CASE STUDY

Successful Underbalanced Drilling Operation with iCruise® Rotary Steerable System

DELIVERY OF THE FIRST iCRUISE® ROTARY STEERABLE SYSTEM IN A MANAGED PRESSURE DRILLING (MPD) UNDERBALANCED OPERATION GLOBALLY

COLOMBIA

OVERVIEW

Requirements for successful horizontal well drilling include hole cleaning, efficient trips, adjusting planned trajectory, achieving a smooth trajectory to control tortuosity, and others. When performing MPD underbalanced drilling with directional tools, these requirements further impact execution results.

CHALLENGES

An operator required drilling in an underbalanced environment with N_2 injection using a rotary steerable system (RSS) without losing directional control. In this MPD drilling environment, another challenge was maintaining data transmission using positive pulse telemetry while drilling with a biphasic fluid, which decreases mud density and can cause signal strength to weaken or become lost. Additionally, during geosteering operations, the operator wanted the capability to hit the target positions with the minimal impact on tortuosity.

CHALLENGES

- Perform hole cleaning in MPD environment
- Operate directional and logging-while-drilling (LWD) tools with N_2 injection (up to 7%)
- Deliver directional curve section per plan, geosteer successfully, and meet performance KPI

SOLUTION

- 6.75-in. iCruise® intelligent RSS for sustained steerability, minimizing wellbore tortuosity, and delivering a high-quality wellbore
- DrillingXpert™ well engineering software for optimum BHA design and modeling and identifying the optimum hydraulics configuration
- LOGIX® autonomous drilling platform—with AI and physics-based ML algorithms for precise steering decisions
- Collaboration and detailed pre-job planning with global team and MPD group to design and verify detailed engineering solutions
- Remote support for real-time drilling performance optimization and vibration mitigation

RESULTS

- Shoe-to-shoe performance, delivering 2,442 ft in a single run
- Performed geosteering in limestone, adjusting trajectory, delivering smooth curvature
- Delivered well trajectory, building inclination to 85° with 4 to 7% N_2 injection without losing steering capacity

HALLIBURTON

SOLUTION

Drilling in an MPD environment with N_2 injection required a detailed pre-job planning and design process, particularly considering the effect of pumping nitrogen on the functionality and configuration of the iCruise® RSS. Several advisory sessions with a global support team were conducted, and the optimum configuration was determined. All engineering was developed using the DrillingXpert™ software to determine the best hydraulic configuration and BHA stabilization to aid trajectory, obtain optimum LWD quality data control, and minimize vibration. The well was accurately steered with the Logix® autonomous drilling platform following the different instructions received while geosteering. A remote drilling center worked directly with field engineers to support drilling performance optimization and vibration mitigation in real time.

RESULTS

This was the first iCruise RSS run globally in an underbalanced environment. Collaborative engineering efforts delivered a 2,442 ft, 85° inclination section in a single run where nitrogen pumped reached up to 7%. The operator required geosteering in limestone and had to adjust the trajectory several times with extreme caution to maintain a low dogleg and deliver a smooth borehole. The section was steered successfully without losing steering capacity.

With this case study, the Halliburton team illustrates how collaborative efforts and innovation solutions can deliver engineering solutions to maximize the operator's asset value.

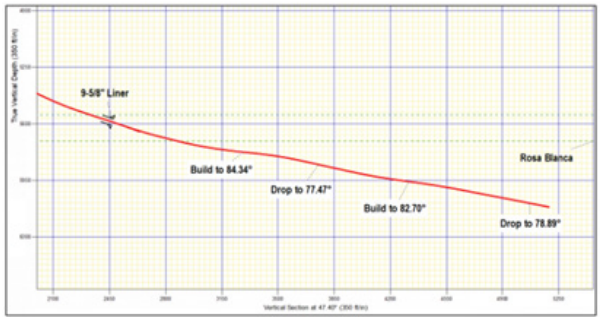

Figure 1—Actual well path

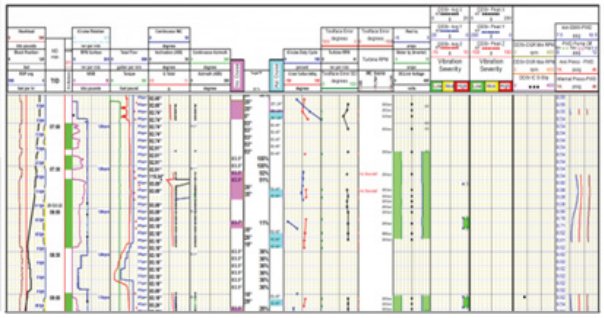

Figure 2—Time based drilling plot