

Engineered Completions Improve Eagle Ford Perforation Efficiency 28%

Open- and cased hole logging used to optimize positioning of fracture stages and perforation clusters for more efficient production from horizontal wells

CHALLENGE

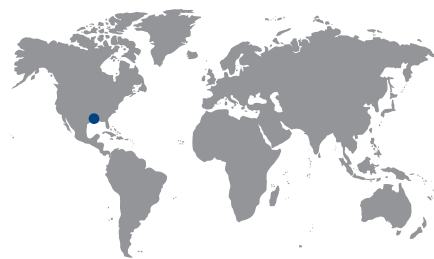
Better account for variations in stress and reservoir quality along laterals to improve the percentage of perforation clusters that contribute to production over the 64% average achieved with conventional geometric completion designs.

SOLUTION

Engineer completions using the completion advisor in Mangrove* reservoir-centric design software with input log data from ThruBit* through-the-bit logging services and the Sonic Scanner* acoustic scanning platform, with the latter obtained in cased hole conveyed by the TuffTRAC* cased hole services tractor.

RESULTS

Achieved average perforation efficiency of 82% for a 50% reduction in the number of nonperforming completion clusters and a calculated increase in NPV of USD 1.5 million for the first year of production.



Production from only 64% of perforation clusters

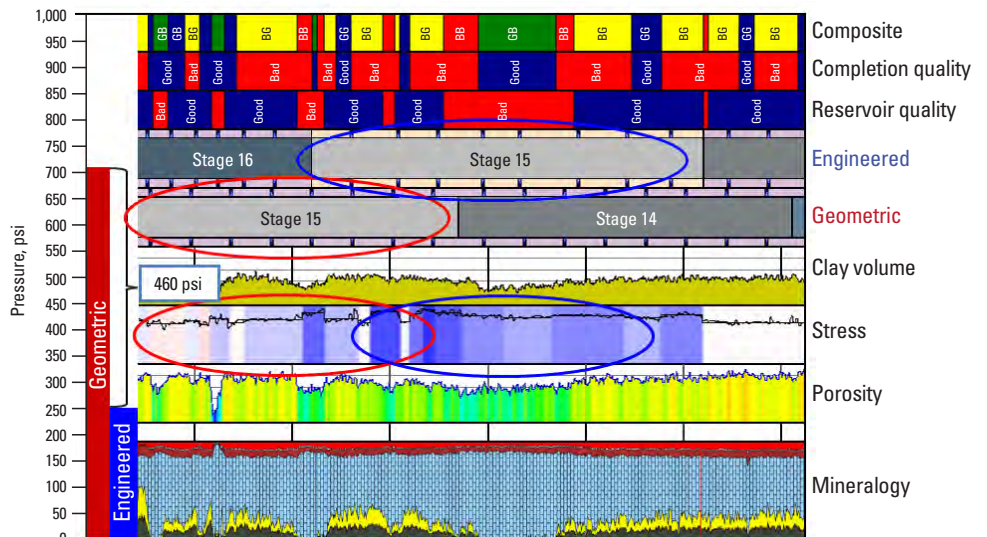
Schlumberger and four operators of Eagle Ford wells in South Texas formed the Eagle Ford Completion Optimization Consortium to investigate improving completion design for horizontal wells through the use of log data. Of particular interest was accounting for the effect of lateral variation in stress along a well to improve the percentage of contributing perforation clusters, termed perforating efficiency, from the 64% average achieved with conventional geometric spacing.

Reservoir quality and completions quality based on logging data

ThruBit logging services were used to efficiently acquire through-the-bit quad-combo logs in 12 wells with minimal interruption to the operators' existing field development workflows. The Sonic Scanner acoustic scanning platform was also run in some wells, with conveyance in cased hole on the TuffTRAC tractor, to determine 3D mechanical properties.

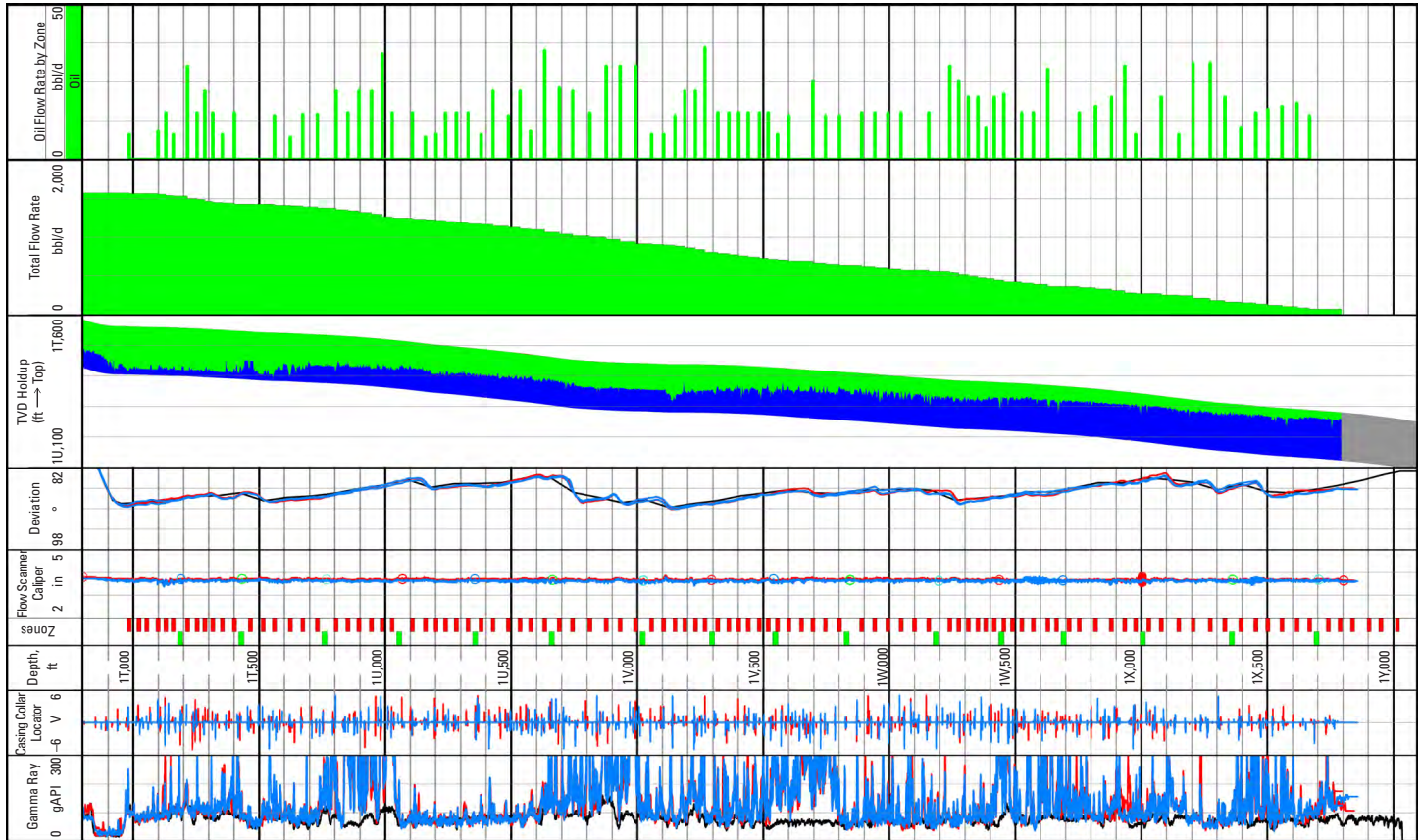
The logging data were used by Schlumberger petrotechnical analysts to conduct a shale evaluation quicklook and assessment of 3D mechanical properties. The results of the petrophysical and geomechanical analyses were used as the completions quality and reservoir quality inputs to the completions advisor of Mangrove reservoir-centric stimulation design software to produce an engineered completion design.

Each of the wells was stimulated according to its customized treatment grouping for similarly stressed intervals, flowed back for cleanup, and logged with the Flow Scanner* horizontal and deviated well production logging system conveyed on the MaxTRAC* downhole wireline tractor system.

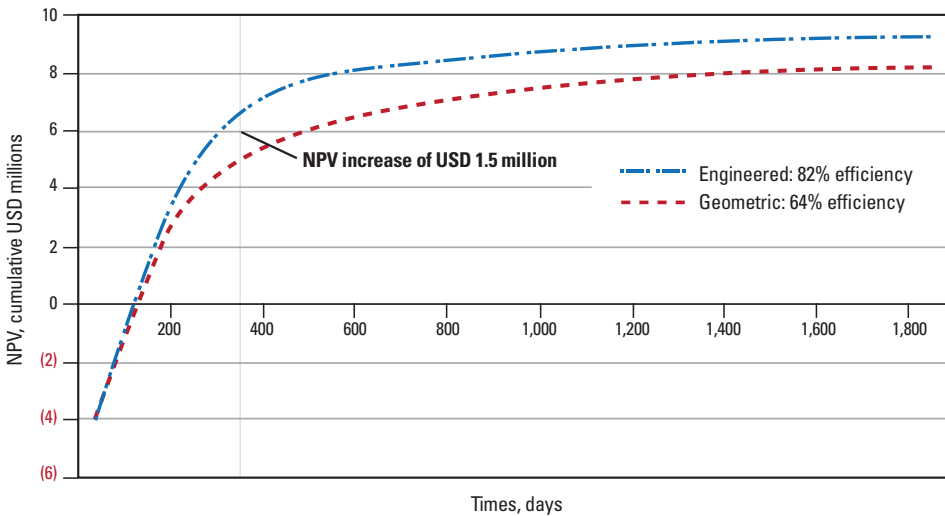


The engineered completion design aligns the fracture stages and their perforation clusters with intervals of high reservoir quality and similar completion quality. In Stage 15, the engineered completion design reduced the variation of the fracture initiation pressure to approximately 250 psi from 700 psi in the geometric design.

CASE STUDY: Engineered completions improve perforation efficiency 28%, Eagle Ford



Flow Scanner production logging confirmed the effectiveness of the engineered completion strategy in this well, with 89% of the perforation clusters (shown in red on the zones track) producing oil.



Perforation efficiency increased to 82%

Flow Scanner production logging showed that on average 82% of the perforation clusters placed following an engineered completion strategy are producing oil, a significant improvement over the benchmark 64% average for conventional geometrically spaced Eagle Ford completions. By using reservoir characterization to automatically group intervals with similar properties into fracture stages and aligning perforation clusters with the stages, the overall stress differential was successfully minimized to more efficiently and effectively produce the unconventional reservoirs.

NPV calculations based on production results from ECLIPSE* reservoir simulation software show a USD 1.5 million increase in NPV in the first year of production for the average engineered completions over the geometric completions. The only difference in the well costs was less than USD 100,000 for the logging supporting the engineered completion. Production was identically choked for the first 200 days.

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