Pacific Rim REPORT

Reservoir Modeling
Models boost field output

MPD/UBD
Choose the right technique

Sand Control
Fine tune frac packs

Fracturing Technology
Light proppant gets results
Multizone treatment saves time

Shaving 4 days off a 5-day job helps independent Goodrich Petroleum save money and get its gas to market faster.

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The tough-to-drill yet prolific Cotton Valley trend of east Texas and northwest Louisiana doesn’t give up its prize easily, but Goodrich Petroleum has drilled 175 wells there with a 99.5% success rate (Figure 1). With 110,000 acres under lease, nine rigs working full-time and a near-perfect record, one might wonder what else can be improved? The answer is efficiency.

So what’s the problem?
Most Cotton Valley and Travis Peak wells need a little help in the form of hydraulic fracturing to stimulate production and maximize reservoir contact. Many Travis Peak wells have multiple producing zones in the form of thin sand stringers spaced out over intervals of about 1,000 ft (305 m). While some of these stringer sands may deliver prolific production, it is critical to the well’s economic success to complete them as efficiently as possible. It would not be economic to complete them conventionally due to the relatively long completion time and high cost weighed against the lower productivity. Cotton Valley completions involve four frac stages of 250 ft to 350 ft (76 m to 107 m) per stage.

The traditional process for completing these wells involved four steps: perforate an interval, stimulate it, flow the zone overnight to clean it up and then set a composite bridge plug to protect the zone so the next shallower zone could be treated. After treating all zones, a coiled tubing (CT) unit would be mobilized to drill out the plugs to enable flowback and final completion. Typically, the process would take 5 days and cost more than US $250,000. Although the traditional plan worked, it consisted of essentially the same steps repeated over and over. Usually when processes are repetitious, ways can be found to make them more efficient.

Completion time and money
The company considered alternative procedures to see if completion time and cost could be reduced. Additional objectives included reducing cycle time without sacrificing production efficiency. In collaboration with service provider Schlumberger, two promising techniques were examined: a coiled tubing fracturing and completion technique, and PerfFRAC combined perforating and fracturing technique. The latter is an enhancement of a field-proven technique licensed from ExxonMobil URC.

Due to the reservoir conditions in the fields under development, the combined technology made the most sense. The choice was based on having the ability to complete each well with a single wireline trip. No composite bridge plugs were required, and no CT unit was needed. Specific benefits of the chosen technique identified included:
- Reduced costs of multizone
• Effective isolation of each zone;
• Point source fracturing of each zone;
• Elimination of plug setting and drilling-out time;
• Compatibility of completion fluid and formation; and
• Commencement of clean-up within 24 hours.

An elegant solution
To perforate and treat a well using the combined perforating and fracture technique requires a fracture fleet and a perforating unit. Select-fire perforating guns were run in the hole and positioned opposite the lowest zone to be completed. Select fire guns allowed the perforating guns to be activated one at a time starting with the lowest gun. As soon as the first (lowest) gun was fired, the first frac stage was pumped — treatments were bull-headed from surface. While this was taking place, the gun string was pulled up and positioned opposite the next zone. In the displacement (flush) of the frac fluid, ball sealers were dropped. They sealed on the open perforations, confirmed by a rise in pressure.

Simultaneously, the second zone was perforated, the ball sealers providing isolation from the previously stimulated zone. The process was repeated until all stages had been perforated and treated. Then the spent guns were retrieved and the well was flowed back. A ball catcher caught the balls as they were produced with the flowstream, or they fell harmlessly into the rathole. The entire process required a single wireline trip and was completed in a day. The sequence is illustrated in Figure 2.

A study comparing the productivity from a well completed using the PerfFRAC technique with two similar offset wells showed significant improvement in cumulative production (Figure 3). In addition, Goodrich Petroleum experienced a 50% decrease in completion time and a 25% decrease in completion costs on the first eight wells treated in the Cotton Valley, Travis Peak and Hosston formations.

Enhancements add value
The use of selective perforating with high-performance guns and perforating techniques offered several additional advantages to this job. The service allowed the economical stimulation of pay zones that might have been otherwise bypassed. This enables operators to maximize the potential of the reservoir. Production is increased through the precise stimulation of target zones as opposed to a limited entry approach involving a large number of intervals and high pump rates. For example, in a recently treated well the enhanced service saved Goodrich Petroleum four days and $100,000, or 40%, over using the conventional bridge plug method (Figure 4). The savings were the result of a cost-effective method that reduced both time and equipment needed. As a bonus, the gas-to-market time was reduced by 4 days.

The PerfFRAC technique is a part of contact staged fracturing and completions services designed to maximize reservoir contact by offering the most efficient and effective stimulation for each well. It comes with a planning workflow that helps prospective users determine its applicability for the specific well or reservoir they are targeting and predict with some accuracy the expected result.

In the example given, Goodrich was able to take advantage of a selection of enhancements to the basic procedure to customize the perforation and treatment package to its specific situation and needs. The planning stage allows each enhancement to be evaluated on its own merits and also as part of the collective result of a customized package. The company plans to continue using the technique while developing and evaluating further enhancements.