GeoSphere Reservoir Mapping Service Used to Geosteer First 6-in Section in North Sea

Equinor uses reservoir mapping-while-drilling service to successfully place the wellbore in a thin target zone

**CHALLENGE**
- Drill the 6-in section through a complex and faulted thin-layer formation.
- Place the injection wellbore within a low resistivity contrast environment, avoiding the overpressured shaly formation above.

**SOLUTION**
- Use the GeoSphere* 475 reservoir mapping-while-drilling service to identify the reservoir and geosteer the wellbore within the target zone.

**RESULTS**
- Drilled 6-in section through a faulted interval without deviating from the pay zone.
- Mapped top and base of the target zone, enabling wellbore placement within a low resistivity contrast chalk environment.

**Drill in a complex geological area without exiting the pay zone**
The Gullfaks oil field on the Norwegian continental shelf in the North Sea is operated by Equinor and has been producing since 1986. The Gullfaks Field structure is highly impacted by faults, and the production drive mechanism for the main reservoirs is primarily water injection, which was the objective of the present well.

Optimizing future injection operations requires actively positioning the horizontal drain through various compartments without exiting the target interval of heterogeneous interbedded chalk and marl into overlying overpressured shale. The target interval’s lateral thickness variation of up to 33 ft [10 m], low resistivity contrast, and expected multiple faults, both seismic and subseismic, were identified as geosteering challenges. To better accommodate the completion strategy, drilling the reservoir section was divided into 8½-in and 6-in sections.

**Deploy new technology for precise mapping while-drilling service**
Equinor selected the GeoSphere 675 service to drill the 8½-in section and the GeoSphere 475 service for the 6-in section. GeoSphere services use deep, directional electromagnetic measurements to precisely map resistivity contrasts, which is valuable in complex geologic environments. This capability provided Equinor with a clear, real-time view of the reservoir for optimized landing without losing lateral exposure or creating sumps.

**Geosteered 6-in section through complex geology while maintaining pay zone exposure**
Equinor’s Gullfaks well was the first 6-in section in the North Sea drilled with the GeoSphere 475 service. In the previous section, GeoSphere 675 service clearly mapped the top and bottom of the target interval. Run data from the GeoSphere 675 and GeoSphere 475 mapping service were consistent. While the wellbore crossed several faults in both sections, the 6-in section encountered an unexpected fault with a throw of approximately 33-m [10-ft] TVD, placing the wellbore higher in the stratigraphic section. The GeoSphere 475 service provided valuable real-time information to make the necessary geosteering decisions—mainly for the 6-in section—to successfully maintain well placement within the target interval. The GeoSphere service helped expose more of the lateral section to the reservoir for increased injection potential while maintaining wellbore integrity.
CASE STUDY: GeoSphere service increases exposure to thin target zone, North Sea

The GeoSphere service inversion for 8½-in (left) and 6-in sections (right), as well as formation evaluation logs (top).
Real-time trajectory is in black, and planned trajectory is in red.

Predrill model (top) and updated model (bottom) after drilling the wellbore with the GeoSphere service.
The drilled trajectory is in black, and planned trajectory is in red.

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