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Latest Bit Designs Drill Faster, Farther

By Colter Cookson

Human beings are exploring deep space, eradicating diseases, designing pilotless planes and cars, and placing horizontal wells with multi-mile laterals on target. Psychologists say we do so much in part because we all share a desire to accomplish big things. For the humans in the oil and gas industry, that means celebrating even their greatest successes for only a few days, then getting to work on the next challenge.

Nowhere could that dynamic be more obvious than in the world of drill bits. Instead of resting after record-setting runs, bit engineers analyze their designs' performance to identify and address the barriers that keep them from drilling even faster and farther.

Their efforts are paying off. PDC makers say their latest designs deliver significant improvements in speed and durability by optimizing hydraulics, enhancing backup cutters, leveraging modern motors, and minimizing reactive torque. Meanwhile, the newest roller cone and hybrid bits employ advanced cutters and application-specific cutter configurations to set new standards for drilling efficiency and durability.

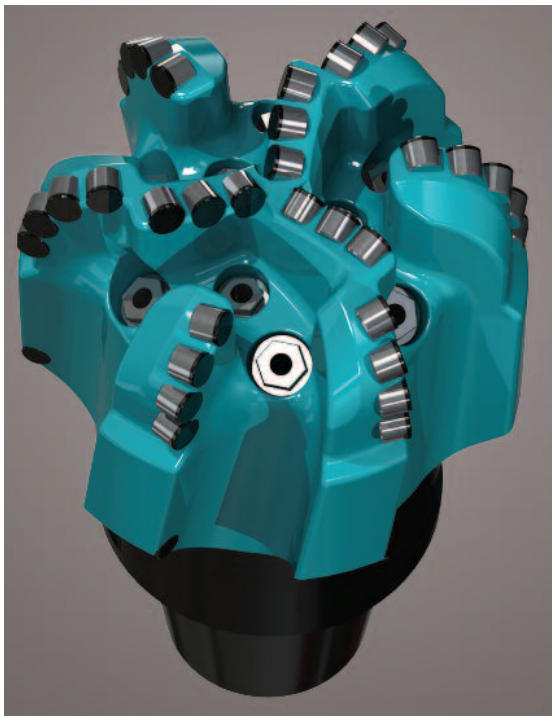
To drill faster, bits need to handle the additional cuttings generated by the extra speed, notes Chris Casad, innovation project manager at Ulterra. "As better PDC bits have unlocked faster penetration rates, it has become clear we need to take the next step in hydraulic performance," he says. "Improving cuttings evacuation not only enables faster rates of penetration, but also keeps the cutters clean and cool. This minimizes thermal degradation and cutter damage, enabling the bits to maintain their high performance longer."

According to Casad, Ulterra has advanced hydraulic performance through a new concept called SplitBlade™. The primary blades in SplitBlade bits are divided into two parts, with the inner part offset from the outer part near the shoulder. "The offset creates a recess to put a second nozzle for each blade," he explains. "Two nozzles create dedicated flow paths from the cone of the bit and from the shoulder outward. The focused flows energize the cuttings and ensure evacuation happens quickly and reliably.

"In addition, offsetting the blades gives bit designers the opportunity to try cutting structures that previously would have been impossible," he comments. "For example, because the offset increases the distance between the cutters, we often can double the diamond volume in areas that are seeing a lot of wear without encroaching on an adjacent cutter."

Casad adds that the offset gives the bit more points of contact with the formation, allowing it to distribute point loads more evenly and reduce torque fluctuations. He says the smoother torque improves tool face control, cutting the amount of time spent sliding in the curve and enabling the bit to stay on target once it is in the lateral.

He highlights one other benefit: Because they are so clean, SplitBlade bits



With two nozzles for each blade, the cutters on Ulterra's SplitBlade™ bits stay clean, cool and sharp. The company adds that the two-part blades have more points of contact with the formation, which improves tool face control by mitigating torque fluctuations.

do a great job of converting weight into energy. "Like a knife, a PDC bit works by applying force to a small area," Casad notes. "When cuttings are recirculating or building up on the tool face, they spread the weight across a wider area, making the cutters less effective."

By applying more weight to the bit, Casad says drillers can increase depth of cut to improve performance. "Fast rotation speeds and a low depth of cut cause the bit to turn and start eating into the well bore, creating bumps and undulations. A high weight and a lower rpm let the bit drill fast, clean and smooth, meaning the wellbore will be easier to complete and produce," he says.

The SplitBlade concept has been tested on more than 300 runs and has drilled more than 2 million feet across North America and in China, Australia and South America, Casad reports.

"The field testing started in the Eagle Ford, where operators were looking for ways to drill 15,000 feet through the curve and lateral sections without steerability issues in the curve or tracking issues in the lateral," he relates. "When we introduced SplitBlade, we were able to combine the sections more reliably while cutting drilling times by 30 percent. The bits came out with a dull grade of 1-1 to total depth and drilled smoothly through both sections."

While it is often used in curve and lateral bits, Casad says the enhanced hydraulics can be applied to large vertical bits as well. "This technology can translate across bit designs," he concludes. "It will have the biggest benefit in applications with fast ROPs, but it is applicable almost anywhere." ❐