Multi-discipline path to value creation in Permian Basin

Laredo Petroleum collaborates with Halliburton to increase reservoir understanding in a multi-target unconventional play

Location: Texas

Overview
Seeking to increase production and maximize shareholder value, Laredo Petroleum Inc. wanted to better target its acreage’s most productive areas and horizons in the Wolfcamp, Cline, and Spraberry formations in the Midland Basin, which is part of the Permian Basin in West Texas. If a deeper understanding of the area’s challenging unconventional geology, stacked formations, and reservoir properties could be achieved, enhanced recovery would be more likely.

Halliburton brought onboard
Laredo had already compiled a comprehensive data set – from core to 3D seismic – early in its unconventional fields’ development. The company asked Halliburton Consulting to integrate the data and provide insight that might lead to improved production and superior capital efficiency. Laredo also wanted Halliburton Consulting to evaluate the vertical and horizontal spacing of its hydraulically fractured stacked lateral well designs, based on the available production history and micro-seismic survey results from several wells.

CHALLENGES | SOLUTIONS | RESULTS
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• Improve production from multi-stack unconventional play | • Understand horizontal production heterogeneity | • Increased the client’s understanding of the multi-stack unconventional play
• Place wells in the sweet spot based on reservoir understanding | • Build 3D earth model integrating subsurface information with production data and well performance history | • The client is using the earth model to help plan future well locations, geosteer horizontal laterals, and optimize completion strategies
• Validate and optimize well spacing and fracture design approach | • Apply multi-discipline approach involving geoscientists, reservoir engineers, and drilling and frac engineers | |

Midland Basin average combined thickness of 5,000 feet.
Collaboration leads to a more robust earth model
Starting with Laredo’s existing data, Halliburton developed an integrated 3D earth model of a specific sector of the acreage. The model contained:
- Structural components and boundaries for different layers of the property
- Seismic inversion and petrophysically derived facies
- Reservoir properties defined by pretrophysics and dynamic single-well simulation to better understand reservoir property distribution from engineering data

From there, a multivariate analysis was performed to determine which seismic and reservoir attributes had a higher correlation coefficient to production information.

The fully integrated earth model was used to identify “sweet spots” (both vertically and horizontally). It enabled improved lateral placement within a given reservoir and the corresponding ideal landing point. The model could then serve as a guide for real-time geosteering, ensuring maximum contact with the most productive reservoir areas. Furthermore, the model is evergreen. Results from new drilling and completions can be incorporated and used to optimize wellbore geometry to deliver higher initial production (IP) rates and estimated ultimate recovery (EUR). It’s important to note that:

The starting point for the earth model can be any level of data currently available to an operator. As field development progresses, optimization based on a balanced data acquisition scheme of geological and geophysical (G&G) and engineering data integrated into the earth model has proven to return multifold on the data investment.

Enhanced evaluation leads to increased accuracy
In examining Laredo’s stacked laterals, Halliburton evaluated historical production data in conjunction with microseismic data, production logs, and additional subsurface information. This enabled a more accurate model of the reservoir, which, when calibrated, was then used to optimize completion design and well spacing to potentially enhance production.

Key to Halliburton’s evaluation was the ability to add production data for a history-matched dynamic reservoir simulation. By correlating patterns discerned from static data with actual productivity results, then using multivariate statistics to assist with the development of a predictive model, Laredo now has a development program that it can fine-tune to optimize both production and operational efficiencies.

Go beyond factory drilling
Halliburton’s Reservoir Characterization and Modeling Consulting Services, delivered using CYPHER® Seismic-to-Stimulation Service tools and workflows, can help you integrate data; evaluate individual wells, pads, and fields; and optimize recovery while maximizing operational efficiencies. With a better understanding of both static and dynamic properties that are impacting production, you will be able to fine-tune well and stimulation designs to get the most out of every well you drill and every dollar you spend.

“Laredo Petroleum has made a significant investment in building cross-discipline databases in order to develop our acreage position in the Permian Basin more efficiently and cost-effectively. Integration of such large volumes of data was achieved by collaborating with Halliburton to use their CYPHER workflow to build a 3D geological model that provides the technical foundation from which we are able to optimize our well spacing, lateral length, and hydraulic-fracturing designs. By applying an integrated data approach, we believe we are well along the way in developing “best practices” as they relate to field development and minimizing the inherent complexities associated with a multiple-target shale play.”

— Pat Curth, Sr. VP of Exploration and Land
Laredo Petroleum, Inc.
There is a strong correlation between the earth model and the ability to predict well results. To date, the model has been compared to the actual results in more than 30 horizontal wells with an average correlation coefficient for the four Wolfcamp and Cline intervals of 0.85.
Halliburton’s CYPHER service enables operators to maximize the value of shale and tight reservoirs from initial field exploration to field development. In reservoirs where we’ve applied CYPHER service, our customers have seen:

- Reduction in cycle time by 80 percent
- Higher initial production rates by 35 percent
- Improved EUR by 124 percent
- Lower costs per BOE by 40 percent

Discover the collaborative CYPHER service, where geoscience, reservoir, drilling, and completion engineering enable you to better produce and predict unconventional reserves.