Halliburton helped operator reinforce casing to meet new deepwater Gulf of Mexico standards

Halliburton Completion Tools and Baroid teamed for record run that saved a major operator $400,000 of rig time

**Overview**

New U.S. government regulations and the industry trend to drill deeper have led to many challenges in the completion of deepwater wells. Operators are searching for safer, more efficient methods to hang casing strings. Halliburton designed the VersaFlex® Big Bore expandable liner hanger system as a better alternative to setting a full string of large casing when strings are 13.625 inches and larger.

Halliburton helped a major operator set a 13.625-inch liner in the bottom of a 16-inch casing using the VersaFlex Big Bore system. Halliburton Completion Tools also ran 900,000 pounds of 13.875-inch scab liner inside the casing – a record liner weight – creating a double barrier that met new government regulations. Halliburton Baroid used its BaraECD™ high-performance fluid system to reduce pump pressures and help the liner hanger from prematurely setting. This solution also helped reduce rig time by more than eight hours, saving the operator $400,000.

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<th>Challenge</th>
<th>Solution</th>
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<td><strong>Setting 1.15 million pounds of casing</strong>&lt;br&gt;The operator needed to set 1.15 million pounds of casing – the primary liner plus a scab liner with a record weight of 900,000 pounds – to meet new government regulations. The rig could not hold this much weight at one time. Nor was it feasible to land approximately three miles of casing at once.</td>
<td><strong>Split casing portions and use liner hanger system</strong>&lt;br&gt;Halliburton developed a casing design that split the string into two portions. Halliburton used the VersaFlex Big Bore system to hang both sections of the primary liner and the scab liner. The VersaFlex Big Bore system has the ability to hang 13.625-inch and larger liners.</td>
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<td><strong>Cementing</strong>&lt;br&gt;Halliburton ran the primary liner to the bottom of the well. However, cementing (by another company) had to be aborted due to pumping issues. The cement was recirculated back out of the hole and then pumped back in, delaying setting the hanger for more than 24 hours.</td>
<td><strong>Exceptionally robust hanger</strong>&lt;br&gt;The VersaFlex Big Bore system is exceptionally robust and withstood the delay without any issues. Since the hanger is not set until the cement is pumped, the cement had full bypass while circulating. The liner was set and cemented successfully without further delays.</td>
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<td><strong>Controlling pressure to set the scab liner</strong>&lt;br&gt;There was less than an inch of clearance to lower the scab liner downhole. This tight tolerance would increase circulating pressures beyond the 3,800-psi at which the VersaFlex Big Bore system sets. Halliburton needed to lower the circulating pressure to avoid premature setting.</td>
<td><strong>Baroid fluid system reduced pump pressures</strong>&lt;br&gt;Modifications to the liner hanger minimized the chance of premature setting. Baroid also used its BaraECD™ high-performance fluid system to reduce pressures by more than 1,700 psi. This ensured a proper set. It also allowed cement to be pumped faster, saving more than eight hours of rig time.</td>
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Solving challenges™
Halliburton placed 1.15 million pounds of casing downhole. In order to handle the load, Halliburton split the casing string into two portions and used the VersaFlex® Big Bore system, with a high-hanging load capacity, to hang the string.

The 13.875-inch scab liner had to fit inside a 16-inch primary casing string with an inner diameter of 14.6 inches. This tight tolerance increased circulating pressures to the point at which the VersaFlex Big Bore system could set prematurely.

Baroid’s BaraECD™ high-performance fluid system decreased pump pressure by more than 1,700 psi. Together with some mechanical alterations to the VersaFlex Big Bore system, this allowed Halliburton to cement the scab liner while maintaining circulating pressures well below 3,700 psi.

There was no NPT during the operation. In fact, Halliburton helped save the operator more than eight hours of rig time or $400,000.

Solving challenges™
Operator sought high-value liner and scab liner for deepwater well
A major operator with operations around the world needed to case a 23,587-foot, 17.5-inch open hole in deep water in the Gulf of Mexico. The operator also needed to meet new government regulations that required a double barrier to ensure pressure containment.

Halliburton Completion Tools system provided alternative
Such large casing strings present numerous challenges in deep water. They include the weight and length of the string, landing it properly, and cementing the entire length before the cement sets. The operator turned to Halliburton for a safe, cost-efficient way to case this well.

Halliburton Completion Tools recommended the VersaFlex® Big Bore liner hanger system for the casing strings. This expandable liner hanger system helps operators reduce risks associated with conventional liner hangers, such as stuck casing and not being able to properly set the string. The VersaFlex Big Bore system provides casing placement flexibility and reliable support. Unlike conventional liner hanger systems, the VersaFlex Big Bore system is not seated before the cement is pumped into the wellbore. This minimizes the possibility that the casing is not seated properly in the hanger. The liner hanger system can rotate during cementing to help ensure a tight seal and bond to the cement.

VersaFlex Big Bore liner hanger system proven durable and robust
Halliburton also split the primary casing string into two portions with a secondary scab liner. The plan required placing a total of 1.15 million pounds of casing downhole. The VersaFlex Big Bore system has a high-hanging load capacity, enabling it to withstand the weight of such casing strings.

Halliburton ran the VersaFlex Big Bore system with a 13.625-inch liner to total depth. The robustness of the system was tested when another company’s cementing issues delayed the setting of the liner hanger. The cement had to be circulated back out of the hole. New cement was then pumped back into place. This process took more than 27 hours, with 11,000 barrels of cement circulated at six to eight barrels per minute over that period. But, since the VersaFlex Big Bore system is not set until after the cement is fully pumped, the recirculation presented no problems. The system performed flawlessly, despite the delay and extra circulation.

After setting the primary liner, Halliburton next needed to run a scab liner inside the primary casing to create a double barrier that increased safety and met government regulations.
Halliburton Complete Tools and Baroid teamed for record run that saved a major operator $400,000 of rig time

**Scab liner pushes setting-pressure limits of VersaFlex system**

The scab liner was 11,144 feet in length. The 13.875-inch liner weighed 900,000 pounds, a record weight, and needed to be placed inside the 16-inch primary casing string with an inner diameter of only 14.6 inches. This narrow annulus with less than an inch of clearance would increase the circulating pressures needed to the point that could prematurely trigger expansion of the liner hanger. Pressures needed to stay below 3,700 psi, and the lower, the better. Halliburton redesigned the hydraulic cylinder of the VersaFlex Big Bore system to help ensure a safe margin between possible circulating pressures and the hanger minimum expansion pressure.

**Innovative fluids and mechanical modification keep pressures safe**

Halliburton Baroid also recommended using its BaraECD™ high-performance fluid system to lower circulating pressure. Halliburton customized the fluid system for this deepwater well to be lighter, to provide buoyancy to the scab liner and help maneuver it into place. The fluid system would also be used to push the cement through the annulus behind the scab liner. Using the BaraECD™ high-performance fluid system reduced the pump pressure by more than 1,700 psi to an average of 2,600 psi during the operation. Once cementing was completed, 200,000 pounds was shared onto the lower VersaFlex Big Bore system using a high pressure, high load seal assembly.

**Combination of technologies helped operator save $400,000**

Halliburton successfully set and placed the scab liner on the first try. The lower pump pressure that the Halliburton BaraECD™ high-performance fluid system provided kept the scab liner from prematurely setting. The low viscosity of the fluid also increased the cement displacement rate from the expected two to three barrels per minute to five to six barrels per minute. This decreased the time to displace the cement. It also saved more than eight hours and $400,000 of rig time. There was no nonproductive time during the operation.

Halliburton helped this major operator successfully set both the liner and the scab liner in this challenging environment, meeting government regulations and providing an extra layer of safety. The operator was so impressed with the results, it immediately hired Halliburton for a similar job on another deepwater well.