000-2400 hr

2. LOCATION:
0000 - 2400 hr, 08 May 2017
Green Canyon 955
UT-GOM2-1-H002

3. DESCRIPTION OF OPERATIONS:
There was a fire/abandon ship drill at 0819 hr. The supply boat transfer was completed and the boat departed at 1227 hr. The mud lab was placed into location and hooked up to utilities. Helix finished installing the duct work for the mud pumps. Helix made up ~2300 ft of drill pipe between 1400-1930 hr and then between1940-2200 hr brought up and laid down pipe in doubles. Starting at 2015 hr, Weatherford software began logging top drive data; they now can record all drilling parameters, except the stroke counter on the mud pumps. Helix performed pressure testing of the upper and lower IBOP valves and the wireline night cap starting at 2315 hr.

4. OPERATIONAL PLAN (Next 24 Hours):
The BHA will be picked up in the morning of 09 May 2017 to begin PCTB flow testing. Geotek will install the cold shuck and chillers. There will be three to four helicopter flights tomorrow for additional crew change and the arrival of the remainder of the science party.

5. DOWNHOLE LOGGING OPERATIONS:
NA

6. CORE DATA:
NA

7. Science Activities
The science party continued to refine coring points. Geotek trained UT personnel in quantitative degassing. UT worked on setting up the mud lab for sampling.

Daily Operational and Science Report
UT-GOM2-1: Hydrate Pressure Coring Expedition

1. DATE: 09 May 2017, 0000-2400hr

2. LOCATION:
0000 -2400 hr, 09 May 2017
UT-GOM2-1-H002

3. DESCRIPTION OF OPERATIONS:

0200	Pressure test of wireline night cap
0310	Pressure test of lower IBOP
0545	Pressure test of upper IBOP
0930 hr	BHA picked up in preparation of the flow test.
1230-1300	Space out with PCTB and instrumented core barrel

1621-1646 hr
Surface Pump Test 1 PCTB-CS
Bit just above sea surface below ship
0-140 SPM; 0-28 GPM
33-1450 psi standpipe pressure (Weatherford)

1653-1710 hr
Surface Pump Test 2 PCTB-CS
Bit just above sea surface below ship
0-140 SPM; 0-28 GPM
19-1824 psi standpipe pressure (Weatherford)

1953-2022 hr
Surface Pump Test 3 (cement pump) PCTB-CS
Bit just above sea surface below ship
0.5-8.0 barrels per minute (BPM); 21-40 GPM
80-1055 psi standpipe pressure (Weatherford need to confirm source)

2130 hr	Space out of cementing core barrel in outer core barrel
2205	Space out of center bit in outer core barrel

There were three helicopter flights for crew change, and the remainder of the science party arrived at 1445 and went through the safety orientation.

4. OPERATIONAL PLAN (Next 24 Hours):
Trip pipe to the seafloor (~10 hrs). Run a pump test just above the seafloor. Spud hole near the end of 10 May 2017.

5. DOWNHOLE LOGGING OPERATIONS:
NA

6. CORE DATA:
NA

7. Science Activities

Preliminary analysis of data from Geotek instrumented core liner shows only small pressure differentials across the core liner during each of the three Surface Pump Test of the PCTB-CS as conducted on 09-May-17. The instrumented core liner upon visual inspection did not exhibit any damage or deformation.

The science party met to discuss the plan for the expedition report and began working on report chapters. The official hole names for this expedition are UT-GOM2-1-H002 and UT-GOM2-1-H005.

Daily Operational and Science Report
UT-GOM2-1: Hydrate Pressure Coring Expedition

1. DATE: 10-May-2017, 0000-2400 hr

2. LOCATION:
0000 - 2400 hr, 10-May-2017
Green Canyon 955
UT-GOM2-1-H002

3. DESCRIPTION OF OPERATIONS:

0000-0015	JSA in support of BHA MU
0015-0215	Continue to MU BHA (PCTB-CS) with drill collars BHA: 203.12ft drifted BHA W/ 4.105" drift
0215-1200	MU in RIH BHA (PCTB-CS) and DP, fill with seawater
1200-1630	Continue to RIH BHA (PCTB-CS) F/ 4929ft T/ 6550ft Drifted each joint W/ 4.125" drift.
1630-1700	JSA/TBT in support of PCTB-CS pump test Vessel off lump sum mobilization
1700-1930	Change bails on TDS, stage PCTB-CS, RU wireline
1930-2110	MU and RIH instrumented core barrel F/surface T/6545ft and POOH
2110-2230	RIH instrumented core barrel F/surface T/6200ft **Seafloor Pump Test X PCTB-CS (incomplete test)** Bit just above sea surfloor Using Hex Pump 2 switched to Hex Pump 1 (circulating seawater) Hex Pump 2: 30 SPM; 150 GPM; 32 psi (Weatherford) Hex Pump 1: 30 SPM; 150 GPM; 18 psi (Weatherford)
2230-2235	Shutdown Hex Pump 1 because of electrical problem
2235-2315	**Seafloor Pump Test 1 PCTB-CS** Bit just above seafloor Using Hex Pump 2 (circulating seawater) 0-140 SPM; 0-700 GPM 16-1922 psi standpipe pressure (Weatherford)
2315-2400	**Seafloor Pump Test 2 (cement pump) PCTB-CS** Bit just above seafloor 0.5-7.0 barrels per minute (BPM); 21-40 GPM 1.0-239 psi standpipe pressure (Schlumberger gauge)

4. OPERATIONAL PLAN (Next 24 Hours):
Update: Spudded hole UT-GOM2-1-H002 at 08:53 on 11-May-2017. Tagged seafloor, drill pipe measured depth 6719 ft. Coordinates: Lat: 27° 00.04548', Long: -90° 25.59312' (WGS 84).

5. DOWNHOLE LOGGING OPERATIONS:
NA

6. CORE DATA:
NA

7. Science Activities

The PCTB-CS pressure core BHA reached near the seafloor (6716 MD) at 2110hr and the Geotek instrumented core barrel was deployed in preparation for conducting a series of seafloor level pump tests. The first attempted seafloor pump test was not completed because of an electrical problem associated with one of the ship's mud pumps. However, two additional seafloor pump tests were completed without any concerns. The pump tests also allowed for the analysis of the performance of all three pump units on the platform (i.e., Hex Pumps 1 and 2; and the Schlumberger cement pump). Analysis of data obtained from both the sea surface and seafloor pump test documented only small pressure differentials across the core liner for all of the completed tests. In addition, the instrumented core liner was not damaged during any of the completed pump test. Modifications to the drilling fluid flow paths through the PCTB-CS appear to have significantly reduced the internal pressure conditions that have in the past resulted in the collapse of core liners within the PCTB-CS system. The pump tests also represented an excellent opportunity for Geotek and the Q4000 rig crew to become familiar with operations and handling of the PCTB-CS pressure core system as deployed on this expedition.

The Science Party continued to work on core handling and sample plans in preparation for the spuding of the UT-GOM2-1-H002 hole now scheduled for early on 11-May-17. In addition, Geotek technical staff and UT scientists have reviewed and further refined the planned pressure core degassing experimental protocols that will be used to conduct new "slow degassing protocols".

Confirmed following shipboard conversions (Geotek, UT, etc.):
-Mud pumps 5.04 US Gallons per stroke, will use 5.0 GPM/stroke in calculations
-US barrels to US gallons (1bbl = 42 gallons)

Daily Operational and Science Report
UT-GOM2-1: Hydrate Pressure Coring Expedition

1. DATE: 11-May-2017, 0000-2400 hr

2. LOCATION:
0000 - 2400 hr, 11-May-2017
Green Canyon 955
Hole UT-GOM2-1-H002
Lat: 27° 00.04548', Long: -90° 25.59312' (WGS 84)
Water depth: 6667.0 ft (6719.0 ft RKB)
Per Datum: RKB 52.0 ft above SL

3. DESCRIPTION OF OPERATIONS:

0000-0100	Complete the PCTB-CS Seafloor Pump Test 2 from 10-May-2017 Flow test Hex Pump 1 (unable to maintain pump rate)
0100-0500	Prepare to spud Hole UT-GOM2-1-H002 POOH instrumented core barrel F/6454 T/surface JSAs to deal with PCTB-CS and wireline systems MU and RIH PCTB-CS center bit barrel MU wireline night cap to TDS
0500-0530	Test wireline night cap on TDS to 5000 psi
0530-0600	Held Spud meeting with all personnel involved
0600-0630	RIH DP F/6550ft T/6709ft
0630-0730	*D/S Q4000* DP moved over proposed drill site
0730-0830	RIH and tagged mudline at 6719.0 ft RKB Pull clear of mudline a reset data loggers
0830-1200	Spud Hole UT-GOM2-1-H002 at 6667.0 ft (6719.0 ft RKB). Advance hole to 6992.0 ft RKB (273.0 fbsf) BSEE inspection (Inspectors Campo, Boudreaux, Fry, Shedd
1200-2300	Advance hole to 8032.0 ft RKB (1313.0 fbsf)
2300-2400	Circulate hole clean with 8.6 ppg mud

4. OPERATIONAL PLAN (Next 24 Hours):
Continue to advance Hole UT-GOM2-1-H002 to planned first core point at 8062.0 ft RKB (1343.0 fbsf), deploy and conduct continuous pressure coring with the PCTB-CS system.

5. DOWNHOLE LOGGING OPERATIONS:
NA

6. CORE DATA:
NA

Daily Operational and Science Report
UT-GOM2-1: Hydrate Pressure Coring Expedition

1. DATE: 30 April 2017, 0000-2400hr

2. LOCATION:
0000 – 2400 hr, 30 April 2017
Brownsville, TX at the dock in the Keppel Amfels shipyard.

3. DESCRIPTION OF OPERATIONS:
UT and Geotek have boarded the Q4000. All Geotek containers have been loaded onto the vessel. Phone and internet have been connected to company man and the 3rd party offices. Representatives from UT, Geotek, Helix, Schlumberger, and Weatherford met to discuss the status/plans for rig floor and container operations going forward. These plans include utility connections to Geotek containers, grating installation, Schlumberger wireline rig up through the top drive, Weatherford instrumentation, and mouse-hole installation/modification. The current priority is for Helix to finish loading and load-testing before the above operations can continue.

4. OPERATIONAL PLAN (Next 24 Hours):
We are scheduled to depart from Brownsville tomorrow morning, May 1, at 0700. The plans discussed above will continue during the transit to GC 955.

5. DOWNHOLE LOGGING OPERATIONS:
Hole: NA
LWD Totals: NA
Wireline Totals: NA

6. CORE DATA:
Hole: NA
PCTB Coring (pressure coring) Totals: NA

7. Science Activities
NA

Daily Operational and Science Report
UT-GOM2-1: Hydrate Pressure Coring Expedition

1. DATE: 01 May 2017, 0000-2400 hr

2. LOCATION:

0000 – 0750 hr, 01 May 2017
Brownsville, TX
0750 – 2200 hr, 01 May 2017
Transit
2200 – 2400
Stationary offshore

3. DESCRIPTION OF OPERATIONS:

At 0750 hr the *Q4000* left the dock and was guided by the harbor pilot through the channel towards South Padre Island. At 1020 hr the vessel entered the Gulf of Mexico, and continued offshore at 1105 after the pilot disembarked. At 1300 there was a fire drill. Geotek gained access to clean freshwater for their containers. Most activities are paused until Helix finishes sea trials for the vessel.

4. OPERATIONAL PLAN (Next 24 Hours):

The *Q4000* will stop and ballast late today and then Helix will perform sea trials of various vessel functions starting this evening, and should be complete by Wednesday. The transit to Green Canyon 955 will continue after the tests.

5. DOWNHOLE LOGGING OPERATIONS:

NA

6. CORE DATA:

NA

7. Science Activities:

Reviewed drilling program and coring plan.

Daily Operational and Science Report
UT-GOM2-1: Hydrate Pressure Coring Expedition

1. DATE: 02 May 2017, 0000-2400 hr

2. LOCATION:
0000-2400 hr, 02 May 2017
26.1025° N, 96.05967° W
Approximately 60 nmi offshore South Padre Island, TX

3. DESCRIPTION OF OPERATIONS:
The Q4000 has remained stationary offshore while conducting a variety of tests. Geotek worked on organizing their containers and are awaiting electrical connections.

4. OPERATIONAL PLAN (Next 24 Hours):
Helix will continue their FMEA sea trials.

5. DOWNHOLE LOGGING OPERATIONS:
NA

6. CORE DATA:
NA

7. Science Activities
The science party has been reviewing the drilling and coring plan.

Daily Operational and Science Report
UT-GOM2-1: Hydrate Pressure Coring Expedition

1. DATE: 03 May 2017, 0000-2400hr

2. LOCATION:
0000 -2400 hr, 03 May 2017
26.1025° N, 96.05967° W
Approximately 60 nmi east of South Padre Island, TX

3. DESCRIPTION OF OPERATIONS:
The *Q4000* remained stationary and Helix completed FMEA tests. Geotek gained electrical power to their equipment and started one their chilling units.

4. OPERATIONAL PLAN (Next 24 Hours):
After a crew change in the morning of 04 May 2017, the *Q4000* will de-ballast and begin transit to GC955. Forecasted strong winds may cause delays.

5. DOWNHOLE LOGGING OPERATIONS:
NA

6. CORE DATA:
NA

7. Science Activities
The science party has been reviewing the drilling and coring plan.

Daily Operational and Science Report
UT-GOM2-1: Hydrate Pressure Coring Expedition

1. DATE: 04 May 2017, 0000-2400hr

2. LOCATION:
0000 – 1800 hr, 04 May 2017
26.1025° N, 96.05967° W
Approximately 60 nmi east of South Padre Island, TX
1800 – 2400 hr, 05 May 2017
Transit towards GC995

3. DESCRIPTION OF OPERATIONS:
Helix completed a crew change through the morning and afternoon with three helicopter flights. After transfers were complete, the *Q4000* was de-ballasted and began to transit towards GC955. Helix began installing the grating around Geotek's containers. Geotek continued to organize and inventory their equipment.

4. OPERATIONAL PLAN (Next 24 Hours):
The *Q4000* will continue its transit to the northeast with an expected arrival at GC955 late on 06 May 2017.

5. DOWNHOLE LOGGING OPERATIONS:
NA

6. CORE DATA:
NA

7. Science Activities
The science party has been reviewing the drilling, coring and sampling plan.

Daily Operational and Science Report
UT-GOM2-1: Hydrate Pressure Coring Expedition

1. DATE: 05 May 2017, 0000-2400 hr

2. LOCATION:
0000 – 2400 hr, 05 May 2017

3. DESCRIPTION OF OPERATIONS:
The *Q4000* continued transit towards GC955 throughout the day. Grating is installed around Geotek's containers and they are continuing to set up their equipment. UT, Helix, Geotek and all third parties had a pre-spud meeting to discuss the expedition objectives and the operational plan. Schlumberger and Helix worked on rigging up the wireline equipment to the top drive.

4. OPERATIONAL PLAN (Next 24 Hours):
The *Q4000* is expected to arrive at GC955 at 1530 on 06 May 2017. The supply boat is ready and will arrive on Saturday.

5. DOWNHOLE LOGGING OPERATIONS:
NA

6. CORE DATA:
NA

7. Science Activities
The science party continued to review and refine the drilling and coring plan.

Daily Operational and Science Report
UT-GOM2-1: Hydrate Pressure Coring Expedition

1. DATE: 06 May 2017, 0000-2400hr

2. LOCATION:
0000 – 1640 hr, 06 May 2017
Transit to GC955
1640 hr – 2400 hr
On site at GC955-H002

3. DESCRIPTION OF OPERATIONS:
The Q4000 arrived 1 nmi from GC955-H002 at 1600 hr after a 307 nmi transit. The wireline equipment is now rigged up to the top drive. Geotek continued to prepare their equipment. The ROV was launched at 2040 to deploy four Compatt transponders and survey the site area. The H001 well was found at 2247 hr at a location of 27° 00.05126' N, 090° 25.58367' W in a WGS84 coordinate system. The condition of the top of the borehole is intact.

4. OPERATIONAL PLAN (Next 24 Hours):
The supply boat is scheduled to arrive early 07 May 2017 and will be offloaded much of the day. Drilling mud will be offloaded and mixed. On-site mobilization will continue in preparation for the flow test. UT will work to unpack and organize the mud lab.

5. DOWNHOLE LOGGING OPERATIONS:
NA

6. CORE DATA:
NA

7. Science Activities
The science party continued to work on resolving the coring points and sampling protocols.

Daily Operational and Science Report
UT-GOM2-1: Hydrate Pressure Coring Expedition

1. DATE: 07 May 2017, 0000-2400hr

2. LOCATION:
0000 - 2400 hr, 07 May 2017
GC955H

3. DESCRIPTION OF OPERATIONS:
A partial crew change occurred via three helicopter flights. The supply boat was offloaded over most of the day; drilling mud, gel, and the mud lab were brought on board. The as-found survey with the ROV was completed. Geotek did a trial run of attaching an autoclave to PCATS. Helix increased the voltage at Geotek's containers to 204 V. Helix worked on installing the HVAC system for the mud pumps. Weatherford installed a new interface and software to record active signals during drilling.

4. OPERATIONAL PLAN (Next 24 Hours):
Potable water and fuel will be transferred to the *Q4000*. Helix will make up doubles in drill pipe. The flow test is planned to occur sometime on 08 May 2017.

5. DOWNHOLE LOGGING OPERATIONS:
NA

6. CORE DATA:
NA

7. Science Activities
The science party worked to finalize the location of the H002 well based on the 'as found' location of the H001 borehole. The final location of the H002 well was selected to be: 27° 0.0460' N 90° 25.5930 W in the WGS84 coordinate system. This is 59 ft SSW from the existent H001 borehole. The Science Party worked on planning the expedition report.

Appendix C. UT-GOM2 Pre-Drill Operations Plan

UT/DOE PCTB Marine Test Activity Forecast and Time Estimate

Revision: K   Date: 1 May 2017

ITEM	ACTIVITY	TASK DESCRIPTION	TIME (hr)	CUM	Start	Stop	NOTES
Saturday, April 29, 2017							
1	**In Port**	Load PCATS and PCTB containers and connect services (electric, air, water).	24.00	24.00	0:00	0:00	
2	**Brownsville**	Load lifting baskets, rack tubulars.					
3	**Texas**	Install grating.					
4		Install wireline unit and test loading weight bar.					Requires rigging up wireline.
5							
Sunday, April 30, 2017							
6	**In Port Brownsville**	Continue port call activities.	24.00	48.00	0:00	0:00	
7							
Monday, May 01, 2017							
8	**FMEA Sea Trial**	Transit to deep water, continue ship refurbishment, complete inspection/FMEA.	24.00	72.00	0:00	0:00	Mobilization tasks to be completed as time, equipment and personnel availability allows.
Tuesday, May 02, 2017							
9	**FMEA Sea Trial**	Continue ship refurbishment, complete inspection/FMEA.	24.00	96.00	0:00	0:00	Mobilization tasks to be completed as time, equipment and personnel availability allows.
Wednesday, May 03, 2017							
10	**FMEA Sea Trial**	Continue ship refurbishment, complete inspection/FMEA.	24.00	120.00	0:00	0:00	Mobilization tasks to be completed as time, equipment and personnel availability allows.
Thursday, May 04, 2017							
11	**FMEA Sea Trial**	Continue ship refurbishment, complete inspection/FMEA.	24.00	144.00	0:00	0:00	Mobilization tasks to be completed as time, equipment and personnel availability allows.
Friday, May 05, 2017							
12	**FMEA Sea Trial**	Complete ship refurbishment, inspection/FMEA.	24.00	168.00	0:00	0:00	Mobilization tasks to be completed as time, equipment and personnel availability allows.
Saturday, May 06, 2017							
13	**Transit to**	Set up and test PCATS.	24.00	192.00	0:00	0:00	
14	**Site GC-955**	Assemble and test PCTB subassemblies.					
15		Install instrumented core liner in PCTB.					
16		Make up drill pipe.					
17		Set up and test chillers.					
Sunday, May 07, 2017							
18	**Transit to Site GC-955**	Continue transit activities.	24.00	216.00	0:00	0:00	
Monday, May 08, 2017							
19	**Mobilization**	Transfer liquid mud and bulk materials.	24.00	240.00	0:00	0:00	
20	**(on site)**	Launch ROV, deploy beacon(s), take up station.					
21		Perform "as found" site survey with ROV.					
22		Prep for PCTB flow tests.					
23		Test DP system.					
24		Load mud van and other equipment from Fourchon.					
25		Embark UT personnel via helicopter.					
Tuesday, May 09, 2017							
26	**Mobilization (on site)**	Continue on-site mobilization activities.	24.00	264.00	0:00	0:00	
Wednesday, May 10, 2017							
27	**Safety**	Operations safety meeting.	0.50	264.50	0:00	0:30	**Start time dependent on completion of mobilization tasks.**
28	**MU Cutting Shoe BHA**	Install lockable float valve in 9-7/8 bit sub.	0.00	264.50	0:30	0:30	Geotek. Pre-install.
29		Install bit seal and fish pill in 9-7/8 cutting shoe bit, MU bit to bit sub.	0.00	264.50	0:30	0:30	Geotek. Pre-install.
30		Pick up seal bore drill collar, make up bit sub/bit subassembly to seal bore drill collar, torque all connections.	0.50	265.00	0:30	1:00	Helix/Geotek.
31		Make up landing saver sub to seal bore drill collar.	0.25	265.25	1:00	1:15	Helix/Geotek. Install replaceable landing seat.
32		Make up top sub to landing saver sub.	0.25	265.50	1:15	1:30	Helix/Geotek.
33		Make up head sub to top sub.	0.25	265.75	1:30	1:45	Helix/Geotek. Install latch sleeve.
34		Place cutting shoe-configured PCTB lower w/ ICL using lifting clamp and tugger; land on assembly stand over 10" mousehole	0.25	266.00	1:45	2:00	Helix/Geotek. May stage in 10" mouse hole.
35		Pick up PCTB upper end w/tugger, make up upper end to lower end.	0.50	266.50	2:00	2:30	Helix/Geotek.

36		Pick up PCTB assy using tugger, remove lower end lifting clamp, transfer into drill pipe and land upper lifting clamp on crossover sub; attach tugger to wireline running tool, insert running tool in PCTB, pick up PCTB, remove latch-lock clamp and lifting clamp, land PCTB assy in BHA	0.50	267.00	2:30	3:00	Helix/Geotek.
37		Space out cutting shoe configured PCTB. Leave PCTB in OCB assembly after spacing out.	2.75	269.75	3:00	5:45	Geotek/Helix.
38		Make up drill pipe to BHA cross over sub to head sub.	0.25	270.00	5:45	6:00	Helix.
39		Lower outer core barrel assembly w/2 stands (doubles) 5-7/8 drill pipe, hang off at rig floor.	0.75	270.75	6:00	6:45	Helix.
40		PU top drive to drill pipe.	0.50	271.25	6:45	7:15	Helix.
41	**Cutting Shoe Flow Test**	Start mud pump and circulate at 25 gpm, note stand pipe pressure.	0.25	271.50	7:15	7:30	Circulate sea water. Note pressure at steady state flow. Helix/Geotek.
42		Increase flow rate in 25 gpm intervals, noting stand pipe pressure for each interval, to 400+ gpm, 1,000 psi max.	0.50	272.00	7:30	8:00	Note pressures at steady state flows. Helix/Geotek.
43		Stop mud pump, rack back top drive.	0.50	272.50	8:00	8:30	Helix. Assumes top drive parked for tripping.
44		POOH with 2 stands 5-7/8 drill pipe.	0.75	273.25	8:30	9:15	Helix. Leave XO sub attached to drill pipe.
45		Pick up PCTB w/tugger and wireline emergency pulling tool, install lifting clamp and latch-lock clamp on PCTB upper end, land PCTB assy on drill pipe, remove emergency pulling tool.	0.25	273.50	9:15	9:30	Geotek/Helix. May stage in 10" mouse hole.
46		Pick up PCTB w/tugger, transfer to 10" mousehole, install lifting clamp on PCTB lower end, land PCTB assy on assembly stand over 10" mousehole.	0.25	273.75	9:30	9:45	Geotek/Helix. May stage in 10" mouse hole.
47		Break PCTB upper end, stage in shuck.	0.50	274.25	9:45	10:15	
48		Recover PCTB lower end w/instrumented core liner and layout w/tugger/crane to service van.	0.50	274.75	10:15	10:45	Geotek/Helix.
49		Remove fish pills from instrumented core liner.	0.00	274.75	10:45	10:45	Perform while breaking down outer core barrel assembly.
50		Break bit - do not remove, break bit sub, lay out bit sub/bit subassembly.	0.25	275.00	10:45	11:00	Helix.
51		Remove bit, recover fish pill(s).	0.25	275.25	11:00	11:15	Geotek.
52		Review flow test pressure data and size bit nozzles accordingly.	0.75	276.00	11:15	12:00	Geotek/UT.
53	**Safety**	Operations safety meeting.	0.50	276.50	12:00	12:30	
54		Continue review flow test pressure data and size bit nozzles accordingly.	1.25	277.75	12:30	13:45	Geotek/UT.
55		Make up 9-7/8 cutting shoe bit to bit sub.	0.00	277.75	13:45	13:45	Geotek/Helix. Complete while reviewing flow test data.
56	**RIH for Coring**	Make up bit sub/bit subassy to outer core barrel assy.	0.00	277.75	13:45	13:45	Helix/Geotek. Complete while reviewing flow test data.
57		Torque up bit and bit sub to outer core barrel assy, land outer core barrel assy at rig floor.	0.00	277.75	13:45	13:45	Helix. Complete while reviewing flow test data.
58		Pick up cementing barrel w/tugger, land on C-plate on crossover sub.	0.00	277.75	13:45	13:45	Helix/Geotek. Complete while reviewing flow test data.
59		Remove lifting clamp, pull C-plate, drop cementing barrel into outer core barrel assy.	0.00	277.75	13:45	13:45	Helix/Geotek. Complete while reviewing flow test data.
60		Check cementing barrel space out.	0.00	277.75	13:45	13:45	Helix/Geotek. Complete while reviewing flow test data.
61		Attach running tool to tugger, insert into cementing barrel, raise cementing barrel from outer core barrel assy, attach lifting clamp, land lifting clamp on crossover sub, remove running tool, attach tugger to lifting clamp, raise and lay out w/tugger.	0.25	278.00	13:45	14:00	Helix/Geotek. Complete while reviewing flow test data.
62		Pick up center bit w/tugger, land lifting clamp on drill pipe, attach running tool to tugger, insert running tool, raise center bit assy, remove lifting clamp, lower and land in outer core barrel assy.	0.25	278.25	14:00	14:15	Helix/Geotek. Complete while reviewing flow test data.
63		Space out center bit. Leave center bit in outer core barrel assy after spaced out.	1.00	279.25	14:15	15:15	Helix/Geotek.
64		Make up 9-7/8 stabilizer to outer core barrel assy.	0.25	279.50	15:15	15:30	Helix.
65		Make up 1 ea. 8-1/2 drill collar to stabilizer.	0.25	279.75	15:30	15:45	Helix.
66		MU 9-7/8 stabilizer to drill collars.	0.25	280.00	15:45	16:00	Helix.
67		MU 4 ea. 8-1/2 drill collars to stabilizer.	1.50	281.50	16:00	17:30	Helix.
68		Make up drill pipe to BHA cross over sub to drill collars.	0.25	281.75	17:30	17:45	Helix.
69		RIH to 6,650 ft on 5-7/8 drill pipe. Seafloor depth = 6716 ft.	6.25	288.00	17:45	0:00	Helix. Note, logging tool drift test may be performed prior to RIH (reference logging tool drift test time estimate).
Thursday, May 11, 2017							
70	**Safety**	Operations safety meeting.	0.50	288.50	0:00	0:30	
71		Continue RIH to 6,650 ft on 5-7/8 drill pipe. Seafloor depth = 6716 ft.	1.75	290.25	0:30	2:15	Helix. Note, logging tool drift test may be performed prior to RIH (reference logging tool drift test time estimate).
72		Pick up top drive.	0.50	290.75	2:15	2:45	Helix. Assumes top drive parked for tripping.
73	**Spud Hole**	Spud hole H-002, drill 6,716 ft to 7,760 ft.	4.25	295.00	2:45	7:00	Helix. Drill with sea water, pump Hi-Vis and/or weighted mud sweeps as needed. May need to begin continuous 10.5 ppg mud circulation to keep hole open. Maintain top hole integrity as much as possible.

74	**Hole Survey (Gyro Tool)**	Rig up wireline.	1.00	296.00	7:00	8:00	Assumes waiver to forego survey until end of hole has been denied.
75		Rig up survey tool.	0.50	296.50	8:00	8:30	
76		RIH w/survey tool on wireline.	0.50	297.00	8:30	9:00	
77		Take inclination survey, POOH w/survey tool on wireline.	0.75	297.75	9:00	9:45	
78		Lay out survey tool.	0.50	298.25	9:45	10:15	
79		Rig down wireline.	1.00	299.25	10:15	11:15	
80	**Drilling**	Drill 7,760 - 8,064 ft.	0.75	300.00	11:15	12:00	Helix. Drill with sea water, pump Hi-Vis and/or weighted mud sweeps as needed. May need to begin continuous 10.5 ppg mud circulation to keep hole open. Maintain top hole integrity as much as possible.
81	**Safety**	Operations safety meeting.	0.50	300.50	12:00	12:30	
82	**Drilling**	Drill 7,760 - 8,064 ft.	0.50	301.00	12:30	13:00	Helix. Drill with sea water, pump Hi-Vis and/or weighted mud sweeps as needed. May need to begin continuous 10.5 ppg mud circulation to keep hole open. Maintain top hole integrity as much as possible.
83		Clean and condition hole as required. Fill hole with 10.5 mud.	1.00	302.00	13:00	14:00	Helix. Maintain continuous pumping of 10.5 ppg mud while coring.
84		Rig up wireline, including sinker bar and jar assemblies.	1.00	303.00	14:00	15:00	Helix/Slb.
85		Break drill string, load wireline/emergency pulling tool, close drill string.	0.25	303.25	15:00	15:15	Helix/Geotek/Slb.
86		RIH w/wireline at max safe speed, latch center bit, maintain circulation at 10 gpm min.	0.75	304.00	15:15	16:00	Slb/Geotek/Helix. Rotate and manipulate as required.
87		POOH w/center bit on wireline @ max safe speed, maintain circulation at 10 gpm min.	0.75	304.75	16:00	16:45	Slb/Geotek/Helix. Rotate and manipulate as required.
88		Break drill string, install lifting clamp on center bit, land center bit on drill pipe, unlatch wireline, change out emergency pulling tool for running tool.	0.25	305.00	16:45	17:00	Helix/Geotek.
89		Lay out center bit w/tugger.	0.25	305.25	17:00	17:15	Helix/Geotek.
90		Pick up PCTB lower end w/tugger, land lifting clamp on assembly stand over 10" mousehole.	0.25	305.50	17:15	17:30	Helix/Geotek. May stage in 10" mousehole.
91		Pick up PCTB upper end w/tugger, make up to lower end, lift and transfer to drill pipe, land PCTB assy on drill pipe.	0.50	306.00	17:30	18:00	Helix/Geotek.
92		Latch wireline to PCTB assy, pick up PCTB assy, remove lifting clamp, close drill string, RIH w/PCTB on wireline @ max safe speed, land/latch PCTB in outer core barrel assy, maintain circulation at 10 gpm min.	1.00	307.00	18:00	19:00	Slb/Geotek/Helix. Rotate and manipulate as required.
93		POOH w/wireline @ max safe speed, break drill string, change out running tool for pulling tool, close drill string.	0.75	307.75	19:00	19:45	Slb/Geotek/Helix. Rotate and manipulate as required.
94		RIH with wireline at max safe speed to 7950 ft.	0.00	307.75	19:45	19:45	Slb. RIH while coring.
95	**Core 1CS**	**Core 8,064 ft to 8,074 ft.**	1.00	308.75	19:45	20:45	Helix/Geotek. Note, top of hydrate @ 8,071 ft.
96		Lower wireline, latch PCTB, POOH w/PCTB at max safe speed, maintain circulation @ 10 gpm min.	0.75	309.50	20:45	21:30	Slb/Geotek/Helix. Rotate and manipulate as required.
97		Break drill string, install lifting clamp on PCTB upper end, land PCTB on drill string, unlatch wireline.	0.25	309.75	21:30	21:45	Helix/Geotek/Slb.
98		Pick up PCTB w/tugger, install lifting clamp on lower end, load/land lower end in cold shuck.	0.25	310.00	21:45	22:00	Helix/Geotek/Slb.
99		Break PCTB upper end, stage in mousehole.	0.25	310.25	22:00	22:15	Geotek/Helix.
100		Pick up refurbished PCTB lower end w/tugger, load/land in assembly stand over 10" mousehole	0.25	310.50	22:15	22:30	Geotek/Helix.
101		Pick up PCTB upper end w/tugger, make up to PCTB lower end, pick up PCTB assy, transfer to drill pipe, land PCTB on drill pipe,	0.50	311.00	22:30	23:00	Geotek/Helix.
102		Change out wireline pulling tool for running tool, latch wireline to PCTB, pick up PCTB w/wireline, remove lifting clamp, close drill string, RIH w/PCTB on wireline @ max safe speed, maintain circulation @ 10 gpm min.	1.00	312.00	23:00	0:00	Slb/Geotek/Helix. Rotate and manipulate as required.
Friday, May 12, 2017							
103	**Safety**	Operations safety meeting.	0.50	312.50	0:00	0:30	
104		Land/latch PCTB in outer core barrel assy, POOH w/wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.75	313.25	0:30	1:15	Slb/Geotek/Helix. Rotate and manipulate as required.
105		Break drill string, change out wireline running tool for pulling tool, close drill string.	0.25	313.50	1:15	1:30	Helix/Geotek/Slb.
106		RIH w/wireline at max safe speed to 7,950 ft.	0.00	313.50	1:30	1:30	Slb. RIH while coring.
107	**Core 2CS**	**Core 8,074 ft to 8,084 ft.**	1.00	314.50	1:30	2:30	Helix/Geotek.
108		Lower wireline, latch PCTB, POOH w/PCTB at max safe speed, maintain circulation @ 10 gpm min.	0.75	315.25	2:30	3:15	Slb/Geotek/Helix. Rotate and manipulate as required.
109		Break drill string, install lifting clamp on PCTB upper end, land PCTB on drill string, unlatch wireline.	0.25	315.50	3:15	3:30	Helix/Geotek/Slb.
110		Pick up PCTB w/tugger, install lifting clamp on lower end, load/land lower end in cold shuck.	0.25	315.75	3:30	3:45	Helix/Geotek/Slb.
111		Break PCTB upper end, stage in mousehole.	0.50	316.25	3:45	4:15	Geotek/Helix.
112		Pick up refurbished PCTB lower end w/tugger, load/land in assembly stand over 10" mousehole	0.25	316.50	4:15	4:30	Geotek/Helix.
113		Pick up PCTB upper end w/tugger, make up to PCTB lower end, pick up PCTB assy, remove lifting clamp from lower end, land PCTB on drill pipe.	0.50	317.00	4:30	5:00	Geotek/Helix.

114		Change out wireline pulling tool for running tool, latch wireline to PCTB, pick up PCTB w/wireline, remove lifting clamp, close drill string, RIH w/PCTB on wireline @ max safe speed, maintain circulation @ 10 gpm min.	1.00	318.00	5:00	6:00	Slb/Geotek/Helix. Rotate and manipulate as required.
115		Land/latch PCTB in outer core barrel assy, POOH w/wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.75	318.75	6:00	6:45	Slb/Geotek/Helix. Rotate and manipulate as required.
116		Break drill string, change out wireline running tool for pulling tool, close drill string.	0.25	319.00	6:45	7:00	Helix/Geotek/Slb.
117		RIH w/wireline at max safe speed to 7,950 ft.	0.00	319.00	7:00	7:00	Slb. RIH while coring.
118	**Core 3CS**	**Core 8,084 ft to 8,094 ft.**	1.00	320.00	7:00	8:00	
119		Lower wireline, latch PCTB, POOH w/PCTB at max safe speed, maintain circulation @ 10 gpm min.	0.75	320.75	8:00	8:45	Slb/Geotek/Helix. Rotate and manipulate as required.
120		Break drill string, install lifting clamp on PCTB upper end, land PCTB on drill string, unlatch wireline.	0.25	321.00	8:45	9:00	Helix/Geotek/Slb.
121		Pick up PCTB w/tugger, install lifting clamp on lower end, load/land lower end in cold shuck.	0.25	321.25	9:00	9:15	Helix/Geotek/Slb.
122		Break PCTB upper end, stage in mousehole.	0.50	321.75	9:15	9:45	Geotek/Helix.
123	**Hole Cleaning (if required)**	Pick up center bit w/tugger, load/land center bit on drill pipe.	0.25	322.00	9:45	10:00	Helix/Slb/Geotek. Rotate and manipulate as required.
124		Latch wireline to center bit, close drill string, RIH w/center bit on wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.75	322.75	10:00	10:45	Helix/Slb/Geotek. Rotate and manipulate as required.
125		Land/latch center bit in outer core barrel assy, maintain circulation at 10 gpm min.	0.75	323.50	10:45	11:30	Helix/Slb/Geotek. Rotate and manipulate as required.
126		POOH w/wireline @ max safe speed, maintain circulation at 10 gpm min.	0.00	323.50	11:30	11:30	Helix/Slb/Geotek. POOH whole cleaning hole.
127		Break drill string, change out wireline running tool for emergency pulling tool, close drill string.	0.25	323.75	11:30	11:45	
128		RIH w/wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.25	324.00	11:45	12:00	RIH while cleaning hole.
129	**Safety**	Operations safety meeting.	0.50	324.50	12:00	12:30	
130		Hole cleaning.	0.75	325.25	12:30	13:15	
131		Latch center bit, POOH w/center bit on wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.75	326.00	13:15	14:00	Helix/Slb/Geotek. Rotate and manipulate as required.
132		Break drill string, install lifting clamp on center bit, land center bit on drill pipe, unlatch wireline, lay out center bit w/tugger.	0.25	326.25	14:00	14:15	Helix/Slb/Geotek. Rotate and manipulate as required.
133	**Coring**	Pick up refurbished PCTB lower end w/tugger, load/land on assembly stand over 10" mousehole.	0.25	326.50	14:15	14:30	Geotek/Helix.
134		Pick up PCTB upper end w/tugger, make up to PCTB lower end, pick up PCTB assy, remove lifting clamp from lower end, transfer and land PCTB assy on drill pipe.	0.50	327.00	14:30	15:00	Geotek/Helix.
135		Change out wireline emergency pulling tool for running tool, latch wireline to PCTB, pick up PCTB w/wireline, remove lifting clamp, close drill string, RIH w/PCTB on wireline @ max safe speed, maintain circulation @ 10 gpm min.	1.00	328.00	15:00	16:00	Slb/Geotek/Helix. Rotate and manipulate as required.
136		Land/latch PCTB in outer core barrel assy, POOH w/wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.75	328.75	16:00	16:45	Slb/Geotek/Helix. Rotate and manipulate as required.
137		Break drill string, change out wireline running tool for pulling tool, close drill string.	0.25	329.00	16:45	17:00	Helix/Geotek/Slb.
138		RIH w/wireline at max safe speed to 7,950 ft.	0.00	329.00	17:00	17:00	Slb. RIH while coring.
139	**Core 4CS**	**Core 8,094 ft to 8,104 ft.**	1.00	330.00	17:00	18:00	
140		Lower wireline, latch PCTB, POOH w/PCTB at max safe speed, maintain circulation @ 10 gpm min.	0.75	330.75	18:00	18:45	Slb/Geotek/Helix. Rotate and manipulate as required.
141		Break drill string, install lifting clamp on PCTB upper end, land PCTB on drill string, unlatch wireline.	0.25	331.00	18:45	19:00	Helix/Geotek/Slb.
142		Pick up PCTB w/tugger, install lifting clamp on lower end, load/land lower end in cold shuck.	0.25	331.25	19:00	19:15	Helix/Geotek/Slb.
143		Break PCTB upper end, stage in mousehole.	0.50	331.75	19:15	19:45	Geotek/Helix.
144		Pick up refurbished PCTB lower end w/tugger, load/land on assembly stand over 10" mousehole.	0.25	332.00	19:45	20:00	Geotek/Helix.
145		Pick up PCTB upper end w/tugger, make up to PCTB lower end, pick up PCTB assy, remove lifting clamp from lower end, transfer and land PCTB on drill pipe.	0.50	332.50	20:00	20:30	Geotek/Helix.
146		Change out wireline pulling tool for running tool, latch wireline to PCTB, pick up PCTB w/wireline, remove lifting clamp, close drill string, RIH w/PCTB on wireline @ max safe speed, maintain circulation @ 10 gpm min.	1.00	333.50	20:30	21:30	Slb/Geotek/Helix. Rotate and manipulate as required.
147		Land/latch PCTB in outer core barrel assy, POOH w/wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.75	334.25	21:30	22:15	Slb/Geotek/Helix. Rotate and manipulate as required.
148		Break drill string, change out wireline running tool for pulling tool, close drill string.	0.25	334.50	22:15	22:30	Helix/Geotek/Slb.
149		RIH w/wireline at max safe speed to 7,950 ft.	0.00	334.50	22:30	22:30	Slb. RIH while coring.
150	**Core 5CS**	**Core 8,104 ft to 8,114 ft.**	1.00	335.50	22:30	23:30	
151		Lower wireline, latch PCTB, POOH w/PCTB at max safe speed, maintain circulation @ 10 gpm min.	0.50	336.00	23:30	0:00	Slb/Geotek/Helix. Rotate and manipulate as required.

Saturday, May 13, 2017							
152	**Safety**	Operations safety meeting.	0.50	336.50	0:00	0:30	
153		Break drill string, install lifting clamp on PCTB upper end, land PCTB on drill string, unlatch wireline.	0.25	336.75	0:30	0:45	Helix/Geotek/Slb.
154		Pick up PCTB w/tugger, install lifting clamp on lower end, load/land lower end in cold shuck.	0.25	337.00	0:45	1:00	Helix/Geotek/Slb.
155		Break PCTB upper end, stage in mousehole.	0.50	337.50	1:00	1:30	Geotek/Helix.
156		Pick up refurbished PCTB lower end w/tugger, load/land on assembly stand over 10" mousehole.	0.25	337.75	1:30	1:45	Geotek/Helix.
157		Pick up PCTB upper end w/tugger, make up to PCTB lower end, pick up PCTB assy, remove lifting clamp from lower end, land PCTB on drill pipe.	0.50	338.25	1:45	2:15	Geotek/Helix.
158		Change out wireline pulling tool for running tool, latch wireline to PCTB, pick up PCTB w/wireline, remove lifting clamp, close drill string, RIH w/PCTB on wireline @ max safe speed, maintain circulation @ 10 gpm min.	1.00	339.25	2:15	3:15	Slb/Geotek/Helix. Rotate and manipulate as required.
159		Land/latch PCTB in outer core barrel assy, POOH w/wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.75	340.00	3:15	4:00	Slb/Geotek/Helix. Rotate and manipulate as required.
160		Break drill string, change out wireline running tool for pulling tool, close drill string.	0.25	340.25	4:00	4:15	Helix/Geotek/Slb.
161		RIH w/wireline at max safe speed to 7,950 ft.	0.00	340.25	4:15	4:15	Slb. RIH while coring.
162	**Core 6CS**	**Core 8,114 ft to 8,124 ft.**	1.00	341.25	4:15	5:15	
163		Lower wireline, latch PCTB, POOH w/PCTB at max safe speed, maintain circulation @ 10 gpm min.	0.75	342.00	5:15	6:00	Slb/Geotek/Helix. Rotate and manipulate as required.
164		Break drill string, install lifting clamp on PCTB upper end, land PCTB on drill string, unlatch wireline.	0.25	342.25	6:00	6:15	Helix/Geotek/Slb.
165		Pick up PCTB w/tugger, install lifting clamp on lower end, load/land lower end in cold shuck.	0.25	342.50	6:15	6:30	Helix/Geotek/Slb.
166		Break PCTB upper end, stage in mousehole.	0.50	343.00	6:30	7:00	Geotek/Helix.
167	**Drilling**	Pick up center bit w/tugger, load/land center bit in drill pipe.	0.25	343.25	7:00	7:15	Helix/Slb/Geotek. Rotate and manipulate as required.
168		Change out wireline pulling tool for running tool, latch wireline to center bit, pick up center bit, remove lifting clamp, close drill string, RIH w/center bit on wireline @ max safe speed, maintain circulation @ 10 gpm min.	1.00	344.25	7:15	8:15	Helix/Slb/Geotek. Rotate and manipulate as required.
169		Land/latch center bit in outer core barrel assy, POOH w/wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.00	344.25	8:15	8:15	Helix/Slb/Geotek. Rotate and manipulate as required. POOH while drilling.
170		**Drill from 8,124 ft to 8,150 ft.**	0.75	345.00	8:15	9:00	Helix.
171	**Hole Cleaning**	Clean hole.	1.00	346.00	9:00	10:00	Helix.
172		Break drill string, change out wireline running tool for emergency pulling tool, close drill string, RIH w/wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.75	346.75	10:00	10:45	Helix/Slb/Geotek. Rotate and manipulate as required.
173		Latch center bit, POOH w/center bit on wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.75	347.50	10:45	11:30	Helix/Slb/Geotek. Rotate and manipulate as required.
174		Break drill string, install lifting clamp on center bit, land center bit on drill pipe, unlatch wireline.	0.25	347.75	11:30	11:45	Helix/Slb/Geotek. Rotate and manipulate as required.
175		Lay out center bit w/tugger.	0.25	348.00	11:45	12:00	
176	**Safety**	Operations safety meeting.	0.50	348.50	12:00	12:30	
177	**Coring**	Pick up refurbished PCTB lower end w/tugger, load/land on assembly stand over 10" mousehole.	0.50	349.00	12:30	13:00	Geotek/Helix.
178		Pick up PCTB upper end w/tugger, make up to PCTB lower end, pick up PCTB assy, remove lifting clamp from lower end, transfer and land PCTB assy on drill pipe.	0.75	349.75	13:00	13:45	Geotek/Helix.
179		Change out wireline emergency pulling tool for running tool, latch wireline to PCTB, pick up PCTB w/wireline, remove lifting clamp, close drill string, RIH w/PCTB on wireline @ max safe speed, maintain circulation @ 10 gpm min.	1.00	350.75	13:45	14:45	Slb/Geotek/Helix. Rotate and manipulate as required.
180		Land/latch PCTB in outer core barrel assy, POOH w/wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.75	351.50	14:45	15:30	Slb/Geotek/Helix. Rotate and manipulate as required.
181		Break drill string, change out wireline running tool for pulling tool, close drill string.	0.25	351.75	15:30	15:45	Helix/Geotek/Slb.
182		RIH w/wireline at max safe speed to 7,950 ft.	0.00	351.75	15:45	15:45	Slb. RIH while coring.
183	**Core 7CS**	**Core 8,150 ft to 8,160 ft.**	1.00	352.75	15:45	16:45	
184		Lower wireline, latch PCTB, POOH w/PCTB at max safe speed, maintain circulation @ 10 gpm min.	0.75	353.50	16:45	17:30	Slb/Geotek/Helix. Rotate and manipulate as required.
185		Break drill string, install lifting clamp on PCTB upper end, land PCTB on drill string, unlatch wireline.	0.25	353.75	17:30	17:45	Helix/Geotek/Slb.
186		Pick up PCTB w/tugger, install lifting clamp on lower end, load/land lower end in cold shuck.	0.25	354.00	17:45	18:00	Helix/Geotek/Slb.
187		Break PCTB upper end, stage in mousehole.	0.50	354.50	18:00	18:30	Geotek/Helix.
188		Pick up refurbished PCTB lower end w/tugger, load/land on assembly stand over 10" mousehole.	0.25	354.75	18:30	18:45	Geotek/Helix.
189		Pick up PCTB upper end w/tugger, make up to PCTB lower end, pick up PCTB assy, remove lifting clamp from lower end, land PCTB on drill pipe.	0.50	355.25	18:45	19:15	Geotek/Helix.

190		Change out wireline pulling tool for running tool, latch wireline to PCTB, pick up PCTB w/wireline, remove lifting clamp, close drill string, RIH w/PCTB on wireline @ max safe speed, maintain circulation @ 10 gpm min.	1.00	356.25	19:15	20:15	Slb/Geotek/Helix. Rotate and manipulate as required.
191		Land/latch PCTB in outer core barrel assy, POOH w/wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.75	357.00	20:15	21:00	Slb/Geotek/Helix. Rotate and manipulate as required.
192		Break drill string, change out wireline running tool for pulling tool, close drill string.	0.25	357.25	21:00	21:15	Helix/Geotek/Slb.
193		RIH w/wireline at max safe speed to 7,950 ft.	0.00	357.25	21:15	21:15	Slb. RIH while coring.
194	**Core 8CS**	**Core 8,160 ft to 8,170 ft.**	1.00	358.25	21:15	22:15	
195		Lower wireline, latch PCTB, POOH w/PCTB at max safe speed, maintain circulation @ 10 gpm min.	0.75	359.00	22:15	23:00	Slb/Geotek/Helix. Rotate and manipulate as required.
196		Break drill string, install lifting clamp on PCTB upper end, land PCTB on drill string, unlatch wireline.	0.25	359.25	23:00	23:15	Helix/Geotek/Slb.
197		Pick up PCTB w/tugger, install lifting clamp on lower end, load/land lower end in cold shuck.	0.25	359.50	23:15	23:30	Helix/Geotek/Slb.
198		Break PCTB upper end, stage in mousehole.	0.50	360.00	23:30	0:00	Geotek/Helix.
Sunday, May 14, 2017							
199	**Safety**	Operations safety meeting.	0.50	360.50	0:00	0:30	
200		Pick up refurbished PCTB lower end w/tugger, load/land on assembly stand over 10" mousehole.	0.50	361.00	0:30	1:00	Geotek/Helix.
201		Pick up PCTB upper end w/tugger, make up to PCTB lower end, pick up PCTB assy, remove lifting clamp from lower end, land PCTB on drill pipe.	0.50	361.50	1:00	1:30	Geotek/Helix.
202		Change out wireline pulling tool for running tool, latch wireline to PCTB, pick up PCTB w/wireline, remove lifting clamp, close drill string, RIH w/PCTB on wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.50	362.00	1:30	2:00	Slb/Geotek/Helix. Rotate and manipulate as required.
203		Continue RIH w/PCTB on wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.50	362.50	2:00	2:30	Slb/Geotek/Helix. Rotate and manipulate as required.
204		Land/latch PCTB in outer core barrel assy, POOH w/wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.75	363.25	2:30	3:15	Slb/Geotek/Helix. Rotate and manipulate as required.
205		Break drill string, change out wireline running tool for pulling tool, close drill string.	0.25	363.50	3:15	3:30	Helix/Geotek/Slb.
206		RIH w/wireline at max safe speed to 7,950 ft.	0.00	363.50	3:30	3:30	Slb. RIH while coring.
207	**Core 9CS**	**Core 8,170 ft to 8,180 ft.**	1.00	364.50	3:30	4:30	
208		Lower wireline, latch PCTB, POOH w/PCTB at max safe speed, maintain circulation @ 10 gpm min.	0.75	365.25	4:30	5:15	Slb/Geotek/Helix. Rotate and manipulate as required.
209		Break drill string, install lifting clamp on PCTB upper end, land PCTB on drill string, unlatch wireline.	0.25	365.50	5:15	5:30	Helix/Geotek/Slb.
210		Pick up PCTB w/tugger, install lifting clamp on lower end, load/land lower end in cold shuck.	0.25	365.75	5:30	5:45	Helix/Geotek/Slb.
211		Break PCTB upper end, stage in mousehole.	0.50	366.25	5:45	6:15	Geotek/Helix.
212		Pick up refurbished PCTB lower end w/tugger, load/land on assembly stand over 10" mousehole.	0.25	366.50	6:15	6:30	Geotek/Helix.
213		Pick up PCTB upper end w/tugger, make up to PCTB lower end, pick up PCTB assy, remove lifting clamp from lower end, land PCTB on drill pipe.	0.50	367.00	6:30	7:00	Geotek/Helix.
214		Change out wireline pulling tool for running tool, latch wireline to PCTB, pick up PCTB w/wireline, remove lifting clamp, close drill string, RIH w/PCTB on wireline @ max safe speed, maintain circulation @ 10 gpm min.	1.00	368.00	7:00	8:00	Slb/Geotek/Helix. Rotate and manipulate as required.
215		Land/latch PCTB in outer core barrel assy, POOH w/wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.75	368.75	8:00	8:45	Slb/Geotek/Helix. Rotate and manipulate as required.
216		Break drill string, change out wireline running tool for pulling tool, close drill string.	0.25	369.00	8:45	9:00	Helix/Geotek/Slb.
217		RIH w/wireline at max safe speed to 7,950 ft.	0.00	369.00	9:00	9:00	Slb. RIH while coring.
218	**Core 10CS**	**Core 8,180 ft to 8,190 ft.**	1.00	370.00	9:00	10:00	Bottom of hydrate @ 8,166 ft RKB (1,445 fbsf).
219		Lower wireline, latch PCTB, POOH w/PCTB at max safe speed, maintain circulation @ 10 gpm min.	0.75	370.75	10:00	10:45	Slb/Geotek/Helix. Rotate and manipulate as required.
220		Break drill string, install lifting clamp on PCTB upper end, land PCTB on drill string, unlatch wireline.	0.25	371.00	10:45	11:00	Helix/Geotek/Slb.
221		Pick up PCTB w/tugger, install lifting clamp on lower end, load/land lower end in cold shuck.	0.25	371.25	11:00	11:15	Helix/Geotek/Slb.
222		Break PCTB upper end, stage in mousehole.	0.50	371.75	11:15	11:45	Geotek/Helix.
223	**Drilling**	Pick up center bit w/tugger, load/land center bit in drill pipe.	0.25	372.00	11:45	12:00	Helix/Slb/Geotek. Rotate and manipulate as required.
224	**Safety**	Operations safety meeting.	0.50	372.50	12:00	12:30	
225		Change out wireline pulling tool for running tool, latch wireline to center bit, pick up center bit, remove lifting clamp, close drill string, RIH w/center bit on wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.50	373.00	12:30	13:00	Helix/Slb/Geotek. Rotate and manipulate as required.
226		Continue RIH w/center bit on wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.50	373.50	13:00	13:30	Helix/Slb/Geotek. Rotate and manipulate as required.
227		Land/latch center bit in outer core barrel assy, POOH w/wireline @ max safe speed, maintain circulation @ 10 gpm min.	1.00	374.50	13:30	14:30	Helix/Slb/Geotek. Rotate and manipulate as required. POOH while drilling.

228		Rig down wireline.	1.00	375.50	14:30	15:30	
229		**Drill 8,190 ft to 8,440 ft.**	1.00	376.50	15:30	16:30	250 ft rat hole for logging
230		Clean hole for logging.	1.00	377.50	16:30	17:30	
231		Rig up wireline.	1.00	378.50	17:30	18:30	
232		RIH w/emergency pulling tool on wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.75	379.25	18:30	19:15	
233		Latch center bit, POOH w/center bit on wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.75	380.00	19:15	20:00	Helix/Slb/Geotek. Rotate and manipulate as required.
234		Break drill string, install lifting clamp on center bit, land center bit on drill pipe, unlatch wireline.	0.25	380.25	20:00	20:15	Helix/Slb/Geotek. Rotate and manipulate as required.
235		Lay out center bit w/tugger, close drill string.	0.25	380.50	20:15	20:30	
236		Rig down wireline.	1.00	381.50	20:30	21:30	
237		POOH w/bit to 7,871 ft.	1.00	382.50	21:30	22:30	
238	**Logging**	EDTC/HLDS/DSI/HRLA, Speed = 1,200 ft/hr		382.50	22:30	22:30	
239		Rig up logging line.	1.50	384.00	22:30	0:00	
Monday, May 15, 2017							
240	**Safety**	Operations safety meeting.	0.50	384.50	0:00	0:30	
241		Continue to rig up logging line.	0.50	385.00	0:30	1:00	
242		Rig up tool string.	1.00	386.00	1:00	2:00	
243		Calibration before run (in pipe).	0.25	386.25	2:00	2:15	
244		Run tool to pipe depth.	1.25	387.50	2:15	3:30	
245		Log down.	0.25	387.75	3:30	3:45	
246		Log up.	0.50	388.25	3:45	4:15	
247		Log down.	0.25	388.50	4:15	4:30	
248		Log up.	0.50	389.00	4:30	5:00	
249		Log to mudline.	1.00	390.00	5:00	6:00	
250		POOH.	1.25	391.25	6:00	7:15	
251		Calibration after run (in pipe).	0.25	391.50	7:15	7:30	
252		Rig down tool string.	0.75	392.25	7:30	8:15	
253		Rig down logging line.	2.25	394.50	8:15	10:30	
254	**Cementing**	RIH to TD @ 8,441 fbsf.	1	395.50	10:30	11:30	
255		Displace hole from TD to 7,900 ft with 11.5 ppg Hi- Vis pad mud.	1	396.50	11:30	12:30	
256	**Safety**	Operations safety meeting.	0.50	397.00	12:30	13:00	
257		POOH to 7,900 ft.	0.75	397.75	13:00	13:45	Bit at top of pad mud, 100 ft above hydrate zone.
258		Drop outer core barrel assembly (OCBA) cementing liner.	0.75	398.50	13:45	14:30	Free fall deploy.
259		Pump cement per Schlumberger program.	5	403.50	14:30	19:30	300 ft plug.
260		POOH to 6,616 ft (100 ft above sea floor).	2.5	406.00	19:30	22:00	100 ft above sea floor. Pull slowly through cement column 5 min/double.
261		Circulate ≥2X drill string volume w/sea water and 3x rubber balls at ≥5 bbl/min.	0.75	406.75	22:00	22:45	Pump foam pipe wipers.
262		Rig up wireline.	1	407.75	22:45	23:45	
263		RIH w/pulling tool on wireline, latch OCBA cementing liner, maintain 10 gpm min circulation.	0.25	408.00	23:45	0:00	Circulate.
Tuesday, May 16, 2017							
264	**Safety**	Operations safety meeting.	0.50	408.50	0:00	0:30	
265		Continue RIH w/pulling tool on wireline, latch OCBA cementing liner, maintain 10 gpm min circulation.	0.5	409.00	0:30	1:00	Circulate.
266		POOH w/OCBA cementing liner, maintain 10 gpm min circulation.	0.75	409.75	1:00	1:45	Circulate.
267		Break drill string, install lifting clamp on OCBA cementing liner, land OCBA cementing liner on drill pipe, unlatch wireline.	0.25	410.00	1:45	2:00	Helix/Slb/Geotek. Rotate and manipulate as required.
268		Lay out OCBA cementing liner w/tugger, close drill string.	0.50	410.50	2:00	2:30	
269		Rig down wireline.	1	411.50	2:30	3:30	
270		Circulate ≥1X drill string volume w/sea water at ≥5 bbl/min.	0	411.50	3:30	3:30	Circulate while rigging down wireline.
271		Rack back top drive.	0.5	412.00	3:30	4:00	
272	**POOH**	POOH to top of outer core barrel assy.	8.00	420.00	4:00	12:00	
273		Observe borehole for signs of out flow.	0	420.00	12:00	12:00	Observe while cleaning drill string
274	**Safety**	Operations safety meeting.	0.50	420.50	12:00	12:30	
275		POOH to bit, break bit - do not remove - break bit sub.	0.25	420.75	12:30	12:45	
276		Lay out bit sub/bit subassembly.	0.25	421.00	12:45	13:00	
277		Remove 9-7/8 cutting shoe bit, bit seal, LFV.	0.50	421.50	13:00	13:30	Inspect for retained cement.
278		Clear rig floor and stage face bit BHA components.	1.00	422.50	13:30	14:30	
279		Continue to clear rig floor and stage face bit BHA components.	1.00	423.50	14:30	15:30	
280	**MU Face Bit BHA**	Install standard float valve in 9-7/8 bit sub.	0.00	423.50	15:30	15:30	Geotek. Pre-install.
281		Install bit seal and fish pill in 9-7/8 face bit, MU bit to bit sub.	0.00	423.50	15:30	15:30	Geotek. Pre-install.
282		Pick up seal bore drill collar, make up bit sub/bit subassembly to seal bore drill collar, torque all connections.	0.50	424.00	15:30	16:00	Helix/Geotek.
283		Make up landing saver sub to seal bore drill collar.	0.25	424.25	16:00	16:15	Helix/Geotek. Install replaceable landing seat.
284		Make up top sub to landing saver sub.	0.25	424.50	16:15	16:30	Helix/Geotek.
285		Make up head sub to top sub.	0.25	424.75	16:30	16:45	Helix/Geotek. Install latch sleeve.
286		Pick up face bit configured PCTB lower end w/ instrumented core liner w/tugger, load/land PCTB lower end in mousehole.	0.25	425.00	16:45	17:00	Helix/Geotek. May stage in 10" mouse hole.

287		Pick up PCTB upper end w/tugger, make up upper end to lower end.	0.50	425.50	17:00	17:30	Helix/Geotek.
288		Pick up PCTB assy w/tugger, remove lower end lifting clamp, land PCTB assy on Outer Core Barrel assy.	0.25	425.75	17:30	17:45	Helix/Geotek.
289		Space out face bit configured PCTB. Leave PCTB in OCB assembly after spacing out.	2.00	427.75	17:45	19:45	Geotek/Helix.
290		Make up drill pipe to BHA cross over sub to head sub.	0.25	428.00	19:45	20:00	Helix.
291		Lower outer core barrel assembly w/2 stands (doubles) 5-7/8 drill pipe, hang off at rig floor.	0.75	428.75	20:00	20:45	Helix.
292		Make up top drive to drill pipe.	0.50	429.25	20:45	21:15	Helix.
293	**Face Bit Flow Test**	Start mud pump and circulate at 25 gpm, note stand pipe pressure.	0.25	429.50	21:15	21:30	Circulate sea water. Note pressure at steady state flow. Helix/Geotek.
294		Increase flow rate in 25 gpm intervals, noting stand pipe pressure for each interval, to 400+ gpm, 1,000 psi max.	0.50	430.00	21:30	22:00	Note pressures at steady state flows. Helix/Geotek.
295		Stop mud pump, park top drive.	0.25	430.25	22:00	22:15	Helix. Assumes top drive parked for tripping.
296		POOH with 2 stands 5-7/8 drill pipe.	0.50	430.75	22:15	22:45	Helix.
297		Break and lay out drill pipe to BHA XO.	0.25	431.00	22:45	23:00	Helix. XO sub can be left on last joint of drill pipe.
298		Pick up PCTB w/tugger and wireline pulling tool, install lifting clamp on PCTB upper end, land PCTB assy on outer core barrel assy, remove wireline pulling tool.	0.25	431.25	23:00	23:15	Geotek/Helix. May stage in 10" mouse hole.
299		Pick up PCTB w/tugger, install lifting clamp on PCTB lower end, land PCTB assy on outer core barrel assy.	0.25	431.50	23:15	23:30	Geotek/Helix. May stage in 10" mouse hole.
300		Break PCTB upper end, stage in shuck.	0.50	432.00	23:30	0:00	
Wednesday, May 17, 2017							
301	**Safety**	Operations safety meeting.	0.50	432.50	0:00	0:30	
302		Recover PCTB lower end w/instrumented core liner and layout w/tugger/crane to service van.	0.50	433.00	0:30	1:00	Geotek/Helix.
303		Break bit - do not remove, break bit sub, lay out bit sub/bit subassembly.	0.25	433.25	1:00	1:15	Helix.
304		Remove bit, recover fish pill(s).	0.25	433.50	1:15	1:30	Geotek.
305		Review flow test pressure data and size bit nozzles accordingly.	1.00	434.50	1:30	2:30	Geotek/UT.
306		Continue to review flow test pressure data and size bit nozzles accordingly.	1.00	435.50	2:30	3:30	Geotek/UT.
307		Make up 9-7/8 face bit to bit sub.	0.00	435.50	3:30	3:30	Geotek/Helix. Complete while reviewing flow test data.
308	**RIH for Coring**	Make up bit sub/bit subassy to outer core barrel assy.	0.00	435.50	3:30	3:30	Helix/Geotek. Complete while reviewing flow test data.
309		Torque up bit and bit sub to outer core barrel assy, land outer core barrel assy at rig floor.	0.00	435.50	3:30	3:30	Helix. Complete while reviewing flow test data.
310		Attach running tool to tugger, pick up cementing barrel w/tugger/running tool, remove lifting clamp, land cementing barrel in outer core barrel assy.	0.00	435.50	3:30	3:30	Helix/Geotek. Complete while reviewing flow test data.
311		Check cementing barrel space out.	0.00	435.50	3:30	3:30	Helix/Geotek. Complete while reviewing flow test data.
312		Remove cementing barrel from outer core barrel assy and lay out w/tugger.	0.00	435.50	3:30	3:30	Helix/Geotek. Complete while reviewing flow test data.
313		Pick up center bit w/tugger and land in outer core barrel assy.	0.25	435.75	3:30	3:45	Helix/Geotek.
314		Space out center bit. Leave center bit in outer core barrel assy after spaced out.	1.00	436.75	3:45	4:45	Helix/Geotek.
315		Make up 9-7/8 stabilizer to outer core barrel assy.	0.25	437.00	4:45	5:00	Helix.
316		Make up 1 ea. 8-1/2 drill collar to stabilizer.	0.25	437.25	5:00	5:15	Helix.
317		MU 9-7/8 stabilizer to drill collars.	0.25	437.50	5:15	5:30	Helix.
318		MU 4 ea. 8-1/2 drill collars to stabilizer.	1.50	439.00	5:30	7:00	Helix.
319		Make up drill pipe to BHA cross over sub to drill collars.	0.25	439.25	7:00	7:15	Helix.
320		RIH to 6,700 ft on 5-7/8 drill pipe. Seafloor depth = 6,716 ft.	4.75	444.00	7:15	12:00	
321	**Safety**	Operations safety meeting.	0.50	444.50	12:00	12:30	
322		Continue RIH to 6,700 ft on 5-7/8 drill pipe. Seafloor depth = 6,716 ft.	3.25	447.75	12:30	15:45	
323		Pick up top drive.	0.25	448.00	15:45	16:00	Helix. Assumes top drive parked for tripping.
324		Reenter Hole H-002	1	449.00	16:00	17:00	
325		RIH to 7600 ft (top of cement), set 15,000 WOB on cement.	2	451.00	17:00	19:00	Rotate only enough to monitor torque.
326		POOH to 6625 ft (100 ft above seafloor)	2	453.00	19:00	21:00	
327		Offset rig to Hole H-005	2	455.00	21:00	23:00	
328	**Spud Hole**	Spud Hole H-005, drill 6,725 ft to 7,765 ft.	0.25	455.25	23:00	23:15	Helix. Drill with sea water, pump Hi-Vis and/or weighted mud sweeps as needed. May need to begin continuous 10.5 ppg mud circulation to keep hole open. Maintain top hole integrity as much as possible.
329	**Hole Survey (Gyro Tool)**	Rig up wireline.	0.75	456.00	23:15	0:00	Assumes waiver to forego survey until end of hole has been denied.
Thursday, May 18, 2017							
330	**Safety**	Operations safety meeting.	0.50	456.50	0:00	0:30	

331		Continue rig up wireline.	0.50	457.00	0:30	1:00	Assumes waiver to forego survey until end of hole has been denied.
332		Rig up survey tool.	0.50	457.50	1:00	1:30	
333		RIH w/survey tool on wireline.	0.50	458.00	1:30	2:00	
334		Take inclination survey, POOH w/survey tool on wireline.	0.75	458.75	2:00	2:45	
335		Lay out survey tool.	0.50	459.25	2:45	3:15	
336		Rig down wireline.	1.00	460.25	3:15	4:15	
337	**Drilling**	Drill 7,765 ft to 8,063 ft.	2.00	462.25	4:15	6:15	Helix. Drill with sea water, pump Hi-Vis and/or weighted mud sweeps as needed. May need to begin continuous 10.5 ppg mud circulation to keep hole open. Maintain top hole integrity as much as possible.
338		Clean and condition hole as required. Fill hole with 10.5 mud.	1.00	463.25	6:15	7:15	Helix. Maintain continuous pumping of 10.5 ppg mud while coring.
339		Rig up wireline.	1.00	464.25	7:15	8:15	
340		Break drill string, load wireline/pulling tool, close drill string.	0.25	464.50	8:15	8:30	
341		RIH w/wireline at max safe speed, latch center bit, maintain circulation at 10 gpm min.	0.75	465.25	8:30	9:15	Slb/Geotek/Helix. Rotate and manipulate as required.
342		POOH w/center bit on wireline @ max safe speed, maintain circulation at 10 gpm min.	0.75	466.00	9:15	10:00	Slb/Geotek/Helix. Rotate and manipulate as required.
343		Break drill string, install lifting clamp on center bit, land center bit on drill pipe, unlatch wireline, change out pulling tool for running tool.	0.25	466.25	10:00	10:15	Helix/Geotek.
344		Lay out center bit w/tugger.	0.25	466.50	10:15	10:30	Helix/Geotek.
345	**Coring**	Pick up refurbished PCTB lower end w/tugger, load/land on assembly stand over 10" mousehole.	0.25	466.75	10:30	10:45	Geotek/Helix.
346		Pick up PCTB upper end w/tugger, make up to PCTB lower end, pick up PCTB assy, remove lifting clamp from lower end, transfer and land PCTB assy on drill pipe.	0.50	467.25	10:45	11:15	Geotek/Helix.
347		Change out wireline emergency pulling tool for running tool, latch wireline to PCTB, pick up PCTB w/wireline, remove lifting clamp, close drill string, RIH w/PCTB on wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.75	468.00	11:15	12:00	Slb/Geotek/Helix. Rotate and manipulate as required.
348	**Safety**	Operations safety meeting.	0.50	468.50	12:00	12:30	
349		POOH w/wireline @ max safe speed, break drill string, change out running tool for pulling tool, close drill string.	0.25	468.75	12:30	12:45	Slb/Geotek/Helix. Rotate and manipulate as required.
350		Continue to POOH w/wireline @ max safe speed, break drill string, change out running tool for pulling tool, close drill string.	0.50	469.25	12:45	13:15	Slb/Geotek/Helix. Rotate and manipulate as required.
351		RIH with wireline at max safe speed to 7950 ft.	0.00	469.25	13:15	13:15	Slb. RIH while coring.
352	**Core 11FB**	**Core 8,063 ft to 8,073 ft.**	1.00	470.25	13:15	14:15	Helix/Geotek. Note, top of hydrate @ 8,071 ft.
353		Lower wireline, latch PCTB, POOH w/PCTB at max safe speed, maintain circulation @ 10 gpm min.	0.75	471.00	14:15	15:00	Slb/Geotek/Helix. Rotate and manipulate as required.
354		Break drill string, install lifting clamp on PCTB upper end, land PCTB on drill string, unlatch wireline.	0.25	471.25	15:00	15:15	Helix/Geotek/Slb.
355		Pick up PCTB w/tugger, install lifting clamp on lower end, load/land lower end in cold shuck.	0.25	471.50	15:15	15:30	Helix/Geotek/Slb.
356		Break PCTB upper end, stage in mousehole.	0.50	472.00	15:30	16:00	Geotek/Helix.
357		Pick up refurbished PCTB lower end w/tugger, load/land on assembly stand over 10" mousehole.	0.25	472.25	16:00	16:15	Geotek/Helix.
358		Pick up PCTB upper end w/tugger, make up to PCTB lower end, pick up PCTB assy, remove lifting clamp from lower end, land PCTB on drill pipe.	0.50	472.75	16:15	16:45	Geotek/Helix.
359		Change out wireline pulling tool for running tool, latch wireline to PCTB, pick up PCTB w/wireline, remove lifting clamp, close drill string, RIH w/PCTB on wireline @ max safe speed, maintain circulation @ 10 gpm min.	1.00	473.75	16:45	17:45	Slb/Geotek/Helix. Rotate and manipulate as required.
360		Land/latch PCTB in outer core barrel assy, POOH w/wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.75	474.50	17:45	18:30	Slb/Geotek/Helix. Rotate and manipulate as required.
361		Break drill string, change out wireline running tool for pulling tool, close drill string.	0.25	474.75	18:30	18:45	Helix/Geotek/Slb.
362		RIH w/wireline at max safe speed to 7,950 ft.	0.00	474.75	18:45	18:45	Slb. RIH while coring.
363	**Core 12FB**	**Core 8,073 ft to 8,083 ft.**	1.00	475.75	18:45	19:45	Helix/Geotek.
364		Lower wireline, latch PCTB, POOH w/PCTB at max safe speed, maintain circulation @ 10 gpm min.	0.75	476.50	19:45	20:30	Slb/Geotek/Helix. Rotate and manipulate as required.
365		Break drill string, install lifting clamp on PCTB upper end, land PCTB on drill string, unlatch wireline.	0.25	476.75	20:30	20:45	Helix/Geotek/Slb.
366		Pick up PCTB w/tugger, install lifting clamp on lower end, load/land lower end in cold shuck.	0.25	477.00	20:45	21:00	Helix/Geotek/Slb.
367		Break PCTB upper end, stage in mousehole.	0.50	477.50	21:00	21:30	Geotek/Helix.
368		Pick up refurbished PCTB lower end w/tugger, load/land on assembly stand over 10" mousehole.	0.25	477.75	21:30	21:45	Geotek/Helix.
369		Pick up PCTB upper end w/tugger, make up to PCTB lower end, pick up PCTB assy, remove lifting clamp from lower end, land PCTB on drill pipe.	0.50	478.25	21:45	22:15	Geotek/Helix.
370		Change out wireline pulling tool for running tool, latch wireline to PCTB, pick up PCTB w/wireline, remove lifting clamp, close drill string, RIH w/PCTB on wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.75	479.00	22:15	23:00	Slb/Geotek/Helix. Rotate and manipulate as required.

371		Land/latch PCTB in outer core barrel assy, POOH w/wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.75	479.75	23:00	23:45	Slb/Geotek/Helix. Rotate and manipulate as required.
372		Break drill string, change out wireline running tool for pulling tool, close drill string.	0.25	480.00	23:45	0:00	Helix/Geotek/Slb.
Friday, May 19, 2017							
373	**Safety**	Operations safety meeting.	0.50	480.50	0:00	0:30	
374		RIH w/wireline at max safe speed to 7,950 ft.	0.00	480.50	0:30	0:30	Slb. RIH while coring.
375	**Core 13FB**	**Core 8,083 ft to 8,093 ft.**	1.00	481.50	0:30	1:30	
376		Lower wireline, latch PCTB, POOH w/PCTB at max safe speed, maintain circulation @ 10 gpm min.	0.75	482.25	1:30	2:15	Slb/Geotek/Helix. Rotate and manipulate as required.
377		Break drill string, install lifting clamp on PCTB upper end, land PCTB on drill string, unlatch wireline.	0.25	482.50	2:15	2:30	Helix/Geotek/Slb.
378		Pick up PCTB w/tugger, install lifting clamp on lower end, load/land lower end in cold shuck.	0.25	482.75	2:30	2:45	Helix/Geotek/Slb.
379		Break PCTB upper end, stage in mousehole.	0.50	483.25	2:45	3:15	Geotek/Helix.
380	**Hole Cleaning (if required)**	Pick up center bit w/tugger, load/land center bit on drill pipe.	0.25	483.50	3:15	3:30	
381		Latch wireline to center bit, close drill string, RIH w/center bit on wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.75	484.25	3:30	4:15	Helix/Slb/Geotek. Rotate and manipulate as required.
382		Land/latch center bit in outer core barrel assy, maintain circulation at 10 gpm min.	0.75	485.00	4:15	5:00	Helix/Slb/Geotek. Rotate and manipulate as required.
383		POOH w/wireline @ max safe speed, maintain circulation at 10 gpm min.	0.00	485.00	5:00	5:00	Helix/Slb/Geotek. POOH whole cleaning hole.
384		Break drill string, change out wireline running tool for emergency pulling tool, close drill string.	0.25	485.25	5:00	5:15	
385		RIH w/wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.00	485.25	5:15	5:15	RIH while cleaning hole.
386		Hole cleaning.	1.50	486.75	5:15	6:45	
387		Latch center bit, POOH w/center bit on wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.75	487.50	6:45	7:30	Helix/Slb/Geotek. Rotate and manipulate as required.
388		Break drill string, install lifting clamp on center bit, land center bit on drill pipe, unlatch wireline, lay out center bit w/tugger.	0.25	487.75	7:30	7:45	Helix/Slb/Geotek. Rotate and manipulate as required.
389	**Coring**	Pick up refurbished PCTB lower end w/tugger, load/land on assembly stand over 10" mousehole.	0.25	488.00	7:45	8:00	Geotek/Helix.
390		Pick up PCTB upper end w/tugger, make up to PCTB lower end, pick up PCTB assy, remove lifting clamp from lower end, transfer and land PCTB assy on drill pipe.	0.50	488.50	8:00	8:30	Geotek/Helix.
391		Change out wireline emergency pulling tool for running tool, latch wireline to PCTB, pick up PCTB w/wireline, remove lifting clamp, close drill string, RIH w/PCTB on wireline @ max safe speed, maintain circulation @ 10 gpm min.	1.00	489.50	8:30	9:30	Slb/Geotek/Helix. Rotate and manipulate as required.
392		Land/latch PCTB in outer core barrel assy, POOH w/wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.75	490.25	9:30	10:15	Slb/Geotek/Helix. Rotate and manipulate as required.
393		Break drill string, change out wireline running tool for pulling tool, close drill string.	0.25	490.50	10:15	10:30	Helix/Geotek/Slb.
394		RIH w/wireline at max safe speed to 7,950 ft.	0.00	490.50	10:30	10:30	Slb. RIH while coring.
395	**Core 14FB**	**Core 8,093 ft to 8,103 ft.**	1.00	491.50	10:30	11:30	
396		Lower wireline, latch PCTB, POOH w/PCTB at max safe speed, maintain circulation @ 10 gpm min.	0.50	492.00	11:30	12:00	Slb/Geotek/Helix. Rotate and manipulate as required.
397	**Safety**	Operations safety meeting.	0.50	492.50	12:00	12:30	
398		Continue POOH w/PCTB at max safe speed, maintain circulation @ 10 gpm min.	0.75	493.25	12:30	13:15	Slb/Geotek/Helix. Rotate and manipulate as required.
399		Break drill string, install lifting clamp on PCTB upper end, land PCTB on drill string, unlatch wireline.	0.25	493.50	13:15	13:30	Helix/Geotek/Slb.
400		Pick up PCTB w/tugger, install lifting clamp on lower end, load/land lower end in cold shuck.	0.25	493.75	13:30	13:45	Helix/Geotek/Slb.
401		Break PCTB upper end, stage in mousehole.	0.50	494.25	13:45	14:15	Geotek/Helix.
402		Pick up refurbished PCTB lower end w/tugger, load/land on assembly stand over 10" mousehole.	0.25	494.50	14:15	14:30	Geotek/Helix.
403		Pick up PCTB upper end w/tugger, make up to PCTB lower end, pick up PCTB assy, remove lifting clamp from lower end, land PCTB on drill pipe.	0.50	495.00	14:30	15:00	Geotek/Helix.
404		Change out wireline pulling tool for running tool, latch wireline to PCTB, pick up PCTB w/wireline, remove lifting clamp, close drill string, RIH w/PCTB on wireline @ max safe speed, maintain circulation @ 10 gpm min.	1.00	496.00	15:00	16:00	Slb/Geotek/Helix. Rotate and manipulate as required.
405		Land/latch PCTB in outer core barrel assy, POOH w/wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.75	496.75	16:00	16:45	Slb/Geotek/Helix. Rotate and manipulate as required.
406		Break drill string, change out wireline running tool for pulling tool, close drill string.	0.25	497.00	16:45	17:00	Helix/Geotek/Slb.

407		RIH w/wireline at max safe speed to 7,950 ft.	0.00	497.00	17:00	17:00	Slb. RIH while coring.
408	**Core 15FB**	**Core 8,103 ft to 8,113 ft.**	1.00	498.00	17:00	18:00	
409		Lower wireline, latch PCTB, POOH w/PCTB at max safe speed, maintain circulation @ 10 gpm min.	0.75	498.75	18:00	18:45	Slb/Geotek/Helix. Rotate and manipulate as required.
410		Break drill string, install lifting clamp on PCTB upper end, land PCTB on drill string, unlatch wireline.	0.25	499.00	18:45	19:00	Helix/Geotek/Slb.
411		Pick up PCTB w/tugger, install lifting clamp on lower end, load/land lower end in cold shuck.	0.25	499.25	19:00	19:15	Helix/Geotek/Slb.
412		Break PCTB upper end, stage in mousehole.	0.50	499.75	19:15	19:45	Geotek/Helix.
413		Pick up refurbished PCTB lower end w/tugger, load/land on assembly stand over 10" mousehole.	0.25	500.00	19:45	20:00	Geotek/Helix.
414		Pick up PCTB upper end w/tugger, make up to PCTB lower end, pick up PCTB assy, remove lifting clamp from lower end, land PCTB on drill pipe.	0.50	500.50	20:00	20:30	Geotek/Helix.
415		Change out wireline pulling tool for running tool, latch wireline to PCTB, pick up PCTB w/wireline, remove lifting clamp, close drill string, RIH w/PCTB on wireline @ max safe speed, maintain circulation @ 10 gpm min.	1.00	501.50	20:30	21:30	Slb/Geotek/Helix. Rotate and manipulate as required.
416		Land/latch PCTB in outer core barrel assy, POOH w/wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.75	502.25	21:30	22:15	Slb/Geotek/Helix. Rotate and manipulate as required.
417		Break drill string, change out wireline running tool for pulling tool, close drill string.	0.25	502.50	22:15	22:30	Helix/Geotek/Slb.
418		RIH w/wireline at max safe speed to 7,950 ft.	0.00	502.50	22:30	22:30	Slb. RIH while coring.
419	**Core 16FB**	**Core 8,113 ft to 8,123 ft.**	1.00	503.50	22:30	23:30	
420		Lower wireline, latch PCTB, POOH w/PCTB at max safe speed, maintain circulation @ 10 gpm min.	0.50	504.00	23:30	0:00	Slb/Geotek/Helix. Rotate and manipulate as required.
Saturday, May 20, 2017							
421	**Safety**	Operations safety meeting.	0.50	504.50	0:00	0:30	
422		Break drill string, install lifting clamp on PCTB upper end, land PCTB on drill string, unlatch wireline.	0.25	504.75	0:30	0:45	Helix/Geotek/Slb.
423		Pick up PCTB w/tugger, install lifting clamp on lower end, load/land lower end in cold shuck.	0.25	505.00	0:45	1:00	Helix/Geotek/Slb.
424		Break PCTB upper end, stage in mousehole.	0.50	505.50	1:00	1:30	Geotek/Helix.
425	**Drilling**	Pick up center bit w/tugger, load/land center bit in drill pipe.	0.25	505.75	1:30	1:45	Helix/Slb/Geotek. Rotate and manipulate as required.
426		Change out wireline pulling tool for running tool, latch wireline to center bit, pick up center bit, remove lifting clamp, close drill string, RIH w/center bit on wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.75	506.50	1:45	2:30	Helix/Slb/Geotek. Rotate and manipulate as required.
427		Land/latch center bit in outer core barrel assy, POOH w/wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.75	507.25	2:30	3:15	Helix/Slb/Geotek. Rotate and manipulate as required.
428	**Drilling**	**Drill from 8,123 ft to 8,149 ft.**	1.00	508.25	3:15	4:15	
429	**Hole Cleaning**	Clean hole.	1.00	509.25	4:15	5:15	
430		Break drill string, change out wireline running tool for emergency pulling tool, close drill string, RIH w/wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.75	510.00	5:15	6:00	
431		Latch center bit, POOH w/center bit on wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.75	510.75	6:00	6:45	Helix/Slb/Geotek. Rotate and manipulate as required.
432		Break drill string, install lifting clamp on center bit, land center bit on drill pipe, unlatch wireline.	0.25	511.00	6:45	7:00	Helix/Slb/Geotek. Rotate and manipulate as required.
433		Lay out center bit w/tugger.	0.25	511.25	7:00	7:15	
434	**Coring**	Pick up refurbished PCTB lower end w/tugger, load/land on assembly stand over 10" mousehole.	0.25	511.50	7:15	7:30	Geotek/Helix.
435		Pick up PCTB upper end w/tugger, make up to PCTB lower end, pick up PCTB assy, remove lifting clamp from lower end, transfer and land PCTB assy on drill pipe.	0.50	512.00	7:30	8:00	Geotek/Helix.
436		Change out wireline emergency pulling tool for running tool, latch wireline to PCTB, pick up PCTB w/wireline, remove lifting clamp, close drill string, RIH w/PCTB on wireline @ max safe speed, maintain circulation @ 10 gpm min.	1.00	513.00	8:00	9:00	Slb/Geotek/Helix. Rotate and manipulate as required.
437		Land/latch PCTB in outer core barrel assy, POOH w/wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.75	513.75	9:00	9:45	Slb/Geotek/Helix. Rotate and manipulate as required.
438		Break drill string, change out wireline running tool for pulling tool, close drill string.	0.25	514.00	9:45	10:00	Helix/Geotek/Slb.
439		RIH w/wireline at max safe speed to 7,950 ft.	0.00	514.00	10:00	10:00	Slb. RIH while coring.
440	**Core 17FB**	**Core 8,149 ft to 8,159 ft.**	1.00	515.00	10:00	11:00	
441		Lower wireline, latch PCTB, POOH w/PCTB at max safe speed, maintain circulation @ 10 gpm min.	0.75	515.75	11:00	11:45	Slb/Geotek/Helix. Rotate and manipulate as required.
442		Break drill string, install lifting clamp on PCTB upper end, land PCTB on drill string, unlatch wireline.	0.25	516.00	11:45	12:00	Helix/Geotek/Slb.
443	**Safety**	Operations safety meeting.	0.50	516.50	12:00	12:30	

444		Pick up PCTB w/tugger, install lifting clamp on lower end, load/land lower end in cold shuck.	0.25	516.75	12:30	12:45	Helix/Geotek/Slb.
445		Break PCTB upper end, stage in mousehole.	0.50	517.25	12:45	13:15	Geotek/Helix.
446		Pick up refurbished PCTB lower end w/tugger, load/land on assembly stand over 10" mousehole.	0.25	517.50	13:15	13:30	Geotek/Helix.
447		Pick up PCTB upper end w/tugger, make up to PCTB lower end, pick up PCTB assy, remove lifting clamp from lower end, land PCTB on drill pipe.	0.50	518.00	13:30	14:00	Geotek/Helix.
448		Change out wireline pulling tool for running tool, latch wireline to PCTB, pick up PCTB w/wireline, remove lifting clamp, close drill string, RIH w/PCTB on wireline @ max safe speed, maintain circulation @ 10 gpm min.	1.00	519.00	14:00	15:00	Slb/Geotek/Helix. Rotate and manipulate as required.
449		Land/latch PCTB in outer core barrel assy, POOH w/wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.75	519.75	15:00	15:45	Slb/Geotek/Helix. Rotate and manipulate as required.
450		Break drill string, change out wireline running tool for pulling tool, close drill string.	0.25	520.00	15:45	16:00	Helix/Geotek/Slb.
451		RIH w/wireline at max safe speed to 7,950 ft.	0.00	520.00	16:00	16:00	Slb. RIH while coring.
452	**Core 18FB**	**Core 8,159 ft to 8,169 ft.**	1.00	521.00	16:00	17:00	
453		Lower wireline, latch PCTB.	0.50	521.50	17:00	17:30	Slb/Geotek/Helix. Rotate and manipulate as required.
454		POOH w/PCTB at max safe speed, maintain circulation @ 10 gpm min.	0.25	521.75	17:30	17:45	Slb/Geotek/Helix. Rotate and manipulate as required.
455		Break drill string, install lifting clamp on PCTB upper end, land PCTB on drill string, unlatch wireline.	0.25	522.00	17:45	18:00	Helix/Geotek/Slb.
456		Pick up PCTB w/tugger, install lifting clamp on lower end, load/land lower end in cold shuck.	0.25	522.25	18:00	18:15	Helix/Geotek/Slb.
457		Break PCTB upper end, stage in mousehole.	0.50	522.75	18:15	18:45	Geotek/Helix.
458		Pick up refurbished PCTB lower end w/tugger, load/land on assembly stand over 10" mousehole.	0.25	523.00	18:45	19:00	Geotek/Helix.
459		Pick up PCTB upper end w/tugger, make up to PCTB lower end, pick up PCTB assy, remove lifting clamp from lower end, land PCTB on drill pipe.	0.50	523.50	19:00	19:30	Geotek/Helix.
460		Change out wireline pulling tool for running tool, latch wireline to PCTB, pick up PCTB w/wireline, remove lifting clamp, close drill string, RIH w/PCTB on wireline @ max safe speed, maintain circulation @ 10 gpm min.	1.00	524.50	19:30	20:30	Slb/Geotek/Helix. Rotate and manipulate as required.
461		Land/latch PCTB in outer core barrel assy, POOH w/wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.75	525.25	20:30	21:15	Slb/Geotek/Helix. Rotate and manipulate as required.
462		Break drill string, change out wireline running tool for pulling tool, close drill string.	0.25	525.50	21:15	21:30	Helix/Geotek/Slb.
463		RIH w/wireline at max safe speed to 7,950 ft.	0.00	525.50	21:30	21:30	Slb. RIH while coring.
464	**Core 19FB**	**Core 8,169 ft to 8,179 ft.**	1.00	526.50	21:30	22:30	
465		Lower wireline, latch PCTB, POOH w/PCTB at max safe speed, maintain circulation @ 10 gpm min.	0.75	527.25	22:30	23:15	Slb/Geotek/Helix. Rotate and manipulate as required.
466		Break drill string, install lifting clamp on PCTB upper end, land PCTB on drill string, unlatch wireline.	0.25	527.50	23:15	23:30	Helix/Geotek/Slb.
467		Pick up PCTB w/tugger, install lifting clamp on lower end, load/land lower end in cold shuck.	0.50	528.00	23:30	0:00	Helix/Geotek/Slb.
Sunday, May 21, 2017							
468	**Safety**	Operations safety meeting.	0.50	528.50	0:00	0:30	
469		Break PCTB upper end, stage in mousehole.	0.50	529.00	0:30	1:00	Geotek/Helix.
470		Pick up refurbished PCTB lower end w/tugger, load/land on assembly stand over 10" mousehole.	0.25	529.25	1:00	1:15	Geotek/Helix.
471		Pick up PCTB upper end w/tugger, make up to PCTB lower end, pick up PCTB assy, remove lifting clamp from lower end, land PCTB on drill pipe.	0.50	529.75	1:15	1:45	Geotek/Helix.
472		Change out wireline pulling tool for running tool, latch wireline to PCTB, pick up PCTB w/wireline, remove lifting clamp, close drill string, RIH w/PCTB on wireline @ max safe speed, maintain circulation @ 10 gpm min.	1.00	530.75	1:45	2:45	Slb/Geotek/Helix. Rotate and manipulate as required.
473		Land/latch PCTB in outer core barrel assy, POOH w/wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.75	531.50	2:45	3:30	Slb/Geotek/Helix. Rotate and manipulate as required.
474		Break drill string, change out wireline running tool for pulling tool, close drill string.	0.25	531.75	3:30	3:45	Helix/Geotek/Slb.
475		RIH w/wireline at max safe speed to 7,950 ft.	0.00	531.75	3:45	3:45	Slb. RIH while coring.
476	**Core 20FB**	**Core 8,179 ft to 8,189 ft.**	1.00	532.75	3:45	4:45	Bottom of hydrate @ 8,166 ft RKB (1,445 fbsf).
477		Lower wireline, latch PCTB, POOH w/PCTB at max safe speed, maintain circulation @ 10 gpm min.	0.75	533.50	4:45	5:30	Slb/Geotek/Helix. Rotate and manipulate as required.
478		Break drill string, install lifting clamp on PCTB upper end, land PCTB on drill string, unlatch wireline.	0.25	533.75	5:30	5:45	Helix/Geotek/Slb.
479		Pick up PCTB w/tugger, install lifting clamp on lower end, load/land lower end in cold shuck.	0.25	534.00	5:45	6:00	Helix/Geotek/Slb.
480		Break PCTB upper end, stage in mousehole.	0.50	534.50	6:00	6:30	Geotek/Helix.
481	**Hole Survey (Gyro Tool)**	Pick up survey tool w/tugger, load/land in drill pipe, latch wireline to survey tool, close drill pipe.	0.50	535.00	6:30	7:00	Rotate and circulate as required.
482		RIH w/survey tool to 6,670 ft @ max safe speed, maintain circulation @ 10 gpm min.	0.75	535.75	7:00	7:45	Rotate and circulate as required.
483		RIH w/survey tool to 7,600 ft @ 200 ft/min, maintain circulation @ 10 gpm min.	0.25	536.00	7:45	8:00	
484		Stop at 7,600 ft for 5 min.	0.00	536.00	8:00	8:00	
485		RIH w/survey tool to 8,182 ft (TD) @ 200 ft/min, maintain circulation @ 10 gpm min.	0.25	536.25	8:00	8:15	

486		Stop at 8,182 (TD) for 5 min.	0.00	536.25	8:15	8:15	
487		POOH w/survey tool to 7,600 ft @ 200 ft/min, maintain circulation @ 10 gpm min.	0.50	536.75	8:15	8:45	Rotate and circulate as required.
488		Stop at 7,600 ft for 5 min.	0.00	536.75	8:45	8:45	
489		POOH w/survey tool @ max safe speed, maintain circulation @ 10 gpm min.	0.75	537.50	8:45	9:30	Rotate and circulate as required.
490		Break drill pipe, lay out survey tool.	0.50	538.00	9:30	10:00	
491	**Cementing**	Rig down wireline.	1.00	539.00	10:00	11:00	
492		Displace hole from TD to 7,900 ft with 11.5 ppg Hi- Vis pad mud.	1	540.00	11:00	12:00	
493	**Safety**	Operations safety meeting.	0.50	540.50	12:00	12:30	
494		POOH to 7,900 ft.	0.75	541.25	12:30	13:15	Bit at top of pad mud, 100 ft above hydrate zone.
495		Drop cementing liner.	0.25	541.50	13:15	13:30	Free fall deploy.
496		Rig up cementing manifold.	1.50	543.00	13:30	15:00	
497		Pump cement per Schlumberger program.	5.5	548.50	15:00	20:30	300 ft plug.
498		Rig down cementing manifold.	1.50	550.00	20:30	22:00	
499		POOH to 6625 ft (100 ft above seafloor).	2	552.00	22:00	0:00	100 ft above sea floor. Pull slowly through cement column 5 min/double.
Monday, May 22, 2017							
500	**Safety**	Operations safety meeting.	0.50	552.50	0:00	0:30	
501		Circulate ≥2X drill string volume w/sea water and 3x rubber balls at ≥5 bbl/min.	1.5	554.00	0:30	2:00	Pump foam pipe wipers.
502		Rig up wireline.	1	555.00	2:00	3:00	Rig up while circulating.
503		RIH w/wireline, latch OCBA cementing liner.	0	555.00	3:00	3:00	Circulate. RIH while circulating.
504		POOH with cementing liner.	0.75	555.75	3:00	3:45	Circulate.
505		Break drill string, lay out cementing liner.	0.25	556.00	3:45	4:00	
506		Circulate ≥1X drill string volume w/sea water and pipe wipers at ≥5 bbl/min.	1	557.00	4:00	5:00	Pump foam pipe wipers.
507		Observe borehole for signs of out flow.	0	557.00	5:00	5:00	Observe while cleaning drill string.
508	**Tag Cement**	Break drill string, pick up center bit w/tugger, load/land center bit in drill pipe.	0.25	557.25	5:00	5:15	Helix/Slb/Geotek. Rotate and manipulate as required.
509		Change out wireline pulling tool for running tool, latch wireline to center bit, pick up center bit, remove lifting clamp, close drill string, RIH w/center bit on wireline @ max safe speed, maintain circulation @ 10 gpm min.	1.00	558.25	5:15	6:15	Helix/Slb/Geotek. Rotate and manipulate as required.
510		Land/latch center bit in outer core barrel assy, POOH w/wireline @ max safe speed, maintain circulation @ 10 gpm min.	0.75	559.00	6:15	7:00	Helix/Slb/Geotek. Rotate and manipulate as required.
511		Rig down wireline.	1.00	560.00	7:00	8:00	
512		Reenter Hole H-005	1	561.00	8:00	9:00	
513		RIH to 7600 ft (top of cement), set 15,000 WOB on cement.	2	563.00	9:00	11:00	Rotate only enough to monitor torque.
514		POOH to 6564 ft (100 ft above seafloor)	1	564.00	11:00	12:00	
515	**Safety**	Operations safety meeting.	0.50	564.50	12:00	12:30	
516		Continue POOH to 6564 ft (100 ft above seafloor)	1	565.50	12:30	13:30	
517		Rig up wireline.	1	566.50	13:30	14:30	If pipe is draining fast enough to not have to pull a wet string center bit can be left in place.
518		RIH w/pulling tool at max safe speed.	0.5	567.00	14:30	15:00	
519		Latch center bit, POOH w/center bit on wireline @ max safe speed.	0.5	567.50	15:00	15:30	
520		Break drill string, lay out center bit.	0.25	567.75	15:30	15:45	
521		Rig down wireline.	1	568.75	15:45	16:45	
522		Rack top drive.	0.5	569.25	16:45	17:15	
523		POOH to top of outer core barrel assy.	6.75	576.00	17:15	0:00	
Tuesday, May 23, 2017							
524	**Safety**	Operations safety meeting.	0.50	576.50	0:00	0:30	
525		Continue POOH to top of outer core barrel assy.	1.25	577.75	0:30	1:45	
526		Break down and layout outer core barrel assy.	2.50	580.25	1:45	4:15	Clean, re-dope, and install thread protectors, all sub and collar threads.
527		Clear rig floor for demobilization.	2.50	582.75	4:15	6:45	
528		ROV site survey.	1.00	583.75	6:45	7:45	Complete while POOH with BHA.
529		Recover ROV, beacon(s).	1.00	584.75	7:45	8:45	Complete while POOH with BHA.
530		Begin demobilization.	15.25	600.00	8:45	0:00	
Wednesday, May 24, 2017							
531		Demobilization. Pack and off load all containers and equipment.	24.00	624.00	0:00	0:00	
Thursday, May 25, 2017							
532		Demobilization. Pack and off load all containers and equipment.	24.00	648.00	0:00	0:00	
533		Disembark Geotek and UT personnel via helicopter.					One Geotek person to accompany core samples on work boat.

Notes:

1 Time estimate assumes worst case and includes gyro survey at 1,000 fbsf and cementing in both holes.
2 Site GC-955, water depth = 6,670 fbsl, RKB to sea level = 51 ft
3 10 pressurized core samples per hole to be taken
4 Instrumented PCTB assembled for deployment
5 Rig capable of handling doubles
6 All depths are referenced to RKB (rig floor).
7 Plug and abandon cementing per Schlumberger program
8 MU = make up
9 POOH = pull out of hole
10 RIH - run in hole
11 Core depths shown are place holders, actual depths to be determined
12 Cementing depths are place holders, actual depths to be determined

APPENDIX F

IODP EXPEDITION 386 OPERATIONAL PLAN

IODP EXPEDITION 386 Operational Plan

Genesis of Methane Hydrate in the Gulf of Mexico

IODP Expedition 386

The University of Texas at Austin

U.S. Department of Energy, National Energy Technology Laboratory

Peter Flemings – Principle Investigator

Jesse Houghton – Program Manager

Carla Thomas – Project Manager

Jamie Morrison – Offshore Operations

Record of Revisions

REV. NO.	DATE	AUTHORS	DESCRIPTION
0.0	04/12/18	PF, JH, CT	Initial issuance following approval of CPP & scheduling of Exp. 386

CONTENTS

LIST OF FIGURES

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NOTE:

The purpose of this document is to define the scope and technical activities required to achieve the scientific goals of this project. As such, this 'living' document will be modified and refined throughout the life of the project as warranted. Major changes to the document will be tracked in the 'Record of Revisions' table provided on the cover page of this document.

1 EXECUTIVE SUMMARY

The *Genesis of Methane Hydrate in the Gulf of Mexico* research project is led by the University of Texas at Austin (UT), and funded by the US Department of Energy (DOE) (DOE Award No.: DE-FE0023919). The objective of this project is to gain insight into the nature, formation, occurrence and physical properties of methane hydrate-bearing sediments for the purpose of methane hydrate resource appraisal. This objective will be achieved through the planning and execution of drilling, coring, logging, testing and analytical activities that assess marine methane hydrate deposits in the Gulf of Mexico Continental Margin.

This document provides the operational plan for International Ocean Discovery Program (IODP) Expedition 386, scheduled for deployment from the *JOIDES Resolution* (*JR*) scientific drilling vessel in early 2020. During IODP Expedition 386, seven holes will be drilled in five locations in the northern Gulf of Mexico for conventional coring, pressure coring, downhole testing, and/or geophysical logging. Conventional core and pressure core will be acquired and returned to shore for analysis.

IODP Expedition 386 results from a Complementary Program Proposal (CPP) submitted by the University of Texas and its partners to the IODP. This effort is conducted in partnership with the DOE, IODP, Lamont-Doherty Earth Observatory (LDEO), Ohio State University (OHSU), Oregon State University (ORSU), the University of New Hampshire (UNH), the University of Washington (UW), the U.S. Geologic Survey (USGS), and the National Energy Technology Laboratory (NETL).

2 OBJECTIVES

IODP Expedition 386 will acquire data to gain insight into the nature, formation, occurrence and physical properties of methane hydrate-bearing sediments in the Gulf of Mexico. Numerous operational objectives must be satisfied in order achieve this purpose and a significant amount of measurements, data, and samples are required for project success.

The success of the IODP Expedition 386 drilling expedition is contingent upon the following:

1. Successful deployment of DOE Pressure Coring Tool with Ball Valve (PCTB) to acquire hydrate-bearing core and retrieve core to under in-situ pressure.
2. Successful transfer of pressure cores from PCTB autoclave into Pressure Core Analysis and Transfer System (PCATS) for preliminary scanning and analysis, while maintaining samples under in-situ pressure.
3. Successful transfer of pressure cores from PCATS into pressurized storage vessels that maintain samples under in-situ pressure throughout duration of voyage and subsequent transfer to UT Pressure Core Center (PCC) in Austin, Texas.

4. Acquisition of conventional cores using conventional wireline coring tools.
5. Acquisition of geophysical data from deployment of conventional wireline logging tools.
6. Acquisition of geophysical data from deployment of logging-while-drilling tools.
7. Completion of wireline formation testing.
8. Acquisition of in-situ temperature and pressure measurements utilizing a probe penetrometer.

3 LOCATION

IODP Expedition 386 drilling sites are located along the outer continental shelf in the northern Gulf of Mexico, approximately 170 nautical miles SSW of New Orleans, LA (**Fig. 3-1**). Fifteen drilling sites have been identified that represent locations that can be drilled safely and meet the project's scientific objectives (**Table 3-1**). Five of these are designated as primary sites. 'Primary' sites are the sites optimally located sites that meet our technical objectives. In addition, there are 10 'Alternate' sites. These sites are alternate technical targets that may be drilled if drilling cannot be conducted at the Primary locations or if additional time is available.

The Primary sites are located within the Orca and Terrebonne Basins in the northwestern Walker Ridge protraction area (**Fig. 3-1**). The Orca and Terrebonne basins are approximately 45 nautical miles NW of the Sigsbee Escarpment and are 12 nautical miles apart. Alternate sites are present at Mad Dog, Terrebonne, and Orca (**Table 3-1**, **Fig. 3-1**).

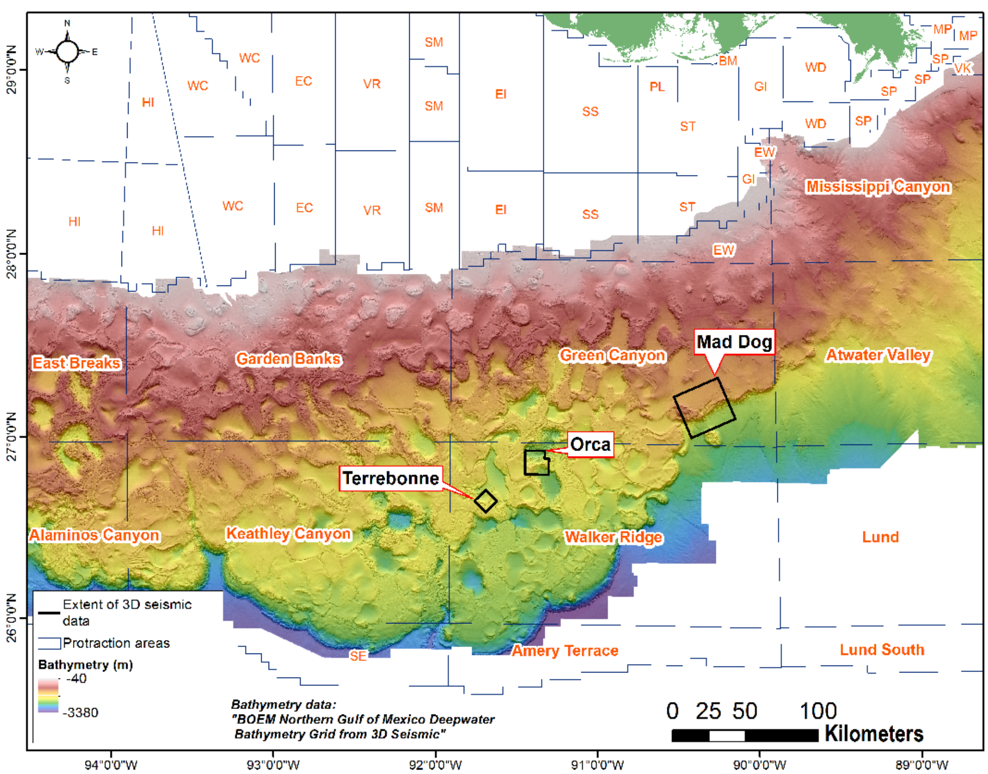


Figure 3-1: Orca, Terrebonne, and Mad Dog drilling locations

Table 3-1: Primary and Alternate drilling locations in Orca, Terrebonne, and Mad Dog

SITE NAME	LOCATION (lat, long)	WATER DEPTH (m)	DEPTH BELOW SEA FLOOR (m)	TOTAL DEPTH† (m)	SITE-SPECIFIC OBJECTIVES
ORCA BASIN - PRIMARY					
ORCAB-11A	26.85, -91.328	1763	584	2358.4	At ORCAB-11A, we propose a primary LWD site to test presence of gas hydrates in coarse-grained units. The key units to be logged are the Red (341 mbsf) and Purple (497 mbsf).
ORCAB-12A	26.856, -91.3246	1800	591	2402.4	At ORCAB-12A, we propose a primary LWD site to test presence of gas hydrates in coarse-grained units. The key units to be logged is the Purple (289 mbsf).
ORCA BASIN - ALTERNATE					
ORCAB-13A	26.846, -91.3342	1800	644	2455.4	At ORCAB-13A, we propose an alternate LWD site to test presence of gas hydrates in coarse-grained units. The key units to be logged is the Red (523 mbsf).
ORCAB-14A	26.8509, -91.3287	1750	591	2352.4	At ORCAB-14A, we propose an alternate LWD site to test presence of gas hydrates in coarse-grained units. The key units to be logged are the Red (344 mbsf) and Purple (518 mbsf). This site may be used as an alternate to primary Site ORCAB-11A.
ORCAB-15A	26.8548, -91.3286	1823	587	2421.4	At ORCAB-15A, we propose an alternate LWD site to test presence of gas hydrates in coarse-grained units. The key units to be logged are the Red (229 mbsf) and Purple (414 mbsf). This site may be used as an alternate to primary Site ORCAB-11A.
ORCAB-16A	26.8572, -91.3263	1833	572	2416.4	At ORCAB-16A, we propose an alternate LWD site to test presence of gas hydrates in coarse-grained units. The key units to be logged is the Purple (303 mbsf). This site may be used as an alternate to primary Site ORCAB-12A.
TERREBONNE BASIN - PRIMARY					
TBONE-01B	26.6626, -91.6764	1966	1045	3022.4	At TBONE-01B, we propose to twin a pre-existing JIP Leg 2 LWD hole, WR313-H. We plan a complete coring, pressure coring and in situ testing program at this site to obtain and examine methane hydrate in coarse-grained layers.
TBONE-02A	26.6604, -91.6742	1942	828	2781.4	At TBONE-02A, we will drill at a new location at the TBONE site, slightly up dip and to the southwest of TBONE-01B to target coarse-grained layers and understand methane migration up dip of TBONE-01B and TBONE-03B. We propose an initial LWD hole and then we will return to this location and perform conventional coring, and pressure coring.
TBONE-03B	26.6633, -91.6842	1999	1111	3121.4	At TBONE-03B, we propose to twin a pre-existing JIP Leg 2 LWD hole, WR313-G. We plan a complete coring, pressure coring and in situ testing program at this site to obtain and examine methane hydrate in coarse-grained layers.

SITE NAME	LOCATION (lat, long)	WATER DEPTH (m)	DEPTH BELOW SEA FLOOR (m)	TOTAL DEPTH† (m)	SITE-SPECIFIC OBJECTIVES
TERREBONNE BASIN - ALTERNATE					
TBONE-05B	26.658, -91.6726	1932	947	2890.4	At TBONE-05B, we propose LWD logging at a new location to confirm the presence of methane hydrates in coarse-grained layers. This alternate site may be used in place of TBONE-02A.
TBONE-06B	26.6472, -91.6931	1965	1176	3152.4	At TBONE-06B, we propose LWD logging at a new location to confirm the presence of methane hydrates in coarse-grained layers. This alternate site may be used in place of TBONE-01B.
TBONE-07B	26.644, -91.691	1939	916	2866.4	At TBONE-07B, we propose LWD logging at a new location to confirm the presence of methane hydrates in coarse-grained layers. This alternate site may be used in place of TBONE-02A.
TBONE-08A	26.661, -91.6743	1945	841	2797.4	This alternate site may be used in place of TBONE-02A. At TBONE-08A, we will drill at a new location at the TBONE site, slightly up dip and to the southwest of TBONE-01B to target coarse-grained layers and understand methane migration up dip of TBONE-01B and TBONE-03B. We propose an initial LWD hole and then we will return to this location and perform conventional coring, and pressure coring.
MAD DOG OIL FIELD - ALTERNATE					
MADOG-05A	27.1687, -90.3423	1404	725	2140.4	At MADOG-05A, we propose LWD to confirm the presence of methane hydrates in coarse-grained layers. This is an alternate site.
MADOG-06A	27.165, -90.339	1428	628	2067.4	At MADOG-06A, we propose LWD to confirm the presence of methane hydrates in coarse-grained layers. This is an alternate site.

† Includes air gap of 11.4 m

3.1 Orca Basin

Orca Basin drill sites are located on the southeastern side of the basin on a ridge that separates Orca Basin from the Choctaw Basin to the immediate SSE (**Fig. 3-2**). Orca Basin drill sites are within Walker Ridge blocks 100 (WR100) and 101 (WR101).

Two Primary sites have been selected for logging while drilling (LWD) in Orca Basin (**Table 3-1**). Four Alternate sites have been proposed in Orca Basin in the event that hydrate accumulations are not found in the primary LWD locations or in the event that LWD in the primary locations is not practicable.

A detailed summary of Primary and Alternate LWD locations in Orca Basin is described in *Exp386_DrillingLocations.xlsx*, and provided in this document as **Table 3-1**).

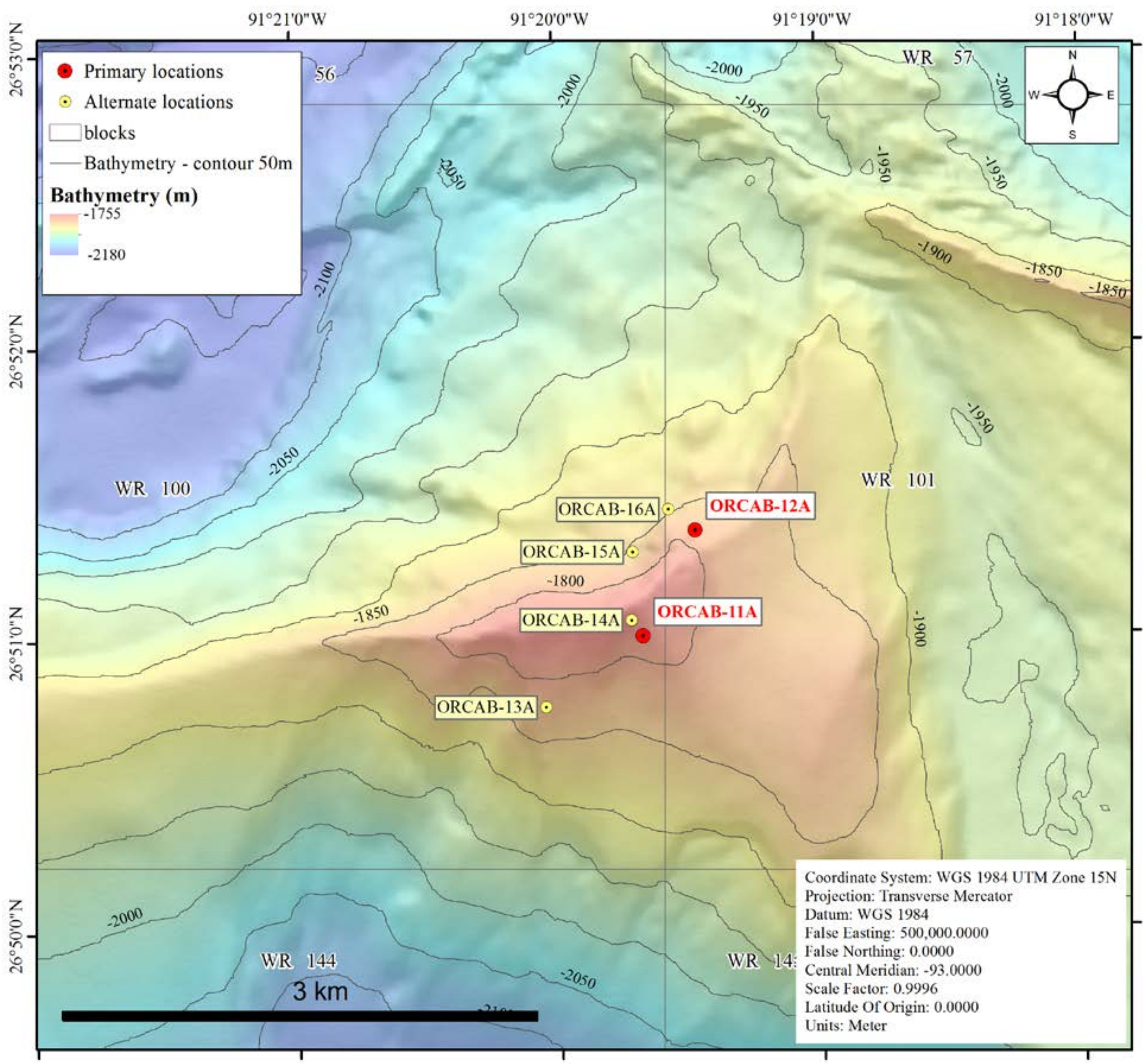


Figure 3-2: Primary and Alternate drilling locations in the Orca Basin

3.2 Terrebonne Basin

Three Primary sites have been selected in the Terrebonne Basin, Walker Ridge block 313, for a combination of LWD, conventional coring, pressure coring and wireline logging (**Fig. 3-3**). At the first site, two holes will be drilled: a LWD hole and a cored hole. Two holes will also be drilled at the second site: a cored hole and a wireline-logged hole. At the third site, one cored hole will be drilled.

Four Alternate sites have been proposed in Terrebonne Basin for LWD in the event that hydrate accumulations are not found in Primary locations.

A detailed summary of Primary and Alternate sites in Terrebonne Basin is described in *Exp386_DrillingLocations.xlsx*, and provided in this document as **Table 3-1.**

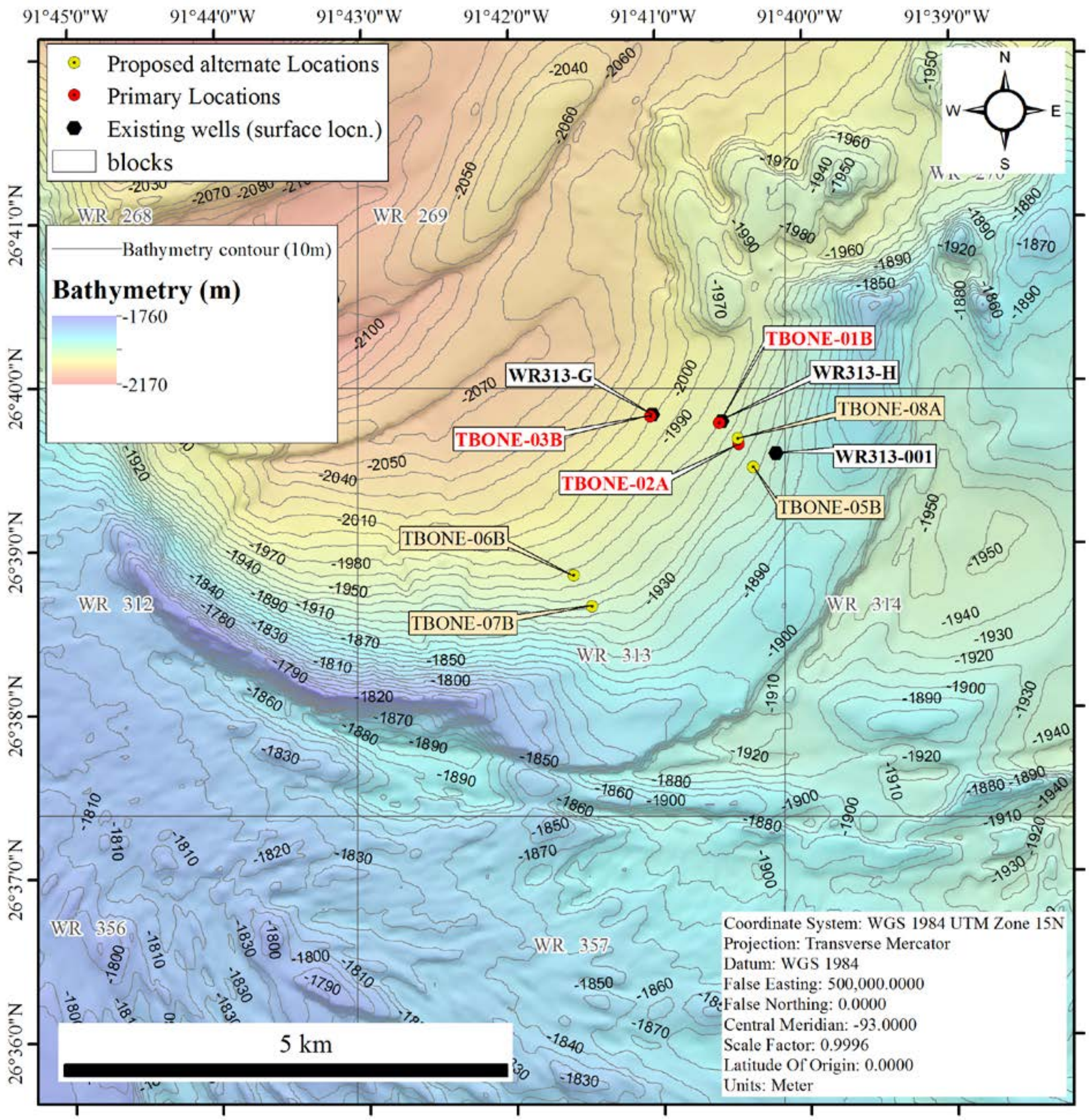


Figure 3-3: Primary and Alternate drilling locations in Terrebonne Basin

3.3 Mad Dog

Two Alternative sites are near the Mad Dog Oil Field, located in Green Canyon block 825 (GC825) (**Fig. 3-4**). The two alterative locations are alternative LWD locations that may be considered in the event that hydrate accumulations are not found in the primary LWD locations, or in the event that LWD in the primary locations is not practicable.

A detailed summary of Alternate LWD locations in Mad Dog Oil Field is described in *Exp386_DrillingLocations.xlsx*, and provided in this document as **Table 3-1.**

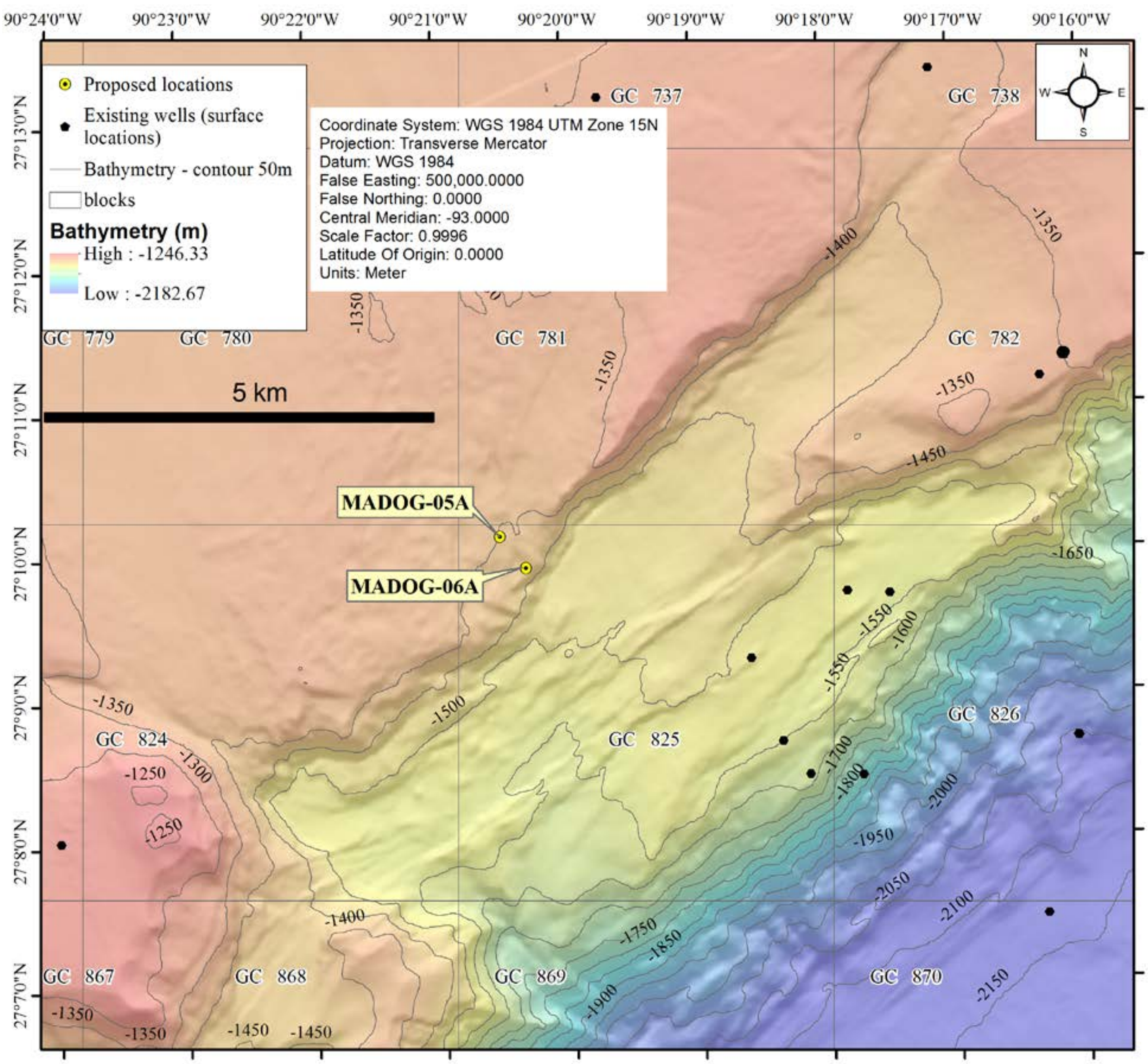


Figure 3-4: Alternate drilling locations in Green Canyon Block 825 near Mad Dog Oil Field

4 SCHEDULE

IODP Expedition 386 will occur between January 21 and March 22, 2020. The Port of Call for embarkation and disembarkation is assumed to be Galveston, Texas. The *JR* will embark on her 61-day voyage after an approximately 2-week Port of Call to load and prepare the vessel for the voyage.

A schedule of the project timeline, planned activities, and location is maintained in *Exp386_TimeEst_Combined_Single_Holes.xlsx,* and provided in this document as **Table 4-1**. The first 11 days of IODP Expedition 386 will be dedicated to LWD at two sites in the Orca Basin and one site in the Terrebonne basin. The LWD tools will then be offloaded and coring operations will be pursued for the remainder of the expedition at three locations in the Terrebonne Basin.

Table 4-1: Operations Plan Summary

Site No.	Operations Description	Transit (days)	Drilling Coring (days)	LWD/ MWD (days)	Days on Site
Galveston	Port Call				5
Transit	Galveston to ORCAB-12A (~234 nmi @ 10.5 kts)	0.9			
ORCAB-12A	Hole A - LWD to 591 mbsf, cement, FFF.		2.3	1.4	
	ORCAB-12A Site Sub-Totals:		2.3	1.4	3.8
Transit	ORCAB-12A to ORCAB-11B @ 10.5 (~2,089 ft)	0.0			
ORCAB-11B	Hole A - LWD to 575 mbsf, cement, FFF.		2.3	1.4	
	ORCAB-11B Site Sub-Totals:		2.3	1.4	3.7
Transit	ORCAB-11B toTBONE-02A (~22 nmi @ 10.5 kts)	0.1			
TBONE-02A	Hole A - LWD to 828 mbsf, cement, FFF.		2.3	1.8	
	Hole B - APC/XCB to 500 mbsf, FFF, round trip, RCB to 740 mbsf, roundtrip, PCTB to 770 mbsf, round trip, RCB to 828 mbsf, cement.		11.3	0.3	
	TBONE-02A Site Sub-Totals:		13.6	2.2	15.8
Transit	TBONE-02A to TBONE-01B (~935 ft)	0.0			
TBONE-01B	Hole A - APC/XCB to 500 mbsf, FFF, round trip, RCB to 800 mbsf, round trip, PCTB to 830 mbsf, round trip, RCB to 1045 mbsf, cement.		13.6	0.3	
	Hole B - Drill to 850 mbsf with HPTC and 6 5/8" pipe, log with large diameter logging tools, cement, FFF.		6.1	0.3	
	TBONE-01B Site Sub-Totals:		19.7	0.7	20.3
Transit	TBONE-01B toTBONE-03B (~2,219 ft)	0.0			
TBONE-03B	Hole A - APC/XCB to 500 mbsf, FFF, round trip, RCB to 930 mbsf, round trip, PCTB to 960 mbsf, round trip, RCB to 1111 mbsf, cement.		13.8	0.3	
	TBONE-03B Site Sub-Totals:		13.8	0.3	14.1
Transit	TBONE-03B to Galveston, TX (~232 nmi @ 10.5 kts)	0.9			
	Expedition 386 Sub-Totals:	**1.9**	**51.7**	**5.9**	**57.6**
	Expedition 386 Total Operating Days:				**59.5**
	Expedition 386 Total Days (includes port call):				**64.5**

5 MUD PROGRAM

At Orca Basin, the holes will be drilled with seawater with occasional gel sweeps. When the total depth of the hole is achieved, the hole will be filled with an 11.5 ppg mud. If the hole is to be plugged with cement, 11.5 ppg high viscosity pad mud will be placed in the bottom of the hole to support the cement plug.

Gel sweeps are composed of gel mixed with fresh water and weighted with Barite as required. Weighted mud initially is composed of sepiolite and fresh water with barite added to a weight of 16.0 ppg. The 16.0 ppg mud will be cut back with seawater to the desired weight as it is used. The pad mud is composed of weighted mud with gel and viscosifiers added.

At Terrebonne basin, the holes will be drilled with seawater, with occasional gel sweeps, to a depth of 600 mbsf. Beneath 600 mbsf, a 10.5 ppg mud will be used. When the total depth of the hole is achieved, the hole will be displaced with 11.5 ppg mud. If the hole is to be plugged with cement, 11.5 ppg high viscosity pad mud will be placed in the bottom of the hole to support the cement plug.

The details of the mud program are maintained as *Exp386_Mud_UseEst_600m.xlsx* and summarized in this document as **Table 5-1**.

Table 5-1: Estimated Mud Usage

IODP Expedition 386 (CPP-887) Estimated Mud Usage		
Revision: 6 Date: 3 April 2018 By: Pettigrew		
Site / Activity	**Vol. (bbl)**	**Fluid Pumped**
ORCAB-12A, Hole A		
LWD 0 - 591 mbsf	-----	Seawater
Hole sweeps	400	10.5 ppg gel
Clean and fill hole	418	10.5 ppg mud
Pad mud (for cement plug)	281	11.5 ppg hi-vis mud
ORCAB-12A, Hole A, Total Mud Usage:	**1,099**	
ORCAB-11B, Hole A		
LWD 0 - 575 mbsf	-----	Seawater
Hole cleaning sweeps	400	10.5 ppg gel
Clean and fill hole	408	10.5 ppg mud
Pad mud (for cement plug)	272	11.5 ppg hi-vis mud
ORCAB-11A, Hole A, Total Mud Usage:	**1,080**	
TBONE-02A, Hole A		
LWD 0 - 600 mbsf	-----	Seawater
Hole cleaning sweeps	400	10.5 ppg gel
LWD 600 - 828 mbsf (pump & dump)	1,785	10.5 ppg mud
Clean and fill hole	381	10.5 ppg mud
Pad mud (for cement plug)	387	11.5 ppg hi-vis mud
TBONE-02A, Hole A, Total Mud Usage:	**2,953**	
TBONE-02A, Hole B		
APC 0 - 250 mbsf	-----	Seawater
Hole cleaning sweeps	180	10.5 ppg gel
XCB 250 - 500 mbsf	-----	Seawater
Hole cleaning sweeps	180	10.5 ppg gel
Clean and fill hole	567	10.5
RCB 500 - 600 mbsf	-----	Seawater
Hole cleaning sweeps	60	10.5 ppg gel
RCB 600 - 740 mbsf (pump & dump)	3,256	10.5 ppg mud
Hole cleaning, wiper trip	1,143	10.5 ppg mud
PCTB 740 - 770 mbsf	1,450	10.5 ppg mud
Hole cleaning	429	10.5 ppg mud
RCB 770 - 828 mbsf	1,637	10.5 ppg mud
Hole cleaning	621	10.5 ppg mud
Pad mud (for cement plug)	341	11.5 ppg hi-vis mud

TBONE-02A, Hole B, Total Mud Usage:	**9,864**	
TBONE-01B, Hole A		
APC 0 - 250 mbsf	-----	Seawater
Hole cleaning sweeps	180	10.5 ppg gel
XCB 250 - 500 mbsf	-----	Seawater
Hole cleaning sweeps	180	10.5 ppg gel
Clean hole and fill with mud	568	10.5 ppg mud
RCB 500 - 600 mbsf	-----	Seawater
Hole cleaning sweeps	80	10.5 ppg mud
RCB 600 - 800 mbsf (pump & dump)	4,700	10.5 ppg mud
Hole cleaning	1,143	10.5 ppg mud
PCTB 800 - 830 mbsf	1,455	
Hole cleaning	429	10.5 ppg mud
RCB 830 - 1045 mbsf	6,229	10.5 ppg mud
Hole cleaning	756	10.5 ppg mud
Pad mud (for cement plug)	442	11.5 ppg hi-vis mud
TBONE-01B, Hole A, Total Mud Usage:	**16,162**	
TBONE-01B, Hole B		
Drill 0 - 600 mbsf	-----	Seawater
Hole cleaning sweeps	400	10.5 ppg gel
Drill 600 - 845 mbsf (pump & dump)	3,056	10.5 ppg mud
Circulate hole clean (2x volume)	608	10.5 ppg mud
Pad mud (for cement plug)	348	11.5 ppg hi-vis mud
TBONE-01B, Hole B, Total Mud Usage:	**4,412**	
TBONE-03B, Hole A		
APC 0 - 250 mbsf	-----	Seawater
Hole cleaning sweeps	180	10.5 ppg gel
XCB 250 - 500 mbsf	-----	Seawater
Hole cleaning sweeps	180	10.5 ppg gel
Clean and fill hole with mud	570	10.5 ppg mud
RCB 500 - 600 mbsf	-----	Seawater
Hole cleaning sweeps	80	10.5 ppg gel
RCB 600 - 930 mbsf (pump & dump)	7,402	10.5 ppg mud
Hole cleaning	1,143	10.5 ppg mud
PCTB 930 - 960 mbsf	1,465	10.5 ppg mud
Hole cleaning	429	10.5 ppg mud
RCB 960 - 1111 mbsf	3,552	10.5 ppg mud
Hole cleaning	797	10.5 ppg mud
Pad mud (for cement plug)	473	11.5 hi-vis mud
TBONE-03B, Hole A, Total Mud Usage:	**16,271**	
Expedition 386 (CPP-887) Estimated Total Mud Usage:	**51,841**	

6 DRILLING & CORING PROGRAM

Expedition 386 will drill seven holes across five sites. The two sites in the Orca Basin (ORCAB-12A and ORCAB-11B) will be drilled using LWD only (**Table 6-1**). The first site in the Terrebonne Basin (TBONE-02A) will be drilled using LWD in the first hole and then cored in the second hole (**Table 6-1**). The second site in the Terrebonne Basin (TBONE-01B) will be cored in the first hole, and then a second hole will be drilled for logging with large-diameter logging tools. The last Terrebonne Basin site will be cored with no logging. The coring program will sample coarse-grained hydrate-bearing reservoirs, hemipelagic mud intervals, and the transitions between these intervals.

Table 6-1: Summary of Logging, Coring, and Pressure Coring to be performed on IODP Expedition 386

Coring/logging tool	ORCA-12A	ORCAB-11B	TBONE-02A	TBONE-01B	TBONE-03B
Holes	1	1	2	2	1
LWD	0-591 mbsf	0-575 mbsf	0-828 mbsf	NA	NA
Wireline log	NA	NA	NA	0-850 mbsf	NA
APC/XCB	NA	NA	0-500 mbsf	0-500 mbsf	0-500 mbsf
RCB	NA	NA	500-740, 770-828 mbsf	500-800, 830-1045 mbsf	500-930, 960-1111 mbsf
PCTB	NA	NA	740-770 mbsf	800-830 mbsf	930-960 mbsf

At the three coring sites in the Terrebonne Basin, conventional coring will be performed with the advanced piston corer (APC) in soft sediments, the extended core barrel (XCB) in firm sediments, and the rotary core barrel (RCB) in lithified sediments. Pressure coring will be performed with the Geotek PCTB. The PCTB will be used to target the main coarse-grained hydrate-bearing intervals at these sites. **Table 6-1** contains the depth intervals that are planned to be cored by each tool. In addition to the intervals listed for PCTB coring, three additional pressure cores will be acquired over the hole.

One bottom hole assembly (BHA) is required for the APC, XCB, and the PCTB in the cutting shoe configuration. Separate BHAs are required for the RCB and the PCTB in the face bit configuration. The PCTB in the cutting shoe configuration can be used for spot cores between APC and XCB cores; however, changing to the PTCB in the face bit will require a round trip of the pipe and BHA. A free-fall funnel (FFF) will be installed before the first BHA change at each cored hole to allow for reentry to the borehole after BHA or bit changes. The planned depths that each tool will be used is listed in **Table 6-1**.

7 CORE PROCESSING

7.1 Conventional Core

Conventional cores obtained through APC/XCB/RCB coring will be processed using the standard laboratories onboard the *JR*. Immediately after core recovery these cores will be cut into standard 1.5 m sections on the catwalk. Samples for void gas, headspace gas, pore water, microbiology, and geotechnical analysis, and biostratigraphy will be collected at this stage. The 1.5m whole round sections will then be scanned for magnetic susceptibility, natural gamma ray, P-wave velocity, and gamma ray attenuation bulk density. After the physical property scans, the cores will be split into archive and working halves. The archive halves will be used for lithostratigraphic description (visual and microscopic), and the working halves will be sampled for onboard analyses including moisture and density analysis, CHN elemental analysis, CO_2 coulometer, and X-ray diffraction. Additional sediment samples for shore-based analysis will be collected from the working halves. Gas chemistry, pore water chemistry, and microbiology samples will be collected every 3 m downhole, with intervals of higher resolution sampling (0.5 m) in the upper 50 mbsf and at transitions from clay intervals to coarse-grained hydrate reservoirs. Gas samples will be analyzed by gas chromatography for methane, ethane and propane. Pore water samples will be collected wither from a titanium squeezer or Rhizon samplers which will then be analyzed for salinity, alkalinity, pH, major elements, trace elements, ammonium, and phosphate. Microbiology samples will be collected adjacent to pore water samples, processed under a sterile environment, and then stored in a -80 °C freezer.

7.2 Pressure Core

As much as 90 m of pressure core could be recovered (with 100 % recovery) using the PCTB. The PCATS from Geotek, Ltd will be used to characterize cores and transfer the samples to pressurized storage devices while on the drilling vessel.

7.2.1 Pressure Core Analysis and Transfer System

As 3.5 m pressure cores arrive on deck, they will be transferred to PCATS where they will be logged (velocity, density) and single scan 2D X-ray images will be taken. These cores will later be scanned at a higher resolution and for 3D X-ray computed tomography (CT). 30-32 m of pressure core will be preserved as 1.0 to 1.2 m subsamples to be shipped to the UT PCC for storage, further analysis, and distribution to the gas hydrate scientific community. The remaining pressure cores will be quantitatively degassed onboard to estimate hydrate concentration or if there is insufficient time for quantitative degassing, then they will be rapidly degassed. The remaining sediment after degassing (either in the liner or disaggregated sediment collected in a bag) will be sampled for onboard description and analysis and archived with IODP

7.2.2 Shipboard Degassing Analysis

Approximately 30cm subsamples will be cut from the 3.5m shipped pressure cores using PCATS. PCATS will then transfer the sample into the degassing chamber, which will be connected, to a Geotek gas collection system for analysis. Gases collected for degassing experiments will be quantified to determine the initial hydrate concentration and collected for gas analysis on-shore. On board gas analyses will include concentration of C1 to C5 gaseous alkanes, O_2 and N_2. Samples will be collected for post-cruise analysis of $\delta^{13}C$ and δD of methane, clumped isotope analysis, concentration of CO_2, and concentration of noble gases.

7.2.3 Depressurized Samples

Most likely, some samples will not seal properly in the PCTB and will lose pressure during retrieval. In addition, some samples may be depressurized on the ship without performing degassing analysis. These samples will be treated like conventional cores and, if possible, processed as described above in Section 7.1.

8 LOGGING WHILE DRILLING

The LWD tools will be on-boarded at sea. Time is allotted time before and after the actual drilling to mobilize and test the tools, and demobilize, respectively. We will deploy LWD at ORCAB-11A, ORCAB12A, and TBONE-02A. Deployment of the LWD BHA will be approximately 5 days.

At Orca, the LWD program will be ”pogo-sticked” in that LWD data will be acquired at ORCAB-12A and ORCAB-14B with a single deployment to save the time required for a pipe trip and tool setup/download. We will then LWD the A-Hole at TBONE-02A. The LWD tools will be off-loaded at sea.

The following logging string tools are proposed:

- geoVISION
- EcoScope
- TeleScope
- SonicScope
- proVISION (conditional upon technical review)

8.1 LWD Components

8.1.1 geoVISION

The geoVISION (GVR) collects five resistivity measurements and natural gamma ray. Three of the electrode-type resistivity measurements are collected using azimuthally focused button electrodes that spin around the outside of the tool and are used to produce 360-degree resistivity images of the borehole wall. These images can be used to identify fractures (including gas hydrate filled fractures), faults and bedding orientation. This tool also provides the highest resolution LWD resistivity measurements needed to calculate a gas hydrate saturation.

8.1.2 EcoScope

The EcoScope measures a suite of electromagnetic wave resistivity, and 360-degree images of neutron porosity, gamma ray, bulk density, photoelectric effect and caliper. The tool also collects geochemical spectroscopy and formation sigma. This wide array of measurements are crucial to characterize gas hydrate reservoirs, understand reservoir anisotropy and to tie information to cores. Measurements include annular pressure-while-drilling (APWD), which is monitored during drilling to identify potential natural gas and water flows.

8.1.3 TeleScope

TeleScope measurements-while-drilling (MWD) service provides electrical power for, and transmits data from, other tools on the BHA. A selected number of channels are mud pulsed in real time to the ship during drilling to monitor downhole pressure during drilling, reduce risk, and increase operational efficiencies.

8.1.4 SonicScope

The SonicScope tool combines high-quality monopole and quadrupole measurements to deliver robust real-time and recorded compressional and shear slownesses along with Stoneley data in both fast and slow formations, regardless of mud slowness. The SonicScope tool uses a powerful wide-band multipole transmitter array to excite monopole and quadrupole modes over a frequency band of 1–20 kHz. Forty-eight digitized receivers with refined interreceiver spacing prevent aliasing at any depth. The resulting datasets can be used to understand the physical properties of gas hydrate reservoirs, determine gas hydrate saturation and tie well logging datasets to seismic datasets.

8.1.5 proVISION

The proVISION is a downhole nuclear magnetic resonance measurement (NMR) tool that provides formation information based on the relaxation time of the magnetically induced precession of polarized protons (hydrogen nuclei) in the pore and bound fluids. The resulting data, proton longitudinal relaxation (T1) and transverse relaxation (T2) times are used to calculate the porosity of fluid filled reservoirs and, when combined with the bulk density measurement, a resistivity-independent gas hydrate saturation. Furthermore, these measurements can be used to understand pore size distributions and provide an estimate of formation permeability.

Historically, the sensitivity at shorter T2 relaxation times was improved by acquiring NMR data in a special tool mode known as the enhanced precision mode (EPM); yielding measurements that were valid within the T2 range of 0.5-5000ms. A new evaluation technique has been developed that addresses the porosity "deficit problem" associated with the fast NMR relaxations in the data recorded by the standard Schlumberger proVISION Plus 675 LWD tool. In the new algorithm, T1-T2 distribution are jointly inverted contrary to conventional NMR processing which is related to measure T2 distribution from the spin-echo signal with a single wait time. Thus, deriving multi-dimensional relaxation and/or diffusion coefficient distributions facilitate accurate porosity determination and hence avoiding under or over estimating porosities.

8.2 LWD Deployment

The LWD BHA is presented in this document as **Figure 8-1**. This is the configuration used on a recent scientific expedition to India: the National Gas Hydrate Program Expedition 2 (**NGHP-02).**

8.3 LWD Survey

Survey data will be produced while completing all LWD boreholes over the entire length of the borehole via the LWD tools in real-time.

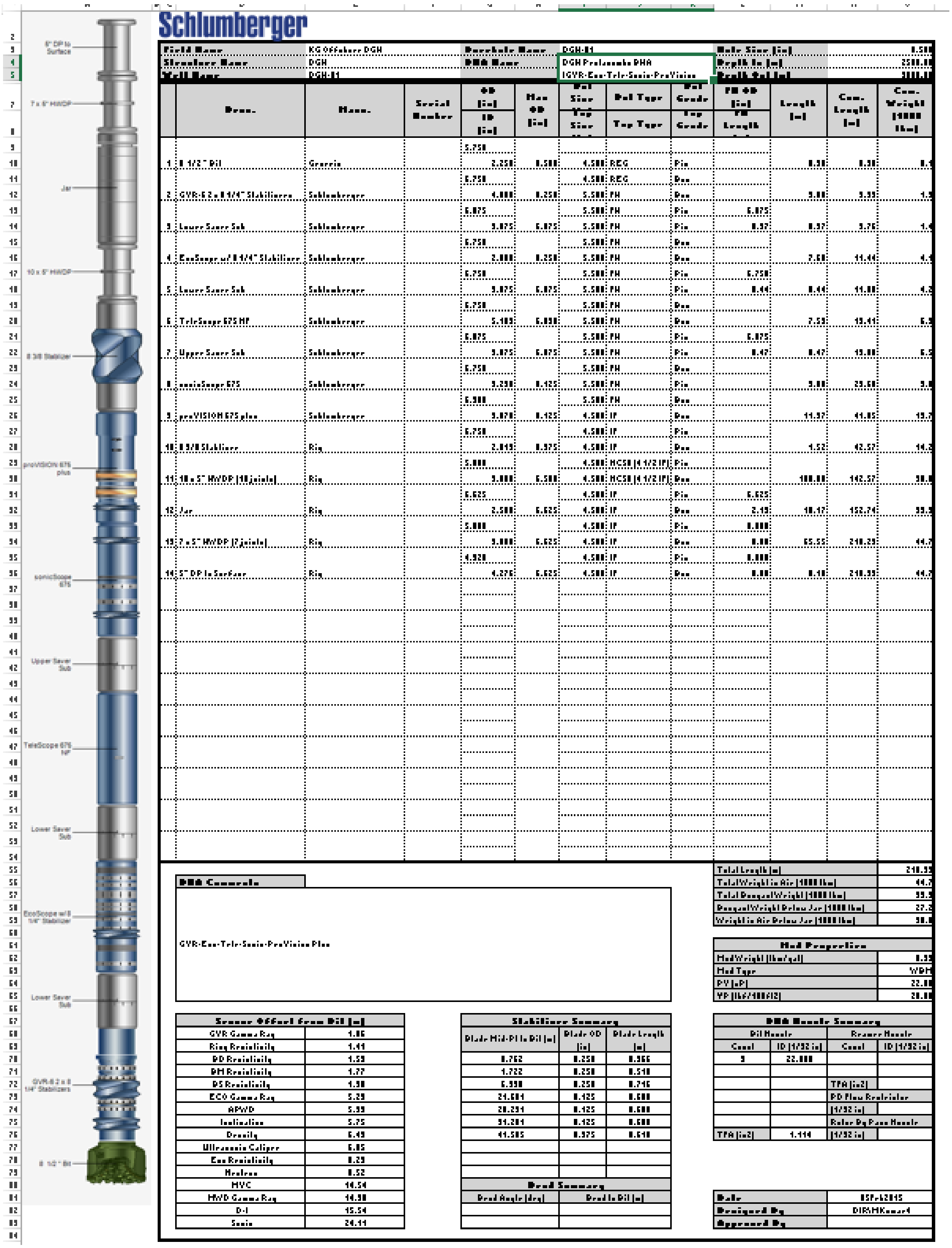


Figure 8-1: Proposed layout of LWD tools and corresponding BHA for IODP Expedition 386

9 WIRELINE LOGGING

Scientific coring and down hole logging programs over the last 20 years have shown that gas hydrate can occur over a wide range of conditions, from uniform distribution (disseminated) in sands and other related porous media to massive forms, such as, layers in vertical to sub-vertical fracture systems. The in-situ physical nature of gas-hydrate occurrences can be evaluated using both standard and specially develop down hole log evaluation techniques. Downhole logging associated with previous gas hydrate expeditions in the Gulf of Mexico, and throughout the world, have provided robust information about complex gas hydrate reservoir systems containing pore- and fracture-filling gas hydrate, sediment grains of various sizes and compositions, water at various reservoir states, and free gas. Downhole log analysis have made significant contributions to our understanding of the formation and occurrence of gas hydrates in nature and is expected to contribute greatly to success of IODP Expedition 386.

To meet Bureau of Safety and Environmental Enforcement (BSEE) regulations, it is required that each hole be surveyed. Survey data will be produced while completing all LWD boreholes over the entire length of the borehole via the LWD tools in real time. All drilled and cored boreholes will be surveyed using a gyroscopic memory tool deployed on the slickline (non-electric) through the drill string. The current survey plan for each borehole is to conduct a survey at ~1,500 feet below the seafloor and then again at total depth of ~3000 ft., providing complete survey data over the entire length of the borehole.

The specialized wireline program will be run in Hole TBONE-01B only (**Table 3-1**). Fifty-eight hours have been allotted for the wireline logging program on IODP Expedition 386. This time would include deployment of the non-specialized triple combo and FMS-Sonic tools that reside on the *JR* and the specialized tools discussed here. By 'specialized', we mean capability that is beyond the routine capability carried onboard the *JR*. All standard wireline services onboard the *JR* will be available as well.

For the specialized wireline logging, we will use large-diameter drill pipe. The proposed drill string components to be used in conjunction with the wireline logging are as follows. Drill pipe, 6-5/8 inch with 6-5/8 internal flush (IF) connections and a minimum inner diameter (ID) through the tool joints of 5.5 inches. Drill collars and the BHA will be composed of 9-1/2 inch drill collars with a 5-1/2 inch inside diameter. The drilling bit will be a 10-5/8 inch outside diameter coring bit with a throat diameter of 5-1/2 inches.

Specialized wireline logging tools are defined as the following:

- Platform Express (PEX) with Rt-Scanner
- Sonic Scanner (MSIP)
- Combinable Magnetic Resonance Tool (CMR)
- Formation Micro Imager (FMI)
- Hostile Natural Gamma Ray Sonde (HNGS)
- Modular Formation Dynamics Tester (MDT)

9.1 Specialized Wireline Components

9.1.1 Platform Express (PEX) with Rt-Scanner

Rt-Scanner triaxial induction tool calculates vertical and horizontal resistivity (R_V and R_H, respectively) from direct measurements while simultaneously solving for formation dip at any well deviation. This measurement provides important information about reservoir anisotropy and heterogeneity. This tool also provides the highest resolution wireline resistivity measurements needed to calculate a gas hydrate saturation.

9.1.2 Sonic Scanner (MSIP)

The multiple monopole and dipole transmitters of the Sonic Scanner platform produce high quality compressional, shear, and Stoneley waveforms. In addition to a robust measurement of P-wave velocity, the MSIP uses the dipole source to generate a flexural mode in the borehole that can be used to estimate shear (S-wave) velocity even in highly unconsolidated formations. The resulting datasets can be used to understand the physical properties of gas hydrate reservoirs, determine gas hydrate saturation and tie well logging datasets to seismic datasets.

9.1.3 Combinable Magnetic Resonance Tool (CMR)

The high-resolution CMR-Plus combinable magnetic resonance tool provides the highest resolution nuclear magnetic resonance (NMR) logging. NMR measurements are based on the relaxation time of the magnetically induced precession of polarized protons (hydrogen nuclei) in the pore and bound fluids. The resulting data, proton longitudinal relaxation (T1) and transverse relaxation (T2) times are used to calculate the porosity of fluid filled reservoirs and, when combined with the bulk density measurement, a resistivity and velocity-independent gas hydrate saturation. Furthermore, these measurements can be used to understand pore size distributions and provide an estimate of formation permeability.

9.1.4 Formation Micro Imager (FMI)

The FMI provides real-time microresistivity formation images and dip data in water-base mud. With 80% borehole coverage in 8-in boreholes and 0.2-in image resolution in the vertical and azimuthal directions, imaging with the FMI microimager is the preferred approach for determining net sands (reservoirs) in laminated sediments of fluvial and turbidite depositional environments.

9.1.5 Hostile Natural Gamma Ray Sonde (HNGS)

Spectral gamma ray tools provide insight into the mineral composition of formations and reservoirs. The total gamma ray spectra measured is resolved into the three most common components of naturally occurring radiation in sands and shales—potassium, thorium, and uranium (K, Th, and U, respectively). These data are used to distinguish important features of the clay or sand around the wellbore. The clay type can be determined, and sand can be identified as radioactive.

9.1.6 Modular Formation Dynamics Tester (MDT)

The primary goal of the downhole formation pressure testing is measure formation pressure and ascertain zonal permeabilities in the pre-hydrate dissociation phase using pressure transient analysis. Schlumberger's MDT wireline dual-packer tool will be used for pressure testing during IODP Expedition 386. The tool string used during NGHP-02 in India is shown in **Figure 9-1.** The inlet port and measurement point in the MDT is between the two borehole packers. The MDT consist of the following modules: 1) Electronic Power Module that converts power from the surface to power for the tool modules, 2) Modular Sample Chambers that contains up to eight 420 cm3 PVT bottles, 3) Pump-Out Module (MRPO) that controls flow and induced pressure conditions, and the 4) Fluid Analyzer Module that includes the In Situ Fluid Analyzer (IFA) analyzer for downhole real time fluid analysis.

9.2 Specialized Wireline Deployment

We intend to target one interval within which we will use the MDT wireline packer both in single probe (SP) and in dual packer (DP) mode. We will sample fluids and perform pressure drawdowns numerous times in SP mode. We will perform mini-frac measurements, and do several pressure drawdowns in the DP mode. Because of the range of flow-rates that have been observed in previous gas hydrate MDT tests, we will need to review and carefully select that appropriate flow module for this test. For controlled depressurization (pumping) above gas hydrate equilibrium pressures, we have need to low flow modules. However, to dissociate gas hydrate we have required high flow pumps.

An example design for the MDT that was deployed in offshore India during NGHP-02 is presented as **Figure 9-1**. The design has a straddle (dual packer configuration) and a probe below the dual packer at the bottom of the tool. We have also discussed including a probe above the dual packer.

9.3 Borehole Survey

All drilled and cored boreholes will be surveyed using a gyroscopic memory tool deployed on the slickline (non-electric) through the drill string. The current survey plan for each borehole is to conduct a survey at ~1,500 feet below the seafloor and then again at total depth of ~3000 ft., providing complete survey data over the entire length of the borehole.

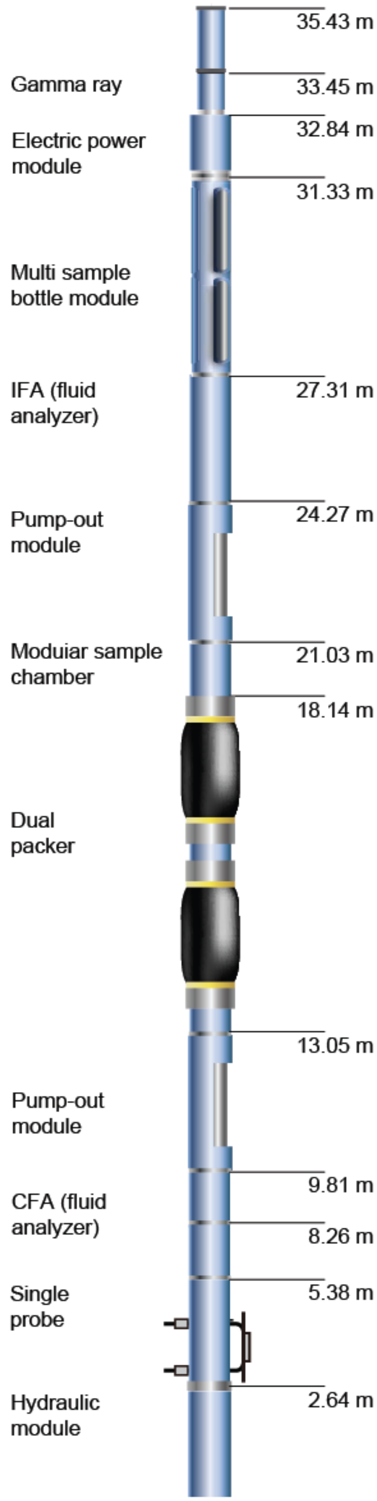


Figure 9-1: Wireline tool string deployed during NGHP-02

10 PLUGGING & ABANDONMENT

Upon completion of coring and measurements, all holes will be plugged with cement for abandonment per BSEE regulations. Prior to emplacement of cement, the bottom of the drill string will be lowered to the bottom of each hole. The hole will then be circulated with 10.5 ppg mud to clean the hole of any remaining cuttings or detritus. Sufficient 11.5 ppg high viscosity pad mud will then be pumped into the hole to fill the hole to within 200 m below seafloor once the drill string is removed. The bottom of the drill string will then be raised to 200 m below the seafloor. Sufficient cement will then be pumped through the drill string to fill the hole to the seafloor. The bottom of the drill string will then be slowly raised above the seafloor and circulated clean with seawater. The borehole will be visually observed for a minimum of 30 minutes for any sign of out flow.

Note that in some holes, BSEE may require a cement plug be placed immediately above the hydrate zone. If required, the same cement plug emplacement procedure will be employed, leaving a 200m column of cement immediately above the hydrate zone. Above the cement plug, the hole will be filled with 10.5 ppg mud to the seafloor.

11 OPERATIONAL FACILITIES & EQUIPMENT

11.1 Drilling Vessel

The *JR* research vessel is a dynamically positioned drillship that is uniquely outfitted with integrated core laboratories. The *JR* is owned by Overseas Drilling Limited, a subsidiary of Siem Offshore, and operated by the IODP Science Operator (JRSO). The *JR* has been utilized for numerous global methane hydrate research projects, beginning with Ocean Drilling Program (ODP) Leg 164 in 1995.

A summary of *JR* specifications are provided in this document as **Table 11-1**.

Table 11-1: JOIDES Resolution Specifications (modified from IODP)

Capabilities
Maximum water depth: 27,000 ft
Minimum water depth: 300 ft
Total hanging drill string length: 30,000 ft
Panama Canal capable (height and width)
Time at sea without re-provisioning: 75 days

Drilling Tubular Storage Capacity
Drill pipe: 46,500 ft (5 and 5½ in.)
Drill collars: 2,300 ft (8¼ and 6½ in.)
Casing: 7,350 ft (20, 16, 13⅜, 11¾, 10¾ in.)

Power
Engines/Generators: 7 EMD 16 cylinder diesel
5 @ 2,100 kW (3,000 hp)
2 @ 1,500 kW (2,200 hp)

Propulsion
12 ea. 750 hp thrusters (10 retractable, 2 fixed)
Main screws: 2 shafts; 9,000 shp

Liquid Capacities
Diesel fuel (MGO): 997,152 gal (3,217 mt)
Drill water: 343,959 gal
Ballast: 182,783 gal
Potable water: 242 st

Mud/Cement
Mud pumps: 2 ea. Oilwell A1700PT triplex
Liquid mud: 3,740 bbl
Bulk capacity: 13,300 cu ft
Cement unit: Halliburton 400 HT

Heave Compensation System
Western Gear model 800-17-20
Lift capacity: 800,000 lb; 1,200,000 lb locked
Total stroke: 20 ft
Max. operating conditions: 15 ft heave; 7½ sec

Core Retrieving Winch
National dual drum, independent drive
Motor: D 79 electric, 750 hp
Capacity: 31,000 ft of ½ in. line per drum

Derrick
Model: Dreco 147 ft
Height above water line: 192 ft
Rating: 1,200,000 lb static; 800,000 lb dynamic

Drawworks
Model: Oilwell E3000
Motors: 2 ea. EMD M89 – ALB x 1,200 hp ea.
Line: 1¾ in.
Brakes: Dual Baylor Elmagco model 7838

Drill String Support
Type: Dual elevator handler (no slips; protects pipe)
Model: Varco DEHS/471
Reach: 60 in. horizontal; 36 in. vertical
Elevator size: 350 or 500 ton; modified side door

Drill String Bending Restraint
Moonpool guide horn (no riser support)

Iron Roughneck
Model: Varco IR 2100
Pipe size: 4 in.– 8½ in. diameter
Make up torque: 63,000 ft·lb
Breakout torque: 75,000 ft·lb

Top Drive
Model: Varco TDS3
Motor: EMD M89 electric, 1,000 hp
Continuous torque: 30,000 ft·lb @ 169 rpm
Intermittent torque: 40,000 ft·lb
Breakout torque: 60,000 ft·lb
Maximum speed: 250 rpm

Rotary Table
Model: Oilwell A-49 1/2
Motor: EMD D 79 MB
Maximum speed: 325 rpm

Cranes
Type: Bucyrus Erie Pedestal type
Model: 2 x MK60; 70 and 80 ft booms
1 x MK35 with 80 ft boom

Pipe Rackers
Type: Horizontal racking (triples)
Manufacturers: Western Gear/VMW
Capacity: 24,700 ft of 5 in. drill pipe;
9,900 ft of 5½ in. drill pipe

ASK System
Manufacturer: Nautronix
Model: 5002 (dual redundant)
Type: intermediate baseline
Capabilities: 2% of water depth
Signal: GPS primary; Beacon secondary

Personnel Complement
Capacity: 129

Scientific Spaces
Square footage: 18,000 sq ft
Refrigerated core storage: 26,250 cu ft

Normal Fuel Consumption
Cruising: 33–38 mt/day
DP (3 engines): 16.5–19.5 mt/day
DP (2 engines): 12–13 mt/day
In port: 9–10 mt/day

Transit Speed: 10.5 kt (optimal)

Helideck: Super Puma AS332L2 capable
D-value: 20; T-value: 9.3 mt

Moonpool: 22 ft diameter

11.2 Large Diameter Pipe-Handling Infrastructure

The *JR* has successfully drilled and cored in the deep water without a drilling riser conduit for many years. The standard pipe sizes are a combination of 5 inch and 5-1/2 inch outside diameter drill pipe. To take advantage of state-of-the art tools and technologies that require 6-5/8 inch outside diameter drill pipe, IODP has invested in large diameter pipe-handling infrastructure on the *JR*. Two 500-ton elevators, an elevator dolly, and stool were tested onboard the *JR* in January 2014. This new capability greatly enhances the operational and scientific uses of the *JR* and enable the specialized wireline logging program for this project to include downhole tools such as Schlumberger's PEX, FMI, and CMR, and to conduct formation testing using the MDT. 6-5/8 inch drill pipe will be rented due to IODP not owning any pipe of this size.

11.3 Remotely Operated Vehicle

UT proposes contracting with Oceaneering International, Inc. (Oceaneering), based in Morgan City, LA for remotely operated vehicle (ROV) services. An inspection class ROV will provide continuous monitoring the wellhead at the seafloor order to confirm no flow and confirm that each hole has been properly abandoned. In most cases, ROV monitoring of the wellhead during drilling provides the first and only direct evidence of flow issues associated with shallow open-hole drilling operations. ROV surveys also provide direct conclusive evidence of the effectiveness of the drilling program intervention program, which is often required by regulatory agencies to confirm compliance to hole abandonment conditions stipulated within the drilling permit. Additionally, the ROV contractor will be retained to provide final Well Survey Plats required by BSEE.

11.4 Pressure Coring Tool with Ball Valve

The PCTB (Pressure Coring Tool with Ball) is a pressure-coring system designed to recover core samples that will be brought to the surface while maintaining in-situ pressure. The PCTB in part, consists of a ball valve, autoclave, and nitrogen pressure booster. As the tool is driven into the formation, the sample is driven into the autoclave. A wireline operator then uses the wireline (non-electric) to pull up on the PCTB, which closes the ball valve and opens the nitrogen pressure booster. The nitrogen gas floods the autoclave until the pressure inside is elevated to ~200 psi above hydrostatic. The wireline operator then brings the PCTB to the surface and the rig floor. The rig floor will be equipped with a glycol cooled 'cold shuck' to thermally stabilize the pressure coring autoclave when it is recovered prior to being disassembled. The pressurized and cooled autoclave is replaced and the ball and nitrogen pressure booster are reset, and the tool is lowered back into the formation. The autoclave is equipped with temperature and pressure recorder, a sample and drain port, and a burst disk. Should pressure build up in the autoclave the burst disk will rupture to prevent an explosion of the autoclave.

11.5 Pressure Core Analysis and Transfer System

Geotek will provide and operate their Pressure Core Analysis and Transfer System (PCATS) on the ship. PCATS has the capability to receive cores from the PCTB autoclave; log cores using 2D, 100 um resolution, X-ray tomography, P-wave Velocity and bulk density; transfer cores into the larger temporary pressure storage chambers; and cut and transfer cores into shorter pressure storage chambers or degassing analysis chambers.

Figure 11-1: PCATS in Geotek Reefer Unit

11.6 Degassing Analysis Chambers

Small Degassing Analysis Chambers will be used on-ship to depressurize the methane-hydrate-bearing core to determine the total methane extracted from and initial concentration of hydrate within the core.

11.7 Core Storage Chambers

UT proposes that Geotek provide temporary storage chambers on the ship that will store cores as long as the largest core length that is captured in the PCTB autoclave, up to 3.5 meters. This type of storage chamber is considered the standard for all hydrate expeditions around the world. The storage chambers will be stainless steel and be rated to >44 MPa (6235 psi). Each pressure core chamber has two safety valves at the bottom of the tank: a 35.5 MPa (5150 psi) pressure relief value, to keep the internal pressure close to 35 MPa; and a 43.75 MPa (6345 psi) rupture disk, to prevent explosion of the tank.

UT proposes leasing 10 1.2m storage chambers from Geotek. 1.2 m chambers are the longest core length that can be shipped overland and can be stored at UT and handled by the UT Mini-PCATS (**Fig.11-3**). The 1.2 m chambers are similar to the larger storage chambers and are considered the standard for all hydrate expeditions around the world. They will be of stainless steel and be rated to >44 MPa (6235 psi). Each pressure core chamber has two safety valves at the bottom of the tank: a 35.5 MPa (5150 psi) pressure relief value, to keep the internal pressure below 35 MPa; and a 43.75 MPa (6345 psi) rupture disk, to prevent explosion of the tank in case the 35.5 MPa relief valve fails.

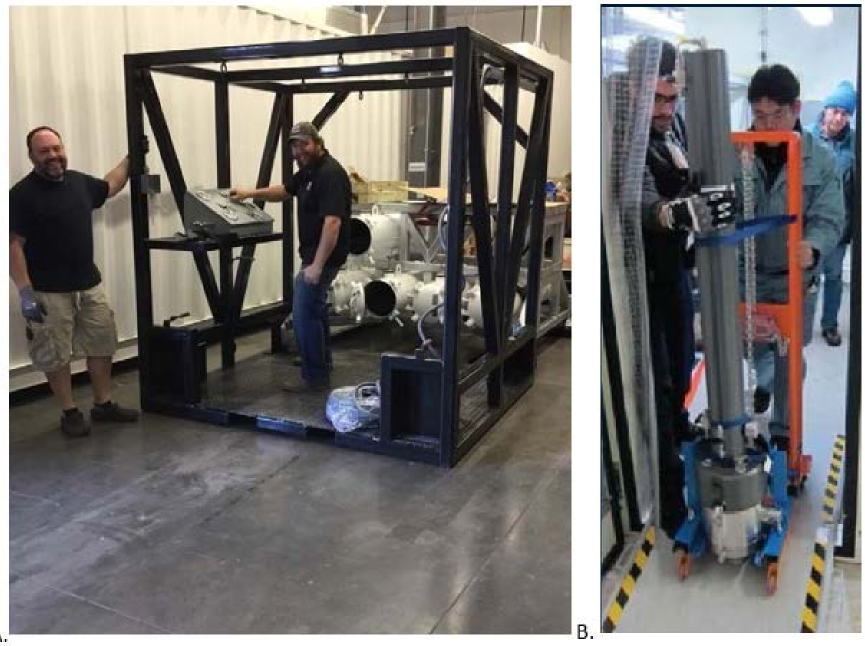
The approximate weight of each chamber will depend on the maximum length of core that it can contain. The largest chambers will be approximately 180 cm in length, 30cm in width, and weigh approximately 100kg (220 lbs.) when full.

The storage chambers described are not rated for Department of Transportation (DOT) capability to transfer the cores overland to UT, an 'Overpack Technology' will be used, See "Overpack Technology" description below. These chambers will ultimately be transferred to shore-based facilities at the University of Texas using this Overpack technology.

Geotek will provide pressure maintenance and cold storage of the 3.5 and 1.2m core storage chambers within PCATS2 (Container #3).

11.8 Overpack Technology

1.2m Pressure cores in storage chambers will be transferred from the ship inside cold storage Container #3 to the dock. Container #3 will be keep cold until a reefer container on a vibration limited truck arrives if it is not waiting at the dock already. The storage chambers will be moved from Container #3 to the overpack frame (**Fig. 11-3**) where they will be individually place inside cold large DOT approved overpacks. The track will then transport the cores from the dock to UT.



A. B.

Figure 11-2: A. Overpack frame; B. Pressure Core Storage Chamber

12 SAFETY AT SEA

The *JR* crew and employees work under International Maritime Organization's (IMO) Safety of Life at Sea (SOLAS), IODP and/or Siem Offshore safety standards and rules. All persons on board the *JR* vessel during IODP Expedition 386 will work under the safety management protocols promulgated by IODP and Siem Offshore. This includes scientific operations such as laboratory and geophysical data collection activities as well as logging, drilling, and other vessel operations.

The *JR* will have a dedicated EHS Supervisor on board the rig. He/she is supported by an onshore EHS Manager and staff.

Task-specific training for IODP and/or Geotek for handling the pressure cores include:

- Safe installation-removal of a glycol cooled cold shuck on the rig floor.
- Safe handling of the PCTB including safe assembly and disassembly.
- Safe handling of autoclaves including removing the autoclaves safely from the PCTB.
- Safe hoist operation to move the autoclaves from the rig floor to PCATS reefer. (IODP)
- Safe operation of PCATS including attaching and detaching pressure storage vessels and Autoclaves, running pressure pumps and other pressure maintenance equipment, cutting and transferring core under pressure.
- Safe operation of PCATS Analysis Tools including density measurements, velocity measurements and X-ray imaging.
- Safe storage of pressure cores and the storage pressure maintenance system.
- Safe Mobilization and Demobilization of the PCATS and storage reefers. Transfer of reefers to land.

13 RISK MANAGEMENT

The risks can be broadly broken into the following categories:

1) <u>Environmental Risk due to drilling:</u>
   a) Release of fluids at the seafloor
      i) In any riserless offshore drilling operation in a petroleum basin, there is the risk of the release of wellbore fluids to the water column when hydrostatic control is not maintained. There are two possible wellbore fluid flows at IODP Expedition 386 locations: 1) water flow and 2) gas flow.
      ii) Uncontrolled shallow flows can result in drilling delays or loss of well site.
      iii) The risk of these events is minimized in the following manner:
         (1) Avoid potential flow zones. Use seismic and previous well data to select surface locations and to design well paths that minimize the possibility of drilling into shallow formations with the potential of flowing fluids.
         (2) Maintain hydrostatic control. Use appropriately weighted drilling fluids during drilling and in response to flow events to slow/stop the flow of fluids. Minimize lost circulation.
         (3) Maintain visual observation of the wellbore returns at the seafloor via ROV camera for early detection of flow.
         (4) Review of offset well data.
   b) Release of pollutants from the rig
      i) Examples include spills of diesel fuel or other chemicals from the rig or supply vessel while on location. Spills can also occur during transit (collision) or during transfer between rig & supply vessel.
      ii) Releases of diesel will evaporate and biodegrade within a few days.
      iii) Most chemicals used during the project will be either non-toxic or used in small quantities.
      iv) Spills are expected to have temporary localized impacts on water quality.
   c) Operational discharges
      i) Will be regulated as per the NPDES General Permit GMG290000
      ii) Operational discharges are expected to have short-term localized degradation of marine water quality
   d) Emissions impact on air quality
      i) Emissions from routine activities are not expected to affect onshore air quality due to prevailing atmospheric conditions, emission heights, emission rates, distance of emissions from the coastline
      ii) There are no plans for burning or flaring during this project
   e) Impact on marine life
      i) Minimal to none expected
   f) Dissociation of gas hydrates
      i) Hydrate dissociation can be either gradual or instantaneous when hydrates are heated or depressurized. In drilling the well bore, fluids cooler than the formation temperature will be introduced, which will act to further stabilize the hydrate zone. Drilling-fluid weight will be controlled to maintain a positive pressure on the formation. During P&A, the cement abandonment plug will be set above the hydrate zone to minimize destabilization concerns due to the cement heat of hydration while the plug sets.

2) <u>Personnel and Equipment Risk due to drilling:</u>
   a) Drilling involves dynamic use of heavy equipment, often under pressure, in a challenging and changing environment. There is risk to personnel and equipment inherit in this environment. Risks are mitigated by equipment & program design, preventative maintenance & inspections, strict adherence to procedure, job safety analyses, personnel competency & supervision, high quality safety culture, and use of a unified Safety Management System.
   b) Project-specific risk
      i) Loss of drill string or logging tools during drilling or other event. The drill string or logging tools can become stuck in the borehole resulting in loss of tools or bottom-hole assembly (BHA) and part of the drill string.
      ii) Loss of drill string due to geological event: It is possible, although very rare, that a submarine mass movement (e.g. landslide) could occur resulting in the loss of the drill string. Loss of equipment due to landslides is extremely rare.
3) Personnel and equipment risk due to dealing with high pressure samples
   a) We will be recovering, transferring, and storing samples that are at significant pore pressures (up to 35 MPa).
   b) The risk is mitigated in the following manner:
      i) All pressure vessels are equipped with pressure release safety valves.
      ii) Pressure cores will be transported by vehicle in 'over-pack' containers, a recognized approach to transport of pressurized material.
      iii) Strict adherence to proper procedure in the presence of pressurized containers.
      iv) Hold pre-job safety discussions.
      v) Assure that personnel involved have been trained in the safe handling of pressurized samples.

14 PERMITTING

ACRONYMS These wells will be drilled under BOEM 'Permit to Conduct Geological or Geophysical Exploration for Mineral Resources or Scientific Research on the Outer Continental Shelf (Form BOEM-0327)', BSEE 'Permits to Drill' (Form BSEE-0123), and the NPDES General Permit for the Western Portion of the Outer Continental Shelf of the Gulf of Mexico (GMG290000). The operations will be conducted on granted 'Rights of Use and Easement'; no leasing of Federal lands will be required. Coastal Zone Management federal-consistency certification will be included as part of the Exploration Plan submitted to BOEM. A NEPA Categorical Exclusion Designation will be required.

15 ACRONYMS

Table 15-1: List of Acronyms

ACRONYM	DEFINITION
APC	Advanced Piston Corer
APWD	Annular Pressure-while-Drilling
bbl	barrels
BHA	Bottom Hole Assembly
BSEE	Bureau of Safety and Environmental Enforcement
cm	centimeters
CMR	Combinable Magnetic Resonance
CPP	Complementary Project Proposal
CT	Computed Tomography
DOE	Department of Energy
DOT	Department of Transportation
DP	Dual Packer
EPM	Enhanced Precision Mode
FFF	Free-Fall Funnel
FMI	Formation Micro Imager
FMS	Formation Micro Scanner
GVR	geoVISION
hi-vis	high viscosity
HNGS	Hostile Natural Gamma Ray Sonde
ID	Inner Diameter
IF	Internal Flush
IFA	In Situ Fluid Analyzer
IODP	International Ocean Discovery Program
JIP	Joint Industry Project
JR	JOIDES Resolution
JRSO	JOIDES Resolution Science Operator
lbs	pounds
LDEO	Lamont-Doherty Earth Observatory
LWD	Logging-While-Drilling
m	meters
mbsf	meters below sea floor
MDT	Modular Formation Dynamics Tester
MRPO	Pump-out Module
MPa	Megapascal
MSIP	Modular Sonic Imaging Platform
MWD	Measurements-While-Drilling
NETL	National Energy Technology Laboratory
NGHP	National Gas Hydrate Program

ACRONYM	DEFINITION
NMR	Nuclear Magnetic Resonance
NW	Northwest
ODP	Ocean Drilling Program
OHSU	Ohio State University
ORSU	Oregon State University
PCATS	Pressure Core Analysis and Transfer System
PCC	Pressure Core Center
PCT	Pressure Coring Tool
PCTB	Pressure Coring Tool with Ball Valve
PEX	Platform Express
ppg	pounds-per-gallon
psi	Pounds-per-square-inch
RCB	Rotary Core Barrel
R_H	Horizontal Resistivity
ROV	Remotely Operated Vehicle
R_V	Vertical Resistivity
SP	Single Probe
SSE	South-Southeast
SSW	South-Southwest
TAMU	Texas A&M University
UNH	University of New Hampshire
USGS	United States Geological Survey
UT	University of Texas at Austin
UW	University of Washington
Vol	Volume
XCB	Extended Core Barrel