Dealing with the drilling data dilemma

There is a fairly big industry focus around drilling ‘data rates’ or ‘bit rates’ these days. Everyone seems to be obsessed with bits-per-second. This attitude has evolved over time, but was brought to a head with the introduction of wired drillpipe. Many thought, “That’s it! Problem solved.” But in reality they should have realized, “That’s it. Problem complicated.”

Reducing the issue to the lowest common denominator, drilling data telemetry benefits users in two ways. Perhaps an over-simplification, but it allows transmission of real-time drilling dynamics, well, and formation information to surface to enable timely drilling decisions, and it allows steering commands and tool controls to be transmitted downhole to implement those decisions.

The 5,000-lb elephant in the room is wired drillpipe. A remarkable breakthrough, it was first billed as a 1 Mbps solution, enabling virtually all downhole data to be transmitted to surface in real time. Wired drillpipe has two major advantages: its ability to transmit high-bandwidth data like sonic or seismic waveforms, and the fact that all data can be transmitted, so it is unnecessary to leave some data downhole stored in memory for later analysis. In the rare case that a drilling event causes loss of the bottomhole assembly, at least all data acquired to that point is safely at surface.

The enormity of the wired pipe data rate overshadowed the fact that few had any idea how that much data could be processed into actionable information, assimilated by the drilling engineers and directional drillers, and presented in time to make and implement meaningful decisions. People were asking, “Why do we need more bandwidth when we are not using all the available bandwidth with our mud pulse systems now?” Clearly, more thought was needed.

When viewed in terms of greatest need, the answer becomes apparent. Reliable downhole drilling data is needed to drill extended reach wells, deepwater wells, and deep wells with high mud weights. Presently, the gauntlet has been thrown down at 40,320 ft (12,293 m)—a record today, perhaps routine tomorrow?

Operators need to be able to control well trajectories at extreme distances from surface.

This requires reliable two-way communication, improved signal-to-noise ratios, and finger-tip control capabilities. At the moment, more data alone is not the answer. More unfiltered data will just slow decisions due to information overload. Imagine the amount of information instantly available to a jet fighter pilot. If all available information was somehow presented, there is no way the pilot could accomplish the mission – identify the target, engage it, avoid counter-fire – all the while maintaining control of the aircraft. Compared with the available data rate, the pilot and the flight controls move at glacial speed.

It is with the drill bit that the analogy holds true. At this time, we do not require faster data rates unless we have a smart system to filter and present the data effectively. Indeed we rarely use the rates we have today. Coupled with this is the need for better downlink capability both in telemetry and in control efficiency. To achieve the operator’s objectives in wells that may soon reach 8 mi (13 km) in length, we must do much more than make toolface adjustments.

Today, we can geosteer with high accuracy in record-length wells. That has been proven. What we need is to be able to perform detailed analyses on command. For example, while drilling, we may need to interrupt the data stream from downhole to perform a detailed, full-spectrum analysis of vibration for a couple of minutes; then switch back to standard data transmission. The geologist may want to take a closer look at a formation for a few feet; then switch back to standard logging. We cannot do this switching today with current downlink technology and tool systems without interrupting the drilling process.

Deep well or extended reach drilling is incredibly complex, but it would be much more efficient and effective with instantaneous tool control and the ability to switch tool functions momentarily to perform operational analyses needed to keep everything running smoothly and on-course, to allow geoscientists and engineers to confirm their positions, or allay their doubts with a brief peek at the rock using a different perspective or scale. This ability, coupled with the massive data highway that wired drillpipe provides instantaneous control and feedback from the bit to surface, is a reality.

However, it is not just about data rates. We must ensure we are getting the answers we need to drill better holes, while maintaining the capability to act with confidence on what those answers tell us. That requires command and advisory systems that make the best use of the data super highway from surface to bit and back that is now a reality.

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