Composites and advanced MWD boost efficiency

BETTER REAL-TIME measurement of downhole conditions, including seismic measurement while drilling, are examples of advancing monitoring and analysis capabilities. And the use of composite materials is expanding.

These are all subjects of presentations during a session, "21st Century Technologies," at the 2002 IADC/SPE Drilling Conference, 26-28 Feb, in Dallas. The session is chaired by **M B Stone**, **Big 6 Drilling Co** and **J Smith**, **Weatherford International Inc**.

DOWNHOLE INTERNET

Drill pipe capable of transmitting high-bandwidth downhole data and surface control signals has been developed and successfully tested.

The system incorporates a high-speed data cable that runs the length of the joint. The cable terminates at induction coils installed in protecting grooves machined in the secondary torque shoulders of double-shoulder tool joints at each end of the pipe. The coils are recessed in U-shaped, ferrite troughs that focus the magnetic field and permit refacing of the torque stops without causing coil damage. The system is virtually transparent to standard rig procedures and offers robust, reliable operation.

IADC/SPE paper 74536, "Telemetry Drill Pipe: Enabling Technology for the Downhole Internet," was prepared for the Conference by **M J Jellison**, **Grant Prideco**; **D R Hall**, **IntelliServ**; **D C Howard**, **BP plc**; **H T Hall**, IntelliServ; **R C Long**, **US Department of Energy**; **R B Chandler**, Grant Prideco; and **D S Pixton**, IntelliServ.

The new system has demonstrated data transmission rates of up to 56,000 bits/sec. Data transmission rates of up to 1 million bits/sec are expected with sophisticated signal processing.

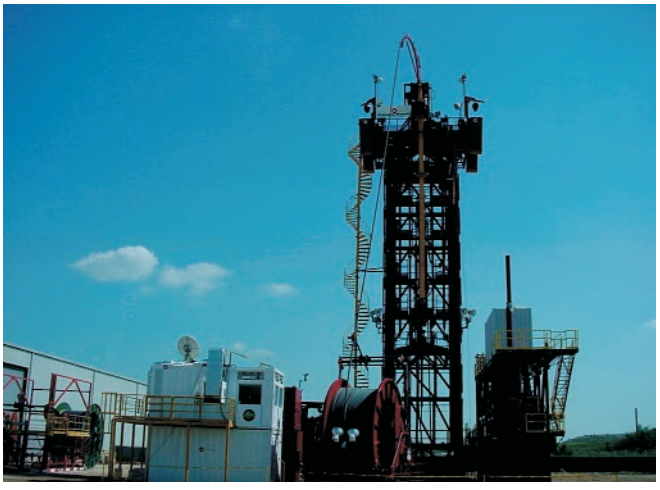
Current mud pulse telemetry is limited to 10-12 bits/sec. Electromagnetic technology provides data rates of up to 100 bits/sec, but suffers from depth and formation related limitations.

Full realization of system benefits requires further development of additional drill stem components with high-speed telemetry capabilities including HWDP, collars, jars and top drive subs, the authors report. A top drive sub that incorporates the telemetry design has been successfully manufactured and tested. Development efforts relating to other drill stem components are also under way.

Telemetry drillpipe can improve well and field productivity by providing more complete, real-time logging information. And it can reduce drilling time and costs and enhance well control by providing real-time downhole drilling data and early kick detection.

HYBRID DRILLING SYSTEM

The potential of a drilling system that combines composite coiled tubing technology and hydraulic workover technology is examined in IADC/SPE paper 74538. "The Hybrid Drilling System: Incorporating Composite Coiled Tubing and Hydraulic Workover Technologies into One Integrated Drilling System," was prepared for the Drilling Conference by **E A Coats**, **Halliburton Energy Services**.



Combining composite coiled tubing technology and hydraulic workover technology promises better wellbore knowledge and increased control.

By using composite pipe with embedded conductors the system achieved uninterrupted real-time two-way communication with the downhole tools. This allowed a step-change improvement in the knowledge of dynamic wellbore conditions and in the control over downhole systems. New procedures were developed to assimilate and utilize this increased functionality, including geosteering and real-time system diagnostics from remote locations.

Incorporating a hydraulic workover jacking system as an integral part of the drilling unit also expanded the operating envelope and functionality of the entire drilling system. This revolutionary full-system development encountered numerous challenges, many of which are related to the unique properties of composite pipe in difficult hole conditions.

WIRED JAR

IADC/SPE paper 74537, "Wired Jar for Drill String Telemetry Systems," discusses the development of a wired jar that sends data from one end of the jar to the other in all of the jar operational modes.

The method used to transfer the signal in and out of the jar will be the same method used in the wired drill pipe, which includes direct contact, inductive coupling or acoustic coupling. The wired jar has been designed to mate up to drill pipe with conventional tool joints or proprietary connections.

The paper was prepared for the Conference by **J E Smith**, **T L Wilson**, **T F Bailey**, and **M F Gravouia**, Weatherford International Inc.

Drill pipe that can convey electronic data or a signal to perform a function downhole is being developed by various companies in the drilling industry and is very near the field test stage.

Data transmission rates in a Smart Pipe system will be on the order of thousands of times greater than mud pulse data rates with no depth limitations.

For a drill string telemetry system to work, drill string components other than drill pipe must also be wired.

SEISMIC MWD

IADC/SPE paper 74539 presents field results obtained while drilling difficult offshore wells in Azerbaijan and Brazil using a new service that delivers conventional check-shot data while drilling. The operation is similar to a conventional wireline operation in that it uses a surface-deployed source and downhole receiver.

The key difference between this service and wireline seismic services is that the receiver is included in the drilling assembly; therefore, drilling does not have to be stopped to take measurements. "Seismic Measurement While Drilling in Azerbaijan and Brazil," was prepared by **T Harrold** and **A Poole**, BP plc.

The first case study presents results from the INX-1 deviated wildcat well in the South Caspian Sea, where the service was used to reduce depth uncertainty. The tool delivered real-time check-shot data that were accurate to within 3 m of a conventional vertical seismic profile (VSP) over the same interval (equivalent to a 10-m depth error at a 4-km depth).

In the second case study, seismic data from the Reki well in Brazil were used to set casing in a narrow window between a fault and the primary reservoir target. The data enabled safe and successful installation of the casing.

Both operations were completed with zero rig downtime.

MUD HAMMER

A consortium was recently formed to conduct mud hammer performance tests at controlled depth conditions. IADC/SPE alternate paper 74540 presents the results of 12 drilling tests with the mud hammers and roller cone bit with a majority of the work being done at 3,000 psi borehole pressure.

"World's First Benchmarking of Drilling Mud Hammer Performance at Depth Conditions," was prepared **G A Tibbits**, **TerraTek Inc**; **B A Tarr**, **ExxonMobil Upstream Research Co**; **R C Long**, US Department of Energy; **B E Miller**, BP plc; and **A Judzis** and **A D Black**, TerraTek Inc.

Two 6 range mud hammers were tested under simulated downhole conditions including weighted mud and 8 ½-in. bits. They were tested in Carthage Marble and Crab Orchard Sandstone. An 8 ½-in. roller cone bit assessed conventional drilling performance.

The primary objective was to place the mud hammers in a typical oilfield drilling environment, circulating a weighted drilling mud while hammering and rotating into the stressed rock samples, and benchmark their respective performance. Two water based mud systems were picked; 10 ppg and 15 ppg bentonite, barite, and water mixtures.

The tests were performed under guidance of the US Department of Energy and industry sponsors BP, ExxonMobil, **Novatek**, **SDS Digger Tools** and **Pajarito Enterprises**.