

Permian Producers Lean on Technology

The industry downturn has operators fine-tuning efficiencies to drive down costs.

By Blake Wright
Contributing Editor



Protracted weakness in commodities prices has done a number on the U.S. oil patch over the past 12 months. The precipitous drop in the price of a barrel of benchmark West Texas Intermediate crude oil, from \$84 to \$45 over that same period, prompted operators to apply downward pressure on service providers and their pricing to better align dollars going into the ground with those anticipated to come back out of the ground. In today's Permian Basin, the venerable, sprawling, resource-rich 250-mile-wide, 300-mile-long area of West Texas/Southern New Mexico, producers are exploring the region's multiple layers of unconventional reservoirs with horizontal wells—a method that has only really been ongoing in the region for the past half-decade or so. One of the challenges in the Permian lies within its multiple, nonhomogeneous productive zones. In a play like the Wolfcamp, one part of the trend is much thinner and may have significantly different properties than the same trend if you travel 50 miles south, for example. Having wrung pricing down to a level that has service companies calling the floor, producers are now turning to efficiencies to make their dollars go further, both above ground and below ground.

A marriage of technology and efficiency has driven the Permian's production output to levels

Schlumberger experts are working in collaborative teams focused on integrated solutions to improve operational efficiencies and optimize well performance. *(Photo courtesy of Schlumberger)*

not seen since the 1970s. Legacy oil production has remained mostly steady in 2015 at about 70,000 bbl/d decline rate. However, the reduction is being offset by an estimated 94,000 bbl/d of crude production from new wells in the basin. If the estimate is correct, overall production from the Permian will grow to 2.02 MMbbl/d, according to the U.S. Energy Information Administration. This will be the first time in decades it eclipses the 2-MMbbl mark. This has been happening as production from both the Bakken and Eagle Ford Shale regions is slipping.

Above ground, operators are not only keying in on new technology related to boosting volumes such as artificial lift but also are looking at the driving efficiency in the simplest day-to-day operations.

An integration inclination

Schlumberger's 80-plus-year commitment to the Permian Basin remains strong as the largest service provider expands on its recently opened Midland, Texas, regional headquarters via commissioning of a cement plant as well as a drilling fluid/mud facility being built on the 60-acre campus. The new cement facility will triple the contractor's previous capacity. The proximity of services and the location of teams of specialists in the basin is helping Schlumberger tout a unique integration offering beyond the historic one-stop shop.

"The market environment over the past 12 months has forced our customers to reevaluate economics of operations, especially in the Permian," said David Christmas, vice president Permian Basin at Schlumberger. "There has been a cost reset. We've seen our customers trying to improve their ROI, but there really is a growing realization that further industry price adjustments are just not going to be sustainable. To continue to improve ROI, Schlumberger is changing the way that business is conducted by integrating services offered so that we can improve the efficiencies and optimize our activities. Schlumberger's core is as a measurements company, and that breadth and range of services lines is pretty unique and allows us to be ahead in the integration approach."

The data stream collected by the contractor to assist clients in designing and carrying out beneficial well placement and completion campaigns

flows through its Petrel E&P software platform and the recently launched Petrel Shale module. Using magnetic resonance T1 logging, Schlumberger can locate the hydrocarbons *in situ* and better determine where to drill to get as close as possible to the hydrocarbons in the lateral.

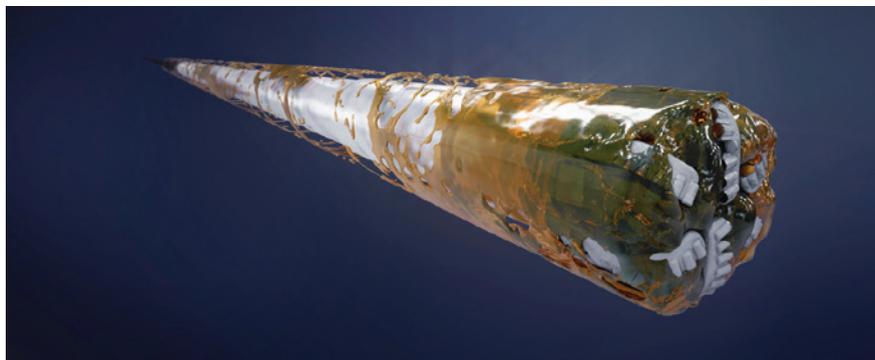
During drilling operations, Schlumberger can call on its PowerDrive Orbit rotary steerable system including its StingBlade conical diamond element bits as well as its HydraGlyde high-performance water-based drilling fluid system.

"The StingBlade bit uses the latest advancements in cutter technology," Christmas explained. "We put these together with an ideal mud. For example, our new HydraGlyde water-based mud [is] a system that delivers an oil-based-mud-comparable rate of penetration [ROP], which gives exceptional hole cleaning, superb wellbore stability in high-angle build and long lateral sections."

Two Schlumberger customers in the Wolfcamp have replaced their conventional diesel-based muds with HydraGlyde, reducing surface torque by about 20% and increasing the average ROP.

"Because it is water-based you eliminate some of the waste transportation and disposal costs," Christmas added. "The customer achieved a 40% reduction in the cost per barrel of their drilling fluid compared to offset wells that used the normal diesel-based mud. Integrating these systems together, we have had some tremendous performance recently in the Delaware Basin. We drilled over a mile within a 24-hr period, then we repeated that three more times for the same client. Elsewhere, we drilled a 2-mile lateral in the Wolfcamp, and from spud to total depth it took 17 days. That 10,000-ft lateral was drilled in a single run."

The HydraGlyde drilling fluid system delivers an oil-based-mud-comparable ROP, optimized hole cleaning and proven wellbore stability in high-angle build and long lateral sections. *(Image courtesy of M-I SWACO, a Schlumberger company)*





In the Midland Basin, Schlumberger recently drilled 5,800 ft in less than 28 hours. Records are falling on an almost daily basis, according to Rich Hawkins, Southwest, West Region manager, Drilling & Measurements for Schlumberger. In Reeves County in the Delaware Basin, the service giant now is routinely drilling sub-15-day wells. Historically, these were wells that could take a month or more to drill.

The organization has been working to develop greater motor technology, Hawkins said. “We leverage the expertise of the Motor Center of Excellence based in Katy [Texas], and we developed and recently commercialized the DynaForce high-efficiency positive displacement motors. The DynaForce transmission, at the lower end, is the strongest in the industry and allows us to use the high-performance power sections, which previously were not possible. We have a number of clients that have recently seen the benefit of this technology, and the DynaForce Flex motor allows us to drill the vertical, the curve and the lateral of a well in a single run, removing the need to trip for a bottom-hole assembly change and significantly improves drilling efficiencies and well cost.”

When it comes time to fracture and complete the well, Schlumberger uses its software suites to find the optimal solution that will lead to the greatest hydrocarbon recovery. Studies have shown that roughly 40% of clusters in fractured laterals do not contribute to resource flow for one reason or another. There are two approaches that can be taken independently or combined for maximum effectiveness to increase the percentage of clusters contributing to production. The first approach, often called geo-engineered completions, involves taking measurements in the lateral, in either open hole or cased hole, to target the best reservoir quality intervals

The Infinity fracture ball and seat dissolve completely and predictably, eliminating the need for milling operations and enabling fullbore production. *(Image courtesy of Schlumberger)*

while minimizing fracture closure stress differences at the perforation cluster locations in each stage. The second approach uses the BroadBand Sequence diversion technology to help stimulate more perforation clusters. The contractor’s BroadBand unconventional reservoir completion services can be employed to maximize wellbore coverage to increase production and recovery, according to the company. The BroadBand offerings include BroadBand Precision integrated completion service, a sleeve system designed to fracture every cluster along the lateral and improve propane transport, and BroadBand Sequence fracturing service, which is aimed at ensuring every cluster within each interval is fractured to maximize reservoir contact.

“BroadBand Sequence is comprised of dissolvable fibers and particles that act as a temporary plug to fractures taking fluid and diverting the subsequent fluid to other perforation clusters that aren’t taking fluid,” explained Aaron Galt, stimulation technical manager for the Permian at Schlumberger. “This technology can be used in new drill wells, problem wells, i.e., wells with casing leaks or not being able to get casing to the bottom. In addition, BroadBand Sequence can be used to extend an interval length and potentially reduce the number of plugs needed, ultimately increasing the efficiency of the fracture treatment. BroadBand Precision is a reclosable hydraulic fracture sleeve system operated by coiled tubing with a reseatable packer isolating a treatment stage. Once the sleeve is open, the fracture fluid is pumped down the annulus of the casing in the coiled tubing. Once the job is done, we unseat the packer, move up, open the next sleeve and continue to fracture. It is a continuous operation.”

Schlumberger’s Infinity dissolvable plug-and-perf system is another efficiency tool in the completions kit that allows for more speedy isolation of fracture stages during pumping operations. The plugs are balls that sit in a seat and are 100% dissolvable. Customers can run the sleeves in the completion hardware and then drop the plugs in to

selectively seal off access to the zones between different fracturing stages targeted for pumping. The seat and ball dissolve at different rates providing a reliable plug but without the need for wireline runs. Once dissolved over a matter of days, the Infinity plug leaves no debris in the well.

Refracking attempts to jumpstart old wells

With cost consciousness at a high level throughout the oil patch, operators are exploring different approaches to jumpstarting production without having to drill new wells. One practice starting to gain traction across the nation, and in the Permian, is the notion of refracturing older wells that might have been completed using less than ideal methods.

“When we talk about the performance of hydraulic fracturing there is a clear recognition that the fluid volumes pumped in the past could be different than what we are doing these days, i.e., less proppant per lateral foot or less total volume

coverage,” Galt said. “This goes back to the less than 40% of the perforations not contributing to production. This is why refracturing is a growing technology. It could be very cost-effective for clients to refracture a well compared to drilling a brand new well.”

Schlumberger recently completed a pair of horizontal well refractures in the region using the BroadBand Sequence technique. One was completed with 17 BroadBand pills and just 7 hours of pumping. The other well was completed in 19 stages in 20 hours of pumping. Both of these wells exhibited pressure increases after the BroadBand pills hit the formation and the instantaneous shut-in pressures showed an increased trend throughout the treatment. Refracture treatments have used BroadBand Sequence to divert the treatment along the lateral, and the volume of these treatments can be similar if not bigger than the original treatment. The original treatment might have taken a week to complete, whereas if a BroadBand Sequence is used, the time required to pump similar or proppant volumes can be done in a day, according to Christmas.

“What I think is really interesting is that you can see the results of a correctly engineered hydraulic fracture operation by watching it in real time on a microseismic display where you can actually see and record the small seismic events glowing in three dimensions as the rock fractures downhole,” he added.

Schlumberger uses its strengths in production data analysts to locate the best candidates for refracture work, according to David Fairhurst, wireline sales and marketing manager for North America Land for Schlumberger.

“We’ve had a very successful campaign in other basins and it is definitely something we want to take into the Permian,” he said. “We already have teams in place that are specifically focused on finding those candidates.” ■

When the BroadBand Sequence service is used to stimulate additional clusters (blue), it provides more accurate results than the highly variable ones produced by conventional stimulation techniques. *(Image courtesy of Schlumberger)*

