**Challenge**
Account for uncertainty in formation dip and other challenges in placing a highly deviated well in the target zones of a reservoir.

**Solution**

- Evaluate formation dip uncertainty using adnVISION* azimuthal density neutron service and the ImPulse* integrated MWD platform.
- Determine optimal well placement using Petrel* E&P software platform and eXpand*BG near-wellbore to reservoir-scale modeling software.
- Maintain directional control using a PowerDrive* rotary steerable system.

**Results**

- Correlated existing seismic data with real-time formation dip while drilling for accurate geosteering.
- Optimally placed the deviated well in the target zones without failures or sidetracks.
- Avoided the water-saturated zone while drilling.

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**Access oil from lower-permeability zones**

An operator drilling in the Dutch sector of the North Sea wanted to access oil from additional lower-permeability zones to increase production. The reservoir is divided into four zones—A, B, C, and D—consisting of Lower Cretaceous prograding shoreface deposits. With most of the oil production coming from the highly permeable A zone, the operator planned to drill a horizontal well to reach the lower-permeability B and C zones, with the option to fracture stimulate.

Reservoir challenges included seismic uncertainty of ±5-m TVD, mud losses, unexpected faults, and formation dip uncertainty. Also, if the well was drilled outside the target production zones, there was potential for water production and poor stimulation results due to deviations in trajectory.

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**Case Study**

**While-Drilling Formation Evaluation and Interpretation Guides Geosteering to Target Zones, North Sea**

Informed geosteering resolves uncertainty to optimize well placement, enabling multiple well targets to be reached.

Real-time formation evaluation and structural interpretation enabled the operator to successfully geosteer in relation to formation dip to reach additional zones for increased oil production.
Deploy a custom-engineered solution for accurate geosteering
Schlumberger petrotechnical and drilling experts collaborated with the operator to determine the optimal well placement, stimulation, and completion strategies based on the specific drilling challenges. The adnVISION azimuthal density neutron service was recommended for use in conjunction with the ImPulse integrated MWD platform to provide critical real-time data for formation evaluation while drilling the horizontal section for accurate well-to-well correlation. The PowerDrive RSS was also recommended to ensure directional control of the well path.

For more informed decision making while drilling, the petrotechnical experts created a workflow for real-time interpretation that integrated the Petrel E&P software platform and the eXpand® near-wellbore to reservoir-scale modeling software. The eXpand® software provides geological interpretation of borehole images and dip data to perform single-well and multwell interpretation, 3D structural modeling, and well placement services for improving drilling and reservoir development decisions.

Placed the well in multiple target zones for stimulation and completion
The real-time interpretation-guided geosteering enabled the operator to successfully land the deviated well in the target zones. A 372-m interval was placed below the top of the lower C zone in a section suitable for fracture stimulation, and 835 m of the trajectory was placed within the B and upper C zones. The last 200-m section was placed parallel to the formation with the bit 3-m TVD below the barrier between the A and B sand zones. This was achieved through accurate geological interpretation of the formation dip while drilling to resolve uncertainty in the seismic data.

This operation was the first remote well placement job for the operator. Expertise, teamwork, and the optimal combination of technologies and services enabled the operator to achieve its objectives without failures and without the need for sidetracking the well.

The real-time geosteering model was constructed using well-to-well correlation and density images.