IDEAS Optimized Bit Increases ROP 250% in China’s Tuha Basin

PowerV RSS and PDC save operator USD 93,000

CHALLENGE
Efficiently drill an 8½-in high-quality vertical borehole though difficult interbedded lithologies at an ROP greater than 2.4 m/h.

SOLUTION
Apply DBOS* drillbit optimization system and IDEAS*integrated drillbit design platform to engineer a PDC bit for the application and capable of running with the PowerV* vertical drilling system.

RESULT
The engineered BHA set a new Tuha field benchmark drilling the demanding J2x formation in a single run increased ROP by 250% and saved USD 93,000 in drilling costs.

Deviation control system and high ROP required
While trying to develop Tuha basin gas reserves in China’s Xinjiang Province, the China National Petroleum Corporation (CNPC) was experiencing deviation tendencies while drilling 8½-in vertical hole sections through the difficult J2x formation. The challenge in this area for operators is to maintain verticality from 2,400 m to 3,500 m while drilling through interbedded sandy claystone and coal layers that have a building tendency away from the planned well path. Operators are often forced to make several costly correction runs before starting the horizontal production hole in the reservoir. In an attempt to address the verticality issue and develop a cost-effective downhole tool system to maintain the desired wellbore trajectory, engineers experimented with a variety of BHAs:

- A pendulum BHA could not maintain verticality, especially in steeply dipping formations. Both bias-shaft and high weight on bit (WOB) methods were attempted. Neither produced effective deviation control low WOB and ROP.
- A steerable motor maintained verticality, but could not drill a perfectly straight hole because of high tortuosity when alternating between slide and rotary mode. Tool face orientation slowed average ROP to an unacceptable level. The steerable motor method also requires the added expense of an MWD tool.

Most recently, wells KE28 and KE33 required between five and six bit trips to complete an 8½-in hole section at the unacceptably low average ROP of 1.6 m/h and 2.4 m/h. To complete hole sections with the fewest bits possible, and thereby reduce field development costs, CNPC sought a BHA configuration and PDC bit that would enable them to maintain verticality while increasing ROP.

The 8½-in Mi616LMHBPX PDC with ONYX cutters increased ROP by 250%.
CASE STUDY: Optimized BHA configuration delivers steerability and record ROP in China’s Tuha basin

Comprehensive engineering analysis
To help CNPC meet their drilling performance goal, Schlumberger formed an engineering team composed of vertical drilling system and PDC bit design experts. The team used the DBOS drillbit optimization system to analyze rock strength and the IDEAS modeling system to analyze different PDC cutting structures to determine the blade count and shearing configuration that would produce the most dynamically stable drilling. Based on the team’s analysis and offset well data, an 8½-in Mi616LMHPX PDC bit was identified as the best candidate to accomplish the operator-driven ROP objectives.

PowerV vertical drilling system
To mitigate deviation tendencies, engineers selected the PowerV RSS vertical drilling system. The rotary steerable system (RSS) can be run with minimal rig-site supervision using the primary rig drive system or a positive displacement motor for rotation. The PowerV RSS automatically maintains well verticality and can be deployed during normal drilling operations including backreaming and shoe drillout. The PowerV RSS significantly reduces the need for costly correction runs.

Tool synergy saves operator 14 days of rig time
The 8½-in Mi616 PDC bit was run in combination with PowerV on KE282 with outstanding results. The drilling system drilled the entire 740 m hole section at 7.1 m/h through the difficult J2x formation in a single run setting a new field benchmark. The IDEAS optimized PDC drill bit increased ROP by 250% eliminating four trips for bit change out. The performance improvement saved CNPC more than 14 days of rig time and bit costs for a total savings of USD 93,000.