DOE Award No.: DE-FE0023919

Quarterly Research Performance Progress Report

(Period Ending 06/30/24)

Deepwater Methane Hydrate Characterization & Scientific Assessment

Project Period 6: 11/15/23 - 09/30/25

Submitted by:

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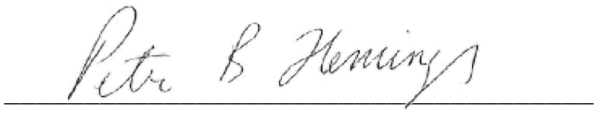

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U.S. DEPARTMENT OF ENERGY | NATIONAL ENERGY TECHNOLOGY LABORATORY

Office of Fossil Energy

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DISCLAIMER

1 ACCOMPLISHMENTS

This report outlines the progress of the second quarter of the tenth fiscal year of the project from Apr. 1 – Jun. 30, 2024 (Budget Period 6, Year 1). Highlights from this period include:

- UT completed the final draft of the UT-GOM2-2 Preliminary Report. The report was submitted to USGS for an extensive technical review which was still ongoing as the end of this performance period.

- UT continued to make progress on the three chapters that will comprise the UT-GOM2-2 Proceedings Volume. The UT-GOM2-2 Proceedings Volume will be completed in Dec. 2024.

- Project team members organized and proposed a dedicated hydrates session at the American Geophysical Union (AGU) fall meeting, in Washington DC, Dec. 9-13. The proposal was subsequently approved: *(OSO29) Natural Gas Hydrate Systems Occurrence and Dynamic Behavior*. Thirty-seven abstracts were submitted from multiple institutions from around the world for this session. Seventeen are co-authored by GOM2 scientists and are related to the UT-GOM2-2 Hydrate Coring Expedition.

- UT finalized planning for a UT-GOM2-2 science workshop that will be held in Boerne, TX from Oct. 27-30. This workshop will include presentations and poster sessions on new science from UT-GOM2-2, brainstorming sessions for collaborative research and papers, and discussions of big science questions related to basin and reservoir insights.

1.1 Major Project Goals

The primary 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 was accomplished through the planning and execution of a state-of-the-art drilling, coring, logging, testing and analytical program that assess the geologic occurrence, regional context, and characteristics of marine methane hydrate deposits in the Gulf of Mexico Continental Shelf. Project Milestones are listed in Table 1-1 and Table 1-2.

Table 1-1. Previous Milestones

Budget Period	Milestone	Milestone Description	Estimated Completion	Actual Completion	Verification Method
1	M1A	Project Management Plan	Mar-15	Mar-15	Project Management Plan
	M1B	Project Kick-off Meeting	Jan-15	Dec-14	Presentation
	M1C	Site Location and Ranking Report	Sep-15	Sep-15	Phase 1 Report
	M1D	Preliminary Field Program Operational Plan Report	Sep-15	Sep-15	Phase 1 Report
	M1E	Updated CPP Proposal Submitted	May-15	Oct-15	Phase 1 Report
	M1F	Demonstration of a Viable Pressure Coring Tool: Lab Test	Sep-15	Sep-15	Phase 1 Report
2	M2A	Document Results of BP1/Phase 1 Activities	Dec-15	Jan-16	Phase 1 Report
	M2B	Complete Updated CPP Proposal Submitted	Nov-15	Nov-15	QRPPR
	M2C	Scheduling of Hydrate Drilling Leg by IODP	May-16	May-17	Report directly to DOE PM
	M2D	Demonstration of a Viable Pressure Coring Tool: Land Test	Dec-15	Dec-15	PCTB Land Test Report, in QRPPR
	M2E	Demonstration of a Viable Pressure Coring Tool: Marine Test	Jan-17	May-17	QRPPR
	M2F	Update UT-GOM2-2 Operational Plan	Feb-18	Apr-18	Phase 2 Report
3	M3A	Document results of BP2 Activities	Apr-18	Apr-18	Phase 2 Report
	M3B	Update UT-GOM2-2 Operational Plan	Sep-19	Jan-19	Phase 3 Report
4	M4A	Document results of BP3 Activities	Jan-20	Apr-20	Phase 3 Report
	M4B	Demonstration of a Viable Pressure Coring Tool: Lab Test	Feb-20	Jan-20	PCTB Lab Test Report, in QRPPR
	M4C	Demonstration of a Viable Pressure Coring Tool: Land Test	Mar-20	Mar-20	PCTB Land Test Report, in QRPPR

5	M5A	Document Results of BP4 Activities	Dec-20	Mar-21	Phase 4 Report
	M5B	Complete Contracting of UT-GOM2-2 with Drilling Vessel	May-21	Feb-22	QRPPR
	M5C	Complete Project Sample and Data Distribution Plan	Jul-22	Oct-21	Report directly to DOE PM
	M5D	Complete Pre-Expedition Permitting Requirements for UT-GOM2-2	Mar-23	Jul-23	QRPPR
	M5E	Complete UT-GOM2-2 Operational Plan Report	May-21	Sep-21	QRPPR
	M5F	Complete UT-GOM2-2 Field Operations	Jul-23	Sep-23	QRPPR

Table 1-2. Current Milestones

Budget Period	Milestone	Milestone Description	Estimated Completion	Actual Completion	Verification Method
6	M6A	Document Results of BP5 Activities	Mar-23	-	Phase 5 Report
	M6B	Complete Preliminary Expedition Summary	Mar-23	-	Report directly to DOE PM
	M6C	Initiate comprehensive Scientific Results Volume	Jun-24	-	Report directly to DOE PM
	M6D	Submit set of manuscripts for comprehensive Scientific Results Volume	Sep-25	-	Report directly to DOE PM

1.2 What Was Accomplishments Under These Goals

1.2.1 Previous Project Periods

Tasks accomplished in previous project periods (Phase 1, 2, 3, 4, 5) are summarized in Table 1-3, Table 1-4, Table 1-5, Table 1-6, and Table 1-7.

Table 1-3. Tasks Accomplished in Phase 1

PHASE 1/BUDGET PERIOD 1	
Task 1.0	**Project Management and Planning**
Task 2.0	**Site Analysis and Selection**
Subtask 2.1	*Site Analysis*
Subtask 2.2	*Site Ranking / Recommendation*
Task 3.0	**Develop Operational Plan for UT-GOM2-2 Scientific Drilling Program**
Task 4.0	**Complete IODP Complimentary Project Proposal**
Task 5.0	**Pressure Coring and Core Analysis System Modifications and Testing**
Subtask 5.1	*PCTB Scientific Planning Workshop*
Subtask 5.2	*PCTB Lab Test*
Subtask 5.3	*PCTB Land Test Prep*

Table 1-4. Tasks Accomplished in Phase 2

PHASE 2/BUDGET PERIOD 2	
Task 1.0	**Project Management and Planning**
Task 6.0	**Technical and Operational Support of Complimentary Project Proposal**
Task 7.0	**Continued Pressure Coring and Core Analysis System Modifications and Testing**
Subtask 7.1	*Review and Complete NEPA Requirements for PCTB Land Test*
Subtask 7.2	*PCTB Land Test*
Subtask 7.3	*PCTB Land Test Report*
Subtask 7.4	*PCTB Modification*
Task 8.0	**UT-GOM2-1 Marine Field Test**
Subtask 8.1	*Review and Complete NEPA Requirements for UT-GOM2-1*
Subtask 8.2	*UT-GOM2-1 Operational Plan*
Subtask 8.3	*UT-GOM2-1 Documentation and Permitting*
Subtask 8.4	*UT-GOM2-1 Marine Field Test of Pressure Coring System*
Subtask 8.5	*UT-GOM2-1 Marine Field Test Report*
Task 9.0	**Develop Pressure Core Transport, Storage, and Manipulation Capability**
Subtask 9.1	*Review and Complete NEPA Requirements for 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	**UT-GOM2-1 Core Analysis**
Subtask 10.1	*Routine Core Analysis (UT-GOM2-1)*
Subtask 10.2	*Pressure Core Analysis (UT-GOM2-1)*
Subtask 10.3	*Hydrate Core-Log-Seismic Synthesis (UT-GOM2-1)*
Task 11.0	**Update Science and Operational Plans for UT-GOM2-2 Scientific Drilling Program**
Task 12.0	**UT-GOM2-2 Scientific Drilling Program Vessel Access**

Table 1-5. Tasks Accomplished in Phase 3

PHASE 3/BUDGET PERIOD 3	
Task 1.0	**Project Management and Planning**
Task 6.0	**Technical and Operational Support of CPP Proposal**
Task 9.0	**Develop Pressure Core Transport, Storage, and Manipulation Capability**
Subtask 9.8	*X-ray Computed Tomography*
Subtask 9.9	*Pre-Consolidation System*
Task 10.0	**UT-GOM2-1 Core Analysis**
Subtask 10.4	*Continued Pressure Core Analysis (UT-GOM2-1)*
Subtask 10.5	*Continued Hydrate Core-Log-Seismic Synthesis (UT-GOM2-1)*
Subtask 10.6	*Additional Core Analysis Capabilities*
Task 11.0	**Update Science and Operational Plans for UT-GOM2-2 Scientific Drilling Program**
Task 12.0	**UT-GOM2-2 Scientific Drilling Program Vessel Access**
Task 13.0	**Maintenance and Refinement of Pressure Core Transport, Storage, and Manipulation Capability**
Subtask 13.1	*Hydrate Core Manipulator and Cutter Tool*
Subtask 13.2	*Hydrate Core Effective Stress Chamber*
Subtask 13.3	*Hydrate Core Depressurization Chamber*
Subtask 13.4	*Develop Hydrate Core Transport Capability for UT-GOM2-2 Scientific Drilling Program*
Subtask 13.5	*Expansion of Pressure Core Storage Capability for UT-GOM2-2 Scientific Drilling Program*
Subtask 13.6	*Continued Storage of Hydrate Cores from UT-GOM2-1*
Task 14.0	**Performance Assessment, Modifications, and Testing of PCTB**
Subtask 14.1	*PCTB Lab Test*
Subtask 14.2	*PCTB Modifications/Upgrades*
Task 15.0	**UT-GOM2-2 Scientific Drilling Program Preparations**
Subtask 15.1	*Assemble and Contract Pressure Coring Team Leads for UT-GOM2-2 Scientific Drilling Program*
Subtask 15.2	*Contract Project Scientists and Establish Project Science Team for UT-GOM2-2 Scientific Drilling Program*

Table 1-6. Tasks Accomplished in Phase 4

PHASE 4/BUDGET PERIOD 4	
Task 1.0	**Project Management and Planning**
Task 10.0	**UT-GOM2-1 Core Analysis**
Subtask 10.4	*Continued Pressure Core Analysis (GOM2-1)*
Subtask 10.5	*Continued Hydrate Core-Log-Seismic Synthesis (UT-GOM2-1)*
Subtask 10.6	*Additional Core Analysis Capabilities*
Subtask 10.7	*Hydrate Modeling*
Task 11.0	**Update Science and Operational Plans for UT-GOM2-2 Scientific Drilling Program**
Task 12.0	**UT-GOM2-2 Scientific Drilling Program Vessel Access**
Task 13.0	**Maintenance and Refinement of Pressure Core Transport, Storage, and Manipulation Capability**
Subtask 13.1	*Hydrate Core Manipulator and Cutter Tool*
Subtask 13.2	*Hydrate Core Effective Stress Chamber*
Subtask 13.3	*Hydrate Core Depressurization Chamber*
Subtask 13.4	*Develop Hydrate Core Transport Capability for UT-GOM2-2 Scientific Drilling Program*
Subtask 13.5	*Expansion of Pressure Core Storage Capability for UT-GOM2-2 Scientific Drilling Program*
Subtask 13.6	*Continued Storage of Hydrate Cores from UT-GOM2-1*
Subtask 13.7	*X-ray Computed Tomography*
Subtask 13.8	*Pre-Consolidation System*
Task 14.0	**Performance Assessment, Modifications, and Testing of PCTB**
Subtask 14.1	*PCTB Lab Test*
Subtask 14.2	*PCTB Modifications/Upgrades*
Subtask 14.3	*PCTB Land Test*
Task 15.0	**UT-GOM2-2 Scientific Drilling Program Preparations**
Subtask 15.3	*Permitting for UT-GOM2-2 Scientific Drilling Program*

Table 1-7. Tasks Accomplished in Phase 5

PHASE 5/BUDGET PERIOD 5	
Task 1.0	**Project Management and Planning**
Task 10.0	**UT-GOM2-1 Core Analysis**
Subtask 10.4	*Continued Pressure Core Analysis (UT-GOM2-1)*
Subtask 10.5	*Continued Hydrate Core-Log-Seismic Synthesis (UT-GOM2-1)*
Subtask 10.6	*Additional Core Analysis Capabilities*
Subtask 10.7	*Hydrate Modeling*
Task 11.0	**Update Science and Operational Plans for UT-GOM2-2 Scientific Drilling Program**
Task 12.0	**UT-GOM2-2 Scientific Drilling Program Vessel Access**
Task 13.0	**Maintenance and Refinement of Pressure Core Transport, Storage, and Manipulation Capability**
Subtask 13.1	*Hydrate Core Manipulator and Cutter tool*
Subtask 13.2	*Hydrate Core Effective Stress Chamber*
Subtask 13.3	*Hydrate Core Depressurization Chamber*
Subtask 13.4	*Develop Hydrate Core Transport Capability for UT-GOM2-2 Scientific Drilling Program*
Subtask 13.5	*Expansion of Pressure Core Storage Capability for UT-GOM2-2 Scientific Drilling Program*
Subtask 13.6	*Continued Maintenance and Storage of Hydrate Pressure Cores from UT-GOM2-1*
Subtask 13.7	*Maintain X-ray CT*
Subtask 13.8	*Maintain Preconsolidation System*
Subtask 13.9	*Transportation of Hydrate Core from UT-GOM2-2 Scientific Drilling Program*
Subtask 13.10	*Storage of Hydrate Cores from UT-GOM2-2 Scientific Drilling Program*
Subtask 13.11	*Hydrate Core Distribution*
Task 14.0	**Performance Assessment, Modifications, and Testing of PCTB**
Subtask 14.4	*PCTB Modifications/Upgrades*
Subtask 14.5	*PCTB Land Test III*
Task 15.0	**UT-GOM2-2 Scientific Drilling Program Preparations**
Subtask 15.3	*Permitting for UT-GOM2-2 Scientific Drilling Program*
Subtask 15.4	*Review and Complete NEPA Requirements*
Subtask 15.5	*Finalize Operational Plan for UT-GOM2-2 Scientific Drilling Program*
Task 16.0	**UT-GOM2-2 Scientific Drilling Program Field Operations**
Subtask 16.1	*Execute UT-GOM2-2 Field Program*
Optional Subtask 16.2	*Add Conventional Coring*
Optional Subtask 16.3	*Add Spot Pressure Coring*
Optional Subtask 16.4	*Add Second Hole at H-Location*
Optional Subtask 16.5	*Add Additional Cores and Measurements*
Task 17.0	**UT-GOM2-2 Core Analysis**
Subtask 17.1	*Routine UT-GOM2-2 Core Analysis*
Optional Subtask 17.2	*UT-GOM2-2 Expanded Core Analysis*

1.2.2 Current Project Period

Current project period tasks are shown in Table 1-8.

Table 1-8. Current Project Tasks

PHASE 6/BUDGET PERIOD 6	
Task 1.0	**Project Management and Planning**
Task 13.0	**Maintenance and Refinement of Pressure Core Transport, Storage, and Manipulation Capability**
Subtask 13.1	*Hydrate Core Manipulator and Cutter tool*
Subtask 13.2	*Hydrate Core Effective Stress Chamber*
Subtask 13.3	*Hydrate Core Depressurization Chamber*
Subtask 13.6	*Continued Storage of Hydrate Cores from UT-GOM2-1*
Subtask 13.7	*Maintain X-ray CT*
Subtask 13.8	*Maintain Preconsolidation System*
Subtask 13.10	*Storage of Hydrate Cores from UT-GOM2-2 Scientific Drilling Program*
Subtask 13.11	*Hydrate Core Distribution*
Task 16.0	**UT-GOM2-2 Scientific Drilling Program Field Operations**
Subtask 16.6	*Post-Expedition Permitting*
Task 17.0	**UT-GOM2-2 Core Analysis**
Task 18.0	**Project Data Analysis and Reporting**
Subtask 18.1	*Sample and Data Distribution and Archiving*
Subtask 18.2	*Collaborative Post-Field Project Analysis of Geologic Data and Samples*
Subtask 18.3	*Scientific Results Volume and Technical Project Presentations*

1.2.2.1 Task 1.0 – Project Management & Planning

1.2.2.1.1 *Coordinate the overall scientific progress, administration and finances of the project:*

- UT monitored and controlled the project budget, scope, and schedule.
- UT completed planning and contracts for an in-person UT-GOM2-2 post-cruise science workshop, which will be held in Borne, TX Oct. 28-29, 2024.

1.2.2.1.2 *Communicate with project team and sponsors:*

- UT organized UT-GOM2-2 science meetings to advance UT-GOM2-2 post-cruise science, analytical, and reporting efforts.
- UT organized sponsor and stakeholder meetings.
- UT organized task-specific working meetings, as needed, to plan and execute project tasks per the Project Management Plan and Statement of Project Objectives.
- UT managed SharePoint sites, email lists, the project website, and the UT-GOM2-2 expedition website.

1.2.2.1.3 *Coordinate and supervise service agreements:*

- UT monitored and validated subcontractor workplans and deliverables.

1.2.2.1.4 *Coordinate subcontractors:*

- UT completed amendments to fund subcontracts through BP6
- UT continued to monitor and control subaward and contractor efforts.

1.2.2.2 Task 13.0 – Maintenance & Refinement of Pressure Core Transport, Storage, & Manipulation Capability

1.2.2.2.1 *Subtask 13.1 – Hydrate Core Manipulator and Cutter Tool*

The mini-PCATS system underwent a full pressure test for 15 days to ensure leak mitigation efforts from the previous quarter were adequate. The system was able to maintain full operational pressure for the entire test duration. The X-ray system underwent quarterly calibration.

1.2.2.2.2 *Subtask 13.2 – Hydrate Core Effective Stress Chamber*

A major effort this quarter was to improve our ability to perform uniaxial strain tests. In this test, the cylindrical samples deform only along the axial direction. However, we previously identified that under high pressure, the samples also undergo radial deformation. We narrowed down the potential causes of this unintended behavior to erroneous estimates of (1) sample diameter, (2) measured length, or (3) pore volume.

In this quarter, UT conducted benchmark studies using a well-known clay material and identified that the sample diameter was incorrect. A radial expansion of 1 mm (radial strain of ~2%) can severely affect measured values. We interpret samples radially expand when placed inside the Hydrate Effective Stress Chamber, possibly during the saturation and extrusion operations. This analysis indicates that the sample diameter must be measured high degree of accuracy to have correct measurements; thus, UT will refine the X-ray capabilities to infer the diameter of pressure cores very accurately.

We also explored the accuracy of our measured lengths and pore volumes. First, we confirmed that measured lengths are correct. This was done by comparing our measurements with an attached displacement sensor (LVDT), and also by comparing the load vs. displacement response of three springs with known stiffnesses. Second, we conducted a leak test to assess the pore volume measurements, and identified a leak rate of 0.29 ml/day, representing <1% of error, which does not significantly affect the results.

1.2.2.2.3 *Subtask 13.3 – Hydrate Core Depressurization Chamber*

The system is in standby mode and ready for use.

1.2.2.2.4 *Subtask 13.6 – Continued Storage of Hydrate Cores from UT-GOM2-1*

The UT Pressure Core Center continues to accommodate the four remaining pressure cores from UT-GOM2-1 as well as the 13 pressure cores collected during UT-GOM2-2.

1.2.2.2.5 *Subtask 13.7 – Maintain X-ray Computed Tomography*

The X-Ray CT continues to operate as designed.

1.2.2.2.6 *Subtask 13.8 – Maintain Pre-Consolidation System*

The system will continue to be evaluated to ensure proper pressure maintenance to generate effective stresses in pressure cores.

1.2.2.2.7 *Subtask 13.10 – Storage of Hydrate Cores from UT-GOM2-2 Scientific Drilling Program*

The UT PCC continues to maintain hydrate-bearing pressure cores at 6°C and connected to the pressure maintenance system, which supplies one-way high-pressure water into the pressure storage chambers. The pressure cores continue to maintain stable storage pressures.

1.2.2.2.8 *Subtask 13.11 – Hydrate Core Distribution*

Future task.

1.2.2.3 Task 16.0 – UT-GOM2-2 Scientific Drilling Program Field Operations

1.2.2.3.1 *Subtask 16.6 – Post-Expedition Permitting*

On April 22, the UT Vice President for Research, Dr. Jaffe, executed a letter to the Bureau of Ocean Energy Management (BOEM) Leasing and Financial Responsibility Section, requesting cancellation of the *Outer Continental Shelf (OCS) Mineral Lessee's or Operator's Bond* No. 651168 in the amount of $200,000, and termination of the period of liability for Right-of-Use and Easement OCS-G 30392. BOEM approved UT's request and cancelled the bond without residual liability, effective May 6, 2024.

UT continued to work on three final UT-GOM2-2 reports for the Bureau of Safety and Environmental Enforcement (BSEE):

1. Final Core Reports
2. Final Paleontology Reports
3. Final Geochemistry Reports

1.2.2.4 Task 17.0 – UT-GOM2-2 Core Analysis

1.2.2.4.1 *Curation*

UT continued to review core reports, coring data, curation data, logs and images to confirm the final integrated recovery data for each core.

1.2.2.4.2 *Physical Properties*

1.2.2.4.2.1 In-situ Temperature

UT compared the measured in-situ data from UT-GOM2-2 with temperature predictions based on seismic data. The measured in-situ temperature between 27 and 144 mbsf at WR313, Site H results in linear temperature gradient of 25 °C/km (Figure 1-1, gray line). We projected the 25 °C/km with depth, assume hydrostatic pore pressure, seawater salinity (35 ‰), and bulk three-phase behavior and estimate the base of the gas hydrate stability zone (BGHS) to be at 610 mbsf (Figure 1-1, blue line). This depth is 285 meters shallower than the observed bottom simulating reflector derived from seismic (BSR – Figure 1-1, brown line). We explored this difference with a steady state 1D model assuming vertical, constant heat flux and heat transport only through conduction. The bulk thermal conductivity used in the model is derived from the density logs and measurements made on cores. We determined the heat flux (Q) by matching the observed temperature and found Q = 25 mW/m^2. We find that considering the depth-dependent thermal conductivity can explain 105 of the 285-meter misfit we initially observed. We extended this 1D model to a 2D time-dependent heat flow model that considered basin and salt geometry, and sediment accumulation rates. We found little difference relative to the 1D model.

Overpressure shifts the hydrate phase boundary to higher temperature values and may explain some of the mismatch between the theoretical BGHS and the BSR (Figure 1-1, red line). UT and Tufts will continue to explore this observation by conducting geomechanical test that may elucidate the in-situ pressure.

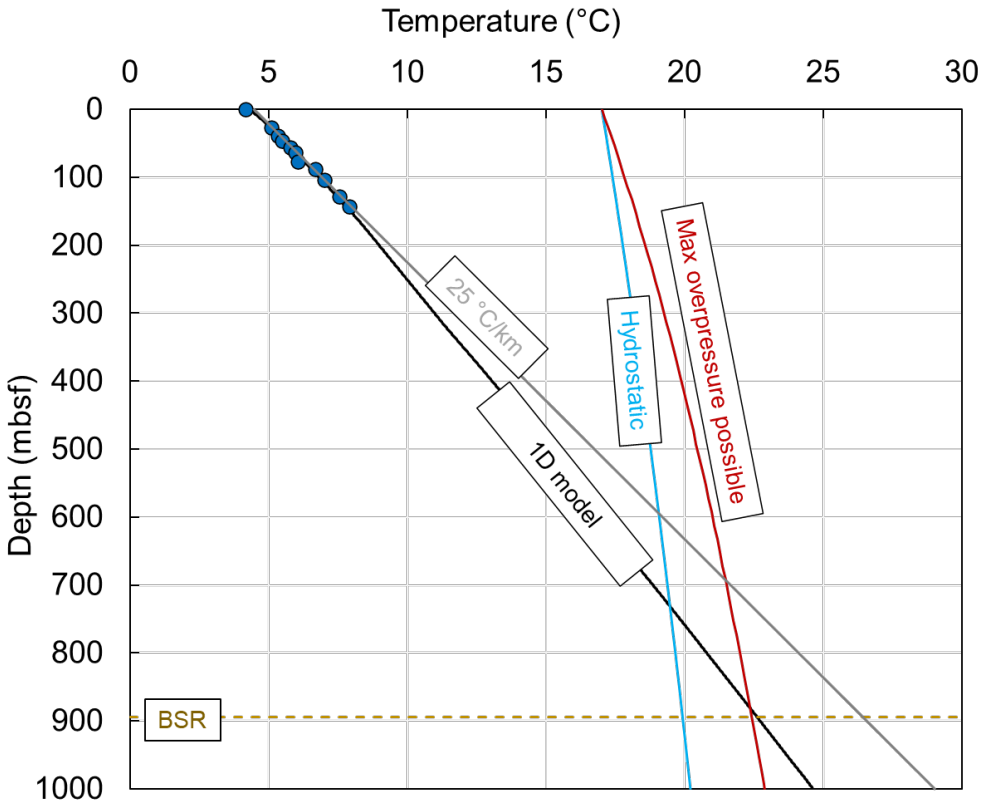

Figure 1-1. Temperature at Walker Ridge 313, Site H. The measured data during the UT-GOM2-2 expedition (blue dots) result in a linear temperature gradient of 25 °C/km (gray line). The 1D model that considers the depth-dependent thermal conductivity is shown as a black line. The hydrate phase boundary is derived for hydrostatic pore pressure (blue) or for the maximum overpressure possible, determined by the overburden (red). The BSR depth is shown as a brown dashed line.

1.2.2.4.2.2 Core Logs

UT continued improving core logging figures in Strater.

1.2.2.5 Task 18.0 – Project Data Analysis and Reporting

1.2.2.5.1 *Subtask 18.1 – Sample and Data Distribution and Archiving*

No additional sample or data requests were received. All data is available to the science team via password protected websites. When the full expedition report is published (estimated Dec 31, 2024) the data will be archived and made public.

1.2.2.5.2 *Subtask 18.2 – Collaborative Post-Field Project Analysis of Geologic Data and Samples*

UT-GOM2-2 Preliminary Report

- UT and the project science team completed a final draft of the UT-GOM2-2 Preliminary Report. This report provides an initial look at the results from the UT-GOM2-2 hydrate coring expedition in Walker Ridge 313. It will later be included as a chapter in the UT-GOM2-2 Proceedings Volume.

- The UT-GOM2-2 Preliminary Report was submitted to USGS for a formal technical review on Jun. 6. USGS's review of the Preliminary Report was still ongoing at the end of this performance period.

UT-GOM2-2 Proceedings Volume

- UT and the project science team continued work on the UT-GOM2-2 Proceedings Volume. This volume will include three chapters: 1 – Initial Results, 2 – Methods, and 3 – WR313 Site H. It will be published on OSTI.gov and expedition website. The estimated completion date is Dec. 2024.

UT-GOM2-2 Science Workshop

- UT continued to plan and organize a UT-GOM2-2 science workshop that will be held at Tapatio Springs in Boerne, TX from Oct. 28-29. The UT-GOM2-2 science workshop will include presentations and poster sessions on new science from UT-GOM2-2, brainstorming sessions for collaborative research and papers, and discussions of big science questions related to basin and reservoir insights.
- Expected participants include science team members and/or project stakeholders from The University of Texas at Austin, The Ohio State University, University of New Hampshire, Oregon State University, University of Washington, Tufts University, US DOE, and the USGS.

1.2.2.5.3 *Subtask 18.3 – Scientific Results Volume and Technical Project Presentations*

American Geophysical Union Fall Meeting

- UT is organizing the session *OSO29: Natural Gas Hydrate Systems Occurrence and Dynamic Behavior* for AGU 24 to be held in Washington DC, 9-13 Dec 2024.
- The session includes abstracts from multiple institutions around the world. A total of 37 abstracts were sent for review, with 17 of those include GOM2-2 data and are co-authored by UT-GOM2-2 scientists.

Table 1-9. List of abstract titles and lead authors submitted to AGU hydrates session by UT-GOM2-2 scientists.

	Abstract title	Lead Author
1.	Accumulation of microbial methane in hemipelagic sediments of the Terrebonne Basin, northern Gulf of Mexico	Stephen C Phillips
2.	An Unusual Seafloor Sand in the Terrebonne Basin, Gulf of Mexico	Aditya Kumar
3.	Characterization of the compressive behavior of sediment in the Terrebonne Basin, Gulf of Mexico	Cathal Small
4.	Comparing High Saturation Hydrate-bearing Sand Reservoirs in the Northern Gulf of Mexico	Ann Cook
5.	Downhole variation of porosity and grainsize in the Terrebonne Basin, Gulf of Mexico	Cathal Small
6.	Exploring the methane hydrate system through coring in the deepwater Gulf of Mexico: the UT-GOM2-2 Expedition	Peter B Flemings
7.	Geochemical Constraints on the Genesis of Methane Hydrates in the Terrebonne Basin, Gulf of Mexico	Evan A Solomon
8.	Heat Flow in the Terrebonne Basin, Gulf of Mexico: Establishing the Gas Hydrate Stability Zone	Alejandro Cardona
9.	High-resolution Calcareous Nannofossil Biostratigraphy in the Terrebonne Basin, northern Gulf of Mexico	Marcie Purkey Phillips
10.	Insights from X-ray computed Tomography on Core from the Terrebonne Basin, Gulf of Mexico	Saffron Martin
11.	Investigating Late Pleistocene to Recent Bimodal Sedimentation in the Terrebonne Basin, Gulf of Mexico	Kayla Tozier
12.	Microbial Distribution in Methane Hydrate-Containing DeepSea Sediments in the Terrebonne Basin, Gulf of Mexico	Jessica Buser
13.	Pressure Coring in the Terrebonne Basin, Gulf of Mexico	Carla Thomas
14.	Sediment Geochemistry and Early Diagenesis in the Terrebonne Basin, Gulf of Mexico	Joel E Johnson
15.	Sediment Shear Strength Properties within the Hydrate Stability Zone: Results from the Gulf of Mexico Deepwater Hydrate Coring Expedition, Terrebonne Basin, Gulf of Mexico	Derek Sawyer
16.	Stratigraphy, sediment composition, and provenance of Pleistocene strata of the Terrebonne Basin, northern Gulf of Mexico	David Awwiller
17.	Using Noble Gas Tracers to Constrain the Residence Time of Methane Gas Hydrates in the Gulf of Mexico	Rachel Coyte

UT-GOM2-2 Scientific Results Volume

- UT and the project science team evaluated journals for a special volume on the UT-GOM2-2 hydrate coring expedition, which will be similar to the two special AAPG journal volumes on UT-GOM2-1. We are considering submitting proposals to Geochemistry, Geophysics, Geosystems, or Marine and Petroleum Geology.

1.3 What Will Be Done In The Next Reporting Period To Accomplish These Goals

1.3.1 Task 1.0 – Project Management & Planning

- UT will continue to execute the project in accordance with the approved Project Management Plan (PMP) and Statement of Project Objectives (SOPO).
- UT will continue to manage and control project activities in accordance with their established processes and procedures to ensure subtasks and tasks are completed within schedule and budget constraints defined by the PMP.

1.3.2 Task 13.0 – Maintenance And Refinement Of Pressure Core Transport, Storage, & Manipulation Capability

- UT will continue to refine our experimental approach to conduct uniaxial strain tests at high fluid pressure. We will confirm that mini-PCATS X-ray imaging is able to provide scans with enough accuracy to allow for adequate measurements, and determine the accuracy of diameters measured with this approach.
- The Mini-PCATS, PMRS, analytical equipment, and storage chambers will undergo continued observation and maintenance at regularly scheduled intervals and on an as-needed basis. Installation of new or replacement parts will continue to ensure operational readiness.
- UT will continue to evaluate and pursue perfecting the uniaxial testing procedures and the upgraded Effective Stress Chamber software.
- UT will continue to test the Effective Stress Chamber computer system upgrade to ensure operational stability.
- UT will continue to evaluate and refine the temperature measurement capabilities of the Effective Stress Chamber test section.

1.3.3 Task 16.0 – UT-GOM2-2 Scientific Drilling Program Field Operations

- UT will complete final post-expedition well record submittals to BSEE:
    - Core Reports
    - Paleontological Reports
    - Geochemical Analysis Reports

1.3.4 Task 17.0 – UT-GOM2-2 Core Analysis

- UT will start testing pressure cores from the GOM2-2 expedition. We will assess compressibility, in-situ stress and permeability behavior.
- Tufts and UT will measure geomechanical properties of GOM2-2 conventional cores. We will determine compression, permeability, lateral to axial stress ratio under uniaxial conditions, and undrained shear strength behavior.
- UNH, USGS, and UT will continue sedimentologic analysis on discrete samples of sediment assessing stratigraphy and incorporating information into Strater.
- Oregon St will continue DNA extractions and amplifications.
- USGS and Ohio State will continue assessing gas sample composition and log-core correlations. More degassing experiments are planned to be run and more gas samples collected over the summer.

1.3.5 Task 18.0 – Project Data Analysis and Reporting

- The project science team will continue working on the Expedition Report to be published in Dec. 2024.
- UT will develop a proposal for the UT-GOM2-2 Scientific Results Volume.

2 PRODUCTS

Project publications webpage:

https://ig.utexas.edu/energy/gom2-methane-hydrates-at-the-university-of-texas/gom2-publications/

2.1 Publications

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2.3 Proceeding of the UT-GOM2-1 Hydrate Pressure Coring Expedition

Volume contents are published on the UT-GOM2-1 Expedition website and on OSTI.gov.

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2.3.2 Prospectus

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2.3.4 Data Reports

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2.4 Proceeding of the UT-GOM2-2 Hydrate Coring Expedition

Volume contents will be published on the UT-GOM2-2 Expedition Proceedings website and on OSTI.gov.

Prospectus

Peter Flemings, Carla Thomas, Tim Collett, Fredrick Colwell, Ann Cook, John Germaine, Melanie Holland, Jesse Houghton, Joel Johnson, Alberto Malinverno, Kevin Meazell, Tom Pettigrew, Steve Phillips, Alexey Portnov, Aaron Price, Manasij Santra, Peter Schultheiss, Evan Solomon, Kehua You, UT-GOM2-2 Prospectus: Science and Sample Distribution Plan, Austin, TX (University of Texas Institute for Geophysics, TX). http://dx.doi.org/10.2172/1827729, 141 p.

2.5 Websites

- Project Website:

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

- UT-GOM2-2 Expedition Website

https://ig.utexas.edu/energy/gom2-methane-hydrates-at-the-university-of-texas/gom2-2-expedition/

- UT-GOM2-1 Expedition Website:

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

- Project SharePoint:

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

- 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

- Pressure Coring Tool Development Video:

https://www.youtube.com/watch?v=DXseEbKp5Ak&t=154s

2.6 Technologies Or Techniques

Nothing to report.

2.7 Inventions, Patent Applications, and/or Licenses

Nothing to report.

3 CHANGES/PROBLEMS

3.1 Changes In Approach And Reasons For Change

None.

3.2 Actual Or Anticipated Problems Or Delays And Actions Or Plans To Resolve Them

None.

3.3 Changes That Have A Significant Impact On Expenditures

None.

3.4 Change Of Primary Performance Site Location From That Originally Proposed

None.

4 SPECIAL REPORTING REQUIREMENTS

4.1 Current Project Period

Task 1.0 – Revised Project Management Plan

Subtask 18.1 – Project Sample and Data Distribution Plan

Subtask 18.3 – UT-GOM2-2 Scientific Drilling Program Scientific Results Volume

4.2 Future Project Periods

None.

5 BUDGETARY INFORMATION

The Budget Period 5 cost summary is provided in Table 5-1.

Table 5-1. Phase 5 / Budget Period 5 Cost Profile

Baseline Reporting Quarter	Budget Period 6							
	Y1Q1		Y1Q2		Y1Q3		Y1Q4	
	11/16/23-12/31/23		01/01/24-03/31/24		04/01/24-06/30/24		07/01/24-09/30/24	
	Y1Q1	Cumulative Total	Y1Q2	Cumulative Total	Y1Q3	Cumulative Total	Y1Q4	Cumulative Total
Baseline Cost Plan								
Federal Share	$ 555,325	$ 71,091,055	$ 471,086	$ 71,562,141	$ 456,085	$ 72,018,226	$ 456,085	$ 72,474,312
Non-Federal Share	$ 282,554	$ 32,363,632	$ 271,503	$ 32,635,135	$ 269,534	$ 32,904,669	$ 269,535	$ 33,174,204
Total Planned	$ 837,880	$ 103,454,687	$ 742,590	$ 104,197,276	$ 725,619	$ 104,922,895	$ 725,620	$ 105,648,516
Actual Incurred Cost								
Federal Share	$ 2,871,720	$ 70,588,076	$ 391,191	$ 70,979,267	$ 407,450	$ 71,386,716		$ 71,386,716
Non-Federal Share	$ 745,317	$ 34,398,513	$ 152,951	$ 34,551,464	$ 160,980	$ 34,712,444		$ 34,712,444
Total Incurred Cost	$ 3,617,037	$ 104,986,589	$ 544,142	$ 105,530,731	$ 568,429	$ 106,099,160	$ -	$ 106,099,160
Variance								
Federal Share	$ 2,316,395	$ (502,979)	$ (79,895)	$ (582,875)	$ (48,636)	$ (631,510)		
Non-Federal Share	$ 462,762	$ 2,034,882	$ (118,552)	$ 1,916,330	$ (108,554)	$ 1,807,775		
Total Variance	$ 2,779,157	$ 1,531,902	$ (198,448)	$ 1,333,455	$ (157,190)	$ 1,176,265		
Baseline Reporting Quarter	**Budget Period 6**							
	Y2Q1		Y2Q2		Y2Q3		Y2Q4	
	10/01/24-12/31/24		01/01/25-03/31/25		04/01/25-06/30/25		07/01/25-09/30/25	
	Y2Q1	Cumulative Total	Y2Q2	Cumulative Total	Y2Q3	Cumulative Total	Y2Q4	Cumulative Total
Baseline Cost Plan								
Federal Share	$ 401,106	$ 72,875,417	$ 401,106	$ 73,276,523	$ 385,250	$ 73,661,774	$ 385,250	$ 74,047,024
Non-Federal Share	$ 218,494	$ 33,392,698	$ 218,494	$ 33,611,191	$ 216,156	$ 33,827,347	$ 216,156	$ 34,043,503
Total Planned	$ 619,599	$ 106,268,115	$ 619,599	$ 106,887,715	$ 601,406	$ 107,489,121	$ 601,406	$ 108,090,527
Actual Incurred Cost								
Federal Share		$ 71,386,716		$ 71,386,716		$ 71,386,716		$ 71,386,716
Non-Federal Share		$ 34,712,444		$ 34,712,444		$ 34,712,444		$ 34,712,444
Total Incurred Cost	$ -	$ 106,099,160	$ -	$ 106,099,160	$ -	$ 106,099,160	$ -	$ 106,099,160
Variance								
Federal Share								
Non-Federal Share								
Total Variance								

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7 ACRONYMS

Table 7-1. List of Acronyms

ACRONYM	DEFINITION
AAPG	American Association of Petroleum Geologists
AGU	American Geophysical Union
AOM	Anaerobic Oxidation of Methane
BOEM	Bureau of Ocean Energy Management
BSEE	Bureau of Safety and Environmental Enforcement
CFR	Code of Federal Regulation
CHNS	Carbon, Hydrogen, Nitrogen, Sulfur
CMT	Cement
CPP	Complimentary Project Proposal
CT	Computed Tomography
DNA	Deoxyribonucleic Acid
DOE	U.S. Department of Energy
DST	Data Storage Tag
GC	Green Canyon
GHSZ	Gas Hydrate Stability Zone
HSTB	Hydrate Stability Temperature Boundary
IODP	International Ocean Discovery Program
JIP	Joint Industry Project
LDEO	Lamont-Doherty Earth Observatory
LF	Low Frequency
LWD	Logging While Drilling
NEPA	National Environmental Policy Act
NETL	National Energy Technology Laboratory
NMR	Nuclear Magnetic Resonance
NTL	Notice to Lessees
OCS	Outer Continental Shelf
OSR	Organoclastic Sulfate Reduction
OSTI	Office of Scientific and Technical Information
OSU	The Ohio State University
PCATS	Pressure Core Analysis and Transfer System
PCC	Pressure Core Center
PCTB	Pressure Core Tool with Ball Valve
PI	Principle Investigator
PM	Project Manager
PMP	Project Management Plan
PMRS	Pressure Maintenance and Relief System
QRPPR	Quarterly Research Performance and Progress Report
RPPR	Research Performance and Progress Report

RUE	Right-of-Use and Easement
SMTZ	Sulfate-Methane Transition Zone
SOPO	Statement of Project Objectives
TN	Total Nitrogen
TOC	Total Organic Carbon
TS	Total Sulfur
UNH	University of New Hampshire
USGS	United States Geological Survey
UT	University of Texas at Austin
UW	University of Washington
WOB	Weight on Bit
WR	Walker Ridge
XCT	X-ray Computed Tomography

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