

# Oil & Natural Gas Technology

DOE Award No.: DE-FE0010175

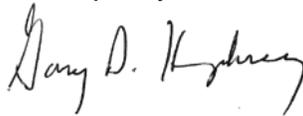
## Quarterly Research Performance Progress Report (Period ending 06/30/2015)

### PLANNING OF A MARINE METHANE HYDRATE PRESSURE CORING PROGRAM FOR THE WALKER RIDGE AND GREEN CANYON AREAS OF THE GULF OF MEXICO

Project Period (10/1/2012 – 09/30/2015 (based on granted extension))

Submitted by:

Gary D. Humphrey, P.E., Project PI



Signature

Fugro GeoConsulting, Inc

DUNS #: 118972301

6100 Hillcroft

Houston, TX 77081-1009

e-mail: GHumphrey@Fugro.com

Phone number: (713) 369-5600



Prepared for:  
United States Department of Energy  
National Energy Technology Laboratory



Submission Date: July 31, 2015

**Office of Fossil Energy**

## **DISCLAIMER**

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## **Executive Summary**

This research effort will focus on developing a site characterization program for naturally occurring gas hydrate deposits. It is based on experience gained from a number of previous expeditions that Fugro has conducted for industry and for various National Hydrate Programs. We will draw upon our experience from previous (and ongoing) work and combine the objectives and site specific aspects of the planning into a comprehensive document that summarizes the best practices and best approaches. We have solicited organizations and academia outside of Fugro for participation in a Workshop to encourage open sharing of experiences and required R&D improvements to help guarantee success in the next field expedition.

Key issues identified for future research include:

- Develop a better understanding of the structure and properties of methane hydrate reservoirs
- Develop improved methodologies to select exploration targets (Topic 3 work)
- Develop improved ability to sample and test the hydrates in their natural state
- Develop improved technology and methodologies to extract and deliver the gas from hydrates to downstream facilities.
- To take the experience and knowledge gained from previous expeditions to help others be better prepared for future expeditions.

We have proposed the following approach; 1) Desktop Study to Prepare Detailed Plans and Recommendations for all Aspects of the Proposed Offshore Campaign (proposed advances in knowledge/technology), and 2) Prepare detailed plans of execution and make budgetary estimates for a future fieldwork program to collect the pressure cores including a recommended Scope of Work.

There are significant changes with the schedule for completion of the project as originally proposed. We do appreciate the granting of a “No-Cost Extension” for the project of nine (9) months which extended the completion date until end of December 2014. Late last year, we recognized that not all the project objectives could be accomplished even within this timeframe. Various personal reasons primarily with the PI’s health and other personal reasons together with other professional distractions have left a gap in the required effort to complete the project within the existing extension period. We have resolved this problem as described in further detail in this report. We have also recently obtained another no-cost time extension until the end of September 2015. We don’t expect any further extensions to be needed or granted.

## **Accomplishments**

- Continued to review related scientific/industry research efforts in the Sea of Japan and the South China Sea.
- Continued updates to the PMP according to the new tasks identified (e.g. Workshop).
- Completed the development of a project execution plan (PEP) for the planning phase through the field work execution and reporting that will assist in identifying critical discussion points and critical cooperation items.
- PEP incorporates the lessons learned from our most recent hydrate expedition in the South China Sea for GMGS, as well as previous hydrate expeditions that Fugro have been involved with.
- Conducted additional planning sessions with Geotek (Peter Schultheiss) and J.A. Aumann & Associates, (Jim Aumann) and Tim Collett, (USGS) in person and by phone.
- Attended planning meetings with Geotek and other Fugro Data Acquisition Groups.
- Made plans for a peer review to follow the Workshop findings and make final recommendations.
- We have completed approximately 75% of the draft report based on the original Table of Contents. However, after internal reviews performed recently, it was determined that we are missing some key elements of the objectives of this study. We have presented here a revised TOC (Exhibit 6).

## **Progress, Results, and Discussion Summary of technical progress**

During this quarter, good progress has been made. Our main accomplishment was to progress the draft report. We prepared a draft and performed an internal review. During that review, it was decided that the current structure of the report was somewhat missing the main objectives of this study. Therefore, we have revised the report structure as evidenced in the Revised Table of Contents (Exhibit 6) presented later in this report.

We have advanced the plan for testing of the improvements to the tool based on issues identified during the GMGS program as well as the tests on a similar tool developed directly for DOE that were conducted in Catoosa, OK at the drilling research center facility. We have concluded a testing plan after the Award from GMGS for their third expedition that is currently underway in the South China Sea.

### **Review previous research projects**

We continue to review the most recent marine hydrate expedition, GMGS China and to apply that experience and its learning opportunities to this project. We are also monitoring India's NGHP2 program that is in progress and we have personnel on board *Chikyu* assisting with the coring operations. We will begin coring operations on board the Fugro Voyager in the South China Sea around 05 August 2015.

### **Identify technical research concepts**

The various research topics include:

- Development of safe drilling procedures for riserless drilling in known hydrate formations based on previous expeditions conducted by Fugro, ODP and IODP.
- Development of core quality measures for rotary pressure coring systems.
- Development of pressure core handling procedures and protocols to ensure best quality results.
- Development of prototype designs on a seabed template to allow control of the rate of penetration and weight on bit from the seafloor instead of the on the deck at the top drive level. This was done completely under Fugro R&D funding, yet we believe it will benefit the next field operation for rotary coring and pressurized coring.

### **Future work in next reporting period**

- We will finalize and report on the updated PMP.
- In lieu of a face-to-face Peer Review, we plan to send the draft report out to to the Peer Review suggested participants and liaise with our key collaborators. This is primarily because many of the Peer Reviewers are in the field on the various ongoing hydrate programs.
- We will continue our work on the pressure core acquisition and quality issues based on the PMP and analysis of the upcoming work in the South China Sea for GMGS.
- We will continue our work on the pressure core analysis handling, timing and quality issues.
- We will continue to work on safe drilling practices for hydrate bearing sediments using open-hole techniques.
- We plan to report the findings and recommendations from the Project Workshop in the final report.
- Progress the research into permitting issues associated with drilling riserless for relatively shallow gas hydrate targets in the Gulf of Mexico.
- Complete the Draft and Final Reports and Review.

## Key References

Collett, T.S, et. al., USDOE/NETL Report Prepared by Consortium for Ocean Leadership, Project No. DE-FE0010195, Development of a Scientific Plan for a Hydrate-Focused Marine Drilling, Logging and Coring Program – **Historical Methane Hydrate Project Review**, June 2013

Campbell, K.J., Humphrey, G.D. and Little, R.L., "Modern Deepwater Site Investigation: Getting It Right the First Time" for the 2008 **Offshore Technology Conference** 06-May-08 in Houston, Texas. Paper No. 19535.

Humphrey, G.D., Schultheiss, P.J., Holland, M., "Borehole Pressure Coring and Laboratory Pressure Core Analysis for Gas Hydrate Investigations" for the 2008 **Offshore Technology Conference** held May 2008 in Houston, Texas. Paper No. 19601.

*Scientific Drilling Magazine*, "Wireline Coring and Analysis Under Pressure: Recent Use and Future Developments of the HYACINTH System", Article by Peter Schultheiss, Melanie Holland and Gary Humphrey, published in March 2009.

P.J. Schultheiss, Geotek Ltd.; J.T. Aumann, Aumann & Associates, Inc.; and G.D. Humphrey, Fugro GeoConsulting, Inc., " Pressure Coring and Pressure Core Analysis for the Upcoming Gulf of Mexico Joint Industry Project Coring Expedition " for the 2010 **Offshore Technology Conference** held May 2010 in Houston, Texas. Paper No. 20827.

E. Tervoort, J. Peuchen & G. Humphrey, Gas Hydrate Quantification By Combining Pressure Coring And In-Situ Pore Water Sampling Tools, **Proceedings of the 7th International Conference on Gas Hydrates (ICGH 2011)**, Edinburgh, Scotland, United Kingdom, July 17-21, 2011.

## Changes or Problems

We recognized the need to incorporate additional collaborators outside of those listed in our original proposal back in 2012. The primary reason for this was a realization that additional expertise and experience outside of Fugro would prove to benefit the effectiveness of the study. The shift in the timeline has been communicated to the NETL project manager.

We have identified key individuals to assist in putting the necessary efforts and time into the project to complete it by end of September 2015. We plan to have the draft report completed by end of August (instead of July) 2015. We realize that this will substantially shorten the period that has been allocated for DOE/NETL review, but it can't be avoided and still produce the quality report that we all desire.. Please see Exhibit 4 for our revised schedule in tabular form. Exhibit 5 in Gantt Chart form. We are perhaps one month behind our schedule reported last quarter.

## Participants and Other Collaborating Organizations

|                              |  |   |   |
|------------------------------|--|---|---|
|                              | Gary D. Humphrey,<br>Principal Investigator /<br>Project Director, Fugro<br>Employee<br>Houston, Texas | Jim Aumann<br>Salt Lake City, Utah  | Dr. Peter Schultheiss,<br>Technical Advisor,<br>Geotek, Ltd. Employee<br>United Kingdom |
| Nearest month worked         | 1  | 0   | 0   |
| Collaboration outside<br>USA | Discussion with offices<br>in UK and The<br>Netherlands  | Worked with Fugro<br>entities in UK and<br>Holland to review<br>performance on GMGS<br>to establish baseline<br>PEP. Upgraded PCTB. | Discussion with offices<br>in USA and The<br>Netherlands                                |
| Travel outside USA           | None this reporting<br>period  | None this reporting<br>period   | None this reporting<br>period   |

### *Other Collaborating Organizations:*

Oklahoma State University and Fugro GeoConsulting have agreed to share progress and results from their respective DOE research projects (DE-FE0009904 and Fugro project DE-FE0010160).

Fugro, Jim Aumann & Associates and Geotek all collaborated on the GMGS China Gas Hydrate field expedition for LWD, coring and pressure coring and in situ testing at several locations in the South China Sea. This work was completed on 08 September 2013. They are both also collaborating with us for the upcoming work (starting 01 June 2015) for GMGS' new expedition, GMGS3 on board the Fugro Voyager.

### **Impact**

The research findings from this project may potentially contribute to the US gas hydrate resource assessment but also international science and governmental organizations that are measuring gas hydrate exploration and production potential in Japan, Korea, China, India, Colombia, Brazil, Vietnam and New Zealand.

Additionally the findings from this project can also have the potential to aid imaging of sequestered CO<sub>2</sub> gas hydrate for greenhouse gas reduction if that technology advances.

### **Special Reporting Requirements**

We have seen better progress in the first and second quarters of 2015 due to the addition of expert staff to assist in our reporting efforts. . We asked for another extension to complete the work outlined in this research program. The project completion date is now the end of September, 2015. At the time of this writing, the extension has been granted.

We expected to submit our draft report by the end of July, but this now seems too ambitious. We have the report as outlined in the original table of contents (TOC) ready, but after internal reviews have determined that the objectives of our study can be better achieved with the revised outline presented here.

### **Budgetary Information**

A cumulative total of \$232,923 has been spent of an allocation of \$578,850. The federal share of the costs incurred to date is \$186,338 and the cost sharing is \$46,585. We do attend several meetings, speak with

hydrate project contacts, and other efforts as being consistent with advancing the research project but these are not reflected in the budget spent to date, nor do we intend to.

### **Exhibit I - Milestone Status**

- Milestone 1, Task 1 was completed November 14, 2012.
- Milestone 2 has been completed prior to December 2013.
- Completion Milestone was adjusted to 31 December 2014 based on the DOE approval of our no-cost extension, approved in Q1 2014. We requested an additional extension in 2015 due to lack of progress during the last half of 2014. This has been granted through end September 2015 at the time of this writing.
- We will continue to check the milestone status versus what has been updated in the PMP.

### **Exhibit 2 - Financial Summary to-date**

We have included the project Cost to-date (by quarter) in the following table:

| Baseline Reporting Quarter | Budget Period |                  |          |                  |          |                  |          |                  |         |                  |         |                  |         |                  |         |                  |         |                  |         |                  |         |                  |
|----------------------------|---------------|------------------|----------|------------------|----------|------------------|----------|------------------|---------|------------------|---------|------------------|---------|------------------|---------|------------------|---------|------------------|---------|------------------|---------|------------------|
|                            | Q4 2012       |                  | Q1 2013  |                  | Q2 2013  |                  | Q3 2013  |                  | Q4 2013 |                  | Q1 2014 |                  | Q2 2014 |                  | Q3 2014 |                  | Q4 2014 |                  | Q1 2015 |                  | Q2 2015 |                  |
|                            | Q1            | Comulative Total | Q2       | Comulative Total | Q3       | Comulative Total | Q4       | Comulative Total | Q5      | Comulative Total | Q6      | Comulative Total | Q7      | Comulative Total | Q8      | Comulative Total | Q9      | Comulative Total | Q10     | Comulative Total | Q10     | Comulative Total |
| <b>Baseline Cost Plan</b>  |               |                  |          |                  |          |                  |          |                  |         |                  |         |                  |         |                  |         |                  |         |                  |         |                  |         |                  |
| Federal Share              | 115000        | 115000           | 115000   | 230000           | 115000   | 345000           | 118080   | 463080           | 0       | 463080           | 0       | 463080           | 0       | 463080           | 0       | 463080           | 0       | 463080           | 0       | 463080           | 0       | 463080           |
| Non-Federal Share          | 28750         | 28750            | 28750    | 57500            | 28750    | 86250            | 29520    | 115770           | 0       | 115770           | 0       | 115770           | 0       | 115770           | 0       | 115770           | 0       | 115770           | 0       | 115770           | 0       | 115770           |
| Total Planned              | 143750        | 143750           | 143750   | 287500           | 143750   | 431250           | 147600   | 578850           | 0       | 578850           | 0       | 578850           | 0       | 578850           | 0       | 578850           | 0       | 578850           | 0       | 578850           | 0       | 578850           |
| <b>Actual Income Cost</b>  |               |                  |          |                  |          |                  |          |                  |         |                  |         |                  |         |                  |         |                  |         |                  |         |                  |         |                  |
| Federal Share              | 2456          | 2456             | 3715     | 6171             | 6064     | 12235            | 7380     | 19615            | 44979   | 64594            | 8876    | 73470            | 12977   | 86447            | 6552    | 92999            | 1724    | 94723            | 41912   | 136635           | 49703   | 186338           |
| Non-Federal Share          | 614           | 614              | 929      | 1543             | 1516     | 3059             | 1845     | 4904             | 11245   | 16149            | 2219    | 18368            | 3244    | 21612            | 1638    | 23250            | 431     | 23681            | 10478   | 34159            | 12426   | 46585            |
| Total Incurred Costs       | 3070          | 3070             | 4644     | 7714             | 7580     | 15294            | 9225     | 24519            | 56224   | 80743            | 11095   | 91838            | 16221   | 108059           | 8190    | 116249           | 2155    | 118404           | 52390   | 170794           | 62129   | 232923           |
| <b>Variance</b>            |               |                  |          |                  |          |                  |          |                  |         |                  |         |                  |         |                  |         |                  |         |                  |         |                  |         |                  |
| Federal Share              | (112544)      | (112544)         | (111285) | (223829)         | (108936) | (332765)         | (110700) | (443465)         | 44979   | (398486)         | 8876    | (389610)         | 12977   | (376633)         | 6552    | (370081)         | 1724    | (368357)         | 41912   | (326445)         | 49703   | (276742)         |
| Non-Federal Share          | (28136)       | (28136)          | (27821)  | (55957)          | (27234)  | (83191)          | (27675)  | (110866)         | 11245   | (99621)          | 2219    | (97402)          | 3244    | (94158)          | 1638    | (92520)          | 431     | (92089)          | 10478   | (81611)          | 12426   | (69185)          |
| Total Variance             | (140680)      | (140680)         | (139106) | (279786)         | (136170) | (415956)         | (138375) | (554331)         | 56224   | (498107)         | 11095   | (487012)         | 16221   | (470791)         | 8190    | (462601)         | 2155    | (460446)         | 52390   | (408056)         | 62129   | (345927)         |

### Exhibit 3 – Actual Project Planning Workshop Participants

In order to capture the experience and knowledge from several hydrate expeditions previously conducted, we propose that a Workshop was conducted at the beginning of May 2014 to pull all of this experience together and establish a “Best Practices” outline or pathway to success. Below is a list of personnel that were included in the Workshop:

| Professional's Name | Affiliation           | Comments  |
|---------------------|-----------------------|---|
| Brian Ferri         | Fugro                 | 35 years+ drilling experience   |
| Steve Brittain      | Fugro                 | 30 years+ experience with tool development and implementation on DW projects  |
| Jeff Scott          | Fugro                 | 10 years+ drilling and vessel design experience   |
| Jens Breinbjerg     | Fugro                 | 10 years+ project management experience on hydrate and DW projects  |
| Michael Benting     | Fugro                 | 10 years+ project management and hydrate experience on DW projects  |
| Pedro Regino        | Fugro                 | 15+ years of project management and 10+ years of hydrate experience on DW projects  |
| Frank Gozeling      | Fugro Holland         | Senior Project manager with 30 years+ experience in offshore geotechnical operations and 10 years+ on hydrate project experience  |
| Floris Tuynder      | Fugro Holland         | Equipment Designer and special consultant for Pressure Coring Systems since 2002.   |
| Dan McConnell       | Fugro                 | Geoscientist with 25 years+ experience also involved in JIP II and responsible for prospecting efforts to find massive sand deposits with hydrates indicated based on LWD work. |
| Luke Hamilton       | Fugro UK              | Drilling Manager for Fugro Seacore and offshore driller on two previous hydrate expeditions. 10+ years of offshore drilling experience.   |
| Carlos Santamarina  | Georgia Tech          | Geotechnical Professor and Gas Hydrate Expert.  |
| Jim Aumann          | JAA                   | Coring Tool Designer  |
| Tom Pettigrew       | Pettigrew Engineering | Ex-IODP, responsible for CORK's and multiple tool designs.  |
| Marshall Pardey     | QD Tech               | President and well accomplished tool designer and manufacturer.   |

Potential Peer Review Candidates for our Draft Report:

| Professional's Name | Affiliation               | Comments                      |
|---------------------|---------------------------|-------------------------------|
| Tim Collett         | USGS                      | World-wide expert on hydrates |
| Ray Boswell         | US DOE / NETL             | World-wide expert on hydrates |
| Richard Baker       | US DOE / NETL             | World-wide expert on hydrates |
| Michael Riedel      | Canadian Geologic Survey  | World-wide expert on hydrates |
| Brian Anderson      | Univ. West Virginia       | Expert Modeler for hydrates   |
| Brad Clements       | IODP                      | possibly Michael Storms       |
| Koji Yamamoto       | JOGMEC                    | Koji Yamamoto or others       |
| Beong-jae Ryu       | KIGAM                     | World-wide expert on hydrates |
| Scott Dallimore     | Geologic Survey of Canada | World-wide expert on hydrates |
| Pushpendra Kumar    | ONGC/DGH                  | World-wide expert on hydrates |
| Craig Shipp         | Shell                     | Industry expert on hydrates   |

## Exhibit 4 – Milestones Table

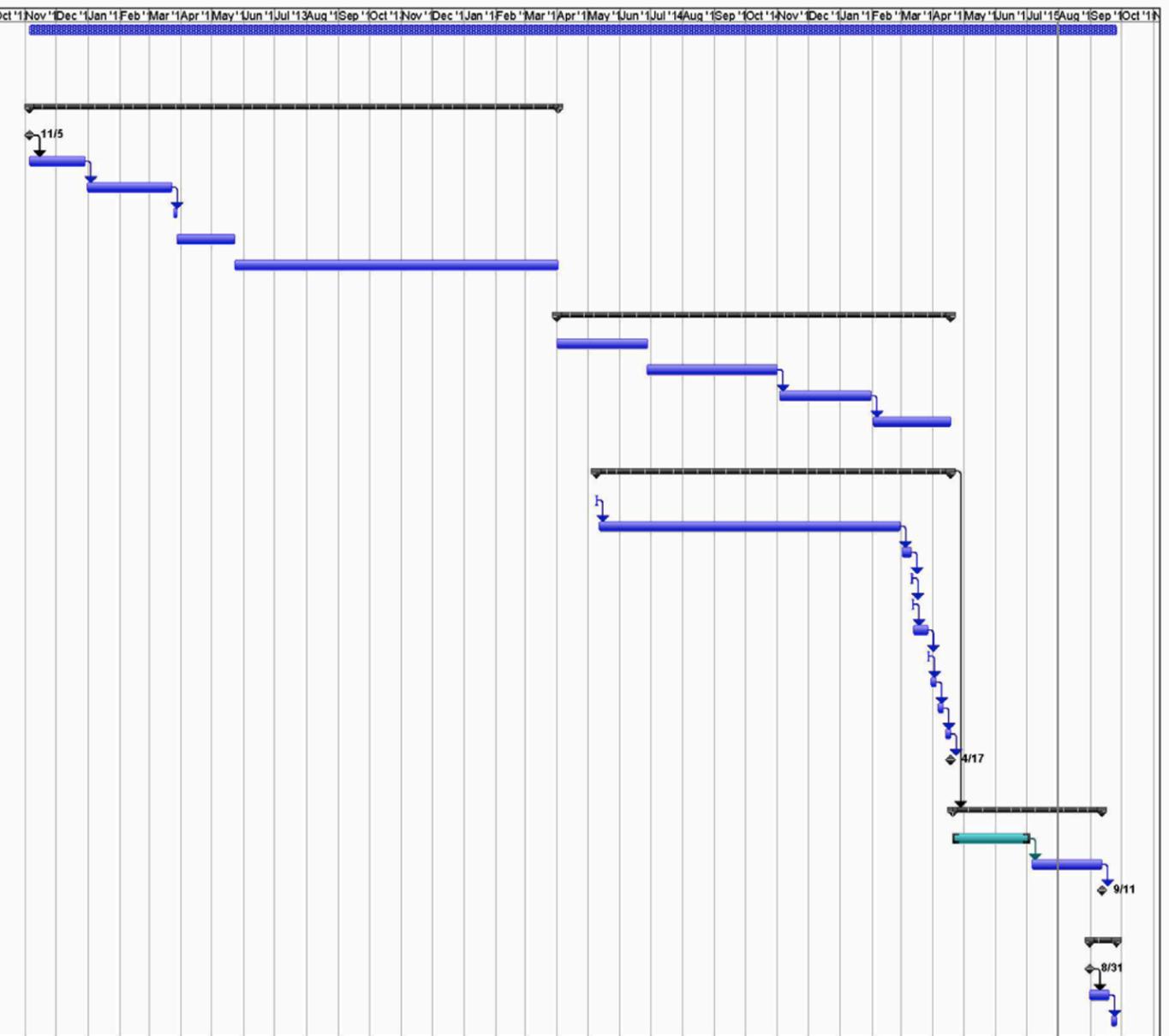
### Schedule to Complete the Hydrate Planning Study 30 July 2015

| Item No. | Task Description(s)   | SOPO Task No.                     | Schedule   |
|----------|---|-----------------------------------|--|
| 1        | Finalize Project Management Plan related to this Desktop Study (DTS) –  | 1                                 | Early April 14   |
| 2        | <ul style="list-style-type: none"> <li>• Conduct Internal Workshop</li> <li>• Selection of workshop participant</li> <li>• Send out invitations</li> <li>• Organize venue</li> <li>• Meet with NETL/DOE advisors</li> </ul> | 2, 2.1,<br>2.2,<br>2.3<br><br>2.4 | Early May 14<br>Early April 14<br>Mid-April 14<br>Early May 14 |
| 3        | Complete job specific PMP/PEP (with details as we currently know them)  | 2                                 | April 14– end April 15   |
| 4        | Conduct Internal Workshop with participation of “key partners”  | 3                                 | Early May 14   |
| 5        | Select Peer Review Team and send invitations <ul style="list-style-type: none"> <li>• Selection of Peer Review Team</li> <li>• Send out invitations</li> </ul>  | 4                                 | Late July15  |
| 6        | Draft Final Report  | 5                                 | End August 15  |
| 7        | Conduct Peer Review via Distribution of Draft Report  | 4                                 | first half of August 15  |
| 8        | Summarize Peer Review Findings and Recommendations  | 4                                 | Mid-September 15   |
| 9        | Plan and Conduct Final Review - Technical Meeting with DOE  | 5                                 | Late September 15  |
| 10       | Allowance for Review, Editing, Additions, and Finalization  | 5                                 | Last week of September 15                                      |
| 11       | Submit Final Report   | 5                                 | End Sept 15  |

## Exhibit 5 – Gantt Chart – Schedule

See attachment on following page.

| ID | Task Name   | Duration  | Start        | Finish         | Predecessors |
|----|---|-----------|--------------|----------------|--------------|
| 1  | DE-FE0010175 METHANE HYDRATE PRESSURE CORING DESKTOP PLANNING STUDY             | 151 wks   | Mon 11/5/12  | Fri 9/25/15    |              |
| 2  |   |           |              |                |              |
| 3  |   |           |              |                |              |
| 4  | <b>Task 1 - Project Management and Planning</b>                                 | 367 days? | Mon 11/5/12  | Tue 4/1/14     |              |
| 5  | Milestone 1 - Kickoff Meeting   | 0 days    | Mon 11/5/12  | Mon 11/5/12    |              |
| 6  | Task 1.1 - Submit draft Project Management Plan to DOE                          | 8 wks     | Mon 11/5/12  | Fri 12/28/12 5 |              |
| 7  | Task 1.2 - DOE review of PMP  | 12 wks    | Mon 12/31/12 | Fri 3/22/13 6  |              |
| 8  | Task 1.3 - Submit final PMP   | 3 days    | Mon 3/25/13  | Wed 3/27/13 7  |              |
| 9  | Task 1.4 - Update and revise PMP  | 8 wks     | Thu 3/28/13  | Wed 5/22/13    |              |
| 10 | Various project delays / Little Progress  | 224 days? | Thu 5/23/13  | Tue 4/1/14     |              |
| 11 |   |           |              |                |              |
| 12 | <b>Task Group 2 - Development of Research Strategy/Internal Workshop</b>        | 274 days  | Tue 4/1/14   | Fri 4/17/15    |              |
| 13 | Task 2.1 - Review Previous and Committed Research Projects                      | 64 days   | Tue 4/1/14   | Fri 6/27/14    |              |
| 14 | Task 2.2 - Review NETL methane hydrate research objectives                      | 91 days   | Fri 6/27/14  | Fri 10/3/14    |              |
| 15 | Task 2.3 - Identify specific research objectives                                | 13 wks    | Mon 11/3/14  | Fri 1/30/15 14 |              |
| 16 | Task 2.4 - Develop pressure coring project concepts                             | 11 wks    | Mon 2/2/15   | Fri 4/17/15 15 |              |
| 17 |   |           |              |                |              |
| 18 | <b>Task Group 3 - Coring Program Concept Evaluation/Project Workshop</b>        | 246 days  | Fri 5/9/14   | Fri 4/17/15    |              |
| 19 | Project Workshop with External Contributors                                     | 1 day     | Fri 5/9/14   | Fri 5/9/14     |              |
| 20 | Various project delays / Little Progress  | 210 days  | Mon 5/12/14  | Fri 2/27/15 19 |              |
| 21 | Task 3.1 - Establish project evaluation criteria                                | 7 days    | Mon 3/2/15   | Tue 3/10/15 20 |              |
| 22 | Task 3.2 - Generate project evaluation matrix and use to evaluate concepts      | 1 day     | Wed 3/11/15  | Wed 3/11/15 21 |              |
| 23 | Task 3.3 - Prioritize project concepts based on matrix evaluation               | 1 day     | Thu 3/12/15  | Thu 3/12/15 22 |              |
| 24 | Task 3.4 - Prepare draft Project Workshop report                                | 2 wks     | Fri 3/13/15  | Thu 3/26/15 23 |              |
| 25 | Task 3.5 - Mid-Project meeting to review project concepts                       | 1 day     | Fri 3/27/15  | Fri 3/27/15 24 |              |
| 26 | Task 3.6 - Revise project concepts; repeat evaluation                           | 5 days    | Mon 3/30/15  | Fri 4/3/15 25  |              |
| 27 | Task 3.7 - Finalize project concept selection                                   | 5 days    | Mon 4/6/15   | Fri 4/10/15 26 |              |
| 28 | Prepare final Project Workshop report   | 1 wk      | Mon 4/13/15  | Fri 4/17/15 27 |              |
| 29 | Milestone 2/Decision Point 1 - Completion of Coring Program Concept Evaluation  | 0 days    | Fri 4/17/15  | Fri 4/17/15 28 |              |
| 30 |   |           |              |                |              |
| 31 | <b>Task Group 4 - Project Definition/Peer Review</b>                            | 105 days  | Mon 4/20/15  | Fri 9/11/15 18 |              |
| 32 | Conduct Internal Review of Draft Report   | 11 wks    | Mon 4/20/15  | Fri 7/3/15     |              |
| 33 | Publish Peer Review Recommendations - Tasks 4.1-4.10                            | 10 wks    | Mon 7/6/15   | Fri 9/11/15 32 |              |
| 34 | Milestone 3/Decision Point 2 - Completion of Preliminary Coring Plan Definition | 0 days    | Fri 9/11/15  | Fri 9/11/15 33 |              |
| 35 |   |           |              |                |              |
| 36 | <b>Task Group 5 - Recommendations and Reporting</b>                             | 20 days   | Mon 8/31/15  | Fri 9/25/15    |              |
| 37 | Task 5.1 - Issue Preliminary report   | 0 wks     | Mon 8/31/15  | Mon 8/31/15    |              |
| 38 | Task 5.2 - DOE report review  | 3 wks     | Mon 8/31/15  | Fri 9/18/15 37 |              |
| 39 | Task 5.3 - Issue Final report   | 1 wk      | Mon 9/21/15  | Fri 9/25/15 38 |              |



Project: Gantt revised 30 July 2015 (re Date: Fri 7/31/15)

|           |                 |                    |                       |                |                    |          |
|-----------|-----------------|--------------------|-----------------------|----------------|--------------------|----------|
| Task      | Summary         | External Milestone | Manual Task           | Manual Summary | External Tasks     | Deadline |
| Split     | Project Summary | Inactive Milestone | Duration-only         | Start-only     | External Milestone |          |
| Milestone | External Tasks  | Inactive Summary   | Manual Summary Rollup | Finish-only    | Progress           |          |

## Exhibit 6 – Revised Table of Contents (TOC) for Final Report

### INTRODUCTION

#### Scope

The primary goal of this research is to develop scientific, operational, and logistical plans for a future methane hydrate-focused offshore coring program, including a scope of work, technical specifications, and schedule and budget estimate needed to implement a marine expedition

#### Purpose

The overall focus of this project is to help enable—through detailed scientific and operational planning—the future collection of methane hydrate pressure cores, which will add to the body of scientific knowledge of the characteristics of in situ methane hydrate occurrences and contribute to scientific and engineering efforts to assess potential exploitation of methane hydrates as an energy resource

### PLANNING A GAS HYDRATE FIELD PROGRAM

#### Overview of the Process

- Need Gas Hydrate Targets
- Range of typical targets and host sediments
- Scientific Objective
- Planning, Budget, and Execution

#### Evolution of Methane Hydrate Field Programs

- History and Background
- Concepts and Tools and their development through field programs

#### JIP Leg II Site Selection Process, LWD logging Expedition, and Results

- Scope
- Prospect Development
- Data
- Drilling Targets
- Permitting Process
- Hazards Analysis
- Operational Platform
- Operational Issues and Performance
- Summary of Results

### CONSIDERATIONS FOR CARRYING OUT A CORING PROGRAM AT THE JIP LEG II GAS HYDRATE DEPOSITS

#### WR 313

- Geologic Setting
- Catalog of Gas Hydrate Deposits

- Host Sediments
- Questions
- Potential Issues

#### GC 955

- Geologic Setting
- Catalog of Gas Hydrate Deposits
- Host Sediments
- Questions
- Potential Issues

#### Pressure Coring Devices and Pressure Core Analysis

- PCS
- FPC
- PCTB/Hybrid PCS
- PTCS

#### Field Program Options

- Onboard Analysis- Pros and Cons
- Shore Based Analysis – Pros and Cons

#### Selection of Coring Tools

- Non-Pressurized
- Pressurized

#### In situ Testing

- Temperature
- Pore Pressure

#### Selection of Scientific Program

- Geochemical
- Physical Properties
- Sedimentology

#### Vessel Selection

- Range of Vessels
- Differences and Similarities
- Operational Constraints
- Costs Schedule and Estimated Timing
- Example Deck Layouts for Different Scientific Programs

### PERMITTING

- Requirements
- Responsibilities

## **PREPARATION**

- Tophole Geologic Conditions.
- Sufficiently Defined Shallow Geologic Conditions at WR313 and GC955
- Partially-resolved Shallow Geologic Conditions at WR313 and GC955
- Summary of Survey Extents and Line Spacing
- Summary of Recommended Survey Equipment Types
- Potential High Resolution Geophysical Surveys
- Survey Areas
- Potential AUV High Resolution Geophysical Survey
- Potential 2-DUHR Survey
- Geotechnical and Geo-mechanical Site Surveys

## **QHSE**

- Project Execution Plan (PEP)
- Shallow Gas Procedures
- Safe Drilling Practices

## **OPERATIONS**

- Geotechnical Site Investigation
- Seabed Mode (Non-drilling Techniques)
- Exploratory Soil Borings
- Geotechnical Laboratory Testing
- Conventional Laboratory Testing

## **CORE ANALYSIS**

## **ONBOARD**

## **ONSHORE**

## **DEMOBILIZATION**

## **PROJECT WRAP UP, REVIEW AND RECOMMENDATIONS**

## **SUMMARY**

## **REFERENCES**

## **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 Road, Suite 225  
Sugar Land, TX 77478

1450 Queen Avenue SW  
Albany, OR 97321-2198

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

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

Customer Service Line:  
1-800-553-7681

