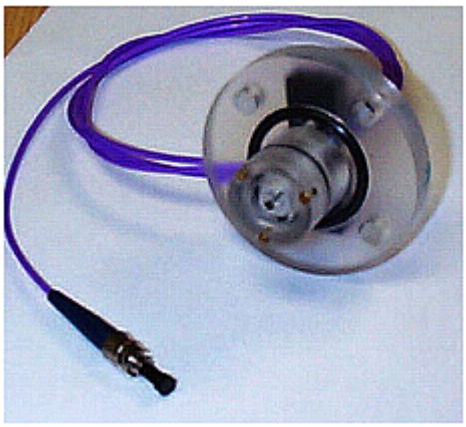
A Robust MEMS Based Multi-Component Sensor for 3-D Borehole Seismic Arrays

DE-FC26-04NT42241

Goal:
The objective of the project is to develop, prototype, and test a robust multi-component sensor that combines Fiber Optic and Micro-Electro Mechanical System (MEMS) technologies for use in a borehole seismic array.

Background:
This project addresses the challenge of imaging deep and complex gas reservoirs. Surface seismic imaging is the industry standard, but it does not provide sufficiently detailed images of complex or deep reservoir targets. Borehole seismic imaging can improve image resolution, but specialized sensors are needed to withstand the pressure and temperature conditions encountered in deep wells. Combining fiber optic and MEMS technologies enables a dramatic increase in the number of sensors that can be deployed simultaneously in a borehole seismic array.

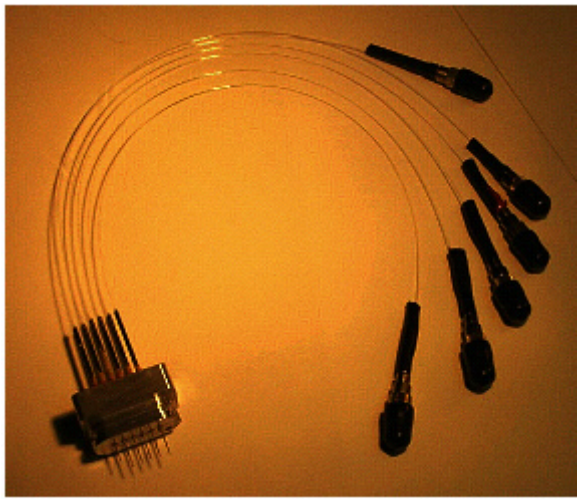

Packaged fiber optic MEMS pressure sensor

The aim of this project is to develop a sensor that can be used in borehole seismic systems designed for deep wells. By combining the fiber optic and MEMS technologies, the resulting sensor should be able to withstand 350–400°F, and 15,000–25,000 psi, sustaining its reliability in both shallow and deep wells.

Performers:
Paulsson Geophysical Services, Inc.
Optiphase, Inc.
Micralyne, Inc.
Davidsson, Inc.

Location:
Brea, CA, 92821

Potential Impact:
This project should advance the state-of-the-art in borehole seismology by developing high-pressure and high-temperature components for a digital sensor system.


Array of fiber optic MEMS pressure sensors mounted inside a stainless steel housing

The sensor could become a reliable component of future vertical seismic profile (VSP) receiver arrays. Such arrays should result in better image quality for characterizing deep gas targets. If successful, this technology should increase the success rate for deep gas wells, and decrease the risk of missing a deep gas target.

Accomplishments:
During Phase I, the project team has designed a prototype of a 3-D Fiber Optic MEMS sensor.

Current Status and Remaining Tasks:
The project was awarded in October 2004. Phase I will conclude November 30, 2006 with a completed prototype of a 3-D Fiber Optic MEMS sensor. Phase II will include laboratory and field testing of the prototype sensor.

Project Start: October 1, 2004
Project End: November 30, 2007

DOE Contribution: $1,204,538
Performer Contribution: $1,204,538

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