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Improving Completions Through Better Near-Wellbore Conditions Knowledge

Drill2Frac's FlowFX solution helps finetune completion designs by modeling parameters such as the number of perf clusters and length of stages.

JENNIFER PALLANICH | SENIOR EDITOR, TECHNOLOGY

A solid understanding of near-wellbore conditions is a key component for successful completions. Operators could use trial and error to test completions effectiveness, but without understanding near-wellbore conditions, that is a costly and time-consuming approach. So, obtaining wellbore conditions using pre-existing data and simulating different completion designs is a better, noninvasive option, according to Drill2Frac.

The company developed its FlowFX near-wellbore fluid distribution solution over a period of years.

Kevin Wutherich, Drill2Frac CTO, started his career as a completions engineer and understands the importance of getting flows right.

"I realized early on that the near wellbore is where everything happens," he said. "If you can get what happens in the near wellbore right, then you can have a good effect on the rest of the job. You can't control what happens after the fluid leaves the wellbore, but you can change what's happening in the near wellbore."

Rock properties in the near wellbore can change foot-by-foot, he noted, meaning clusters can be placed in different types of rocks.

"If you can get what happens in the near wellbore right, then you can have a good effect on the rest of the job."

—KEVIN WUTHERICH, Drill2Frac

To adapt to the near wellbore, it is important to understand what the initial conditions are, he said.

"There have been models built to understand fracture efficiency, but they haven't been able to effectively take into account near-wellbore rock properties," Wutherich said.

Between 2016 and 2019, Drill2Frac president Dharmesh Mehta said the company focused on improving the process it uses to characterize rock properties in the near wellbore, leveraging drilling data and other information operators had obtained, such as via downhole cameras or fiber optics.

The entire focus is to use data the customer already has instead of requiring them to collect new data, he said.
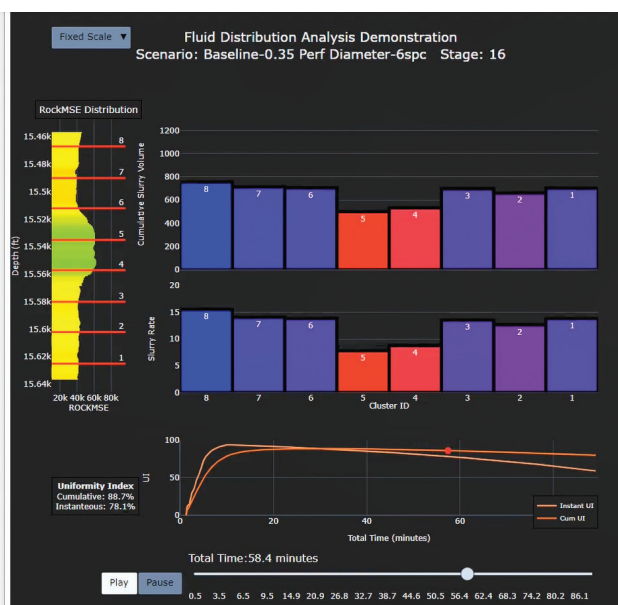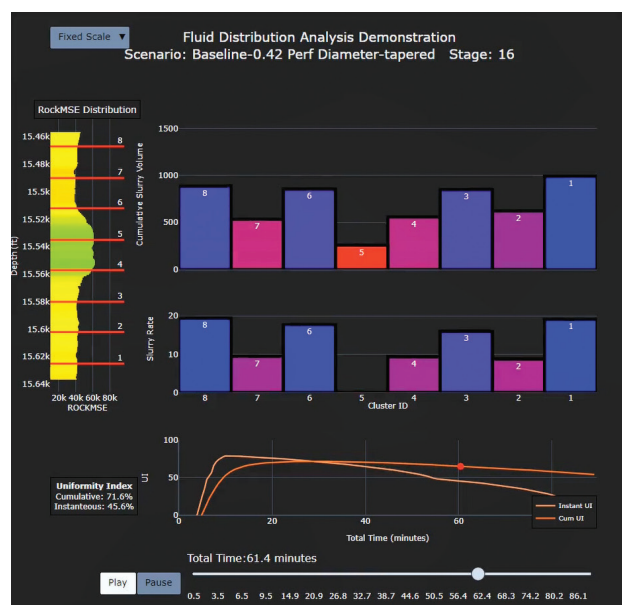
Source: Drill2Frac

The FlowFX simulation demonstration on the left shows how insufficient perforation friction allows intra-stage stress shadowing to dominate. However, when sufficient pressure drop is used, as shown on the right, a much better distribution occurs.

"Our entire focus is to use data the customer already has."

—**DHARMESH MEHTA,** Drill2Frac

But data alone is not enough, Mehta added.

"That left the last frontier, understanding things like erosion and stress-shadow models," he said.

Integrating those models with customer data was the next step.

With digital solutions for fluid distribution in place and the ability to detect depletion using data and processes, Drill2Frac's data and analytics help operators fine tune completion designs by modeling parameters such as number of perf clusters and length of stages, he said.

The result is a cloud-based solution designed as noninvasive in nature to help operators achieve more consistent and productive wells.

PLAYING WHAT-IF

FlowFX allows completion engineers to visualize frac plans and quickly simulate the effects of different designs, Mehta said.

It may seem reasonable to think that 1,000 lb of proppant pumped into eight clusters in a stage will distribute equally, he said. "The reality is that is not the case. You never get equal distribution."

As Mehta puts it, FlowFX provides a visualization of how the proppant is going into each cluster for each stage.

From there, it is possible to play what-if and learn what might happen if an element of the completion is tweaked, he said. All the physics and modeling happen behind the scenes, he said.

Customers can "turn the knobs" on the completion design to see how variables like number of stages, stage length, number of clusters per stage, shots per cluster, perf diameter, orientation of perfs, pump rates and the volume of proppants may affect the completion's effectiveness.

Mehta said it makes it easy for customers to understand the effects of the near-wellbore conditions.

"[It makes] that process simpler, easier and leverages the data you already have instead of collecting new data," he said.

Wutherich said the process makes it possible to model many different scenarios to show what they can expect to happen during fracturing with any modification, which is more cost-effective than trial and error.

"It's a model. It's not going to be perfect, but it's based on solid physics and data." So, it makes it possible to predict how changes in completion designs will affect fluid distribution along the wellbore, he said.

Instead of running operational trials on 50 completion designs, FlowFX can shortlist those designs to the five most likely to succeed, he said.

According to Wutherich, the model cannot take everything into account. Poor cement, for example, makes it hard to model what is going to happen because the cement is not fully controlling where the fluid will go.

Wutherich said Gordy Oil, a customer, made completion design decisions based on FlowFX for wells in the Delaware Basin. The ability to model different designs led to an optimized design that resulted in a significantly improved completion and production increase, he said.

Drill2Frac announced the availability of FlowFX during URTeC 2021 and has been using it internally for customers. The FlowFX 2023 update, which will be launched in the first quarter of 2023, incorporates feedback from customers.

One of the biggest changes is that it will be cloud-based, which will allow Drill2Frac customers to work directly with the digital solution and run simulations themselves. ∎
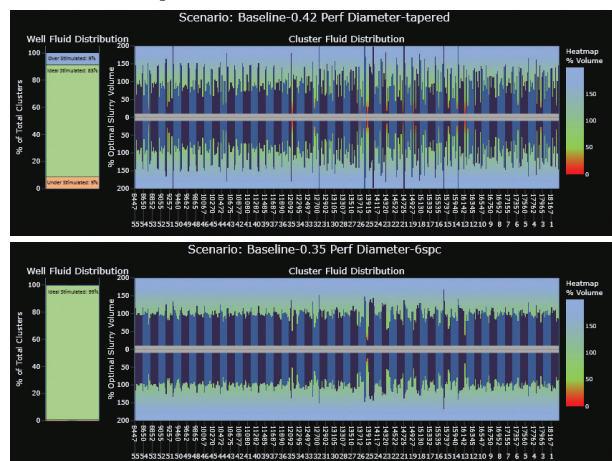
Drill2Frac OmniLog Example
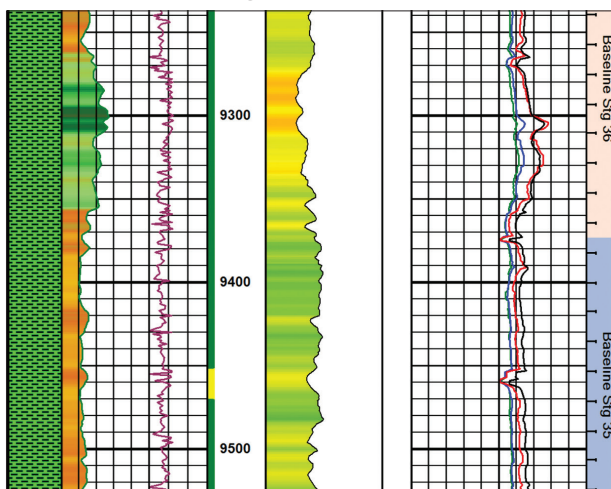
Source: Drill2Frac

Some rock properties can be ascertained from drilling data as shown in this log. From left to right, mud log lithology, gamma ray, rate of penetration, OmniLog RockMSE, gas composition, stage and cluster design.

FlowFX Near-Wellbore Fluid Distribution Model Comparison

Source: Drill2Frac

FlowFX models how fluid will be distributed among perforation clusters for differing completion designs.