

Operator Optimizes Oil Recovery, Drills to Produce in Cyclic Steam Application

ACCURATE GEOSTEERING HELPS TO PRECISELY POSITION WELLBORE

HEAVY OIL FIELD, CANADA

CHALLENGE

- » Geosteer a horizontal well in a heavy oil reservoir, 2m (6.6 ft.) above a low shale boundary

SOLUTION

Engineered drilling solution, including:

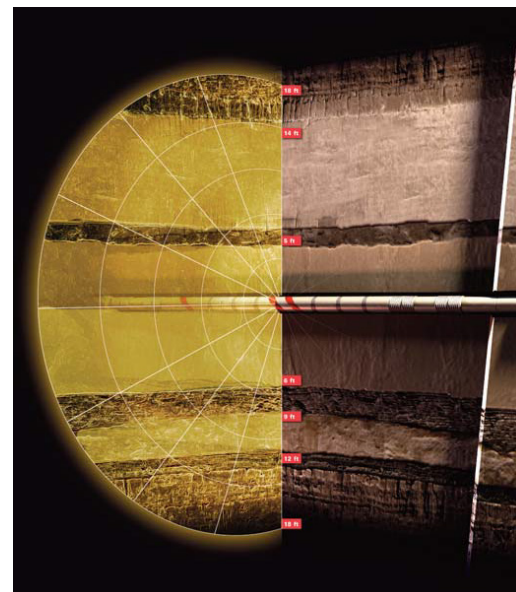
- » InSite ADR™ azimuthal deep resistivity sensor
- » StrataSteer® 3D geosteering service
- » Mercury™ electromagnetic telemetry system
- » Interpolated in-field referencing geomagnetic field measurement service

RESULT

- » Reservoir capture was maximized as the smoother wellbore was kept well within the goal of 2 meters (6.6 feet) of the bed boundary with no reservoir exits, allowing more reservoir to be produced

OVERVIEW

In a heavy oil reservoir, an operator needed to geosteer a horizontal well for precise wellbore placement, 2m (6.6 ft.) above a lower shale boundary. Halliburton Sperry Drilling collaborated with the operator and delivered an engineered drilling solution utilizing InSite ADR™ azimuthal deep resistivity sensor, StrataSteer® 3D geosteering service, Mercury™ electromagnetic telemetry system and IIFR interpolated in field referencing (IIFR) geomagnetic field measurement service. Sperry Drilling helped maximize reservoir capture by constructing a smoother wellbore well within the goal of 2m (6.6 ft) of the bed boundary with no reservoir exits, which in turn will allow more reservoir to be produced.



WELLBORE PLACEMENT IS KEY FOR CYCLIC STEAM APPLICATION

The operator of a heavy oil field in Canada, using cyclic steam injection as a method of thermal oil recovery, required a horizontal wellbore to be placed in the reservoir sands and remain 2 meters (6.6 feet) above the lower shale boundary. Cyclic steam injection is used extensively in heavy oil reservoirs and tar sands—steam saturates the oil sands formation, softening and diluting the bitumen so it can flow to the producing wellbore during the production phase. In a cyclic steam application, the objective is to place the wellbore as close as possible to the reservoir base.

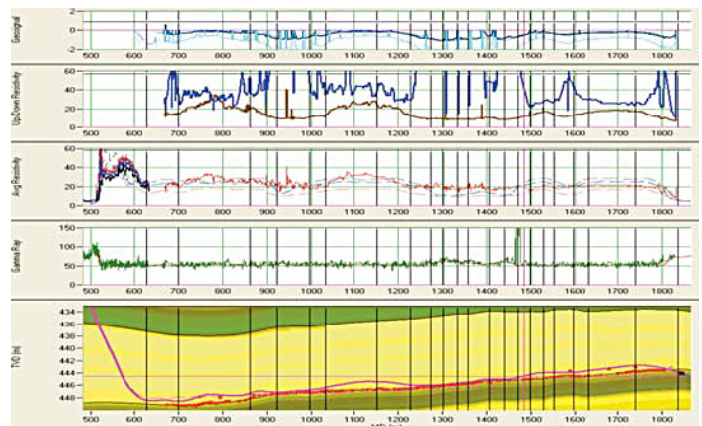
The well was planned to land horizontally at a true vertical depth (TVD) of 444 meters (1,457 feet) and stay in the sand laterally for 1,200 meters (3,937 feet). Precise wellbore placement of this extended reach well was important to help maximize reservoir exposure for enhanced oil recovery.

ENGINEERED DRILLING SOLUTION HELPS MAXIMIZE ASSET VALUE

The InSite ADR sensor provides deep reading (up to 18 feet into the formation) directional and high-resolution images that give early warning of approaching bed boundaries before the target zone is exited. As bed dip changes along the course of a long horizontal section, the well trajectory can be corrected to run parallel with bed boundaries at a fixed distance.

The StrataSteer service integrates digital 3D geological earth models, directional well plans, petrophysical models and real-time LWD sensor data into a dynamic, interactive and intuitive geosteering application. Wellbore positioning services from Sperry Drilling are, crucial to placing a well, especially in smaller targets that often require complex well paths and more accurate wellbore positioning.

The Mercury EM M/LWD telemetry system allows high speed data transmission without a continuous fluid column, providing an alternative to negative and positive pulse systems. The EMT system establishes a two-way communication link between the surface and the tool downhole. Using low frequency electromagnetic wave propagation, the EMT system facilitates high-speed data transmission to and from the surface through the formation. Higher data rates equal higher data density for real-time geosteering decisions.



The IIFR service provides 24-hour support and quality control analysis. Every survey is corrected immediately in real time for any magnetic interference seen by the survey tool while drilling. Magnetic interference can come from the drill string, geological formations or from the Earth's magnetic field. Correcting for this interference increases steering efficiency, reduces the ellipse of uncertainty and greatly improves accuracy of the overall wellbore location.

Drilling commenced from the shoe at 647 meters (2,123 feet) measured depth (MD)/448 meters (1,470 feet) TVD. This was the first use of an InSite ADR sensor in a cyclic steam application and it worked very well calculating the distance to bed boundary and mapping the lower boundary for the entire length of the wellbore. Throughout the well, the distance to bed boundary estimated the lateral to be between 0.15 cm (.06 inch) and 1 meter (3.3 feet) above the boundary. Total depth was reached at 1,844 meters (6,050 feet) MD/444 meters (1,457 feet) TVD.

Sperry Drilling delivered accurate formation evaluation and precise wellbore placement in the heavy oil reservoir. The InSite ADR sensor was a valuable tool, allowing the well to be drilled closer to the bottom boundary than had been possible with other resistivity sensors. Reservoir capture was maximized as the smoother wellbore was kept well within the goal of 2 meters (6.6 feet) of the bed boundary with no reservoir exits, which in turn will allow more reservoir to be produced.

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