

New Bit Innovations Offer Higher ROPs And Lengthy Run Times

By Colter Cookson

Drill bits have an impact that far exceeds their cost. A well-designed bit that is appropriate for the application can save thousands or even millions of dollars by reducing rig time, staying in the sweet spot, and delivering a high-quality wellbore.

Given bits' dramatic impact on well economics, it is no wonder bit designers continue to engineer new approaches to old problems. In the endless quest for faster penetration rates, longer runs and better steerability, manufacturers have introduced cutter configurations that counter vibration; bits that drill a small hole to relieve rock stress, then widen the hole to the desired diameter; and designs that turn conventional wisdom on its head by increasing ROPs with smaller cutters. Other bits leverage advanced manufacturing capabilities, application-specific designs, and ultratough seals to tackle hard, abrasive formations.



Large Diameter Directional

“In plays with challenging geological conditions, such as lost circulation, operators desire to start with larger diameter bits so they will have an adequately-sized borehole, even if they encounter a problem and need to set casing early,” observes Drillformance Chief Executive Officer Rusty Petree.

To make such wide bores more economic, Drillformance has developed an innovative bit.

“We designed the bit at the request of an operator who wanted to drill 9 $\frac{3}{4}$ -inch holes in the Eaglebine play,” he says. “It was taking two or three roller cone bits and five to six days to drill the curve at that diameter, so it was too expensive to do on every well. The operator asked us to design a PDC bit that would reduce time and costs.”

Within 30 days, the company produced a solution. “In the first run, the bit built the curve in 42 hours,” Petree recalls. “Today, it is building curves in fewer than 20 hours.”

Petree says the company’s bit worked where other PDC bits failed because it broke from tradition. “Previous designs were based on conventional wisdom, which says a bit needs to have small cutters and more diamond volume to become passive enough to build the curve. At a 9 $\frac{3}{4}$ -inch size, that logic does not apply because the BHA is so stiff.

“We took a completely different approach and made the bit laterally aggressive,” he says. “The operator still can put considerable weight on the bit because the center is passive, but the sides are so aggressive the bit naturally takes off in the direction the bit is pointed, which makes it easy to start the curve and get 10-plus degree build rates every hundred feet.”

The bit is providing operators significant value, Petree states. “The operator who asked us to develop it went from drilling 9 $\frac{3}{4}$ -inch holes only in wells that posed a lot of risk to drilling them as a standard,” he says. “Other operators are adopting this approach because there is a big advantage in being able to set an ex-

tra string of casing when that is dictated by geological conditions.”

Small Cutter, High Speed

In formations across the United States, including the Eagle Ford, Marcellus and Utica, Drillformance has achieved substantial success drilling curves and laterals with its DF516T. When an operator approached the company in search of an even higher ROP, the company achieved it with an unusual approach. It reduced the cutter size from 16 to 13 millimeters.

“We have enabled that operator to go from drilling curves and laterals at 80 feet/hour to drilling them at more than 150 feet/hour,” Petree reports. “The wells used to take 12-13 days, but now take only six or seven.”

According to Petree, the smaller cutters leave more room for improving bit hydraulics and blade configuration. “Because we used a smaller cutter, we were able to utilize a unique, aggressive cutter profile and still maintain tool face control and steerability,” he says.

“The design also improves durability,” adds Drillformance Application Engineer Zane Pettiet. “Like all bits, when the 513T encounters rock density changes, energy surges through it. However, because it takes less weight on bit to drill at the same ROP, the fluctuation in energy needed to maintain differential pressure is less. This allows for a more constant load to the cutting structure and improved dull condition.

The 513T also offers shorter slide times, Pettiet continues. In a study that compared three wells drilled with a 513T to four wells that were from the same pad but were drilled with a 16 millimeter PDC bit, average ROPs increased from 115-123 feet/hour to 143-145 feet/hour, and slide times fell significantly, providing higher quality well bores.

Pettiet points out that both the 9 $\frac{3}{4}$ bit and the 513T have a diameter to length ratio less than 0.6, compared with an industry standard greater than 1.2 “This is one of several reasons why Drillformance offers unmatched directional capabilities,” he says. □

