CASE STUDY

Staged Hole Opener BHA Eliminates One Run and Reduces Planned AFE by 2 Days, Offshore Russia

In a single run, operator opens 610-m interval of a directional well profile from 8½ in to 12¼ in, offshore Russia

CHALLENGE
Enlarge borehole from 8½ in to 12¼ in while mitigating shock and vibration throughout a directional well profile with a dogleg severity (DLS) of 3°/30 m in an interbedded formation offshore Russia.

SOLUTION

- Customize staged hole opener (SHO) reamer BHA using the IDEAS* integrated dynamic design and analysis platform and Drilling Office* integrated drilling software.
- Establish a DrillMAP* drilling engineering and operations plan to be followed and monitored using PERFORM Toolkit* data optimization and analysis software.

RESULTS
Eliminated one trip in and out of the hole to save 2 days of rig time by following the DrillMAP plan for the SHO reamer BHA instead of conventional changeout of the BHA for two-stage enlargement of the hole.

Reduce shock and vibration in high-DLS well profile
An operator on the remote island of Sakhalin offshore Russia’s eastern coast targeted a formation comprising an interbedded lithology of sandstone and clay. Prior to performing hole opening operations, hole exposure lasted more than 24 days over the course of 10 coring and 4 drilling runs.

In seeking a solution that would open an 8½-in hole to 12¼ in, the operator required technology that could achieve this uncommon enlargement step increase. The section to be opened was from 2,041 m [6,696 ft] to 2,651 m [8,698 ft]. The well profile consisted of tangent zones in the cored section combined with directionally drilled zones—inclination decreased from 40° to 19° at 3°/30 m. The directional profile created zones of high bending stress, which can initiate shock and vibration, leading to fatigue-induced drillstring failure.

The BHA selected for the operation would need to mitigate shock and vibration, reduce differential sticking in the highly permeable reservoir section, maintain the desired ROP, and avoid twistoff. To achieve steady torque, low vibration, and a clean deviated wellbore, the operator aimed to maintain 100 to 130 rpm and a WOB of 5,423 to 8,135 N.m [4,000 to 6,000 lbf] at an ROP of 30 m/h [98 ft/h] with flow rates of 3,875 L/min [1,050 galUS/min].

Customize BHA and drilling plan to run with continuous monitoring
Schlumberger engineers used the IDEAS platform to model BHAs that would provide stability, reduce shock and vibration, and withstand bending stresses while enlarging a hole after drilling. In total, 24 BHA designs were modeled before finding one that met these criteria. Additional BHA modeling was performed using Drilling Office software to minimize collar contact with the borehole through optimal secondary stabilizer placement between drill collars. The BHA selected comprised an 8½-in × 12¼-in SHO and bullnose from Smith Bits, a Schlumberger company.

Of the 16 BHA designs modeled using the IDEAS platform, BHA 4.3 was selected as the best fit for the application based, in part, on bending moment performance with 4,000-lbf WOB at 120 rpm.
A DrillMAP plan provided an improved connection procedure to ensure that the SHO remained in the pocket, minimizing time and risk by eliminating reaming between connections. During drilling, the operation would be monitored 24/7 by a local Schlumberger drilling optimization group with access to PERFORM Toolkit software for risk identification, hole cleaning status, and torque and drag analysis.

Prior to the drilling and coring of the 8½-in section that was to be enlarged, the operator cleaned out the 13¾-in casing set at a 40° inclination with a nonspecific 12¼-in BHA to reduce the risk of sticking issues in the 13¾-in shoe track when using an undersized 8½-in BHA.

Eliminated one trip and saved 2 days with improved hole enlargement process

The operator deployed the customized SHO reamer BHA in a single run to open a 610-m [2,001-ft] interval from 8½ in to 12¼ in. By using one BHA comprising all of the necessary hole-opening components, the operator was able to reduce 2 days from the estimated AFE by eliminating one trip out of hole to change out the BHA to open the hole in two stages. The well reached TD successfully and the SHO had a postrun International Association of Drilling Contractors dull grading of 0-0-NO-A-XXX-IN-LT-TD.

The use of the SHO reamer BHA can be replicated on future wells in the field to achieve the operator’s drilling objectives. This operation demonstrated that core samples could be obtained in a directional 8½-in section and that a hole can be opened more safely to 12¼-in to meet well construction requirements.