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Drilling BHAs Gain Speed, Precision

By Colter Cookson

A bottom-hole assembly is like an orchestra in that when its components work together, the results can be amazing.

Whether that result is a stunning performance of the hit musical "Hamilton" or a record-setting run in a formation full of tough stringers, it takes time to achieve quality. Just as musicians spend decades rehearsing several hours a day, the engineers who design BHA components continue to hone their craft to deliver stellar performances.

That drive for efficiency is reshaping mud motors and the rotary steerable systems those motors often support. According to their manufacturers, the latest motors and rotary steerables can drill longer, faster and more precisely than their predecessors, providing meaningful reductions in drilling costs and improvements in hole quality that are welcome now more than ever.

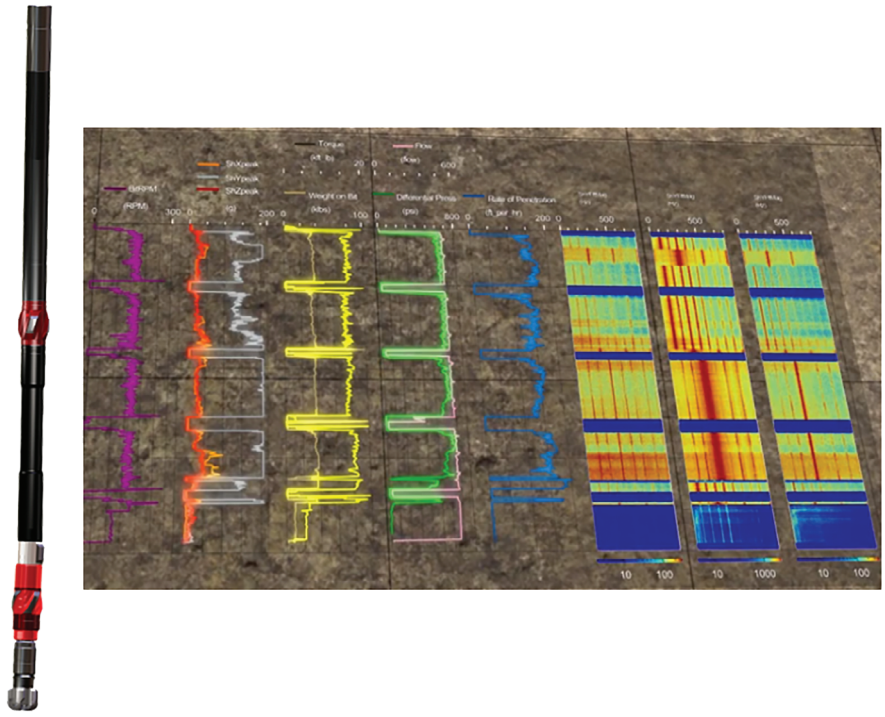
"These are unprecedented times," reflects Myles Woloshyn, president and chief executive officer of Turbo Drill Industries Inc. (TDI). "For the past four years, we have focused on ensuring we can survive at $35 oil and thrive at $45. Today, we are developing tools and techniques that can help the industry thrive at $35 and survive at $25."

Collaboration between operators and service companies is key to the industry's success, Woloshyn argues. "We need to work together to examine every step of the well delivery process and make it more efficient," he outlines. "That likely will mean standardizing well designs, hole sizes and BHA components to streamline supply chains."

Because standardization is crucial to efficiency, Turbo Drill has developed a customizable BHA with standardized components aimed at reducing drilling costs in shale plays, Woloshyn reports. TDI's customizable BHA consists of a next-generation drilling motor, any measurement-while-drilling system, a friction reduction tool and a stick-slip mitigation tool.

According to Woloshyn, every component is designed to be easy to manufacture and service. He adds that TDI makes every part in the United States, which simplifies quality control and ensures they will be available even when unusual events disrupt international manufacturing or shipping.

"To control costs, the only electronic component in the BHA is the MWD tool," Woloshyn says. "Mechanical systems can drill wells at a much lower cost. Our goal is to achieve 85%-90% of an electronic system's performance with half the daily cost and only 40% of the lost-



To reduce drilling costs, Turbo Drill Industries Inc. has developed a compound angle motor that has a lower bend-angle on the outside and an internal bend on the inside. While sliding, TDI says, the two angles combine, allowing the motor to achieve high build rates in the curve. It is embedded with sensors that gather shock, vibration, rpm and temperature data to help pinpoint drilling dysfunctions, TDI adds.

in-hole cost."

Compound Angle Motor

The customizable BHA can deliver such strong performance because it uses a compound angle motor, Woloshyn says. "This proprietary motor has a lower bend-angle on the outside and an internal bend on the inside," he describes. "While sliding, the two angles combine, allowing the motor to achieve high build rates in the curve."

If the wellbore deviates from the plan in the lateral, the motor's high dogleg capability while sliding allows for quick corrections, mentions Chad Feddema, TDI's chief technology officer. "Switching from a conventional motor to a compound angle motor dramatically reduces the sliding time," he states.

The motor's flexibility allows the driller to complete the curve and lateral in a single run, Woloshyn says. In addition to reducing trips, this simplifies the service company's supply chain. "For every motor, the industry historically has demanded a backup motor on location, plus another in the shop. Using one motor design to drill the curve and lateral, rather than two, frees up at least one motor to go elsewhere, helping the service company deliver quality products at a lower cost."

When the motor is rotating, it drills faster than high bend-angle designs, Feddema says. "With any bend-angle, the bit will deviate slightly and waste energy drilling an over-gauge hole. The lower the bend-angle, the more drilling efficiency increases," he explains.

The low bend-angle also reduces cyclic stress on the motor, allowing it to run at higher drill string revolutions, Feddema adds. "The compound angle motor can withstand 120 rpm in applications where high bend-angle motors would rapidly fatigue at 65 or 75 rpm," he says. "Coupled with a U-joint that transfers power more efficiently from the motor to the bit, this helps the express BHA deliver higher rates of penetration."

Every motor TDI deploys comes embedded with drilling dynamics sensors from Sanvean Technologies, one of TDI's business units, Woloshyn notes. He says this is possible because the sensors can be embedded in all TDI motors. Sensors also can be embedded in bits and other BHA components rather than utilizing carrier subs.

"The sensors gather shock and vibration data, which is critical for understanding cyclical fatigue, as well as rpm and temperature. We can use the sensor information to pinpoint drilling dysfunctions such as stick-slip and torsional oscillations to see how they are affecting the bit and BHA," Woloshyn says.

"After each run, we use proprietary software to download and analyze the drilling dynamic data so we can highlight areas of concern and help the operator improve performance on the next run," he says. "This process is efficient and rapid enough to analyze the data before the next section or well." ❐