

Case study: North Sea

World's first successful offshore deployment of an automated directional drilling service

Baker Hughes drilled two sections of an offshore development well for Equinor using an automated, closed-loop, directional drilling service.

The **i-Trak™ drilling automation system**, in a first-of-a-kind operation in the complex offshore environment, used distributed downhole and surface controllers to drill smooth 3D sections and land the well on target without human intervention, according to plan.

Baker Hughes drilled the 8 ½-in. pilot hole section and the 12 ¼-in. section of the well while maintaining an extremely low wellbore tortuosity. This was measured by the inclination and bending moment sensors of the **AutoTrak™ rotary steerable system** and **CoPilot™ real-time drilling optimization service**.

In the pilot section, the i-Trak service sent the first automated downlink at 2458 m (8,064 ft), then drilled the entire 432 m (1,417 ft) of the section with a total of nine downlinks in automated mode. The automated trajectory drilling application kept the well path close to plan over the entire 8 ½-in. section and completed the section 1.14 m (3.7 ft) below, and 1.4 m (4.6 ft) to the right of plan.

The well was sidetracked from the pilot hole off of a cement plug at 2410 m (7,907 ft). The i-Trak service then drilled all of the 466 m (1,529 ft) of the 12 ¼-in. hole section with a total of 19 downlinks sent automatically. This equates to one downlink every 24 m. The automated trajectory drilling application finished drilling the 12 ¼-in. hole section 2 m (6.5 ft) right of plan

and 9 cm (3.5 in.) below plan, showing exceptional TVD control for the section.

Continuously comparing actual downhole wellbore positioning data with the planned well path, the i-Trak automated trajectory drilling service automatically sent steering parameters to the downhole steering unit to make sure the well was drilled on the planned well path. Drilling the two sections—performed with zero HSE incidents or nonproductive time while drilling the sections in automated mode—proved to Equinor that its strategic goal of consistent drilling using automation is reachable.

Drilling forward

This step-change in the way directional wells are drilled is a result of close collaboration between Equinor's Research and Development, and Operations teams and the Baker Hughes Automation team.

It is an important first step toward automation of the whole drilling process and confirmed to Equinor the future value of true automation. The future of this technology will bring performance improvement, NPT reduction, reduced costs with remote operations, and enhanced crew resource management, enhanced wellbore quality and predictable performance.

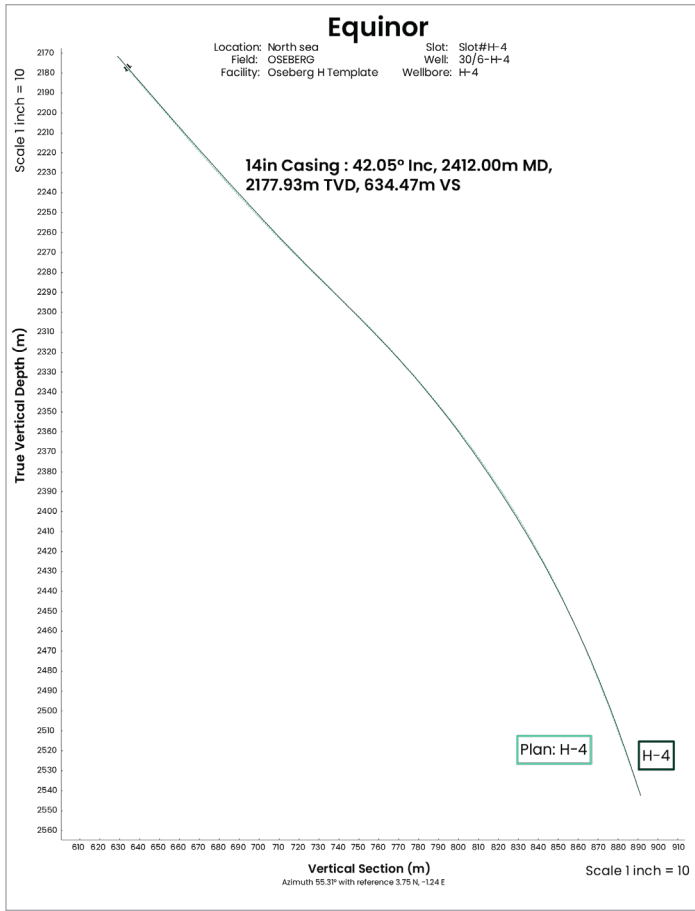
Baker Hughes is scaling up the deployment of this technology to all 10 rigs currently in operation for Equinor.

Challenges

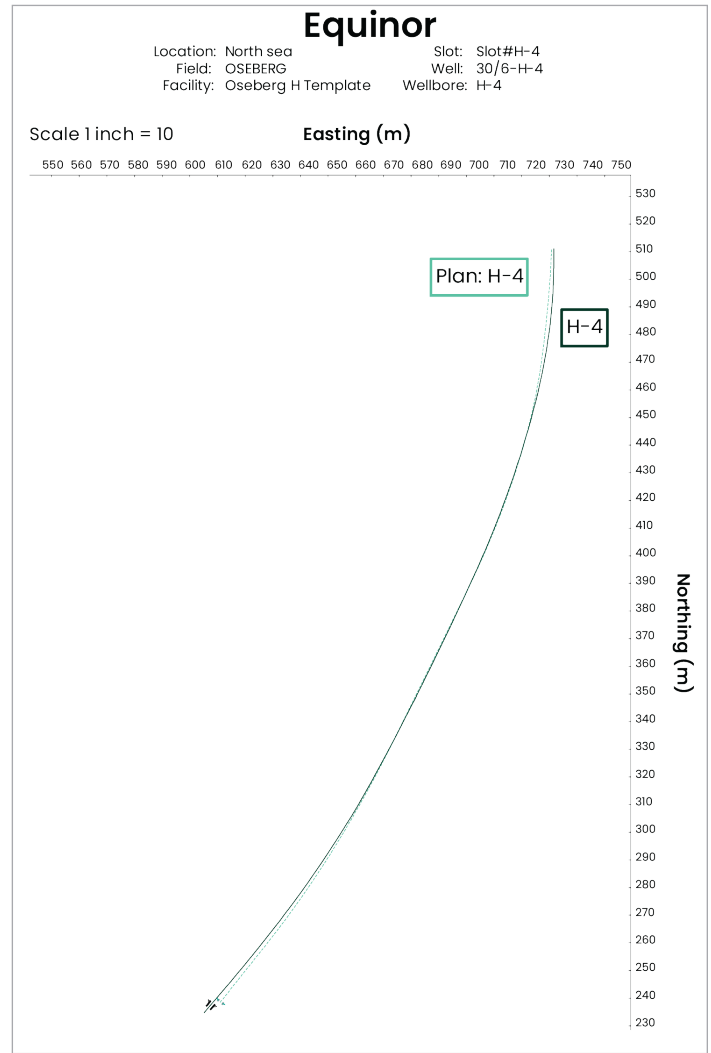
- Increase performance and consistency in drilling process
- Interbedded formations and partial stringers that cause unwanted deflection of well path
- Avoid excessive doglegs

Results

- Precisely drilled two sections with computerized steering
- Landed 8 ½-in. section within 1.15 m and 12 ¼-in. section within 2 m of planned well path
- Delivered smooth well paths with low dogleg severity



Vertical section view of 8 ½-in. pilot section shows the planned and actual path vertical section are virtually identical.



Horizontal view of 8 ½-in. pilot section shows the planned and actual path horizontal section are virtually identical.