Halliburton provided accurate, real-time production logging service for horizontal wells

**OVERVIEW**

After the completion stage of three horizontal wells in North Dakota, a multi-national energy company wanted accurate data to optimize production of future wells. It's difficult to get accurate readings in horizontal wellbores because of the simplicity of traditional logging tools, which typically only have one sensor located in the center of the casing. Water, oil and gas are often segregated across the horizontal wellbore and flow at different rates.

The company turned to Halliburton, which recommended using production array logging tools from its Wireline and Perforating service line. The tool's multiple sensors read the entire cross section of a wellbore. Halliburton also recommended obtaining real-time data with an e-coil string from its Boots & Coots service line, increasing quality control and eliminating multiple downhole trips. The company used these tools to determine production rates and find trends for future well development.

### CHALLENGE

| Accurate data needed from horizontal wells | Real-time data required to reduce downhole trips | Reading data accurately after logging job complete |

A multi-national company wanted accurate data from three horizontal wells to optimize production of future wells. Traditional logging tools use one sensor and can't accurately read horizontal wellbores because water, oil, and gas separate in the laterals and flow at different rates.

To ensure quality control, the company wanted to log in real time. Most logging tools record data for analysis, but without the ability to see the data as it is being recorded, operators don't know if tools are working properly. Errors could lead to multiple trips downhole.

Analyzing multiple sensor logging data is complex. A large number of sensors determine the volumes of oil, gas and water in the wellbore. The company also needed the information in a format that it could easily use to help locate trends in different stimulation methods.

### SOLUTION

| Multiple sensors for accurate well logging | E-coil string allowed real-time data to be seen | Software and analysts specialized in logging data |

Halliburton recommended its production array logging tools, which use multiple sensors across the wellbore to detect fluids and flow rates across different zones in the wellbore. The tools also help determine choke points and how much water, oil or gas is produced in each zone.

Boots & Coots used its coiled tubing system for real-time quality control. The array was sent downhole with coiled tubing, creating an e-coil string. Real-time data allowed the operator to identify and resolve problems and re-log areas if necessary without the need for another trip downhole.

Halliburton analysts integrated the data provided by the array tool into a comprehensive report. Analysts used Halliburton customized and optimized software, along with their own calculations, to determine flow rates, trends, and production rates of different stimulation techniques.
Halliburton’s production array logging tools help provide accurate data of a horizontal well, reading the entire cross section of the wellbore with multiple sensors. Boots & Coots’ e-coil string provides real-time information during logging, eliminating multiple trips downhole.

The logging of the well took approximately 30 hours for each well, with the entire job taking about a week and a half.

This international oil and gas company hired Halliburton for the entire logging job, rather than hiring multiple service providers.

The e-coil string and production array logging tools logged half the horizontal wellbore and 20 stages for each well.
Multi-national company wanted to optimize production in North Dakota
An international oil and gas company needed accurate production data from three horizontal wells in North Dakota. It wanted to use this data to determine if different hydraulic fracturing treatments resulted in an increase or decrease of production and optimize production for future wells. The company first turned to one company to provide this information, but it was unable to finish the job. Company officials then turned to Halliburton, which recommended using its production array logging tools on an e-coil string.

Production array logging tools provided accurate data
Traditional logging tools do not provide accurate information in horizontal wells because the tool only reads information from one point. These readings are accurate in vertical wellbores because oil, gas and water remain uniformly distributed across the wellbore. However, in a horizontal wellbore, fluids separate into their own streams and move at different rates.

Halliburton’s production array logging tools provide accurate data of a horizontal well. The production array logging tool reads the entire cross section of the wellbore. It uses multiple sensors that are essentially lined up in a circle, creating an array. These sensors detect fluids across the wellbore and identify flow rates and volumes of fluid at each stage. This gives analysts the ability to break down the individual zones and determine how much each is producing. Halliburton has experience providing these solutions to many oil companies around the globe.

E-coil string provided real-time data during logging
The company also wanted the ability to log the data in real time. With real-time logging, quality control operators monitor the data from the surface and confirm that the tools are working properly. Other systems only record the data, without the ability to see if an error has occurred before the tool returns to the surface. Boots & Coots’ coiled tubing system provided the deployment solution. A 2-inch coiled tubing unit enabled deeper reach, continuous circulation and the ability to run an e-coil string with real-time data. If an error occurs, the area can be re-logged without a separate downhole trip, saving time and money.

Company hired Halliburton rather than multiple service providers
Collaboration was critical to the success of this project, because many different types of equipment were needed to complete the job. Hiring Halliburton meant the company only needed to hire one service provider to handle all aspects of the job, rather than multiple service providers. Halliburton moved people and equipment from across the United States and Canada for the project. Halliburton had also provided the pumping services and conducted the hydraulic fracturing on these wells, so the different product service lines coordinated to provide logging analysts the information needed to efficiently and accurately locate trends in the analysis.
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**Halliburton logged each well in just over a day**
All three wells were similar and in the same field. Each well reached depths of 20,000 feet and consisted of 40 different stages. To reach these depths, a 2-inch OD coiled tubing string was used to send the production logging array tools downhole.

Logging took approximately 30 hours for each well, with the coiled tubing reaching just over 15,000 feet before friction stopped it from going further. Crews were able to conduct each job in about three days and complete the logging of all three wells in a week and a half.

**Halliburton provided in-depth data analysis of production and trends**
After completing the logging of all three wells, the results were sent to Halliburton’s Formation and Reservoir Solutions Center for analysis. Analyzing production array logging data is much more complex than standard logging data due to the multiple sensors downhole. Each one of the tools measures a different property. Analysts use industry-standard software, customized and optimized for Halliburton’s use, to help calculate the results, which are based on a series of mathematical equations from each of the tools.

Analysts provided an in-depth report that looked at trends from each of the zones and each of the stimulation methods. The analysis not only provided the company visibility into how much oil, gas and water each stage produced, it also showed correlations between wellbore trajectory and stage production.

**Company can use results to optimize future production**
Halliburton accurately logged all three horizontal wellbores, providing the company valuable data, as well as trends and correlations between different stimulation methods. The company can now use this information to efficiently stimulate and optimize production of future wells.