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The First Offshore Use of an Ultra High Speed Drillstring Telemetry Network Involving a Full LWD Logging Suite and Rotary Steerable Drilling System

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Abstract

Drill string telemetry network technology allowing reliable data transmission at speeds up to 57,600 bits per second has been utilized in many land based drilling applications.

The drill string telemetry network incorporates a high-strength data cable that runs the length of each tubular joint. The cable terminates at inductive coils that are installed in the secondary torque shoulder of each connection. As the drill string is assembled, the inductive coils in adjoining tubulars are brought close together allowing data to flow across the connection. The network signal is boosted occasionally by repeater subs, which also provide locations for along-string temperature measurements. The technology offers robust, reliable operation and is virtually transparent to standard rig procedures.

In 2007, the Troll field in Norway saw the first commercial deployment of this technology into a complex offshore multilateral drilling project.

This paper details the lessons learned and value derived from the use of an ultra-high speed drill string telemetry network and compatible rotary steering, drilling dynamics and advanced formation evaluation measurement tools while drilling multiple laterals of an extended reach horizontal well from a semi-submersible drilling rig.

Of particular focus will be discussion of the specific value gained from: real-time analysis of high resolution dynamics and inclination measurements to instantly manage the drilling transition between relatively unconsolidated sands with imbedded hard calcite-cemented stringers; instantaneous network-enabled surface control of rotary steerable tools to eliminate non-productive time and improve directional control; real-time transmission and interpretation of high-volume, memory quality formation evaluation measurements to improve geological well placement; and non-productive time elimination resulting from the availability of full telemetry redundancy.

The paper includes comment and perspective from the Troll field operator regarding the immediate value and likely future utilization of telemetry drill string technology.

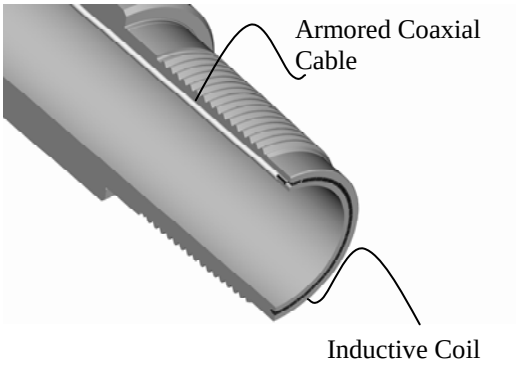
Introduction

Nine years of engineering and development, funded in part by the U.S. Department of Energy, has produced the IntelliServ® network, a high-speed, bi-directional drill string telemetry system.[1]

This network makes it possible to obtain large volumes of data from downhole tools and other measurement nodes along the drill string instantaneously – greatly expanding the quantity and quality of information available while drilling.

The network currently has a data transmission capability of 57,000 bits per second and the critical elements of its telemetry tubulars are illustrated in figure 1 below.

Figure 1: Cutaway of Double-Shouldered Pin Tool Joint, Armored Coaxial Cable and Inductive Coil Used in Drill String Telemetry Network. Graphic courtesy IntelliServ.



The system's bi-directional architecture allows simultaneous high-speed transmission of downhole data to the surface and commands from the surface to downhole devices, such as Rotary Steerable Systems (RSS).

Through the insertion of a physical and electrical interface to the telemetry drill string (an 'interface sub'), existing MWD/LWD/RSS tools can be made fully compatible with the