



## Cased-Hole Services

# Halliburton succeeds where competitors failed on pump-down plug and perforating operations in the Jiaoshiba shale play

Halliburton cased-hole technology for shale gas reservoirs broadly used on every pad in southwest China

Location: Jiaoshiba, China

### Overview

Halliburton was approached by an operator in the Jiaoshiba shale play in China to perform plug and perforating operations on a project with a steep, lateral well. Previous service professionals on the project had been unsuccessful in navigating their tools with the incline and were unable to complete the work. Many challenges needed to be addressed and overcome to ensure successful operations, including the pull of gravity, how to best pump the gun assembly upward, and operating accurately on depth. Careful planning, superb engineering design, and teamwork ensured all obstacles were handled. A decision was made to cease using rollers to pump the gun assembly upward and use a “firing while moving” technique instead. Modeling software aided in the engineering design, and a Mono-Cable Tension Device (MCTD) and Pump-Down Visualization (PDV) assisted the local crew in successfully completing 89 stages in 2014 without any nonproductive time (NPT) or HSE issues. These seamless operations saved rig time and frac spread standby time, ultimately saving the operator USD 800,000. Throughout the entire project, the customer was impressed with Halliburton’s efforts and awarded more work based on this outstanding performance. Halliburton looks forward to completing many more stages for this operator in the future.



CHALLENGES	SOLUTIONS	RESULTS
<b>Well required a pump-down at a steep 107 degrees</b> The biggest challenge on this project was the well’s steep lateral incline of 107 degrees.	<b>Thoughtful engineering design and careful job planning Cerberus™</b> software was used for the engineering design. An experienced team carefully planned and executed the job using a “firing while moving” technique.	<b>Seamless job execution</b> Halliburton completed 89 stages in 270 hours, saving the customer rig time and frac spread standby time.
<b>Safe job performance without HSE incidents or NPT</b> Several competitors previously on the job experienced NPT and HSE incidents, and had failed to complete the necessary stimulation operations.	<b>Attention to detail ensures safe and incident-free operations</b> Again, careful job planning and attention to detail ensured safe and incident-free operations.	<b>Excellent job performance where others failed</b> Halliburton completed 89 stages of plug and perforating work without any NPT or HSE incidents.
<b>Addressing unintentional pump-offs</b> Competitors had experienced unintentional pump-offs (or guns separating from the cable), which can result in NPT and production delays.	<b>Monitor conditions in real time</b> Halliburton’s unique PDF software and MCTD helped pinpoint the location of guns and reduce risk of pump-off with real-time feedback.	<b>Rig time and frac spread standby time avoided</b> Use of these technologies helped avoid pump-offs, saving rig time and frac spread standby time.

### Well with a steep 107-degree lateral incline poses challenges for plug and perforating operations

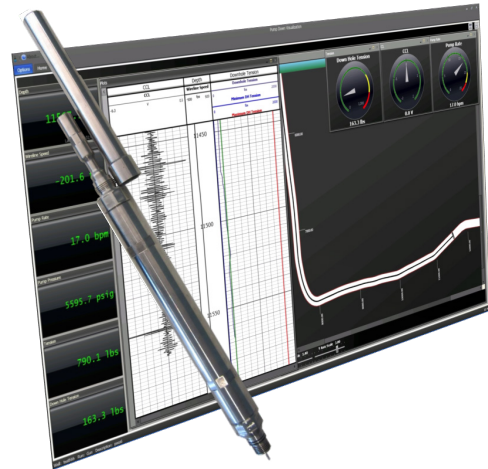
The rapidly expanding development of shale gas has meant more jobs and a greater role for Halliburton in the Jiaoshiba shale play in China. By year-end 2014, 86 stages of plug and perforating operations were successfully completed on a project for a major operator in China without any health, safety and environment (HSE) incidents—one of the biggest challenges when pumping down at a 107-degree lateral incline. In fact, Halliburton received this stimulation work after several domestic service competitors had issues navigating the incline with their tools. A variety of obstacles needed to be understood and overcome to ensure Halliburton would not meet the same fate while operating on this project. Challenges included addressing the pull of gravity, how to best pump the gun assembly upward, and operating accurately on depth to avoid pump-offs.

### Job planning critical for successful operations

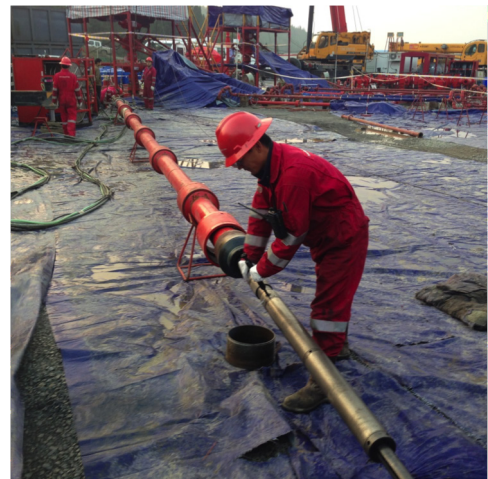
To tackle these challenges, all job-related crews met to devise a plan of action. Because of the spectacular angle of the target well, a decision was made to quit using rollers to pump the gun assembly upward. To ensure that Halliburton would always operate at the accurate depth, a “firing while moving” technique would be used. Halliburton employed Cerberus software to map out the best design scenario for the project. The software indicated a simulated pump rate of approximately a 1.8 m<sup>3</sup>/min at a minimum was required, and that an additional 150 percent—2.7 m<sup>3</sup>/min—would successfully maintain a line speed at 30 m/min during the whole operation.

### Halliburton technology offers valuable information in real time to avoid pump-offs

Using a Mono-Cable Tension Device (MCTD) and Pump-Down Visualization (PDV), the local crew was able to pinpoint the location of the guns in real time and avoid pump-offs. The team initially completed 10 stages without any nonproductive time (NPT) or HSE issues. The customer and competitors alike were amazed by this terrific and previously unattainable achievement. This seamless operation saved rig time and frac spread standby time, ultimately saving the operator USD 800,000. Throughout the entire operation, the customer was impressed with Halliburton’s efforts and awarded more work based on this outstanding performance, with the team eventually completing 89 stages in 270 hours through 2014. Halliburton looks forward to completing many more stages for this operator in the future.



Real-time downhole information is available in easy-to-understand graphics



The crew successfully completed 89 stages in 2014 without any NPT or HSE issues.