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Novel High Speed Telemetry System with Measurements Along the String Mitigate Drilling Risk and Improve Drilling Efficiency

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Abstract

Novel systems such as the wired-pipe or networked drillstring telemetry system have allowed broadband communication with downhole tools in various operating areas around the world, including in deepwater. Two capabilities are vital to offer operators and service companies with cost effective drilling and completion in challenging scenarios:

1. *High speed*: real-time, bi-directional data transfer at a rate of 57,600 bits per second (bps) enables downhole and subsurface conditions to be measured and controlled,
2. *Measurements all along the string*: annular pressure and temperature measurements distributed at network nodes beyond just at the drill bit enable early warning of developing trouble events.

This paper describes cases where the broadband network provided downhole information for identifying poor hole cleaning, determining sweep efficiency, revealing cutting accumulation and recognizing pack offs early on.

Further, examples are described that improved drilling risk mitigation by the capability to measure as many as 45 different drilling dynamics parameters that are updated every few seconds revealing bit whirl, stick slip, lateral and axial movement while drilling trouble zones.

The successful mitigation of downhole vibration resulted in a 68% increase in time on bottom and a 58% increase in rate of penetration (ROP). Annular pressure evaluation all along the drillstring ensured adequate hole cleaning in challenging wellbores.

Introduction

Successfully drilling and completing wells in challenging environments, while also keeping costs under control and risks at a minimum, has made the need for fast and accurate decision-making while drilling increasingly imperative. Deepwater reservoirs present several unique challenges that hinder data collection and transmission, which require technology advances in transmission speed and accurate measurement along the drillstring. These include:

- *Deep, sub-salt reservoirs*. The challenges of accurately characterizing sub-salt reservoirs by seismic imaging force drillers to place greater reliance on measurement while drilling (MWD) techniques to stay in zone and accurately place the well for optimal productivity. This requires high-speed, bi-directional data transmission and accurate measurement of string vibration, to increase time on bottom and maximize the ROP, and help ensure improved wellbore stability.
- *Narrow pore pressure and fracture gradient (PPFG) margins*. To quickly mitigate the challenges associated with unknown pressure regimes in deep, complex reservoirs that require many casing strings and have a high likelihood for kick/loss events, drillers benefit from access to formation pressure testing and high-resolution sonic data. They also need assurances that the data is of good quality and verification from multiple sensors that the pressure event is real.