Integration of Full Tensor Gravity and ZTEM Passive Low Frequency EM Instruments for Simultaneous Data Acquisition

Project Officer: Ava Coy: Total Project Funding: $1.8M: April 25, 2013

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Track Name

Relevance/Impact of Research

- **Objectives**
  - Combine Air-FTG® and ZTEM™ onto One Platform for Simultaneous Acquisition
  - Test Applicability of Technologies for Geothermal Exploration

- **Challenges**
  - Integration of ZTEM System onto New Platform
  - Survey Parameters Compatibility between Systems
  - Imaging Geologic Structure Sufficiently to Aid Geothermal Exploration

Relevance/Impact of Research

- **Innovations**
  - Combining Two of the Most Advanced Airborne Geophysical Methods onto One Platform

- **Geothermal Technologies Program's Goal(s) Impact**
  - Reduce Risk for Exploration
    - Provide a Better Model of Subsurface Geology
  - Reduce Cost for Exploration
    - Increase Efficiency of Data Acquisition

Scientific/Technical Approach

- **Survey Platform Systems Integration**
  - Utilized Previously Certified Designs to Expedite Installation
  - Winch Hydraulic System, Winch and Latching Mechanism, Winch Control Console, Camera, and ZTEM Bird
- **Data Acquisition**
  - Survey a Well-Characterized Geothermal Deposit to Test Viability of Each Survey System and the Combination
  - Perform Commercial Test Survey over a Greenfield Site Using the Methods Developed at Initial Test Site
- **Data Integration and Interpretation**
  - Joint Interpretation of Density and Electrical Properties for Geologic Model Development
  - Release Final Integrated Interpretation Report

Accomplishments, Results and Progress

- **System Integration**
  - Winch, Camera, and ZTEM System All Installed, Flight tested, and Operators Trained
  - Highest Integration Risk - Identified
    - ZTEM Antenna Interaction with Aircraft
- **Data Acquisition**
  - Planned Date for First Survey - 04/01/2012
  - Aircraft Arrived On Location at First Survey Area - 03/25/2012
  - FTG Only Acquisition of Test Area and Most of Phase II Area
  - Combined FTG & ZTEM Acquisition Delayed
- **Technical Performance Issue**
  - ZTEM Tow Cable Wiring Failed During Calibration Flights on Survey Location

- **Resolution**
  - 1st Redesigned Tow Cable Iteration
    - Changed Rope Weave, Cable Assembly, and Integration
    - Changed Wire Construction – Fillers Added to Smooth Surface
    - Enlarged Directional Pulleys 3” to 5”
  - 2nd Redesigned Tow Cable Iteration
    - Modified Wire Composition – Higher Tensile Strength
    - Modified Wire Construction – Loosened Outer Jacket
    - Enlarged Exit Guide Pulley 3” to 5”
  - 3nd Redesigned Tow Cable Iteration
    - Maintained Wire Composition From Previous
    - Modified Tow Rope – Added Internal Load Member
- **Current Tow Cable Test Results (3rd Iteration)**
  - Tow Rope Aerodynamically Unstable
  - Unable to Retrieve ZTEM Antenna

Accomplishments, Results and Progress

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Original Planned Milestone/ Technical Accomplishment	Actual Milestone/Technical Accomplishment	Date Completed
FTG & ZTEM System Integration	System Installations Complete	03/15/2012
Dynamic Flight Tests	Flight Dynamic Testing Complete	03/19/2012
Test Survey Acquisition	Completed FTG Only Portion	04/07/2012
Production Survey (Go – No Go)		
Final Report		

Future Directions

- **Immediate**
  - Complete Redesign and Testing of Replacement Tow Cable
  - Complete Rebuild of ZTEM Antenna
- **Project Milestone Risks**
  - Tow Cable Performance
  - ZTEM Noise due to Aircraft and Flight Direction
  - FTG Performance due to Increased Altitude and Flight Direction
- **Long Term Research & Development**
  - Integrated Interpretation Methods
    - Thermal Forward Model
    - Simultaneous and/or joint Inversion Methods
    - Noise Reduction Methods

Milestone or Go/No-Go	Status & Expected Completion Date
Combined FTG & ZTEM, and Individual System Acquisition of Test Survey Area	FTG & ZTEM Individual – Completed FTG Only ZTEM Only, FTG & ZTEM – Q4 2013

Mandatory Summary Slide

- **Integration of Two Advanced Geophysical Survey**
  - Air-FTG® & ZTEM™ Integrated On Aircraft Completed
  - Dynamic Flight Tests Completed with No Flight Issues
- **Acquisition of the Test Survey has Started**
  - Completed FTG Only Portion Ahead Of Schedule
  - Preliminary Modeling of FTG Data is Continuing
- **Tow Cable Issues Can Be Resolved**

Project Management

Timeline:

Planned Start Date	Planned End Date	Actual Start Date	Current End Date
09/01/2011	03/08/2011	01/01/2012	07/10/2013

Budget:

Federal Share	Cost Share	Planned Expenses to Date	Actual Expenses to Date	Value of Work Completed to Date	Funding needed to Complete Work
$1M	$800K	$1.8M	$1.4M	$1.173M	$400K

- Hardware Funding Moved From Phase II into Phase I
- Project On Track to Finish within Schedule Extension
- Primary Schedule Delays Result from Redesign Time and Production Schedule Slots Available for Retests