**CASE STUDY**

**Shell Reduces NPT and Drills Best-in-Class Well in Central China with Remote Operations Workflows**

After stuck pipe and lost-in-hole incidents with low footage per BHA, multidisciplinary teams collaborated to improve operations in a shale oil play.

**CHALLENGE**

Achieve the desired dogleg severity (DLS) in an interbedded formation in which two previous wells faced wellbore stability issues and multiple lost-in-hole (LIH) incidents.

**SOLUTION**

Leverage technical expertise across Schlumberger disciplines through remote operations workflows to improve efficiencies and deploy the best-fit solution to overcome drilling challenges.

**RESULTS**

Eliminated NPT in two sections and reduced drilling time 52% to successfully drill a horizontal well that ranked among the best in class for the field.

**Drill horizontal well in interbedded formation**

During horizontal drilling operations in the Daanzhai Formation onshore China, Shell lost its first well to wellbore stability issues that resulted in an LIH incident. Its second well—sidetracked from the first—was also lost because of poor borehole stability experienced during the completion stage. The wells’ lateral sections in the interbedded formation were drilled to less than 500 m [1,640 ft] each before being terminated.

It was determined that the push-the-bit rotary steerable system (RSS) had failed to deliver the planned DLS of 3° in the first well because of breakout within the formation. Multiple stuck pipe events were recorded while drilling at a 15° azimuth and the borehole collapsed, despite the high mud weight (17 lbm/galUS) used to balance high formation pressure. Throughout the short-lived drilling phase using a push-the-bit RSS, the first well also experienced slow ROP.

**Identify inefficiencies to improve operational workflow**

Shell recognized that it would require a new approach when drilling its third horizontal well in the formation. Schlumberger suggested running point-the-bit PowerDrive Xceed* ruggedized RSS to help achieve the planned DLS in the breakout interval. Additionally, a different lateral orientation and casing seat design were proposed, discussed, and adopted. For this well, the lateral section azimuth was changed to 145° and the intermediate casing set deeper to isolate the troubled upper zone.

Working closely with Shell’s well engineering and subsurface teams and using drilling data from offset wells, the Schlumberger drilling engineering team implemented a prejob well engineering plan. Additional expertise in geomechanics was provided by Schlumberger personnel in the local engineering center. During the drilling execution phase, a remote operations workflow was used to connect Schlumberger personnel from across the organization to share knowledge in support of the ongoing operation.

- Experienced remote operations engineers monitor the drilling process closely while performing essential job-related tasks. The escalation of an upcoming or ongoing challenge is done in real time.
- Service delivery managers provide 24-h coverage for decision making and monitoring service quality.
- Customer engagement coordinators are dedicated to meeting customer needs at all times.
- Operational team members ensure that tools are fabricated at or shipped to the location before the job begins.

“Thorough prejob engineering planning and diligent engagement with our well engineering and subsurface teams by the Schlumberger team was a key starter of this best-in-class performance well. Your engineers and base support team executed a flawless job. The team demonstrated a strong work spirit, good communication, and exceptional adaptability in providing a fit-for-purpose BHA comprising an RSS and MWD and LWD tools, all on such short notice. Job well done.”

Lin Dong, Sichuan Well Engineer
Team Lead, Shell

Drilling
Eliminate NPT in two sections and reach desired footage

Closely integrated teams of Schlumberger drilling engineers and geomechanics experts collaborated with Shell experts to overcome the technical challenges preventing past success. Schlumberger was involved in the directional drilling of the most challenging 9½-in and 6½-in sections over a drilling cycle of 19.1 d, including a break for casing. The total footage drilled in these two sections was 1,854 m [6,083 ft] with zero NPT.

The subject well was drilled in 24.2 d with a total footage of 3,667 m [12,031 ft]. In contrast, the best offset well in the block took 50.8 d to drill and reached only 3,491 m [11,453 ft]. This 52% reduction in drilling time was coupled with a DLS of more than 3.5°, which surpassed the targeted DLS of 2.5°. Based on cost-per-meter, the well ranks in Shell’s top quartile and is considered best in class by the operator.

Compared with the best offset well in the block, the well incorporating remote operations workflows took 52% less time to drill and reached TD 176 m [577 ft] deeper.