Microhole Wireless Steering-While-Drilling System

DE-FC26-05NT15488

Goal

The project goal is to provide a smart steering tool for a modular and economic coiled tubing drilling (CTD) system that allows domestic operators to produce more oil from existing reservoirs. This will be achieved by providing accurate and precise real-time geosteering even under conditions where the rig surface gear and equipment need to be minimized for cost-effectiveness. The following objectives support this goal:

- Develop a 2⅜-inch diameter bi-directional power and communications module (BCPM) as a part of the modular CTD bottomhole assembly (BHA).
- Develop a fit-for-purpose surface control system that communicates with the BHA.

Performer

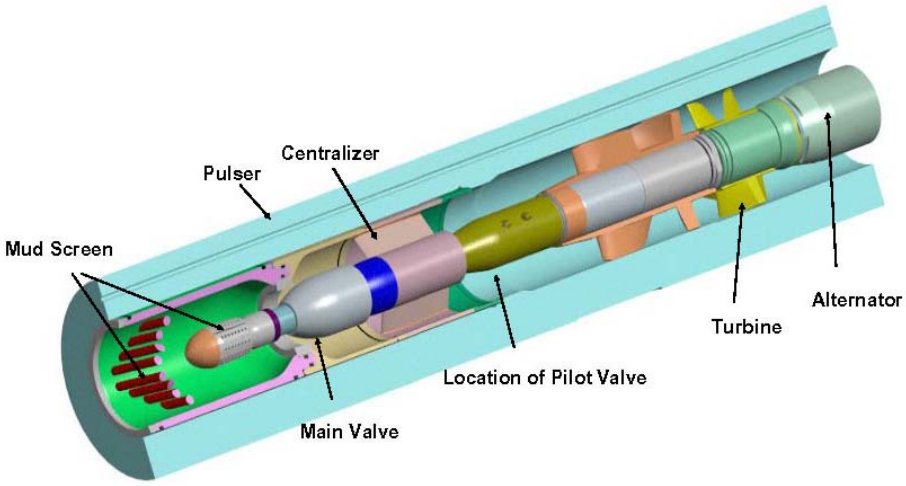
Baker Hughes INTEQ
Houston, TX

Results

A new, smart steering tool for a modular CTD system is the expected result. Progress has been made in the design of a BCPM that complements the existing modular CoilTrak™ drilling BHA. The system includes a fit-for-purpose surface control system.

Benefits

The new BCPM for the 2⅜-inch steerable CTD BHA will considerably reduce the capital expenditure needed to drill a "smart", yet relatively shallow, land well. The BCPM eliminates the need for a coil with an electric wire connection, thereby enabling the use of a smart drilling BHA in locations where an electric line is not affordable. The elimination of the electrically supplied coil saves the cost of one complete reel, which could reach about $100,000. In addition, with land rig day rates averaging $30,000 or more, considerable operational savings may be realized if a change in reels (between wired and non-wired) is avoided for special operations, such as cementing or window cutting.



Schematic of the bi-directional power and communications module MWD component. The surface control system communicates via mudpulse signals. The turbine/alternator provides power to other MWD components in the BHA.

Background

For drilling 3½-inch diameter development wells, CTD technology offers many benefits over rotary drilling. However, insufficient steering accuracy and low borehole quality are often experienced during CTD drilling. Electric wire is currently needed with coiled tubing strings to provide power to the steering tool and for downhole-to-surface communication; however, there are cases where a wired coil requires too much of an effort or expenditure.

This project builds on an existing wireless BCPM for a 6¾-inch tool that integrates an alternator-based electric power supply, an actuator to send information to the surface, and the capability to receive digital signals downhole.

Summary

Project tasks break down into two phases: the system design and the manufacturing and testing phase. The design phase consists of system concept evaluation, draft and detailed design of downhole components, and manufacturing decision.

The manufacturing and testing phase commences after a decision to proceed to manufacturing: This phase consists of manufacture of two prototype 2⅜-inch BCPMs and a surface control system, field testing of the prototypes, and evaluation of their performance.

Conceptual design reviews for the BCPM were held, and preliminary designs for the alternator and pulser currently are being developed. Components for a test setup are being designed and constructed to evaluate power requirements to generate sufficient pulse height with flow rates of 150-300 liters/minute. Long lead-time materials were placed on order.

Current Status (January 2006)

The project is in the preliminary design phase, and the design appears stable. Prototype components were machined and assembled for low-loop testing in January-February 2006, and the design will be re-evaluated based on those tests.

Project Start / End: 2-1-05 / 9-30-06
DOE / Performer Cost: $760,000 / $253,334
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