WELL SITE AUTOMATION

Frac plug drill out and snubbing operations in long horizontal wellbores streamlined

Mobile completion platforms, real-time job monitoring, and experienced completion teams integrate with long-lateral frac plug drill-out and snubbing solutions

By Michael Hopkins and Mark Haubert, *Ranger Energy Services*

Oil & gas drilling operators strive to improve performance and mitigate risks with frac plug drill-out and snubbing completion operations in challenging long horizontal wellbores. These processes require considerable pre-planning, operational and state-of-the-art machinery, constant inspection, real-time communications capability, and an experienced, trained and competent crew on the job site. Meeting these expectations, however, can be a considerable challenge for completion operators.

One completions service provider has developed a comprehensive, integrated solution to these challenges.

Long horizontal wellbores – typically completed using the plug and perf technique – may require drilling out 50 to 100 frac plugs at 200-foot spacing, depending on the length of the lateral. Drilled lateral lengths are now exceeding 10,000 feet and are at times being drilled up to 20,000 feet. Directional drillers are drilling laterals as fast as possible, making it difficult to drill out toe plugs due to the requirement for more friction reducers and increased hole cleaning challenges, sacrificing zones at the toe and resulting in lost production.

Coiled tubing (CT) has been the primary method of drilling out frac plugs. CT is becoming more challenging to deploy due to the increased tortuosity and frictional drag as the laterals are routinely exceeding 10,000 feet in length. The CT will have difficulty drilling out the plugs; it may stall in the lateral section, or worse, the CT may get stuck, causing a major fishing job and excessive costs. The CT may have trouble effectively cleaning the wellbore and removing the frac plug cuttings and frac proppant.

> **Drilled lateral lengths are now exceeding 10,000 feet and are at times being drilled up to 20,000 feet.**

Mobile completion rigs

Some operators are mitigating these difficulties by using mobile completion rigs to remove the challenges of using CT for frac plug drill out operations.

An example is the high-spec rigs in operation by Ranger Energy Services (Ranger), a US-based provider of high-specification well-service rigs and associated services. These state-of-the-art rigs are equipped with 600 HP 300,000 lb. lifting capacity and mast heights up to 112 feet. Also involved are rig-assisted snubbing units with 600 – 2500 HP pumps, API-certified BOP stacks and 42-foot elevation pipe handlers with high-torque power swivels for maximum torque.

However, using the latest technology in mobile completion rigs has proved not to be enough to address the complex challenges inherent with completion in long horizontal wellbores. A comprehensive, total-integrated approach encompassing all facets of completion is required.

An optimized frac completions solution

Completions operators often use multiple service suppliers to complete the drill out process. This practice opens the door to various potential differences in operating and safety procedures and per-

sonnel competency. Coordination of services can be challenging. One process is dependent on another, and scheduling can be difficult, frequently resulting in production delays.

An integrated completions solution can provide fewer logistical challenges, increased efficiency, less personnel needed, better communications and improved safety performance. A single point of contact can better deliver a uniform approach to quality service execution.

With this concept in mind, Ranger built out a comprehensive completions package of services, fully integrated with its fleet of 300+ mobile completion rigs. Operating as a single-source completion solution, it encompasses equipment, personnel, safety and reporting, ensuring consistent and standardized delivery.

FIGURE 1: Completion field crew. Image courtesy Ranger Energy Services

Completion solutions

This comprehensive, integrated suite of completion services, called Ranger Elite Completion Solutions, has raised the performance bar considerably when it comes to making completions operations more efficient, safe and economically feasible.

Ranger Elite provides the highest level of performance solutions across personnel, equipment, technology and QHSE. It integrates the most stringent operational, safety and quality standards, encompassing the following: 1) Systems; 2) Personnel; 3) Equipment; 4) Engineered Solutions; and 5) Safety.

1. Systems

Ranger personnel are equipped with the Ranger Live mobile platform, a customized suite of applications via tablet or other mobile device that enables field crews to operate safely and efficiently.

The suite includes a safety and quality system, a vehicle tracking and driver behavior management system, an electronic ticketing system, and a preventive maintenance management system. Data for each system is captured on-site, transmitted via cloud-based internet, stored on the company's secure SQL servers, and is made available for access on any laptop, tablet or smartphone device.

A component of Ranger Live is its Information Gathering System (eRIGS). A data acquisition system, eRIGS consists of sensors on the rig and ancillary equipment that gather data metrics such as pump rates, pressures and volumes, weight, depth and torque. Operational alarms can be set to notify personnel when parameters are nearing or exceed the desired operational range.

The data is collected on location and transmitted via the cloud to Ranger engineers and managers, as well as its customers, wherever they are located. This data provides remote, real-time visibility to the operation that is taking place at a wellsite.

2. Personnel

Fundamental to the performance of any completions solution is the performance capability of its field-based personnel, engineering and management teams. This forms the backbone of Ranger Elite Completion Solutions.

All employees engage in a formal employee development program including safety, onboarding, training and employee development. The company's crews are trained and qualified with Well Control Certification, Ranger Readiness Personnel Certification (safety and SOP training), root cause analysis and problem-solving. Its crews have multi-basin completion operations experience, including frac plug drillout and refrac operations.

The crews are outfitted with state-of-the-art equipment and Ranger Live mobile tablets, including the company's eQHSE quality and safety application that provides standard operating procedures, safety forms and observation management, safety alerts, push notification and additional functions.

Ranger's mobile app employs a learning management system (LMS) for documentation, tracking, reporting and delivery of training materials for technical competen-

FIGURE 2 : Completion field crew. (Image courtesy Ranger Energy Services)

cies. This app helps deliver training materials to the crews, track crews' progress and manage record-keeping. The LMS enables Ranger's management to record individual employee scores, learning event scores and identify benchmark scores.

The app also provides employees access to the company's library of written and recorded compliance and training resources, including standard operating procedures (SOPs) for the company's various service lines. Each SOP details the skills required and the process to complete each task in connection with daily work plans and job safety analysis activities.

Management can view real-time data and daily dashboards to make operational decisions in response to employee and customer needs. It can react or anticipate needs in a fraction of the time than would be possible otherwise. The ability to perform long-term data analytics and trend analysis provides management with actionable data.

3. Equipment

Ranger's completion solution encompasses its fleet of high-spec mobile completion rigs. These rigs include the ancillary equipment needed for frac plug drill-out operations in extended reach horizontal wells and post drill-out operations to snub-out the workstring and snub-in the production string.

Before mobilization, all equipment is API certified and Ranger Readiness Equipment Certified. Ranger's certification consists of a two-to-four-week pre-mobilization process based on a composite best practice of the most stringent operator standards.

> **"What's wanted is completion efficiency,** performance and safety for long horizontal frac wells."

All Elite equipment is maintained in top operating condition according to API standards after mobilization, using the Ranger Live ePMM application for preventive maintenance. From an asset management perspective, Ranger's app integrates with the company's preventative maintenance management (PMM) system to ensure that equipment is inspected and repaired routinely according to preventive maintenance schedules.

4. Engineered solutions

Field teams are supported by a completions engineer built into the job planning process. Pre-job completion engineering includes a torque and drag model, hydraulics model, location plat, and previous offset job analysis.

Data acquired during each completion job is used to document actual versus planned performance metrics, calibrate the torque and drag and hydraulics models, and prepare a post-job report.

Data is also used to benchmark operational performance metrics and identify operational improvement opportunities.

5. Safety

Reducing injuries, dangerous circumstances and incident rates is a crucial focus for operational leaders who rely on a robust quality, health, safety and environmental (QHSE) management system to accomplish this objective.

Completion solutions deliver heightened safety performance because all personnel are trained in the same safety management system and tools. All services are coordinated by a single wellsite manager, who is responsible for achieving the operational objectives.

Ranger Live delivers a customized suite of applications to field crews for observation and incident reporting, learning management, audits, asset management, job reporting and field ticketing. It also enables the company to automate all aspects of fleet and driver management, including driver behavior, and state and federal Department of Transportation (DOT) compliance.

The eQHSE mobile platform fully embodies the concept of integrated data capture and reporting. It has been designed to be intuitive, easy to use, and as familiar to the user's paper reporting process as possible to facilitate and encourage reporting.

A unique feature of Ranger Live is the ability to examine reports and send information to the originator immediately. This is something that is seldom if ever, done with paper reporting. Near real-time response to critical issues builds a culture of trust and respect, which is the bedrock of safety and quality.

When an employee enters a new observation report into the app, it is immediately routed to the appropriate QHSE personnel. Depending on the severity and potential impact of the observation, it may be escalated to management for resolution. A root-cause analysis may be conducted, and the results can be communicated directly to the originator.

Further, safety alerts are pushed out to all impacted employees to educate them about the situation and the corrective action. Each safety alert requires the user to acknowledge that they have received, read and understand the alert by capturing their signature.

Setting the standard

Ranger Elite Completion Solutions has set a new standard for completion efficiency, performance and safety for long horizontal frac wells.

High-spec mobile completion platforms, real-time job monitoring, post-job metric reporting, and elite highly trained and experienced completion teams are smoothly integrated to execute comprehensive and optimized long-lateral frac plug drill out and snubbing solutions. OG

Ranger Energy Services (NYSE: RNGR), a premier provider of well completion and intervention solutions, is one of the largest providers of high-specification well service rigs and associated services in the United States, with a focus on technically demanding unconventional horizontal well completion and production operations. With a fleet of 300+ well service rigs, the company is among the largest in the industry. Ranger's ancillary rentals, rig-assist snubbing, flowback and transportation services complement the well service rigs to offer comprehensive completion and production solutions.

For more information, contact Mark Haubert – Vice President of Business Development, Marketing & Technology, Ranger Energy Services; 800 Gessner, Suite 1000, Houston, TX 77024; Phone 713-935-8900; www.rangerenergy.com.

***Michael Hopkins,** is founder & vice president, operations, and Mark Haubert, vice president of business development, marketing & technology, Ranger Energy Services*