Base Technology and Tools for Super Critical Reservoir

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High Temperature Tools and Sensors, Down-hole Pumps and Drilling

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Overview

- Project Overview
  - Timeline
    - Project start date April 2010, Project end date April 2012
  - Budget
    - ARRA project Total budget $1956k (with $100k cost share)
      - FY10 $885.6k (funding received to date)
  - Barriers
    - Funding needed for completion
    - Possible funding delays
  - Partners
    - Thermochem, Inc.,
Relevance/Impact of Research

• Inline with DOE objective of advancing base technology required for developing downhole tools for supercritical reservoirs

• Designing any tool to operate in a supercritical reservoir is ambitious
  – Will require an innovative design approach
  – Advances in electronics packaging and materials are needed
    • Developed concepts will provide a foundation for applications outside this work effort

• The tools were chosen as they provide information critical to developing and maintaining an EGS supercritical reservoir
Objective

- Develop building blocks necessary for robust tools that can operate in supercritical environments
  - Building blocks consist of MCMs; each with specific functionality
    - Sandia-designed analog MCM and DOE (NTEL) digital MCM
- Design and field test tools based on developed building blocks
  - Tools include:
    - 240° C Dewarless Pressure/Temperature/Collar locator (PTC) Tool
    - 450° C Dewared PTC tool
    - 450° C Fluid sampler (not currently funded)
- Collaborate with universities and industry to help solve the technical challenges detailed in this proposal
  - Packaging reliability
  - Interconnect issues
Scientific/Technical Approach

• While keeping in mind DOE’s objective, advance base technology that can be utilized in a wide variety of applications
  – Dewar development potentially will enable additional tools to be developed
  – HT valve development could be utilized in tracer work, etc.
  – MCMs are building blocks for future tools
    • Advancements in packaging and innerconnects will increase reliability in MCMs
• Demonstrate advances by fielding tools
  – Choose tools critical to developing and maintaining an EGS supercritical reservoir
Scientific/Technical Approach

- Major milestones:
  - Year 1: Dewarless 240°C PTC Tool – April 2011
  - Year 2: Flasked 450°C PTC Tool – April 2012
  - Year 3: Flasked 450°C Fluid Sampler Tool
Accomplishments, Expected Outcomes and Progress

• Project in early stages
  – Dewar contract initiated
  – HT valve companies contacted; negotiations underway
  – HT team being selected to help guide sample collection methodology
  – University contract in negotiations
Project Management/Coordination

- **Schedule**
  - Early stages
  - First major milestone due in 10 months

- **Application of resources**
  - Sandia geothermal department – hardware and electronics design
  - Scot Engineering – HT valve mechanical design
  - Sandia explosives department – pyrotechnic development
  - University of Maryland – MCM reliability study
  - Harvey Mudd College – high speed data link

- **Project Integrated**
  - HT tools and samplers required during the developing of EGS reservoirs. As such, this tool is aligned with DOE geothermal program objectives

- **Coordination with industry**
  - Working with Themochem
Future Directions

• Year 1 PTC Tool Development
  – Design, fabricate and assemble PC boards for analog MCM, RPDA, and support circuits
  – Determine if HT battery will be available; if not, use wireline to deploy
  – Assemble, test, calibrate and verify performance at 240° C
  – Determine well of opportunity and field tool

• Required subtasks performed in parallel to meet year 2 and year 3 objectives
  – Evaluate conventional Dewars;
  – Initiate pyrotechnic actuated valve design
  – Investigate HT cablehead and e-line design for 450° C

• University Collaboration
  – Initiate collaboration with the University of Maryland
    • Model behavior of MCM operating at 250° C and predict lifetime based on conventional die attach and wire-bonding techniques.
Future Directions

• Year 2 PTC Tool Development
  – Analog MCM development; convert circuit to MCM and test
  – Design, fabricate and assemble PC boards
  – Determine if HT battery will be available
  – Assemble, calibrate and verify performance of electronics
  – Determine well of opportunity and field tool

• Dewar development
  – Hold design review for prototype 450°C Dewar
    • Fabricate and evaluate up to 450°C (goal)

• Valve development
  – Hold design review for proposed pyrotechnic actuated valve
    • Fabricate and evaluate up to 450°C (goal)

• University Collaboration
  – Continue collaboration with the University of Maryland
    • Validate model by performing accelerated powered life tests of MCM
Year 3

Included in proposal, but not currently funded

• 450°C Fluid Sampler
  – Hold final design review; accommodate design changes
  – Assemble, calibrate and verify performance of electronics
  – Determine well of opportunity and field tool

• University Collaboration
  – Continue collaboration with the University of Maryland. Investigate improvements for longer life at 250°C and to extend the temperature to 300°C with engineered enhancements
  – Graduate student will present result of research at conference (GRC and/or HiTEC).
Summary

• Project is in the early stages
  – Dewar contract initiated
  – HT valve companies contacted; negotiations underway
  – HT team being selected to help guide sample collection methodology
  – University contract in negotiations
• Detailed work plan presented
  • Developed tools include:
    • Dewarless 240° C PTC Tool
    • Dewared/Flasked 450° C PTC Tool
    • Dewared/Flasked 450° C Fluid Sampler Tool (not currently funded)
• Project advances HT electronics and promotes the design of future HT downhole tools
  • Dewar advancement
  • HT valve designed
  • MCM development
  • MCM reliability study
Early stages of project. As such, no publications so far.

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