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'Intelligent' Wired Drill-Pipe System Allows Operators to Take Full Advantage of Latest Downhole Sensor Developments

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Abstract

Transmission of real-time data acquired during drilling from downhole MWD or LWD sensors is now an integral part of almost all drilling operations. The value of the data received, whether it is directional, formation evaluation or drilling mechanics is now well established, and it is difficult to imagine drilling modern well designs without this data. Sensor technology has developed to the point where almost all traditional wireline sensors can now be replaced with LWD sensors that can provide equally good and often better data than their wireline equivalents. However a limiting factor on MWD and LWD data has been their reliance on mud-pulse telemetry and the limits it places on transmission speed. Even under the best conditions the maximum transmission speed is only in the order of 10-12 BPS, and under certain conditions even these speeds are difficult to achieve. In addition the electro-mechanical mud pulser is often the most unreliable element in an MWD or LWD tool string and is responsible for a disproportionate amount of the NPT resulting from unwanted trips for MWD/LWD failures.

The IntelliServ[®] network is designed to overcome both these shortcomings of mud-pulse telemetry by utilising a unique system of wired drillpipe and associated drilling tools connecting the MWD/LWD string to the surface. As such transmission speeds of up to 57,000 BPS have been demonstrated and the reliance on the mud-pulser removed. Complete formation evaluation data suites such as high resolution images, multiple depths of investigation and sonic wave forms can now be transmitted routinely in real-time.

This paper will describe the IntelliServ wired drill-pipe network and the latest advances in MWD and LWD technology. A case history will be used to demonstrate the advantages achieved for both geological and drilling efficiency scenarios.

Introduction

Telemetry Drill String Technology Overview

The IntelliServ Network offers an ultra high-speed alternative to current mud pulse and electro-magnetic telemetry methods. The network utilizes individually wired drill string components that can deliver bi-directional telemetry at speeds of 57,000 bits per second. Existing MWD telemetry has shown data rates of up to 24 bits per second but this data rate is lagging behind advancement in downhole MWD/LWD tools that are becoming more and more complex. The ability to transmit at 57,000 bits per second connects the downhole tools (and other measurement nodes along the drill string) instantaneously, greatly expanding the quantity and quality of information available while drilling.

The network utilizes a high strength coaxial cable and low loss inductive coils embedded within double-shouldered connections in each tubular joint to convey information. Signal repeaters are placed periodically along the drill string to ensure an acceptable signal to noise ratio is maintained. These repeaters serve as individually addressable nodes within the telemetry network and therefore also provide a location at which potentially valuable measurement data can be acquired.