Case study: Norway

PRIME Technology Platform delivers critical metal milling solution in North Sea well

A customer had a new, large bore subsea well which was not producing as expected. As a result, a plug and re-perf intervention was planned. During deployment, the plug string hung up at approx. 4400m measured depth in the deviated section of the well. Correlation and marks on the retrieved toolstring indicated the plug was running into the closed flapper of the completion's full-bore isolation valve. Several attempts to mechanically shift open the flapper proved unsuccessful. A camera was also run to further diagnose the situation.

It was concluded that the valve was mechanically stuck with the flapper in a partially closed position, requiring flapper milling to re-gain access to the wellbore. Due to space and access limitations on the Modular Drilling Unit topside, the use of coiled tubing was not an option. The customer requested an e-line deployed solution be devised – to mill through the flapper and ensure unhindered access for the planned e-line intervention. Dimensions were considerable, with the 9.385 in. valve incorporating a 0.735 in. thick 13-chrome steel curved flapper, and an access hole requirement of 5.645 in.

Solution

A solution was devised, using our new **PRIME Technology Platform**. This technology offered the capability, performance, and control via e-line deployment that was required of such a demanding milling operation. There was a high level of instrumentation and integrated tractor/rotation device control available in real-time. the **PowerTrac PRIME Tractor** would provide dynamic, in-well optimization of its tractor speed, force and anchor function, in unison with the **PRIME Direct Drive Rotation** (DDR) rotational torque component, optimizing both the conveyance to task depth, and the milling task itself. Coupled with this was a bespoke bit designed to pulverize the flapper into fine granules, leaving no flapper remnants that could inadvertently cause access issues or worse tool sticking during the subsequent intervention runs. The **Pulverizer Bit** and milling toolstring were designed and repeatedly tested over several months, independently and as a full system string, with many adjustments, modifications and iterations resulting in a proven solution.

Challenges

- A large bore subsea well was not producing as expected
- A malfunctioned flapper valve was mechanically stuck
- Space and access were limited on the modular drilling unit. The use of coiled tubing was not an option

Results

- High precision milling removal of malfunctioned flapper isolation valve re-established well access, enabling subsequent intervention operation
- Highly effective, precise and controlled e-line milling operation
- Bespoke bit technology milled 5.645 in. access hole, with no debris remnant

Results

The operation was planned meticulously and executed leveraging the breadth of instrumentation and real-time data available throughout, enabling replication of the shop tests. This enhanced the visibility and handling of milling parameters allowing fine-tuned, seamless adjustments to be made during the operation, and a high understanding of milling progress. The **PRIME Technology Platform** also allowed continual rotation to occur, even when switching the tractor from driven to free rolling mode – this enabling effective back reaming to be done hence minimizing the chance of jamming. The **PrecisionStroker** tool was also added to the e-line toolstring as a contingency, enabling overpull above that available from safe e-line pull if/as required. The milling operation was completed successfully, and subsequent plug deployment and several perforation runs undertaken without issues when running through the milled flapper in both directions. This light, precise and highly effective solution solved the problem with unprecedented precision and control, minimizing risk and enabling well performance without the need of a costly sidetrack operation.

PRIME real-time surface read out data available during the operation