CAST-I™ tool results confirmed casing integrity, saved USD 10 million by avoiding unnecessary sidetrack

Location: Angola

**Overview**
Operator needed to confirm a suspected 9 5/8-in. casing collapse which unexpectedly occurred while pulling out of the hole with the lower completion in a 7-in. liner on an extended reach drilling (ERD) well. The operator needed to better understand the extent of the failure to determine if a sidetrack was required or the well could be remediated. The casing interval in question was located at approximately 13,000 ft in a highly deviated section of the wellbore, making conveyance a critical concern. Halliburton recommended running a modified Circumferential Acoustic Scanning Tool (CAST-I™)/Cement Bond Log (CBL) tool combination deployed via a specialized logging tractor powerful enough to overcome well length deviation and tool string weight. The CAST/CBL combo produced excellent results and provided valuable information about the casing condition and cement, which gave the operator confidence to patch the 9 5/8-in. casing, saving approximately USD 10 million by avoiding a sidetrack. It also identified the root cause of the casing collapse, which was the result of pipe grooves due to pipe tripping during previous sidetrack operations and lack of mechanical support. The ability to do a single-pass intervention in both the 7-in. and 9 5/8-in. casings on ERD wells to identify potential trouble areas is a critical finding, and gave the operator renewed confidence for upcoming sidetrack or slot recovery operations.

<table>
<thead>
<tr>
<th>CHALLENGES</th>
<th>SOLUTIONS</th>
<th>RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator had a suspected collapsed casing and needed to better understand its condition before making decisions on how best to intervene the well.</td>
<td>To make a more informed decision, Halliburton recommended running a CAST/CBL combo to better visualize the logging interval and determine the mechanical integrity of the casing.</td>
<td>From the CAST/CBL run, Halliburton was able to generate a 3D image that depicted a collapsed casing that could be patched, avoiding a costly sidetrack.</td>
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<td>The collapsed casing was suspected of having a 6-in. inner diameter, which would limit the CAST operation in 9 5/8-in. casing.</td>
<td>The CAST Planner software indicated that a 4 5/8-in. scanner head could be used to log both the collapsed and regular casing intervals.</td>
<td>Excellent data quality enabled Halliburton to generate a 3D image, depicting the casing inner wall despite the CAST tool modification.</td>
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<td>With a 13,000-ft highly deviated (&gt;80°) interval and several completion size changes, tool conveyance was a critical aspect of the operation.</td>
<td>The CAST tool was combined with a specific logging tractor powerful enough to overcome well length, tool string, cable weight, and completion restrictions.</td>
<td>The ERD well characteristics posed no challenge to CAST operations, successfully logging both 7-in. and 9 5/8-in. casing intervals, providing high-resolution data information to the customer.</td>
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CAST results save sidetrack and increase awareness. Cabinda Gulf Oil Concession, Malongo Angola.
CASE STUDY: Casing collapse visualized by CAST/CBL combo enables informed decision making

With a 13,000-ft highly deviated wellbore and several completion size changes, tool conveyance was a critical aspect of this operation. The CAST-I tool offers flexibility in conveyance. Despite the length and trajectory of the well, the CAST-I/CBL combination performed as expected downhole.

Job saved USD 10 MILLION by avoiding a costly sidetrack operation.
CAST/CBL tool combination provides critical data, avoiding a costly sidetrack

A deepwater Angola operator needed to confirm a suspected 9 5/8-in. casing failure, which unexpectedly occurred while pulling out of the hole with the lower completion in a 7-in. liner on an extended reach drilling (ERD) well. The operator needed to fully understand the extent of the failure to determine if a well sidetrack was required or whether it could be remediated. The casing interval in question was located at approximately 13,000 ft in a highly deviated (>80°) interval of the well, making conveyance a critical concern.

The well is located in a platform considered to be the fifth largest freestanding structure in the world, which shows the enormous investment the operator has committed to overcome the technical challenges in producing the field. Understanding the critical aspect that well integrity plays in the management of its assets, the operator approached Halliburton to suggest a solution that could enable them to better understand the concerns they were experiencing with their casing.

To confirm casing integrity, Halliburton recommended a Circumferential Acoustic Scanning Tool (CAST-I™)/Cement Bond Log (CBL) tool combination be mobilized. Prior to rigging up, a 6-in. watermelon mill was run on pipe, which encountered problems at 12,950 ft—the same depth where the casing failure was suspected. Based on the mill run, the largest inside diameter (ID) tool that could safely pass this area would have to be 6 in. or smaller. Although a 7-in. head is typically required for 9 5/8-in. casing inspection, recent successes in the North Sea in logging 10 ¾ in. and 13 3/8 in. suggested an undersized head could record usable data if properly planned. The CAST Planner software indicated that a 4 5/8-in. scanner head could be used to log both the collapsed and regular casing intervals.

Pipe groove in the 9-5/8-in. casing is easily seen on the field log in the Amplitude plot.

The Cement Program indicated top of lead cement was expected at approximately 10,900 ft, but CAST Acoustic Impedance is increasing, which is a very atypical response. Further investigation indicated this was a swelling shale that had collapsed around the pipe.
With a 13,000-ft highly deviated wellbore and several completion size changes, tool conveyance was a critical aspect of the operation. The CAST tool was combined with a specific logging tractor powerful enough to overcome well length, tool string, cable weight, and completion restrictions. Field results were excellent, and the CAST data quality enabled Halliburton to generate a high-resolution 3D image, clearly depicting the casing inner wall. Halliburton was able to provide casing inspection and cement evaluation in both 7-in. and 9 5/8-in. casings, as well as identify considerable casing damage at 12,950 ft. Also very visible was a large pipe groove on the low side of the 9 5/8-in. casing, which likely got so deep, it caused the failure. This pipe groove developed from running in and out of the well with various bottomhole assemblies while drilling the original well and the first sidetrack. The ability to see up into the 9 5/8-in. casing, which had previously not been assessed, suggested that every ERD well could be prone to similar failure due to the long section of pipe that the BHA must pass before it drills the bottom 8.5-in. hole. Most importantly, the CAST/CBL combo confirmed that the cement and casing were suitable enough to support a patch, thus avoiding a costly sidetrack operation and saving the operator approximately USD 10 million.

Current reservoirs require ERD well construction to maximize assets and ensure suitable payback for deepwater platforms. Based on the CAST results identifying trouble spots, notably pipe grooves in the primary barrier, operators have an increased confidence to successfully address these challenging wells and add additional hydrocarbons during the delineation of the platform.