Petrobras Accurately Lands Multiple-Target Wells Without Pilot Holes Offshore Brazil

Reservoir mapping-while-drilling service investigates 100 ft from wellbore in real time to detect reservoir boundaries

**CHALLENGE**
Land three multiple-target wells in thin-sand environment without exact knowledge of reservoir depths or drilling pilot holes.

**SOLUTION**
Map reservoir sand layers with unparalleled depth of investigation offered by GeoSphere* reservoir mapping-while-drilling service to guide drilling trajectory for precise landings.

**RESULTS**
Accurately landed three wells, each with multiple targets in channel sands, leading to optimized drain trajectories.

**Land multiple-target wells with limited reservoir depth data**
Petrobras wanted to land three wells offshore Brazil in multiple sand bodies of unknown depths without the use of pilot holes. To meet its objectives, the selected technology would need to be capable of remotely detecting reservoir markers, mapping contrasting layers to identify the "sweet zone," and optimizing the trajectory of the horizontal section using real-time information. The three planned wells would drill through one or two thin reservoir sand bodies before landing in one of the main reservoirs below. The TVD of each of the sand bodies was not clearly defined, as reservoir data was limited to seismic data gathered at the surface.

**Map reservoirs, land wells in real time with reservoir mapping-while-drilling service**
The operator selected the GeoSphere reservoir mapping-while-drilling service, which extends the radial depth of investigation to more than 100 ft [30 m]. Using deep directional resistivity measurements, the service accurately maps reservoirs, strategically navigates through them, and lands wells optimally.

**Landed three wells, altered trajectories of two wells with increased reservoir data**
Petrobras successfully landed all three multiple-target wells using the increased depth of investigation offered by the GeoSphere service. In Well 1, the section was landed within the second sand body while mapping the top of the third reservoir sand 13-ft [4-m] TVD below the sensor measure point. The real-time results also provided a mapping of all three sand channels and the intermediate shale thicknesses.

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*GeoSphere is a trademark of Schlumberger.
In addition to determining the structural dip and the depth distribution of these layers, the base of the reservoir was also detected 10-ft [3-m] TVD higher than expected, prompting a crucial model and trajectory update for the planning of the horizontal injector.

In Well 2, during the real-time landing, Reservoir A was not detected and Reservoir B was detected 75-ft [23-m] TVD below the sensor measure point with the bit 328-ft [100-m] MD from the Reservoir B intersection. The thickness of Reservoir B could also be estimated when closer. With the drillstring still in Reservoir B, the top of Reservoir C could be detected 66-ft [20-m] TVD below. The base of Reservoir C could be seen more than 105-ft [32-m] TVD away from the well trajectory.

In Well 3, the inversion from the GeoSphere service indicated that the top of Reservoir A was detected 52-ft [16-m] TVD deeper than expected, 26-ft [8-m] TVD below the sensor measure point. Reservoir A was also much thinner than expected—less than 7 ft [2 m] thick. Reservoir B was absent and upon penetration of the main Reservoir C, the formation structure below could also be mapped to show the base of Reservoir C at 105-ft [35-m] TVD below. The trajectory inclination was further adjusted to land in the higher resistive part of this structure.