

Petroindependencia Drills the Longest ERD Well While Staying 100 Percent in Target Zone

GEO-PILOT® DIRIGO™ RSS REDUCES WELL TIME BY THREE DAYS IN AN EXTENDED-REACH WELL

VENEZUELA

CHALLENGES

- » Overcoming steerability challenges and anti-collision issues in shallow, soft formations in an extended-reach drilling (ERD) lateral with other wells in close proximity

SOLUTIONS

- » Utilize the 7600 Geo-Pilot® Dirigo™ RSS with M/LWD sensors, an ABI™ sensor, and a PDC bit to achieve fast ROP and accurate geosteering
- » For faster data transmission, utilize JetPulse™ high-data-rate telemetry service to send large amounts of data for on-the-fly corrections

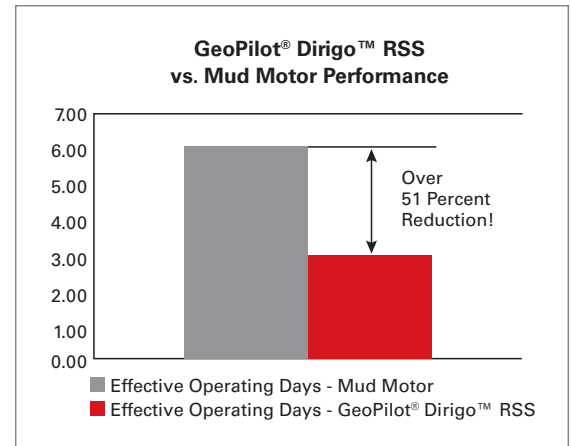
RESULTS

- » Drilled field's longest lateral in three days while staying 100 percent in the sweet spot
- » Reduced well time by three days

OVERVIEW

Petroindependencia, a Petróleos de Venezuela S.A. (PDVSA) joint venture, operates in the Orinoco oil belt, where the target reservoirs are located in the Morichal member of the Oficina formation, which can be characterized as a shallow, unconsolidated formation. To meet production targets with this unconventional extra-heavy oil asset, Petroindependencia had to drill many extended-reach drilling (ERD) wells from the same pad. The wells are very close, requiring precise directional control to avoid well collision or lost production from drilling out of zone.

Sperry Drilling utilized the 7600 Geo-Pilot® Dirigo™ rotary steerable system (RSS) and an 8½-inch polycrystalline diamond compact (PDC) bit to drill 4,602 feet (1,403 meters) inside the reservoir, maximizing asset value for PDVSA by placing the lateral 100 percent in the target zone and reducing drilling time by nearly three days.



OVERCOMING DRILLING AND STEERING CHALLENGES IN SOFT FORMATIONS

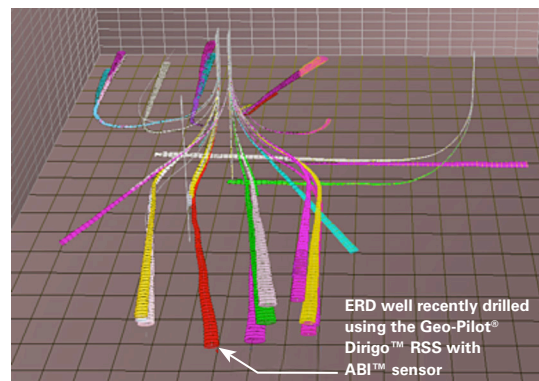
Petroindependencia challenged Sperry Drilling to reduce well time, reduce the number of trips, and mitigate hole cleaning problems while drilling an ambitious ERD horizontal well in a shallow, unconsolidated formation. In previous wells that were drilled with conventional mud motors, the formation softness led to difficult well steering because of the poor weight-on-bit transfer when sliding and led to poor hole cleaning because of the requirement to maintain low mud flow circulation to avoid hole enlargement. These difficulties led to drilling inefficiencies and nonproductive time (NPT) for pipe swaps to achieve enough weight-on-bit transfer for sliding. In addition, with multiple ERD wells drilled from the same pad, Petroindependencia needed to ensure accurate well trajectory to avoid well collision and invasion of other drainage areas. Sperry Drilling needed to deliver an RSS bottomhole assembly (BHA) solution that was capable of reacting and correcting for azimuthal and inclination changes that frequently occurred (high walking and dropping tendencies) in this area.

GEO-PILOT DIRIGO RSS WITH ABI™ SENSOR PROVES OPTIMAL FOR SOFT FORMATIONS

Sperry Drilling collaborated with Petroindependencia to listen, understand, and analyze the challenges, and then engineered a drilling solution that would help the operator reduce well time and lower operations costs. We advised PDVSA to drill with the 8½-inch production section by using the Geo-Pilot Dirigo RSS with measurement-while-drilling/logging-while-drilling (M/LWD) sensors, an at-bit inclination (ABI™) sensor, and an 8½-inch PDC bit. The Geo-Pilot Dirigo RSS provided consistent doglegs with quick reaction, which were required to drill the production section in such a shallow, soft formation. The RSS also delivered high wellbore quality and rate of penetration (ROP) by reducing torque and drag, thus facilitating faster and smoother tripping, and a more efficient liner run. The ABI sensor provided inclination measurements 3.2 feet (0.97 meters) away from the bit, sending critical real-time data to the surface and enabling precise wellbore placement. To ensure correct pressure drop across the drillstring while minimizing the risk of hole enlargement due to bit impact force, Sperry Drilling installed an internal flow restrictor at the bit. Throughout the operation, Sperry Drilling controlled the Geo-Pilot Dirigo RSS from the surface by using the JetPulse™ telemetry service for transmitting large amounts of data to enable quick corrections to inclination and azimuth as needed.

GEO-PILOT DIRIGO RSS SOLUTION DRILLS LONGEST LATERAL IN FIELD, SAVING THREE DAYS OF RIG TIME

In fewer than six days and in a single run, Petroindependencia drilled 4,602 feet (1,403 meters) in this ERD well with a measured depth to true vertical depth (MD:TVD) ratio of 3.28:1, resulting in the longest lateral in this field upon completion. In addition, the well was drilled 100 percent in the target zone even with multiple offset wells in proximity. The matched BHA enabled the joint venture to reach an average ROP of 600 feet/hour (183 meters/hour) and to eliminate extra trips, reducing well time by over 51 percent or by three days. Not only did this RSS BHA solution perform better than a conventional motor BHA, but it also placed the well better than another service provider's RSS BHA that resulted in the well being 200 feet (61 meters) away in azimuth from the target. With the success of this drilling campaign, Petroindependencia now plans to use the Geo-Pilot Dirigo RSS solution as the preferred choice for other ERD wells in the area.



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In this field with multiple wells, the Geo-Pilot® Dirigo™ RSS, matched with the ABI™ sensor proved to be an optimal solution over conventional motors and another RSS solution. The operator placed the ERD well 100 percent in the target zone and reduced well time by three days.

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