Oil & Natural Gas Technology

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Quarterly Report

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Remote Sensing and Sea-Truth Measurements of Methane Flux to the Atmosphere (HYFLUX project)

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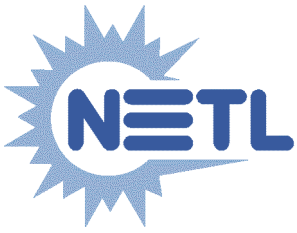

Office of Fossil Energy

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Executive Summary of HYFLUX Program Work

On 1 October 2008, Texas A&M University - Corpus Christi began work on the National Energy Technology (NETL) funded project Remote Sensing and Sea-truth Measurements of Methane Flux to the Atmosphere (HYFLUX). This portion of the project was Budget Period 1. Project management activities during Quarter 1 were dedicated to completing the project management plan and setting up sub-contracts with Scripps Oceanographic Institution, University of California, Santa Barbara, University of Southern Mississippi, and Texas A&M University-College Station. Discussions in relation to planning for the upcoming cruise were completed by email and conference call among the project investigators at the conclusion of Quarter 2. During Quarter 3, preparation for the seatruth cruise was the major focus of effort for all investigators. During Quarter 4, the investigators completed the seatruth cruise, curated the samples and data collected during the cruise, and submitted a report describing the results of the cruise.

Phase 2, budget period 2 for the project was initiated on 1 October 2009. Figure 1 shows a Gantt style chart outlining tasks during the quarterly period October through December 2010. This is the tenth and last scheduled quarter of the project. During budget period two, work on the project had been largely over-shadowed by response to the Gulf of Mexico oil spill particularly for MacDonald, Garcia-Pineda, and Leifer. Kastner was also involved. Consequently, there was a diversion of effort away from project tasks that is being redressed as the project comes to a close. A no-cost extension of project deadlines was requested and has been allowed by DOE NETL managers.

Project investigators are now engaged in final reporting and development of publications for the fieldwork and remote sensing components of the program. A series of conference calls among the investigators has focused attention on the final report with associated publications. Because

each of the disciplinary groups, i.e., remote sensing, air-sea flux, water column, bubble flux, and carbonate sequestration, has approached the question of methane flux from hydrate formations separately, care must be taken to coordinate the results into a coherent presentation.

Project investigators are now engaged in final reporting and development of publications for the field work and remote sensing components of the program. The report outline shows the general form of the final report and relates report sections to specific tasks.

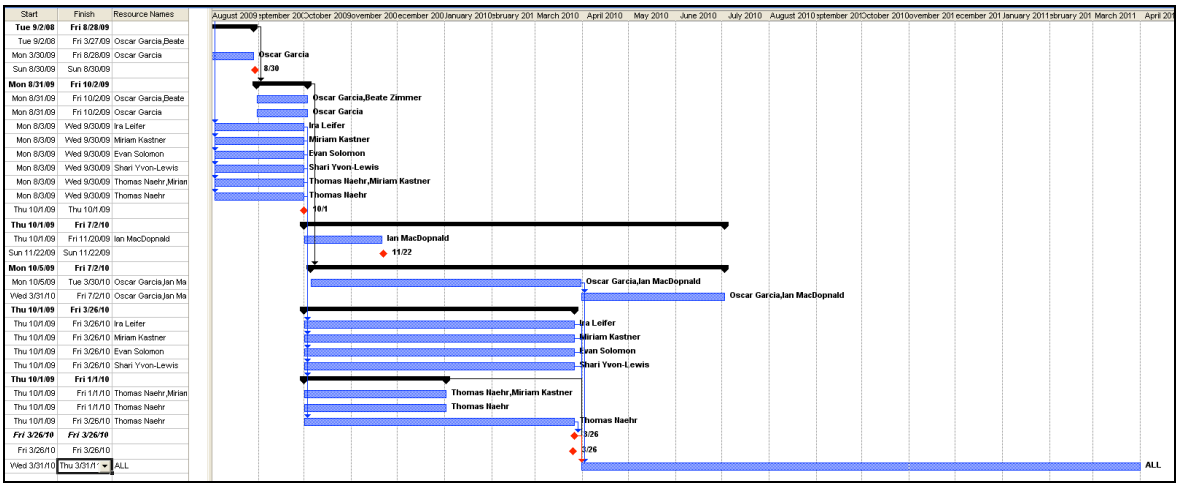


Figure 1: Gantt chart for 4th Quarter 2009 through revised project conclusion.

Progress, Results, and Discussion

The following is the working outline of the final report. Specific project tasks that will be addressed in each section are indicated in underlined italics.

HYFLUX Final Report Outline

1. Introduction

1.1 Methane flux to mixed zone and atmosphere

Background on methane fluxes from marine seeps

Shallow Seeps

Deepwater Seeps

1.2 Gas hydrate in the Gulf of Mexico

Gas hydrate occurrence on continental margins is predominantly in the form of disseminated deposits at the base of the GHSZ.

Focused flow conduits occur in margins where tectonic processes including plate boundaries and diapirism force fluids through stratigraphic traps.

Where gas hydrate occurs: well-studied examples include Hydrate Ridge, Black Sea, and Gulf of Mexico.

1.3 Formation of seafloor carbonates and chemosynthetic communities

2. Methods and Materials

2. 1 Remote sensing ***Task 9***

4 Integration and discussion

4.1 Spatial and temporal variation in fluxes

Evidence from Remote Sensing Results
Evidence from Sea-Air Measurements
Site-to-Site comparisons

4.2 Comparison of Gulf of Mexico hydrate system to other regions

4.3 Gas hydrate CH_4 sources and fluxes

Discussion of factors affecting water column profiles, importance of hydrate skins, importance of plume processes, importance of oil
Discussion of importance of stratification, particularly pycnocline
Discussion of fresh water lensing (fresher surface waters)
Detailed discussion of CH4 distribution in the upper 100 m
Estimation of extent of methane oxidation
Numerical modeling implications for seepage over a range of Gulf depths
Comparison between 2003 and 2009 results at GC 185
Diffusive CH_4 flux estimates to the atmosphere
Possible impacts of Climate Change on hydrate stability and methane flux
Comparison between Sea-Air and water column flux measurements-difficulty in measuring methane flux from hydrate systems.

5. Literature Cited

6. Appendices

Remote Sensing Data (FSU)
Water sample data (Scripps, UW, FSU)
Carbonate data (TAMUCC)
Bubble flux data (UCSB)
Sea-air data (TAMU)

Presentations and publications (***Task 14***)

Four principal publications for the peer-reviewed literature are being developed based on the results described above with anticipated submission in 2011. Additional student publications may be forthcoming at future dates. The titles and authorship is as follows:

Title: Methane fluxes to the atmosphere from deep hydrocarbon seeps in the northern Gulf of Mexico
Authorship: L. Hu, S. Yvon-Lewis, J. Kessler, I. MacDonald
Submitted to: *Earth and Planetary Science Letters*

Title: Methane emissions from 550-1200 m seeps in the Gulf of Mexico
Authorship: E. Solomon, M. Kastner, I. Leifer, I. MacDonald, J. Chanton
For submission to: *Limnology and Oceanography or Global Biogeochemical Cycles*

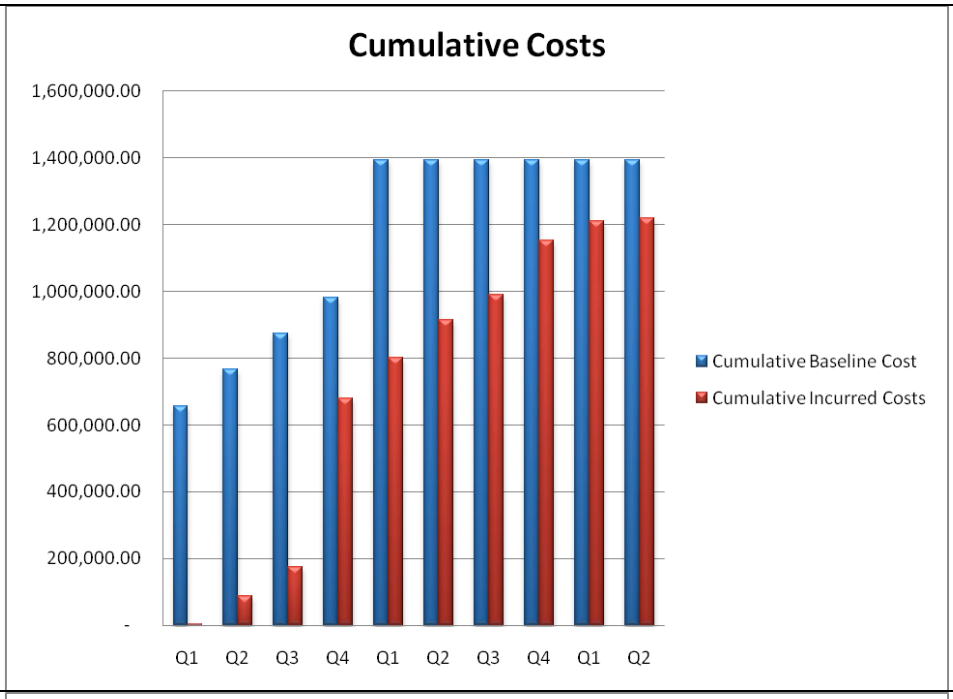
Title: Natural oil and gas sources in the Gulf of Mexico: Quantification by satellite remote sensing
Authorship: I. MacDonald and O. Pineda-Garcia
For submission to: *Nature Geoscience*

Title: Rates of carbonate precipitation in gas hydrate sediments of the Gulf of Mexico
Authorship: T. Naehr, R. Shapiro, W. Ussler III, and M. Kastner
For submission to: *Marine Chemistry or Chemical Geology*

Conclusion

The HYFLUX project has completed its project phase and is entering its reporting period.

Cost Status



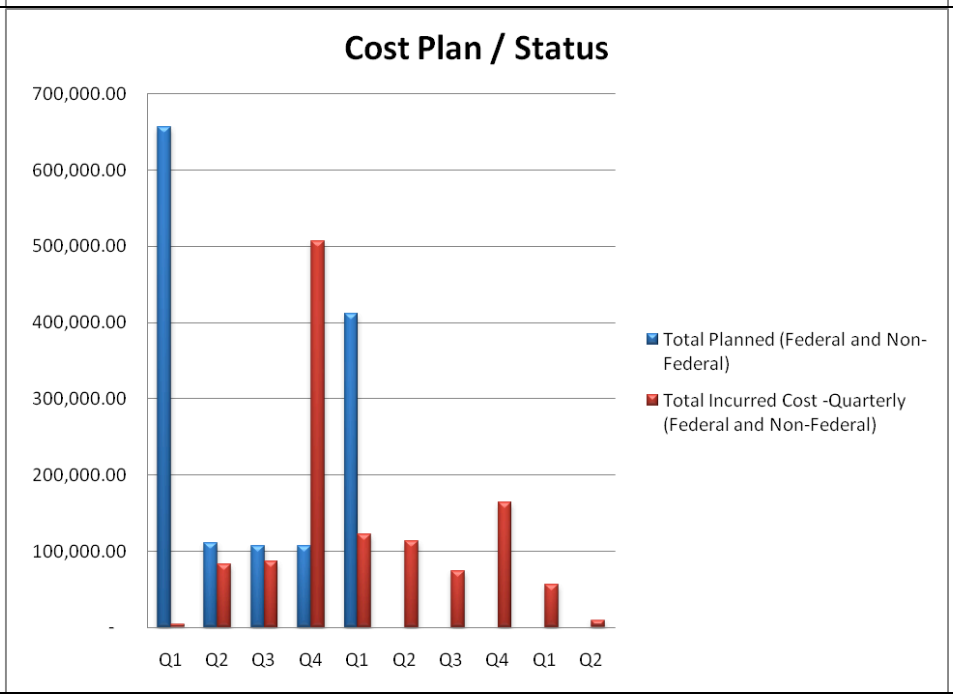


Figure 2 Expenditures by Quarter. Cumulative projected costs (upper panel) and cost status as of Quarter 2, 2011.

Milestone Status

No Milestones achieved during this reporting period.

Problems or Delays

A no-cost extension of the project was granted. Final reporting will be completed prior to 29 August 2011.

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