Remote Operations Center Facilitates Nimble Geosteering to Narrow Target in Heavy Oil Sands
Location: Rubiales Field, Colombia

OPERATOR’S CHALLENGE – To reduce costs by improving drilling time, an operator drilling through complex shale and sand formations in a remote Colombian field, where the oil-water contact can reach to within 10 feet (3 meters) true vertical depth (TVD) below the top of sand, required accurate real-time information to navigate to the target zone.

HALLIBURTON’S SOLUTION – Sperry Drilling services established a Remote Operations Center (ROC) and provided all directional drilling and measurement-while-drilling (MWD) tools and personnel, coordinating operations between the ROC and in the field.

ECONOMIC VALUE CREATED – Compared with an offset well on the same cluster, ROC intervention produced an excellent result in navigating this well, helping to achieve the target in about 30 percent less time while providing good exposure to the pay zone.

CHANGING LITHOLOGY PRESENTS CHALLENGE TO NAVIGATION – A remote location that requires 15 hours to reach by land is not the only challenge of Colombia’s Rubiales Field. The heavy oil sand requires horizontal wells be drilled through a sequence of sand-clay and shale to the target sand where the oil-water contact sometimes approaches 10 feet (3 meters) TVD below the top of sand, creating a very narrow target zone.

Although the lithology is well-known, precise geosteering is necessary to successfully drill the plan and land the well. Within this well cluster, the proposed well plan typically called for a series of build and hold sections with doglegs as high as 4.3 degrees per 100 feet (30.5 meters) before a final build to horizontal in the target Basales sand at 2.2 degrees per 100 feet (30.5 meters).

With such a narrow target zone, the need for accurate data processed as quickly as possible is critical to successfully navigating these wellbores to target depth (TD). Typical drilling time to TD on such a well was 3.5 days when Sperry established a ROC to deliver directional drilling and MWD systems and real-time information.

ROC YIELDS BENEFITS OF REAL-TIME DATA – With communication established between rig site and ROC, Sperry developed a plot of pressure, flow rate, rate of penetration (ROP) and toolface, monitoring the data in real time to allow quick reaction in case of any sudden change downhole.

The downhole pressure-while-drilling (PWD) data proved to be accurate and reliable in providing early warning of drilling problems, particularly valuable in this basin for monitoring ECD and hole cleaning to prevent stuck pipe and lost circulation. Increases in pressure, for example, can indicate a packed hole, while changes in ROP may reflect a change in lithology.
Data acquired through downhole MWD and surface sensors are managed with Halliburton’s InSite® rigsite information system. The InSite system communicates with a remote-site system server, creating a duplicate database that can be used for remote-site analysis of factors such as BHA design, drilling parameters, bit types, formation lithology and well azimuthal orientation. Although the drilling parameters in this well were kept relatively constant, weight on bit and rotary speed were adjusted periodically according to information received from the ROC, enhancing drilling performance and saving time.

**SPERRY DELIVERS OPTIMIZED DRILLING PERFORMANCE, PRECISE WELLBORE PLACEMENT**

- In this heavy oil well, while drilling the 8-1/2-inch section, survey interference at 418 feet (127 meters) measured depth showed a high value, suggesting close proximity to offset wells.

At the ROC, directional drilling personnel ran an anti-collision analysis using Landmark’s COMPASS™ directional well planning software. COMPASS software receives survey data from the InSite system via WITSML (wellsite information transfer standard markup language), which eliminates the potential for error from manual data input that could give erroneous indications of well position.

In this well, the analysis identified the nearest point between the wells and determined the operator could drill the remaining trajectory without issue. It was not necessary stop every 15 feet (4.5 meters) to take a check survey or to call the coordinator maintaining the stand-by operation.

In addition, Sperry ran WHIRL™ vibration avoidance software simulations to determine optimum rotary speeds throughout the well. WHIRL modeling is performed on the proposed BHA and then transferred to the rig for monitoring in real time. WHIRL simulation results are also stored in the InSite database, and the model is constantly updated to reflect changes in drilling parameters. In this case, WHIRL modeling data enabled the driller to keep the drillstring rotating at optimum rotary speeds so that the borehole sustained no damage from vibration.

As a result of this coordinated real-time effort, drilling time on the well was reduced by 30 percent compared to offsets. A recent well on the same cluster had been drilled in 3.5 days, while drilling time in this case was just 2.5 days.

Intervention through the ROC enabled the operator to achieve good exposure to the pay zone area while saving approximately one day in drilling time.