

# Oil & Natural Gas Technology

DOE Award No.: DE-FE0010180

## Quarterly Progress Report (Period ending September 30<sup>th</sup> , 2016)

### Gas Hydrate Dynamics on the Alaskan Beaufort Continental Slope: Modeling and Field Characterization Project Period: October 1, 2012 –March 31st, 2017

Submitted by:

*Digitally signed by Matthew J. Hornbach on 5/6/2016*

Matthew J. Hornbach

Associate Professor of Geophysics

Southern Methodist University

DUNS #:001981133.

P.O. Box 750302

Dallas, Texas 75275

e-mail: mhornbach@smu.edu

Phone number: (214) 768-2389

Prepared for:

United States Department of Energy  
National Energy Technology Laboratory

October 31st, 2016



Office of Fossil Energy

***DISCLAIMER***

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

***ABSTRACT***

The 4th quarter of FY2016 (July – September of 2016) was the culmination of the research elements of the project, with the team spending three weeks in Alaska collecting heat flow and chirp seismic reflection data. Despite weather delays and associated travel complications, the cruise was a success with ~1400 temperature data points collected in the Beaufort, all within budgeted resources. The full cruise report is now complete and final editing of initial data analysis should be completed in the next quarter.

**TABLE OF CONTENTS**

**EXECUTIVE SUMMARY..... V**

**PROGRESS AND RESULTS..... W**

**COST STATUS..... X**

**PROBLEMS OR DELAYS..... 3**

**CONCLUSIONS AND FUTURE DIRECTIONS ..... Z**

## EXECUTIVE SUMMARY

In October 2012, Southern Methodist University in close partnership with The United State Geological Survey at Woods Hole and Oregon State University, began investigating methane hydrate stability in deep water (>100 mbsf) environments below Alaskan Beaufort Sea. In late 2014, the project was further expanded to include analysis of methane hydrates and slope stability off the US east coast. This research is part of a now 4.5 year study funded by the Department of Energy's (DOE) National Energy Technology Laboratory (NETL) that analyzes methane hydrate stability on both the Atlantic and Beaufort Margin. Key goals of this study include integrating and processing marine seismic data collected at the USGS as well as other publically available data with dynamic 2D/3D/4D heat flow models developed at SMU to determining the depth, location, and dynamics of methane hydrate stability along the Alaskan Beaufort Margin and similar environments. A major component of this study is to constrain how the methane hydrate stability zone is changing with time. Additional goals of this study include determining areas where concentrated methane hydrate might exist in the subsurface and to understand the role methane hydrate plays in slope stability along continental margins. To accomplish these goals, researchers use geophysical (seismic, heat flow, CTD/XBT) data combined with numerical models to assess methane hydrate stability in space and time. Researchers also integrate regional coring and biological data with methane hydrate stability models to place further constraints on hydrate dynamics.

## PROGRESS AND RESULTS

### 1. Cruise Preparation

Nearly all of Quarter #4 was spent preparing or collecting data in the arctic.

#### 1.1 Safety prep.

During the third quarter, all scientists (Hornbach, Phrampus, Harris, Brokaw, Jones) completed cold water safety training in Seattle, Wa, and Houston, TX.

#### *2.2 equipment shipping and preparation*

Chirp seismic equipment went through final testing and shipment to Alaska. While in Alaska, along with specification for building a pole mounting device for chirp deployment. Additionally, 12 high pressure temperature thermistors were tested and shipped to Alaska prior to the cruise by Jones and Brokaw.

#### *2.4 Contingency cruise line planning*

To better prepare for probe deployment. The SMU group downloaded and analyzed ~50,000 km<sup>2</sup> of multibeam and backscatter data to assess zones where soft sediment likely exists, ensuring deep probe penetration. This resulting in pinpoint the likely best transects for data recovery as well as contingency cruise transect lines. From these data

we were able to rank high vs low risk probe deployment sites. We weighted each of these transects with the potential scientific value of acquiring data at each of these sites.

### ***2.5 Data collection during the cruise***

We spent approximately 3 weeks in Alaska collecting heat flow data on the R/V Norseman II. The approach, methods, timing, and preliminary results of this study are highlighted in our cruise report.

## **COST STATUS**

Through September 30, 2016, the DE-FE00010180 has expended \$908,783.28. This does not include SMU cost share contributions of \$84,553.86.

The remaining budget is \$421,831.72, not including SMU cost share. The largest remaining budget line items are the travel expenditures for the Alaska travel, the facilities rental for the use of the Norseman II for data collection and related expenditures, and the OSU sub-award. The charges for the Norseman II and the travel will be processed in the upcoming (Oct-Dec 2017) quarter.

SMU has requested permission to reallocate surplus funds in the facilities rental budget towards personnel and associated charges. Additionally, we anticipate a modest surplus in travel funds upon completion of the project in March of 2017. We would like to request a no-cost extension so that we may use any remaining travel funds to present the research results at conferences occurring after the current grant end date of 3/31/2017.

## **PROBLEMS OR DELAYS**

There were no significant problems or delays. Our planned departure port of Wainwright experienced poor weather conditions resulting in 2 extra days in Anchorage with no signs of improvement. Thus, we reversed the data collection direction and the ship was redirected to Prudhoe Bay where we boarded. We also encountered poor weather and sea ice at various times during the cruise itself, leading to the decision to disembark in Nome, where we were assured of a navigable port. This extended the cruise by several days total, but the negotiated rental contract took this possibility into consideration and we were able to complete the work within the budgeted resources.

We also experienced some equipment challenges while all on board, such as chafing the line from which the heat flow probe was suspended. However, the science team and the ship's crew worked through all situations effectively and without incident. In short, the cruise was a tremendous success, as outlined in our cruise report.

We did move one heat flow data collection point by 250 meters to provide a mother polar bear and two cubs a wide berth as they tried to swim towards our boat. We also adjusted the ship course to steer clear of potential whaling grounds and large sea ice.

All science team members received safety training prior to the cruise and there were no health and safety incidents to report.

## **CONCLUSIONS AND FUTURE DIRECTIONS**

We remain on schedule with research and reporting requirements. We anticipate two publications will be submitted if not published within the next 12 months related to this work, the first associated with methane hydrate stability on the US Beaufort Margin; the second outlining heat flow and ocean temperature change in the Beaufort. We would like to request a no-cost extension, to permit us to use any remaining travel funds to share results of the project at scientific conferences during 2017.

## **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

13131 Dairy Ashford, Suite 225  
Sugarland, TX 77478

1450 Queen Avenue SW  
Albany, OR 97321-2198

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

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

Customer Service:  
1-800-553-7681

