Modular Whipstock Sidetracking System Saves 5 Rig Days on North Sea Slot Recovery Operation

Dynamic modeling and TrackMaster Select system result in setting largest tight-tolerance liner in 20-in casing

CHALLENGE

- Mill a clean, full-gauge 18½-in window in a mature North Sea well to create access for a new wellbore.
- Run a large 17-in liner through a casing exit with dogleg optimized for the completion string.

SOLUTION

Configure the TrackMaster Select* modular whipstock sidetracking system to efficiently mill a clean, full-gauge window using

- advanced modeling and simulation platform to optimize the mill design
- Runner* drillstring analysis program
- WhipSim* whipstock simulation software to model the milling operation and the window geometry of the milled window and to test the pass-through capability of the follow-up completion assemblies.

RESULTS

- Set a mechanically anchored whipstock in the existing casing and milled a full-gauge 18½-in window in the 20-in casing.
- Set a 17-in liner with 17.207-in maximum OD, the largest ever run through 20-in casing.
- Saved 5 rig days.

Sidetrack to create new wellbore and run oversized 17-in liner

A North Sea operator wanted to perform a slot recovery operation on a well in a mature oil and gas field. The well was drilled in 1974 and recently plugged and abandoned because of damage to the existing completion and casings. The operator contacted Schlumberger for a more efficient, less expensive approach to slot recovery.

The plan was to create access for a new wellbore by setting a whipstock in the original 20-in casing and milling a window through which a large 17-in liner could be run. The biggest challenges were high dogleg across the whipstock and delivery of the smooth window. Prejob analysis, modeling, and planning were keys to the success of the operation.

Provide prejob planning and modeling to minimize dogleg and enable a consistent well path

The TrackMaster Select system was chosen for the operation because it uses sophisticated dynamic modeling to engineer a wellbore departure design. The design, modeling, and simulation are supported by analytical software systems that complement the TrackMaster Select system.

During the planning phase, simulations indicated how each BHA would perform, and calculations showed the stresses of all components as they passed through the window. The WhipSim whipstock simulation software was used to model the milling operation and the window geometry of the milled window and to test the pass-through assemblies for the completed window. The milling string design and operating procedures were validated using an advanced mill design platform. The Runner program modeled shear setting operations, jar placement, DLS, and full well contact force profiles for the subsequent strings.

By calculating DLS for the casing exit, the WhipSim software helped ensure that completion strings were not affected by the dogleg across the whipstock.
CASE STUDY: Modeling and modular whipstock sidetracking system save 5 days in North Sea slot recovery operation

<table>
<thead>
<tr>
<th>Modeled Versus Actual Wellbore Trajectory</th>
<th>Depth, ft</th>
<th>Inclination</th>
<th>Azimuth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top of Milled Window</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WhipSim software model</td>
<td>1,444</td>
<td>7.6</td>
<td>201.3</td>
</tr>
<tr>
<td>Gyro measured</td>
<td>1,444</td>
<td>7.76</td>
<td>201.15</td>
</tr>
<tr>
<td>Bottom of Rathole</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WhipSim software model</td>
<td>1,485</td>
<td>9.8</td>
<td>194.4</td>
</tr>
<tr>
<td>Gyro measured</td>
<td>1,488</td>
<td>10.75</td>
<td>191.02</td>
</tr>
</tbody>
</table>

During the operation phase, the TrackMaster Select system was run in hole, and the anchor was set at the planned depth and orientation. Window milling was completed based on parameter recommendations from the prejob modeling, leaving a 15-ft rathole to accommodate the drilling BHA. After a trip to change the BHA, the sidetracked well was drilled to section TD.

The 17-in liner shoe track was made up and run in hole while monitoring drag. The shoe track passed over the whipstock and through the window within the Runner program’s predicted drag. Subsequent gyro survey data confirmed the accuracy of the DLS predicted by Runner program modeling.

Run a large 17-in liner through 20-in casing, setting a world record

Prejob planning and the use of advanced analytical software systems for dynamic modeling and simulation delivered operational efficiencies that enabled milling a usable window. Isolating the damaged 20-in pipe saved 5 days of rig time. Running the large 17-in liner set a world record. As a result of the success of the operation, the operator plans to use the TrackMaster Select system with dynamic modeling on all future workovers where new intermediate barrier casing and liner string are required.

The TrackMaster Select system’s bimill configuration and expandable anchor provided the flexibility to mill a clean, full-gauge 181/2-in window in the 20-in casing, which allowed running the large 17-in liner.