CYPHER® Seismic-to-Stimulation Service helps operator set record with a 65 percent reduction in drilling days plus a 32 percent increase in production

Location: Delaware Basin

Overview
An operator in the Permian Basin drilled and completed three unconventional horizontal wells in the Delaware Basin, but, after a year, results had not proven economical. Other wells just outside this operator’s acreage had shown to deliver top-quartile performance. Believing the field had more to offer, the operator turned to Halliburton to help solve its unconventional challenge.

Planning the work together
This acreage position presented some unique challenges for the operator and Halliburton. First, the area lacked basic seismic data to better understand the subsurface, and, second, the acreage position was quite large in breadth and presented challenges correlating formation tops across the area. Halliburton collaborated with the operator and applied the CYPHER® Seismic-to-Stimulation Service to help address these challenges and improve well performance while achieving the lowest cost per BOE.

In order to gain better subsurface insight, Halliburton built an interactive earth model, using DecisionSpace® Earth Modeling software, which allows the drilling, reservoir, completion, and geological and geophysical (G&G) disciplines to work together on a single platform, thus vastly improving communication. Halliburton’s experts provided support to analyze the subsurface in 3D and help the operator achieve a better visual of the most productive areas in the field.

An initial pilot well was drilled to obtain key well information – including total organic carbon (TOC), effective porosity, water saturation, and geomechanical properties such as brittleness – to aid in identifying lateral landing targets. Next, a pulsed neutron log was run to better correlate the heterogeneities with the vertical pilot and to identify the best parts of the rock for stimulation and production potential. Formation cuttings and fluids were collected to optimize fluid chemistry for the stimulation treatment. With this detailed technical knowledge and an interactive earth model to visualize the subsurface, Halliburton’s local technology team worked with the operator to identify and apply advanced technologies for the stimulation treatment to maximize full field development.

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<td>Underperforming wells in Delaware Basin</td>
<td>CYPHER® Seismic-to-Stimulation Service</td>
<td>46 percent reduction in cost per BOE</td>
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<td>Top 4 out of 5 wells for initial production</td>
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CASE STUDY: CYpher® Seismic-to-Stimulation Service delivers big production increase

65% REDUCTION IN DRILLING DAYS

32% INCREASE IN PRODUCTION

BEST 4 OUT OF 5 WELLS IN THE DELAWARE BASIN!

WELLS STILL MAKING MONEY!
**Calibration, validation, and adjustments for optimization**

Before spudding the first well, reviews and analyses indicated that the following adjustments to the drilling plan could enhance chances for success:

- The azimuth of the lateral was changed to orient for transverse fractures
- The casing program was modified to accommodate a salt interval in the vertical
- A lateral target was selected based on analysis of the quad-combo log from the pilot holes
- VersaFlex® liner hangers were run to improve wellbore integrity

After drilling the first well, the team modified the casing design by running a shallow intermediate casing string to the base of the salt interval, plus a second string to the bottom of the formation. Then, the well was successfully drilled to total depth.

**Collaborative identification of challenges leads to successful completion**

Continual Earth Modeling interpretations and engineering analysis combined with the operator’s expertise and Halliburton’s local experience indicated that the following revisions in the completion design would better address multiple challenges:

- Stage placement and non-geometric perforation design were determined using vertical pilot well logs correlated to pulsed-neutron cased-hole lateral logs with FracInsightSM service
- SoluCem™ acid-soluble cement was implemented to minimize breakdown pressure and reduce entry friction pressure
- RapidStart® initiator sleeve system was run to eliminate a coiled tubing run to perforate and clean the wellbore
- The surfactant program was created using RockPermSM service to analyze formation cuttings and produced fluids
- SandWedge® ABC aqueous-based conductivity enhancement system was employed for the last third of each stage to improve near-wellbore conductivity and to mitigate sand flowback issues
- Proppant volume, concentration, and mesh size were optimized to reduce the risk of placement issues and to maximize production potential
- The fracturing fluid system was changed from a cross-link system to a hybrid slickwater/gel, based on local expertise

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**Collaboration Structure**

*CYPHER® seismic-to-stimulation workflow begins with the team. The collaboration and information sharing between the customer and Halliburton teams is critical to the success of the service.*
**Results speak for themselves**

Six wells were drilled and completed with excellent results overall.

Along with the subsurface expertise, Halliburton provided the wellsite services for the drilling and completion operations including cement, drill bits, mud, directional, completion tools, wireline logging, and fracture stimulation. Over the course of one year, the operator drilled and completed six wells in the Delaware Basin and obtained significant cost reductions and production improvements.

- Drilling time to total depth (of the well) was reduced from 60 days to 21 days - a new record for the area that represented a 65 percent reduction in days to drill
- Drilled and completed four of the top five producing wells in the Delaware Basin
- Six-month results show a 32 percent production increase per BOE/1,000 lateral feet vs. offset operators
- All of the wells in this project continue to provide favorable economic returns even at current market conditions
- Reduced cost per BOE by 46 percent vs. offset competitor wells

**CYPHER Seismic-to-Stimulation Service** is a collaborative, integrated workflow that leverages subsurface insight to know precisely where to drill, how to drill, where to frac, and how to frac. With CYPHER service, operators will maximize the value of their shale assets by increasing production, lowering cost per BOE, and reducing uncertainty every step of the way.

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