Planning, Collaboration and an Optimized Drilling Performance Deliver Record-Breaking Extended Reach Unconventional Wells in Bakken/Three Forks

Location: North Dakota, USA

Overview
In the Bakken and Three Forks formations in North Dakota, where tough drilling conditions include hard rock, pyrite stringers, and high temperatures, the operator's objective was to drill two extended reach wells, followed by drilling three more wells with 50 percent longer laterals.

The Denver Drilling Engineering Solutions Center (DESC) and technical advisor team conducted a feasibility study for the project and proposed drilling two typical laterals, study the data in real time and post well, and then apply the lessons learned to drill three more laterals, each ~5,000 ft longer (3-sections, or 15,000 ft MD lateral) than a typical extended reach lateral in the Williston Basin. The project was passed to Casper operations for execution using Sperry’s CORE processes.

Sperry’s customized solution included the DrillDOC® and pressure-while-drilling (PWD) tools with ADT® real-time drilling optimization services and post-well analysis. This was the first use of a 4.75-in. DrillDOC tool worldwide.

The three extended laterals were drilled with a GeoForce® XL motor assembly, with a motor-assisted Geo-Pilot® Dirigo 5200 rotary steerable system available if needed for drilling efficiency.

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<td>• The Bakken and Three Forks formations present extremely tough drilling conditions with hard rock, pyrite stringers, and high temperatures that cause excessive vibration, stick-slip, and wear on tools.</td>
<td>• Extensive planning and collaboration.</td>
<td>• Sperry successfully delivered three wells, each with approximately 15,000 ft (4,572 m) of lateral.</td>
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<td>• Drill extended reach laterals at depths greater than 20,000 ft (6,096 m) through the hard, fractured formations.</td>
<td>• GeoForce® XL motor and motor-assisted Geo-Pilot® Dirigo 5200 rotary steerable system (run with a GeoForce XL motor assembly).</td>
<td>• Continuous performance improvement over the course of each well, with the second well at 25,431 ft (7,751 m) MD breaking the record for the longest well drilled by Sperry in the region. The third well then broke that record, reaching TD at 25,465 ft (7,762 m) MD.</td>
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<td>• Experienced ADT® drilling optimization engineers to analyze downhole drillstring dynamics using DrillDOC® sensor data including weight-on-bit, torque-on-bit, RPM, downhole bending moments, vibration, and mud analysis.</td>
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To ensure that best engineering practices were used on these challenging wells, the Casper team collaborated with global subject matter experts in Houston, frequently engaging the client to determine the best process to deliver a successful project. Real-time data collection requirements, post-well data analysis, tool troubleshooting, communication protocols, and contingency planning were finalized before the project mobilized.

The first two wells (10,000 ft. horizontal section) were drilled with a GeoForce XL motor, DrillDOC tool, PWD sensor, and ADT service support. Data analysis from these wells enabled the team to provide focused planning and solutions for the subsequent three-section laterals (15,000 ft. horizontal section). Improvements were made, summarized and presented to the customer post well.

The three longer wells commenced drilling using the GeoForce XL motor; the Geo-Pilot Dirigo 5200 motor-assisted rotary steerable system was used to complete the wells. ADT service engineers supported the field personnel 24/7. Lessons learned from the first two wells were applied to the third, which was drilled to the planned total depth of 25,465 ft (7,762 m) MD and is now the longest well in the US Northern/Canada region.

**Results**

Directly measuring tension, torsion, bending and vibration identified the actual drilling parameters that were being applied to the bottomhole assembly (BHA) and the bit. These measurements, utilized by our experts, provided greater insight into the wellbore to reduce uncertainty, minimize unplanned events and optimize the drilling performance.

Effective drilling at depths greater than 20,000 ft (6,096 m) presented a major challenge in these extended reach wells. Sperry Drilling successfully delivered the three wells, each with approximately 15,000 ft (4,572 m) of lateral, a first for this client and for Sperry operations in the region.

Performance continuously improved over the course of each well, with the second well at 25,431 ft (7,751 m) MD breaking the record for the longest well drilled by Sperry in US North/Canada region. The third well then broke that record, reaching TD at 25,465 ft (7,762 m) MD.

Pre-job planning to understand how to make this project a success and then implementation of that planning was critical to the project. Ultimately, Sperry teams customized technology applications for the customer’s needs, and engineered the solution to drill on target and on depth.