New Age Fracture Mapping Diagnostic Tools - A STACK Case Study

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ABSTRACT

The application of learnings from an underground laboratory has led to significant completion changes in a world-class North American unconventional asset. Understanding the stimulated fracture geometry in unconventional reservoirs allows for optimal development of the asset. In this article, we will review a case study comparing both new and commonly accepted technologies to quantify stimulated fracture geometry.

The technologies applied to improve the understanding of fracture geometry in this case study include fiber optic monitoring (Distributed Acoustic Sensing and Distributed Temperature Sensing), borehole microseismic, electromagnetic imaging, offset well pressure monitoring with IMAGE Frac technology, water hammer analysis, and fracture modeling. The validation tools used include a production interference test, Rate Transient Analysis (RTA), Oil Soluble Tracers (OST), and Fracture Fluid Identifiers (FFI).

Fiber optic monitoring was used to assess cluster efficiency, fluid and sand distribution per cluster and diverter effectiveness. Hydraulic half-lengths, heights, and fracture azimuth were estimated using a borehole microseismic system consisting of three vertical arrays and two horizontal arrays. Electromagnetic imaging provided insight on hydraulic half-length for 12 stages. Offset pressure monitoring provided hydraulic and propped half-lengths, heights, and fracture azimuth. The fracture model was calibrated using a diagnostic fracture injection test and vertical logs from the section of interest. Results from the technologies suggest an increase in well density is required to maximize the project net present value.

The offset well pressure data coupled with fiber optic monitoring led to optimization of diverter applications. A variety of completion variables were tested, including fluid design, proppant size, perforation designs and diverter types, results have been integrated into an improved completion design.