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Autonomous Milling of Isolation Valve Doubles Production and Eliminates Drillship Requirement

Tandem tractors deploy and power wireline milling tool from light well intervention vessel

An operator used tandem TuffTRAC* cased hole services tractors to power the ReSOLVE* instrumented wireline intervention service's milling tool to mill a stuck valve from a light well intervention vessel, offshore Angola.

Identify cause of choked well

Once the completion was installed in a well at a water depth of 1,226 m offshore Angola, high skin was observed, indicating a possible choke in the well.

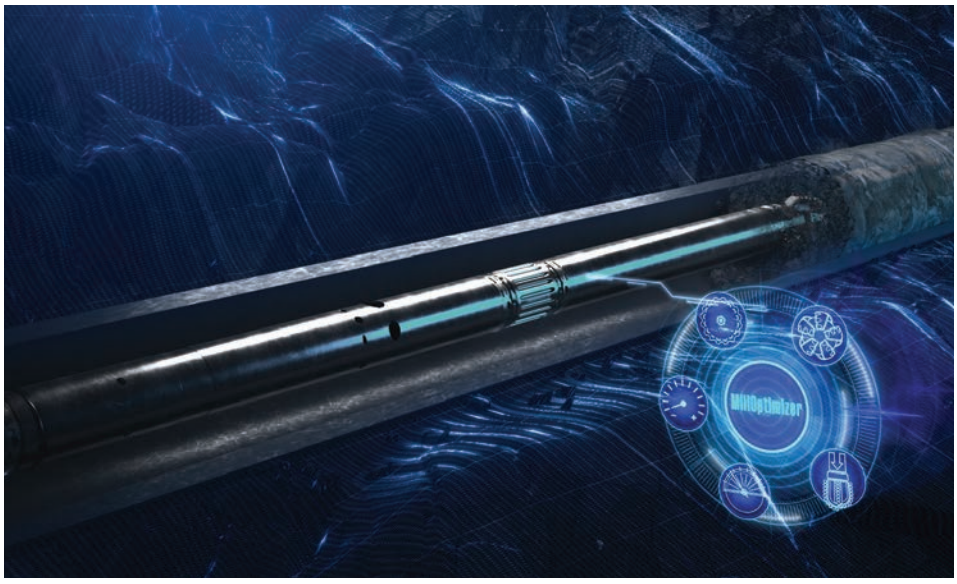
Enable cost-efficient solution to avoid drillship requirement

The operator tried cycling the isolation valve, only to discover that the ball valve was only partially open. This caused a significant reduction in the flow rate from the reservoir to the well. The operator turned to Schlumberger for a cost-efficient, wireline intervention solution to avoid bringing in a drillship for working over the well.

Convey tandem tractors with instrumented wireline intervention service

An initial run with PS Platform* production services platform conveyed by the TuffTRAC tractor confirmed access to the valve and proved that the ball was mostly closed because the caliper could not pass the valve. Schlumberger proposed pairing the intelligent ReSOLVE instrumented wireline intervention service with the TuffTRAC tractor for conveyance and to power the milling tool. The milling intervention was conducted as part of a multiwell campaign from the light well intervention vessel. To prove that the dynamically controlled and monitored intervention tools could address all contingencies with the valve, Schlumberger first conducted a system integration test (SIT) at the Schlumberger base in Luanda.

The first challenge of the SIT was to simulate locking the valve. In normal operations, the valve is either open or closed. To lock the valve for the SIT, an open-only shifting tool was run below the ReSOLVE service anchor-linear actuator tool and conveyed through the surface test setup using the TuffTRAC tractor. After the actuator anchored the tubing, the valve was shifted until it was about 75% closed. The valve body was then modified to lock it in place by drilling four holes offset at 90° to one another radially around the outer housing. As the drill penetrated the outer valve housing, it continued through the internal sleeve of the valve, which is connected between the shifting profile and yoke to the ball. The holes were then tapped, and threaded rod was used to secure the inner sleeve to the outer valve housing. With the valve now locked partially open, only the ReSOLVE service shifting tool was released from the shifting profile by retracting the linear actuator module. It was visually confirmed that the ball remained locked open after the shifting tool was removed.



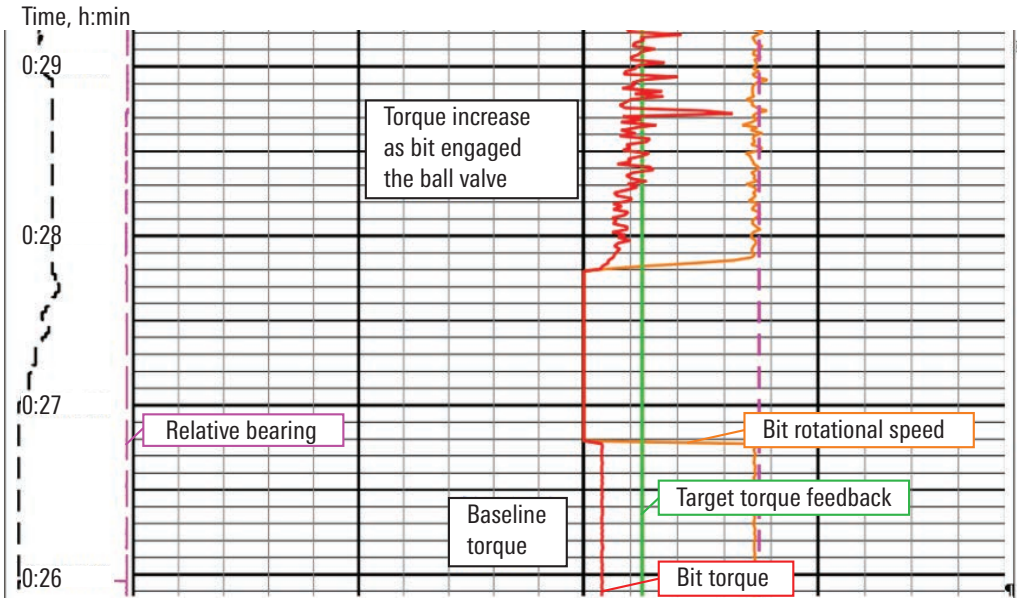
With the autonomous, coordinated control of the MillOptimizer autonomous milling system, the TuffTRAC tractor and milling tool operate as a single intelligent system to maximize milling efficiency.*

Next, the ReSOLVE service milling tool was configured with a 3.938-in qualified milling bit and conveyed by tandem TuffTRAC tractors to engage the ball valve. The TuffTRAC tractor seamlessly integrates with ReSOLVE service to autonomously drive the milling tool forward and resist rotation while the tool's rotating bit engages the obstruction. Unlike for conventional uninstrumented milling tools, the engineer is fully informed of the tool's performance status through real-time monitoring while dynamically controlling the bit speed and WOB. After approximately 40 min of milling, the bit broke through the ball valve, confirmed by the torque output from the tools.

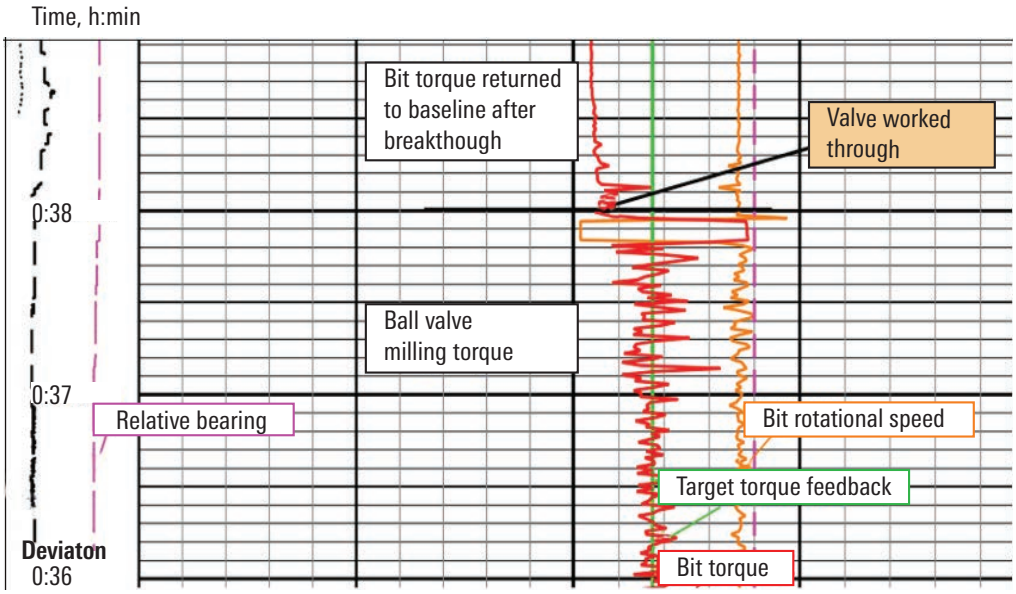
This successful demonstration of shifting, locking, and milling the partially open ball valve gave the operator confidence to mill the stuck valve in the deepwater well in Block 18.

Mill stuck valve, save costs, and increase production

Following completion of the intervention operation, the well was handed back to the operator and positive results were seen immediately: Postmilling production was doubled, with an increase of 5,500 bbl/d. This successful approach from a light well intervention vessel saved the operator millions of dollars in conducting a conventional workover and running of a new completion from a drillship.



The ReSOLVE service milling tool was autonomously powered by tandem TuffTRAC tractors to engage the ball valve with real-time monitoring and control to achieve a set torque.



After a total of 40 min of milling, breakthrough by the bit was confirmed on the torque output from the tools. The mill was continued at baseline torque an additional meter through the ball valve to ensure access to the lower reservoir zone.

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