Perforation Placement Optimized by Verifying Centralization in 22-in Casing with Heavy Mud

PowerFlex annular evaluation service acquires third-interface echoes in conditions where conventional acoustic tools cannot function

**CHALLENGE**
Evaluate centralization of 14-in casing filled with heavy synthetic oil-base mud (SOBM) within 22-in casing to guide puncher performance for a plug and abandon (P&A) operation.

**SOLUTION**
Run new PowerFlex® annular barrier evaluation service for dual-measurement certainty in imaging the position of inner casing strings in heavy mud weights and in large-diameter and thick-walled outer casings.

**RESULTS**
Updated the perforating plan and received regulatory agency approval for primary and alternative intervals identified from the third-interface echoes (TIEs) obtained by PowerFlex service to confirm casing centralization.

**Unknown casing centralization**
An operator planned to use a puncher gun in P&A operations to perforate 14-in casing with a thickness of 0.85 in. However, puncher performance would be less than optimal if the 14-in casing string were in contact with the outer 22-in casing. Conditions were not favorable for determining casing centralization with conventional acoustic logging, which is adversely affected by the impedance of heavy muds in relation to that of the casing and is also challenged by large casing sizes.

**Radial measurement beyond conventional ultrasonic boundaries**
New PowerFlex annular barrier evaluation service incorporates innovative power transducer technology in an advanced mechanical design to efficiently provide full azimuthal coverage for definitively resolving annular information in casing diameters up to 22 in and thicknesses up to 1 in. Unlike conventional ultrasonic methods, measurements by PowerFlex service can quantify acoustic impedance for almost any cement type and well fluid, including very heavy muds, to enable imaging beyond the primary casing. The superior-quality data is also available faster through the optimized downhole and surface telemetry systems. Integrated workflows drive visualization and processing for an efficient 2-hour turnaround time from acquisition to answers.

**Centralization certainty for optimized puncher performance**
Despite the challenging two-casing configuration and signal-attenuating heavy SOBM, PowerFlex service acquired TIEs to identify the annular materials and to pinpoint the interface of the 14-in casing and the outer 22-in casing. Although simulations had predicted that the heavy SOBM would attenuate the signal to the extent that the TIE reflections would be too weak to be received by a conventional ultrasonic tool, the signal quality measured by PowerFlex service’s powerful transducer was not adversely affected.

The originally planned perforating depth was found to be in eccentralized casing, and PowerFlex service’s visualizations were used to identify both a primary and alternative perforating depths with centralized casing. This information was used to update the P&A plan, which received regulatory approval for the operator to proceed with certainty.

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**PowerFlex service provided a 3D visualization of the centralized 14-in casing inside the 22-in casing. The blue section to the right is the 16¼-in liner.**
**Case Study:** PowerFlex service acquires TIEs for 22-in casing with heavy mud to optimize perforating.

The recommended new perforating depth and an alternative are shown on a two-azimuth display of the TIE images. For cement analysis, a 360° view is used.