CASE STUDY

Ecuadorian Operator Executes First Horizontal Well via Fully Automated AI-Driven Drilling Technology

LOGIX® AUTONOMOUS DRILLING PLATFORM INTEGRATED WITH GEOSTEERING SOFTWARE PROVIDES INSIGHT AND RECOMMENDATIONS TO SUCCESSFULLY LAND WELL

ECUADOR

OVERVIEW

An operator planning to drill the first horizontal well in one of Ecuador's main platforms faced high uncertainty due to true vertical depth (TVD) variations seen in close-by platforms along the basin. At a time when the drilling industry was witnessing a significant transformation with the introduction of automation technologies, Halliburton Sperry Drilling and the customer agreed to a field trial of the latest advancements in automating the integration between formation evaluation data and directional drilling through the LOGIX® autonomous drilling platform. This job demonstrated the industry's first fully automated workflow designed to incorporate geosteering-based target changes into the projected well path in real-time.

CHALLENGES

- Maximize reservoir exposure and achieve landing target based on real-time geosteering interpretation
- Maintain a DLS less than 1°/100 ft in the 300-ft tangent section for ESP placement
- Gain operator's confidence in deploying fully autonomous drilling technology

SOLUTION

- Steer the well path and avoid collisions with LOGIX® autonomous drilling platform
- Accurately identify the landing zone with real-time formation data using logging-while-drilling (LWD) triple-combo services
- Real-time visualizations of reservoir structure and fluid boundaries with geosteering software

RESULTS

- Successfully landed well at the desired target despite high uncertainty reservoir characteristics
- Followed AI/ML-driven geosteering recommendations to guide the Logix autonomous drilling platform
- Drilled a total of 87.4% of the section footage without human intervention
- Proved the industry is closer to the integration of formation evaluation data with autonomous directional drilling

HALLIBURTON

CASE STUDY

CHALLENGES

The well profile was a complex 3D well with a build interval, followed by a 300-ft tangent, and then a build and turn interval to reach the reservoir section. The goal was to ensure that geosteering changes were realistic and could be achieved based on real-time drilling tool performance; thus, providing the necessary recommendations for the LOGIX® autonomous drilling platform to accurately land the well on target. The biggest challenge was to execute an automated workflow in real time between the formation evaluation data while drilling and the directional drilling instructions for the first time in the industry.

AUTOMATED PROCESS

The unique process comprises a two-way exchange of data, in which the geosteering target changes use the output of a real-time digital twin and machine learning (ML) / artificial intelligence (AI) algorithm to define a target that can be drilled. This fully automated process to modify the well plan takes seconds to complete—without requiring any human intervention.

Figure 1—Drilling and geosteering workflow integration

SOLUTION

The LOGIX autonomous drilling platform was set up at the rig site and operated by the geosteering team from the customer's office to remotely drill the curve and the tangent. In the tangent section, the maximum dogleg severity (DLS) was 0.85 deg/100 ft (0.85, 0.36, and 0.35 DLS at the three survey stations), far exceeding the customer requirements to place the electric submersible pump (ESP).

The original well plan was followed until the point when the geosteering team confirmed a change in the geological surface, resulting in a new target to land the well. The updated well path was automatically sent to LOGIX for auto-steering. A combination of ML algorithms were applied to real-time, directional sensor data to determine the real-time steering tendency of the bottomhole assemble (BHA) and the digital twin of the BHA.

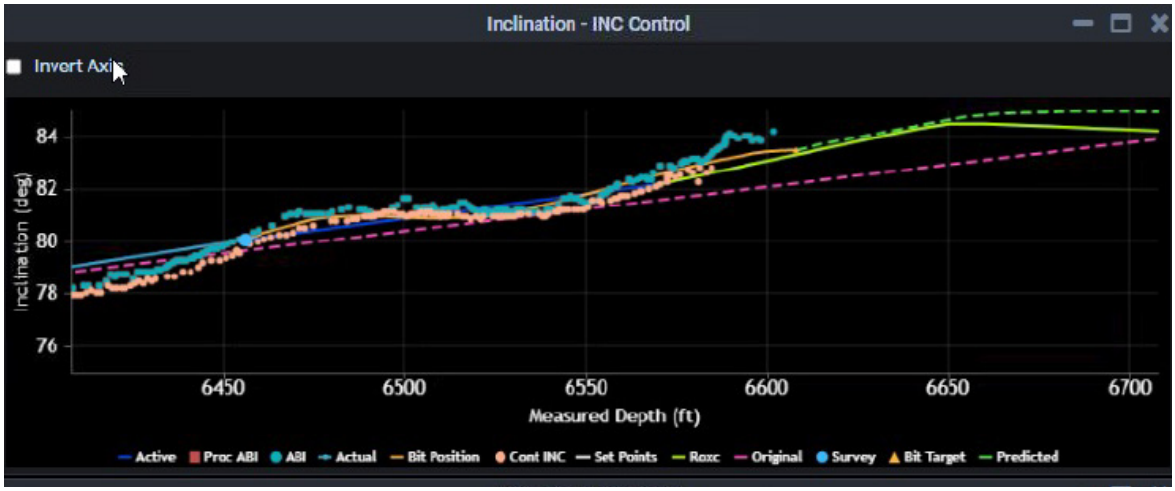

Figure 2—Software-generated wellpath (yellow line) set up as trajectory to follow by LOGIX autonomous drilling platform.

BENEFITS

By automating the geosteering target changes, the operator was able to:

- Eliminate communication hurdles between the geologist, geosteering engineer, and directional driller
- Eradicate the need for manually calculating well path projections
- Maintain drilling performance throughout the process

RESULTS

The first autonomous job to land a horizontal well at the desired target was successfully executed by the team in Ecuador through the LOGIX autonomous drilling platform integrated with geosteering software. A total of 87.4% of the footage was autonomously drilled, and the use of ML/AI algorithms insight into real-time (BHA) tendencies, resulting in faster reaction time compared to a directional driller making decisions based on manual calculations. This field trial brings the industry a step closer to a more comprehensive autonomous drilling solution—seamlessly integrating formation evaluation data with autonomous directional drilling.