

SPECIAL FOCUS: ADVANCES IN DRILLING

U-lateral drilling innovations: Making breakthroughs possible for directional projects

U-laterals are being employed increasingly by operators to gain access to greater amounts of reserves while simultaneously yielding significant savings.

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Technology innovations continue to bring significant changes to the drilling portion of the upstream industry. U-lateral directional drilling is an important new pathway to underground success. It's already starting to have an impact that could reverberate throughout the global upstream economy.

These U-laterals (also known as U-turns, horseshoes or paperclips) involve creating a wellbore path that resembles the shape of the letter "U." An advanced solution of this type enables operators (although drilling, completions and facilities all contribute to the savings) to economically access underground resources that may be difficult or impossible to reach with conventional vertical or horizontal drilling methods.

U-laterals have become an innovative approach to accessing challenging subsurface targets—a method for producing more hydrocarbons while simultaneously generating substantial savings. At SPE, a *Journal of Petroleum Technology (JPT)* article, "The trend in drilling horizontal wells is longer, faster, cheaper," said, "The trend toward drilling longer horizontal wells is growing, with lateral lengths of three miles reached."

Accordingly, experts are convinced that U-laterals can be drilled with existing technology. In fact, this has been demonstrated by almost 70 U laterals drilled successfully, using existing technology, including conventional mud motors, RSS, wireline services, dissolvable plugs and coiled tubing.

In their very first article about this innovation, *JPT's* editors called U-laterals something new: "A well design unlike anything most in the shale sector have seen before." Thus, it makes sense that industry leaders now think this is one of the most important breakthroughs to come along in many years.

U-laterals are especially important when engineers are confronted by "stranded acreage." These are operator-owned or leased sections not connected to any other owned or leased sections—a fact that prevents the drilling of a two-mile lateral. One-mile laterals are marginally economic or uneconomic, while two-mile laterals are not possible in a stranded section. Solving this problem means using new and better methods to drill a two-mile lateral in a stranded section.

Evolving techniques have been pioneered by Altitude Energy Partners—a leading directional drilling company working to make U-laterals work for both larger and smaller companies. According to Altitude President Tyler Clark (**FIG. 1**), "as directional drilling technology continues to advance, this technique is becoming increasingly important for those who want to maximize resource recovery while minimizing surface impact."

Based on years of work solving problems associated with using U-laterals, Altitude veteran and V.P. of Technical Services, Andy Biem (**FIG. 2**), concludes that "this unique variation of specialized directional drilling allows an operator to drill and produce acreage once thought not economically feasible." One really big advantage to U-laterals should be noted: economics. Therefore, it's no surprise to see a spike in interest in U-laterals. In fact, a growing number of projects in the field are adopting these techniques.

Clark explains that “out in the field, several critical needs arise, where this type of well profile does fit. This was seen clearly during planning for the first project in the Permian, which was engineered and executed for Shell by our previous directional company.” Further details on that project were shared by Shell in an article in the *Society of Petroleum Engineers Journal*.²

This Permian basin project came about by necessity, according to Biem. “Shell had a pad location, where severe challenges arose in the vertical section of one of their planned wells,” he explained. “The standard approach would have been to abandon that particular production section. Shell asked us to drill the lateral section of one production slot and then turn the well 180°, and then line up on the other production slot that would have been missed. We engineered a design for the well, which included that well profile. We then had to go to work trying to find technology within our portfolio which could execute that.”

Since the successful completion of that first project, this team has built “a powerful and collaborative ecosystem of partners, who work closely with Altitude to deliver, each and every time, just the right mix of tools and methods.” Notable names on that partners list include Schlumberger/Extreme3 and Pacesetter Corp.⁴



FIG. 1. Altitude Energy Partners President Tyler Clark.



FIG. 2. Altitude Energy Partners V.P. of Technical Services Andy Biem.

Following that first project with Shell, the lessons learned—including trajectories, equipment selection and bottomhole assembly (BHA) design—have been applied to all subsequent U-laterals, to ensure that Altitude delivers a successful well to their customers. According to Biem, “our organization believes in a philosophy of continuous learning and improvement. It is engrained in our DNA. If we can apply lessons learned to achieve future success, that is exactly what we do.”

U-lateral activity in the U.S. has been on an exponential growth curve, **FIG. 3.** For expert insights, we asked John Huycke, the Founder of Turning Point E&P Consul-

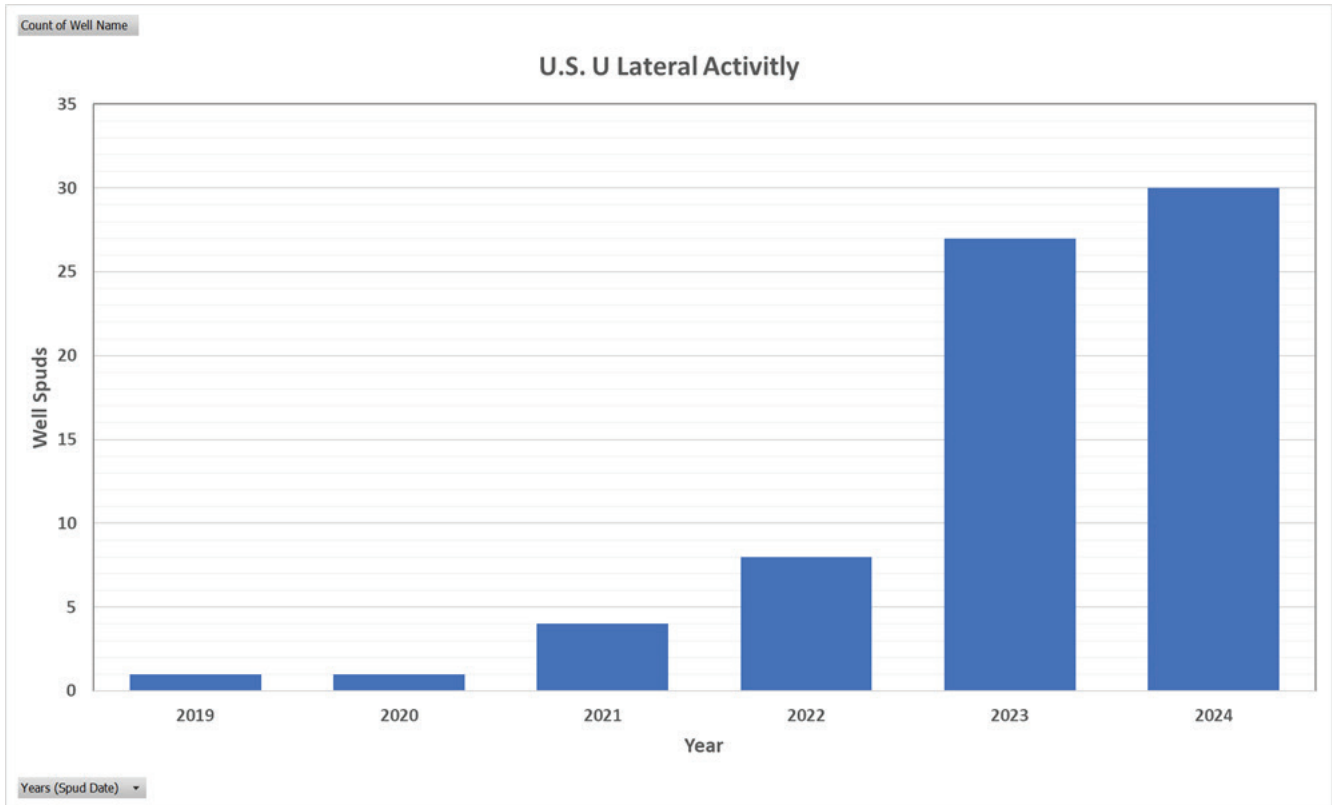


FIG. 3. U.S. U-lateral activity over time.

tants. He notes the trends shown in **FIG. 3** since the first well was drilled by Shell in 2019: “There were 27 U-laterals drilled in 2023, and the U-lateral count for 2024 has exceeded that number as of today.”

At PDC Energy Corp.—before being acquired by Chevron—Huycke was instrumental in planning and executing the first multi-well U-lateral development as part of a highly motivated interdisciplinary asset team. He’s a life-long drilling engineer, with three decades of experience. He has held positions that range from drilling engineer to drilling manager.

There actually are U-laterals in most of the major U.S. basins, **FIG. 4**. According to Huycke’s database, the most active basin for U-lateral drilling is the Delaware basin (in the Permian region), with 30 spuds to date, and “[t]his probably reflects the large rate of return bump seen in the Delaware, due to the difficult and expensive intermediate hole section.” The second-most active basin is the Denver-Julesburg (JD) basin, with 14 spuds, as reflected in Huycke’s datasets. He notes, “The drilling in the DJ is much easier and faster than in the Delaware (**FIG. 5**), so the large number of spuds is a testament to the improved economics, even in an easy drilling environment. This may be due to savings on completions and facilities costs.

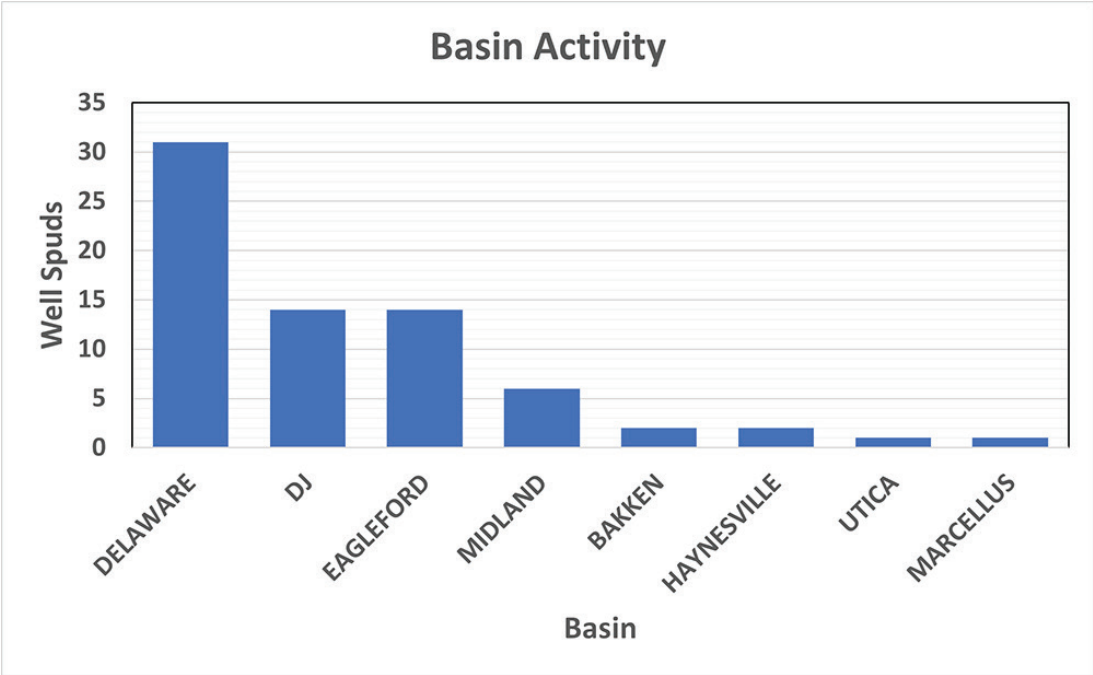


FIG. 4. Drilling activity in U.S. basins over time.

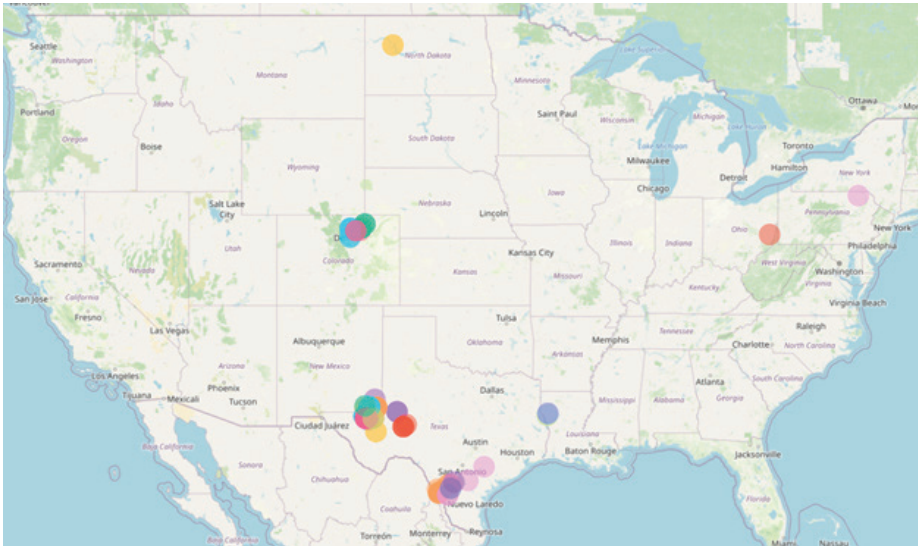


FIG. 5. Locations of U-laterals in the U.S.

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Huycke explains how U-laterals fit in the history of innovation of directional drilling. Like any drilling technology development, U-laterals are “driven by economics,” and “[s]tranded sections and one-mile horizontal wells often result in poor economics, compared to two-mile laterals.” The U-lateral allows for economics closer to those of two-mile laterals, with a potential 30% boost on rate of return, compared to one-mile laterals.

Huycke found that due to the disjointed land structure in much of the U.S., based on townships and sections, many sections are stranded. While U-laterals are a niche innovation, they have the potential to save the industry billions of dollars and allow the development of sections that would otherwise have been uneconomic.

Occidental and PDC top the charts on spuds, with ten, each, in multiple basins, **FIG. 6**. Both firms drilled U-laterals in multiple programs, and Huycke adds that “they have seen the results and have come back for more. Chevron bought PDC and has continued with the U-lateral program, spudding five U-laterals of their own for a combined 15 U-laterals in-house.” Matador has been publicly bullish on U-laterals, with the company’s publicly stated \$5 million in savings per well and three pads drilled in the Delaware. The Eagle Ford is the third most active basin, with Chesapeake (which recently merged with Southwestern Energy to become Expand Energy Corp.) claiming most of the well count. Other operators are replacing Chesapeake’s activity there. Increased permitting activity shows continued interest by operators in U-laterals, and according to Huycke, “expect more spuds.”

Lateral hole size selection is an important consideration, since operators have preferred hole sizes and supply chain limitations. Huycke’s data show that U-laterals have been drilled with the major production hole sizes from 6 in. to 8¾ in. Huycke found that there have recently been successful U-laterals drilled with RSS around the turn in 6½ in. and 8½:8¾ in. hole sizes. “This has demonstrated improved cycles times and sufficient DLS’s for one-and-done BHAs in the lateral. These are RSS systems provided by Sperry and SLB.”

Clark is pleased with feedback from customers, saying, “they tell us that these drilling innovations allow for longer, effective lateral lengths in their space-constrained leases. These companies say we’re improving well economics by increasing production potential from a single vertical section. Their executives are especially pleased by the fact that we’re reducing drilling costs, compared to multiple shorter wells.”

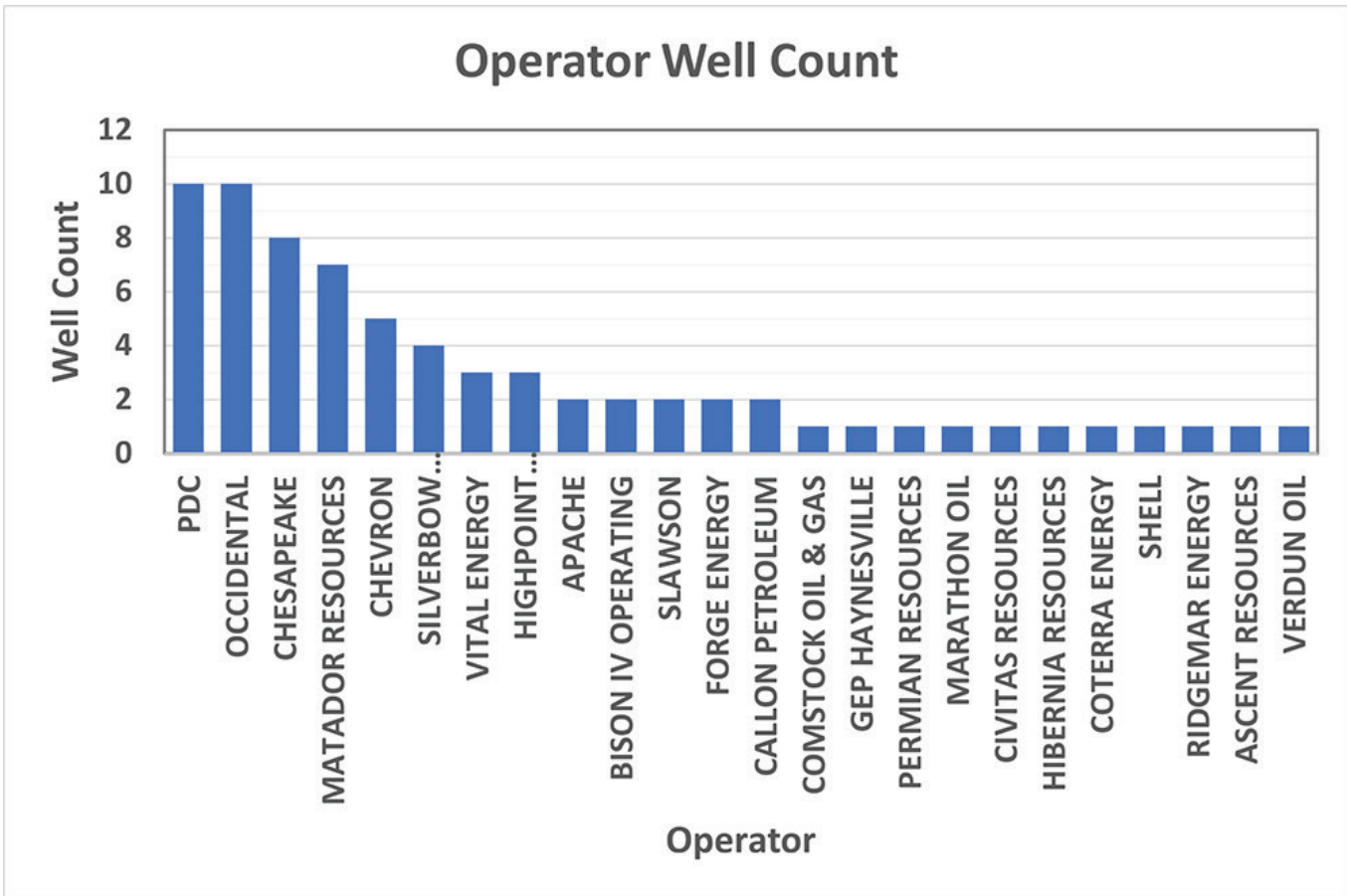


FIG. 6. Operator well counts in the U.S.

Biem added one key proviso to keep in mind: “Careful planning, modeling and real-time monitoring have been key to the successful execution of each one of our many U-lateral projects.” **WO**

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