PROGRAM facts

U.S. Department of Energy
Office of Fossil Energy
National Energy Technology Laboratory

Strategic Center for Natural Gas & Oil

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Step Change In Directional Drilling Control and Efficiency When Using Motor Steerable Systems

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Background/Problem

Directional drilling is primarily accomplished today with either a rotary steering system or with a conventional steerable mud motor in tandem with a measurement-while-drilling (MWD) system.

Rotary systems are highly efficient and make for a smooth wellbore but are extremely costly. High day rates for rotary systems rule them out for most onshore and marginal offshore wells. Steerable mud motor/MWD systems are affordable but often bog down (the hole becomes "sticky") in the "sliding" mode —when the downhole motor is used to transmit power to the drill bit, without rotating the drill pipe, to drill a tangent section.

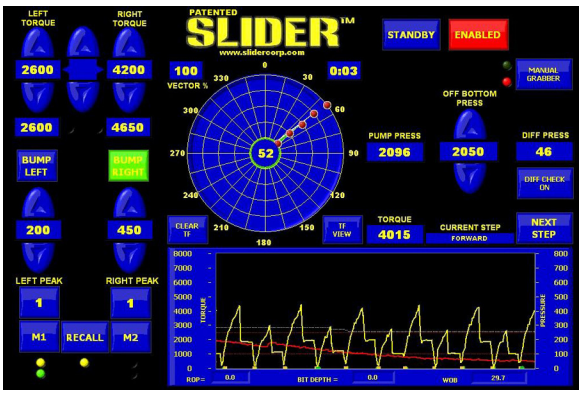
Directional drillers often use a rocking motion to reduce drill pipe stickiness and improve rate of penetration (ROP). Commencing a slide and reorienting the tool face thus invariably entails costly rig downtime and increases the risk of wellbore failure during such an intervention.

Slider LLC is seeking to commercialize a technology developed at Noble Corp. that overcomes the shortcomings of steerable motor/MWD systems used in directional drilling by employing a combination of robotics and innovative software from the surface to automate the rocking motion during sliding.

Project Description/Accomplishments

Slider is a new, patented tool that controls torque from the surface with a combination of hardware and software that integrates surface and MWD data to automate rocking during sliding. The Slider system works over the pipe rotation equipment of top drives, power swivels, or silicon-controlled rectifier (SCR)-driven rotary tables. No equipment is added downhole.

After developing a laboratory-scale physical simulator and conducting initial field tests, Slider LLC sought to extend the technology beyond initial field tests that involved a hydraulic power swivel.



Slider user interface

MAIN PROJECT SITE

Slider LLC
Houston, TX

PROJECT DATA/ DURATION

DE-AF26-05NT50396
March 23, 2005 - March 22, 2006

COST

Total Project Value
$87,000

DOE/Non-DOE Share
$29,000 / $58,000

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WEBSITE

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NETL contributed funding to a Drilling Engineering Association joint industry project—also funded by Chevron Corp. and Anadarko Petroleum Corp.—that called for the following:

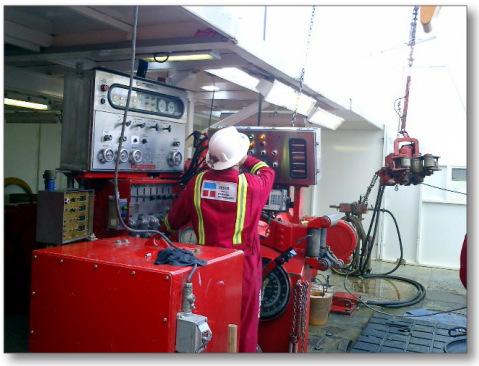
- Modifying the Slider software to accommodate electric top-drive drilling systems.
- Building a two-robot system and testing related robot software.
- Conducting at least three field tests to validate the technology on electric top drives.
- Documenting the cost-effectiveness of the technology.
- Developing a new computer torque-and-drag program that incorporates the rocking effect.

In addition, Slider LLC built a plug interface that eliminated the need for robots, trained directional drillers for the field tests, and analyzed the results from the three field tests.

Benefits/Impacts

The Slider technology demonstrated these benefits in the sliding mode:

- Improved ROP and horizontal-reach capability through automated rocking, using torque as an input.
- Improved tool-face correction through a torque pulse method, using the drillstring.
- Enhanced well trajectory through an order-of-magnitude improvement in tool-face correction while on bottom.
- Avoided orientation time losses through a semiautomated transition from rotating to sliding.
- Virtually eliminated stalling, thus extending motor and bit life.



A top-drive technician tests the Slider equipment soon after installation on a land rig working for Anadarko in Canada.

Field tests of the Slider technology in the Austin chalk showed that the system increased sliding ROP by 60-200% for estimated savings of 11-23% of total well costs.

America's oil and gas production continues to decline, even as demand for both continues to rise, increasing U.S. dependence on imported supplies. Meanwhile, service/supply costs still escalate in a capacity-constrained industry. To tackle the job of recovering more oil and gas from the world's most mature petroleum province amid this business environment, producers need every efficiency and cost advantage they can find.

Significant well-cost savings such as the Slider technology provides thus offers another research opportunity to enhance the Nation's energy security.