

SPECIAL FOCUS: HYDRAULIC FRACTURING

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Halliburton's ZEUS IQ™ powers the first fully autonomous fracturing platform with closed-loop automation

Closed-loop automation delivers real-time control, proven return on investment, and a new global standard for hydraulic stimulation

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Fig. 1. In 1949, a Halliburton crew conducts an early fracturing job with manual controls, the foundation for modern stimulation.

In March 2025, at a frac site in Colorado's DJ basin, a crew watched as the pumps roared to life, but no one touched a control panel. The equipment ran itself. More than that, the job plan was modified in real time, all without human intervention. The system autonomously adjusted pumping schedules, volumes and rates, based not only on surface response but—more importantly—on subsurface feedback.

What once required dozens of manual decisions per stage and days of engineering review now happens automatically, guided by intelligent software, real-time diagnostics, and the customer's asset knowledge.

This was not a demo. It was Halliburton's [ZEUS IQ™ intelligent fracturing platform](#) in action.

HOW THE ZEUS IQ PLATFORM CHANGED HYDRAULIC FRACTURING

Moments like this mark a pivotal turning point for hydraulic fracturing and for an industry that for decades has long been the backbone of unconventional resource development. Halliburton led the way in 1949, invested in fracturing, and completed the first commercial job in Oklahoma. **Figs. 1 and 2.** That milestone, along with technological industry breakthroughs, fueled the U.S. oil and gas boom of the 1950s and 1960s (**Fig. 3**) and, eventually, the shale revolution of today.



Fig. 2. In 1949, crews gather at a truck-mounted pump unit as on-site calls direct the job.



Fig. 3. By 1963, multi-pump spreads added horsepower, but every decision was still made manually.

[Hydraulic fracturing](#) has evolved dramatically since shale asset development began in North America. In the early years of the shale revolution, the industry relied on technical advances to unlock hydrocarbons from tight formations: more sophisticated fluid designs, specialized proppants, and improved subsurface modeling. The next major shift focused on scale. Demand for higher efficiency to optimize costs, 24-hour operations, increased horsepower, and the adoption of lower-cost stimulation designs became the focus. Yet, every leap introduced new challenges. Efficiency gains often came at the expense of consistency, precision and control; all requirements to drive better asset performance. This set the stage for the next evolution in fracturing.

Today, we see another pivot. Operators face tight margins and a desire to improve asset performance; they require more value from each frac without increased complexity or cost. The industry requires a step-change beyond incremental tweaks. That step change is here. Halliburton delivers the industry's first fully autonomous intelligent fracturing platform: the ZEUS IQ platform, giving our customers control to close the loop between subsurface measurements and surface execution, ultimately pushing to improve asset performance, **Fig. 4.**

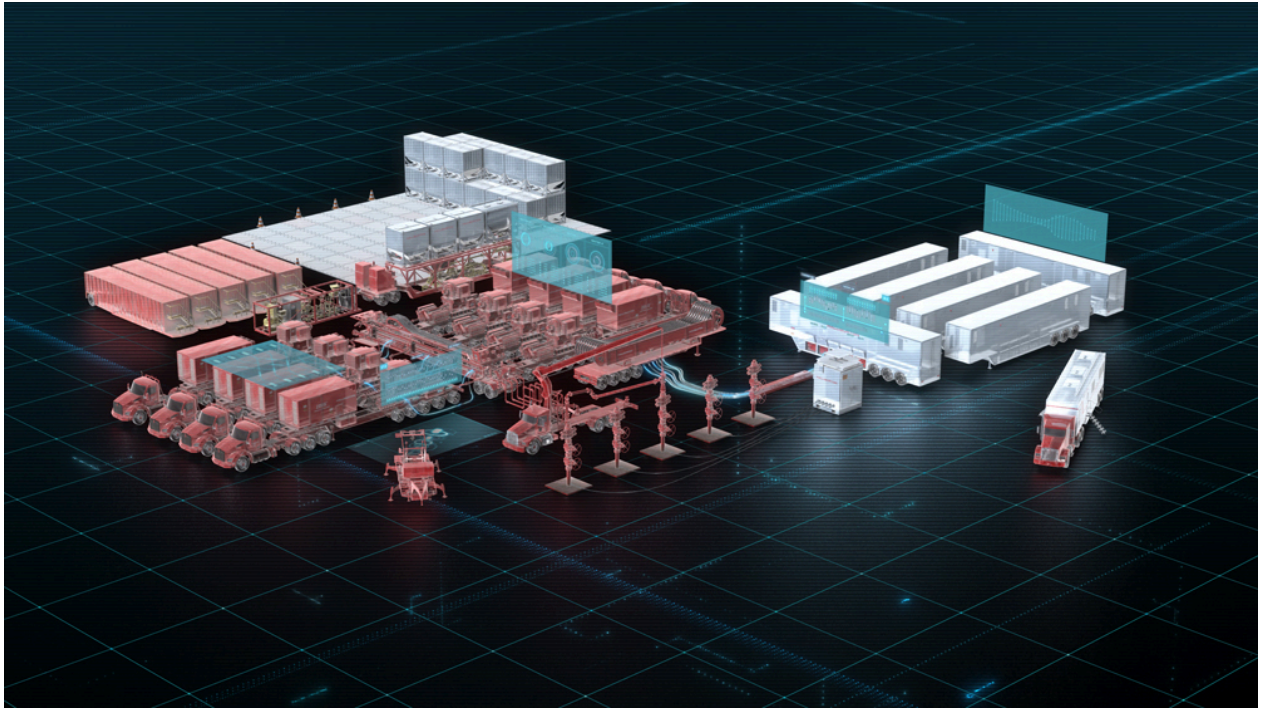


Fig. 4. ZEUS IQ™ intelligent fracturing platform architecture links surface automation, subsurface diagnostics, and decision control to deliver closed-loop fracturing.

“The ZEUS IQ platform redefines what success looks like in hydraulic fracturing,” said Shawn Stasiuk, senior vice president of Completion and Production at Halliburton. “Operators can set desired outcomes, and the system delivers—autonomously, consistently, and with proven economic results. This is not just automation; it is intelligent control that delivers performance at scale.”

The rise of **closed-loop automation** marks a fundamental shift in how fracturing jobs are planned, executed and optimized. The ZEUS IQ intelligent fracturing platform sets a new standard for performance and control that delivers measurable return on investment (ROI) at scale. It does more than measure results and automate. It empowers operators to take control and make real-time, data-driven decisions through end-to-end integration. The result is unmatched efficiency, consistency and asset performance.

This transformation is not just about technology. It is about sustained economic value from maturing unconventional assets.

The journey from manual fracturing operations to today’s intelligent systems represents a true leap forward. Early workflows relied heavily on human judgment and static designs, which often caused inefficiencies and slow improvement.

Today, operators want solutions that deliver greater value without adding significant expense or complexity. Lowering the cost per barrel of hydrocarbon produced has always been an important metric. The ZEUS IQ intelligent fracturing platform solves both sides of the equation. Optimized execution performance on the surface, while ensuring subsurface fracture placement aligns with the operator’s desired results. Halliburton’s ZEUS IQ platform, powered by automation and real-time diagnostics, proves it delivers this value today.

The ZEUS IQ platform reflects years of innovation and transforms fracturing from a manual, imperfect process into a fully autonomous, precision-driven operation.

TRUE CLOSED-LOOP FRACTURING, NOT PARTIAL AUTOMATION

Most “automated” fracs still require human intervention to make critical decisions in real time. True closed-loop fracturing removes that completely. It delivers end-to-end automation that connects subsurface diagnostics with surface execution in real time. The platform creates a feedback system that constantly adjusts pumping schedules, volumes, and rates based on actual reservoir response.

The ZEUS IQ platform ensures that operators control their outcomes, using their asset knowledge before execution begins. They define objectives, constraints, and decision frameworks in advance, guiding how the automated system will respond as conditions change. By embedding expertise into the control loop, the platform optimizes continuously through an intuitive interface, eliminating the need for real-time human decision-making.

The ZEUS IQ platform puts operators in control from the start. Halliburton’s intelligent platform empowers them to make every decision and manage every outcome, using their deep asset knowledge to guide the process and influence decisions in real time, all through an easy-to-use platform experience.

Unlike traditional workflows, where engineers design jobs weeks in advance and hope the geology plays along, they often wait months, post-frac, to see if they estimated correctly, while closed-loop systems make decisions instantly. With the ZEUS IQ platform, every stage is integrated, and operators maintain control while automation ensures accuracy. This approach shifts fracturing from guesswork to precision, and it moves beyond reactive adjustments to deliver reliable results and help minimize risk.

The benefits are clear:

- **Operator control:** Complete surface and subsurface integration to control the treatment outcomes. Operators can adjust decisions, based on specific stages, wells, or even target formations.
- **Improved consistency:** Standardized execution within fleets and basins. Automation eliminates the inconsistency of manual decision-making.
- **Increased recovery:** Real-time optimization ensures more desirable fracture placement. Subsurface fracture placement improvements should occur while pumping in real-time, not months later.

Closed-loop automation means real-time action at the wellsite—not just recommendations. Every lever from sensing to optimization to execution is integrated with diagnostics and is adaptive, without traditional human intervention. While some service providers claim closed-loop capabilities, most only automate isolated steps. Critical decisions still depend on human intervention, and their data flows remain disconnected. The ZEUS IQ platform changes that. It delivers true closed-loop control by integrating surface and subsurface diagnostics to execute in real time. The platform ensures operators maintain control while automation guides outcomes.

HOW THE ZEUS IQ PLATFORM POWERS CLOSED-LOOP FRACTURING

Halliburton’s closed-loop system integrates three critical components:

1. **Surface automation:** Electric fleets and intelligent automation of the frac spread execute each stage without human intervention
2. **Subsurface diagnostics:** Surface and subsurface sensors deliver real-time measures on fracture growth in the reservoir and cluster uniformity at the near wellbore
3. **Integrated decision-making:** The platform autonomously modifies and executes design changes through direct control of the frac spread, based on reservoir response, all guided by the asset knowledge of the operator. **Fig. 5.**

This integration unlocks a level of automation and intelligent fracturing previously unattainable that empowers customers to adjust inputs and control parameters on-the-fly. This collaboration allows operators to configure tolerance levels, prioritize measurements, and set operational guardrails—all executed automatically. The results: unmatched execution control for our customers to improve asset performance.

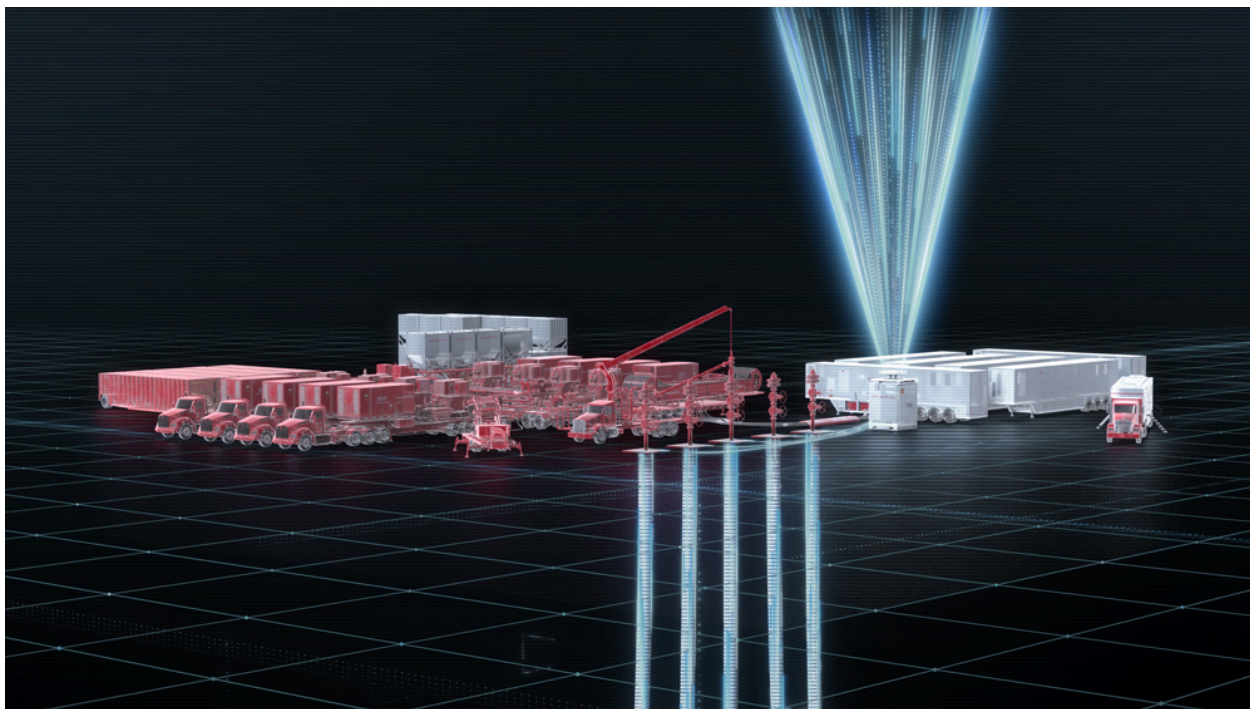


Fig. 5. Real-time subsurface data feeds the platform, which adapts designs and executes changes while pumping.

INSIDE THE ZEUS IQ PLATFORM: THE INTELLIGENCE THAT CHANGED EVERYTHING

What makes the ZEUS IQ platform more than just a bundle of equipment? It is the intelligence layer that sets it apart. Beyond automation, the platform uses a combination of advanced algorithms and machine learning to predict fracture behavior and react to treatment results, based on how they will affect performance. This predictive capability transforms fracturing from a reactive process into a proactive one, where adjustments occur in real time to anticipate changing conditions. With the ZEUS IQ platform, Halliburton has essentially given the frac job a “brain”—it constantly learns and adjusts, which means customers get the results they want without overseeing every stage.

Historically, treatment designs were static, relied on predefined schedules, and required limited manual adjustments in a fast-paced, complex environment. Even with forward modeling, on-the-fly human intervention, latency, errors, and lack of responsiveness to the subsurface will continue to limit performance. The ZEUS IQ platform overcomes these barriers to combine predictive analytics with automation, allowing dynamic treatment designs that adapt to subsurface variability and anticipate reservoir behavior. The result: unparalleled precision, fewer nonproductive events, and optimized recovery at every stage.

This intelligence layer empowers operators to achieve consistent, high-performance outcomes with minimal manual intervention and adds controls, precision, speed and confidence to every stage of the job.

ZEUS IQ PLATFORM IS THE BENCHMARK FOR INTELLIGENT FRACTURING

The ZEUS IQ platform sets a new benchmark for automation and performance, offering the industry a solution that delivers efficiency, consistency, and sustainability at scale. For years, operators sought a way to close the loop between design, execution and evaluation. This platform makes that vision a reality and gives customers real-time control at every stage of the fracturing process.

It combines Halliburton's [electric fracturing fleet](#), [OCTIV[®] auto frac service](#) (Fig. 6) and [Sensori[™] fracture monitoring service](#) to allow autonomous job execution, based on real-time reservoir feedback without manual human intervention. This integration creates a fully autonomous system that optimizes fracture execution based on customer-defined outcomes, which makes intelligent fracturing a proven reality, not just a concept.

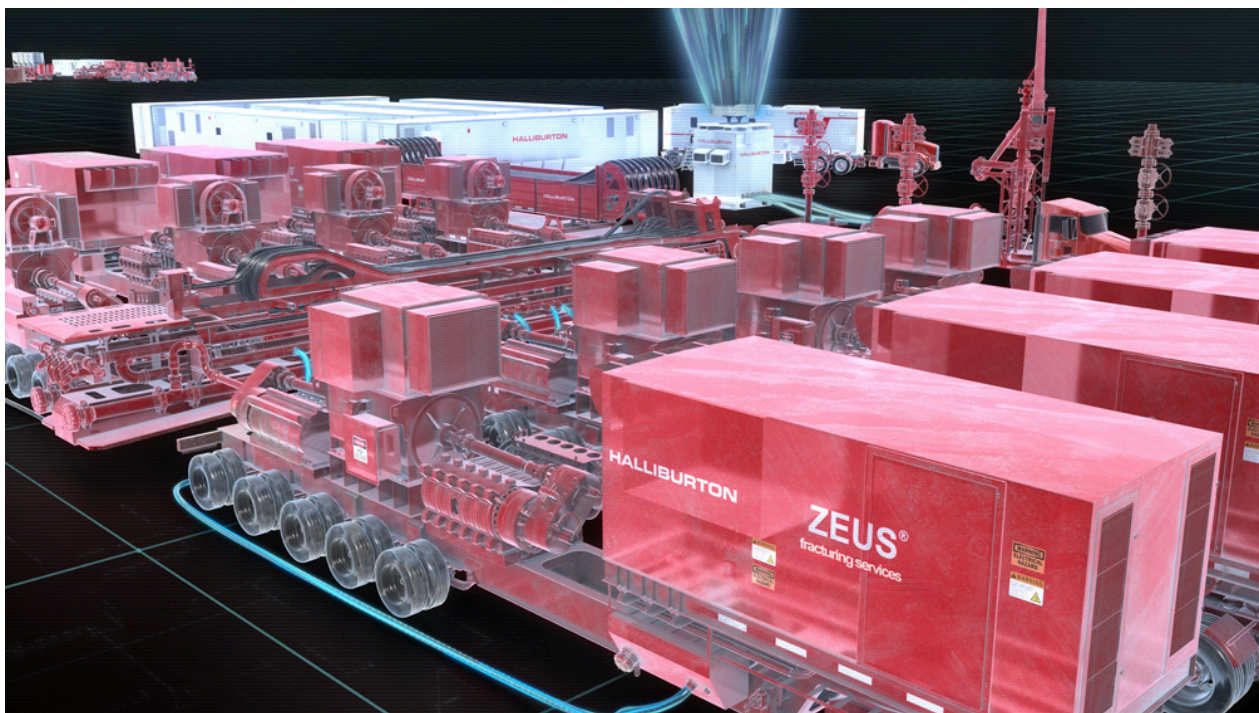


Fig. 6. ZEUS IQ[™] intelligent fracturing platform pairs electric fleets with OCTIV[®] auto frac service, and Sensori[™] fracture monitoring service— the system acts in real time to deliver consistent results at scale.

CASE STUDIES: THE ZEUS IQ PLATFORM IN ACTION

Field deployments confirm that the ZEUS IQ platform delivers precision and control under real-world conditions. Recent milestones include successful deployments that validate scalability and set the stage for international expansion and offshore stimulation.

DJ Basin: Faster recovery, shorter cycles. In the DJ Basin of northeastern Colorado, an operator pushed the limits of what their wells could do. Faced with the challenge of maximizing asset recovery while reducing cycle times to make an engineering change, the operator had to overcome a process that historically involved months of data analysis before design adjustments could be implemented, delays that frustrated engineers and slowed performance gains.

The team began planning with a clear goal: deploy a fully closed-loop frac, an autonomous system that constantly integrates feedback without manual intervention. The teams combined deep asset knowledge

continually integrated feedback without manual intervention. The teams combined deep asset knowledge with operational expertise and large-scale analytics to build a shared framework that allowed dynamic, data-driven decisions and consistent performance. For the first time, engineers were not waiting months to tweak designs; the ZEUS IQ platform learned and adjusted on the fly, stage by stage.

With the ZEUS IQ platform, the operator achieved:

- **Reduced cycle times**, which allowed faster feedback loops, and removed people from the critical path of decision-making and actions
- **Real-time fracture diagnostics** allowed autonomous adjustments to pump schedules, based on subsurface feedback
- **Material savings** through optimized proppant and fluid usage, reduced waste, and lowered costs

Permian Basin: Closed-loop control two years ahead of schedule. In the Permian Basin, a major operator set a bold timeline to accelerate its automation and optimization technology roadmap to move from semi-automated processes to full closed-loop control by 2027. They are two years ahead of schedule, executing in 2025.

With the ZEUS IQ platform, the operator:

- Achieved full closed-loop fracturing two years ahead of schedule
- Applied OCTIV auto frac service to reduce manual interventions by over 100 clicks per stage
- Integrated Sensori fracture monitoring for near-well and cross-well diagnostics, allowed real-time fracture growth tracking and cluster uniformity adjustments.

For the first time, the operator's engineers were not reacting to post-job data; they watched the system adapt in real time, stage by stage, with decisions executed autonomously and outcomes aligned to their subsurface strategy. This resulted in a step-change in operational efficiency that proved intelligent fracturing can deliver both speed and precision at scale.

These successes are just the beginning. As operators embrace the ZEUS IQ platform, the potential for even greater operational improvements and efficiency gains grows. This momentum sets the stage for further innovation, expanded deployment, and transformative results in the global energy sector.

ZEUS IQ PLATFORM DELIVERS PRECISION THAT PAYS

The success of the ZEUS IQ intelligent fracturing platform underscores the deep collaboration and shared vision between Halliburton and its customers. The platform delivers more than technical innovation; it delivers measurable performance. By placing fluid where it matters most, the ZEUS IQ platform maximizes stimulated reservoir volume and increases production potential. At the same time, operators report significant time savings through automation, accelerated pad completions, improved capital efficiency, and reduced fluid and proppant waste, which cut costs.

The ZEUS IQ platform provides a trifecta of benefits: unparalleled execution consistency, faster, more accurate decision-making, and greater operator control of asset performance.

Field deployments demonstrate more than technical success; they reflect a meaningful shift in how fracturing jobs are experienced by the people who run them. For the frac crew and engineers, the ZEUS IQ platform means far fewer troubleshooting sessions and more predictable, safer operations. With automated routine decisions and aligned execution with subsurface feedback, the platform frees teams to focus on higher-level analysis and strategic optimization, rather than react to unexpected variables in real time.

GLOBAL REACH WITH CONSISTENT RESULTS

Beyond North America, Halliburton's [intelligent fracturing](#) has been deployed successfully in Latin America, Australia and the Middle East, validating its scalability and adaptability in diverse geologies and job types. These global deployments demonstrate the platform's ability to deliver consistent performance worldwide. Another benefit is that as the organization executes more jobs in localized areas, the solution's intelligence is improving, specifically to address the challenges in each market. The platform is not a one-size-fits-all intelligence.

Closed-loop automation is not just about economics. Electric fleets reduce emissions and noise. Optimized pumping minimizes water and proppant waste. Real-time control helps operators meet sustainability goals without compromising performance.

As global energy markets demand cleaner, more efficient operations, Halliburton's intelligent fracturing capabilities align with these priorities. By cutting material waste and boosting efficiency, operators can achieve sustainability targets and preserve profitability—a critical balance in today's energy landscape.

ZEUS IQ INTELLIGENT FRACTURING PLATFORM STANDS ALONE

- Industry-first innovation: The first true closed-loop fracturing solution
- Intelligent integration: Combines automation, diagnostics, and predictive analytics for smarter decisions
- Proven ROI: Accelerates completions, reduces wasted materials, and delivers improved asset performance
- Global success: Halliburton's intelligent fracturing ecosystem, which includes OCTIV® auto frac services and Sensori™ fracture monitoring service, has proven its value in Latin America and the Middle East, while the ZEUS IQ platform sets the benchmark in North America

BEYOND AUTOMATION

The ZEUS IQ platform redefines what is possible. Today's workflows are the foundation for tomorrow's breakthroughs. The platform integrates advanced diagnostics and expands completion levers to unlock new ways to maximize asset value. Halliburton looks ahead and aims to achieve dynamic control in complex simul-frac and tri-frac environments, which will allow customized performance by-well and lay the groundwork for next-generation completions.

Imagine a future where every frac job is not only automated, but also predictive—to anticipate fracture behavior before the first pump starts. That future is closer than many believe. With advancements in machine learning and real-time data processing, intelligent fracturing will evolve from reactive optimization to proactive improvement.

ZEUS IQ PLATFORM DELIVERS TODAY AND TOMORROW

- **Closed-loop automation is here:** Transforms hydraulic fracturing from manual to autonomous
- **Future-ready:** Lays the foundation for next-generation completions
- **Sustainability advantage:** Aligns with sustainability priorities without compromising profitability

- **Competitive edge:** ZEUS IQ platform operators gain efficiency and consistency at scale.

THE FUTURE OF FRACTURING IS THE ZEUS IQ PLATFORM

The industry has reached a turning point. By closing the loop between design, execution and evaluation, Halliburton empowers operators with real-time control, unmatched consistency, and improved asset performance. The future of hydraulic stimulation is not coming—it is here and proven.

The ZEUS IQ platform is the only fully autonomous fracturing solution that delivers measurable ROI, sustainability, and a competitive edge today.

Experience [Halliburton's ZEUS IQ platform](#) and see how intelligent fracturing can transform your operations. **WO**



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