

Case study: Gulf of Mexico, United States

XACT acoustic system monitored real-time fluid levels to reduce TCP risk, minimize rig impact

A customer operated a partially depleted field in deepwater Gulf of Mexico and was expected to intersect under-pressured formations during perforating operations.

Tubing conveyed perforating (TCP) is widely practiced in deepwater completions but the operation is not without its challenges. Safety is critical when perforating depleted or high permeability formations because fluid losses can quickly reduce the hydrostatic column in the well. As reservoirs are drawn down in the deepwater environment, this becomes an increasing issue. Amounts and rates of fluid loss or gain and the densities of the fluids in the wellbore become critical information. Maintaining balance in the well is a critical factor in addition to the difficult-to-measure fluid level in depleted cases.

The only conventional option for the customer was to use echometers but they are difficult to interpret, are non-continuous, interrupt rig operations, and are prone to misinterpretation due to erroneous reflections.

To overcome these issues, Baker Hughes recommended the **XACT™ bi-directional acoustic telemetry service**. With the XACT service it's possible to eliminate guesswork to get a clear, real-time understanding of the downhole environment—driving efficiencies safely and predictably in a variety of well activities from spud to well abandonment.

Unlike mud pulse telemetry systems which are limited to wellbore flow conditions, the XACT service transmits

digital data along the drill pipe via encoded sound waves. This means it can be used effectively during tripping, completion installation, liner running, and cementing.

Eliminate guesswork from your operations

The XACT service delivers real-time downhole data throughout the well construction process, not just while drilling. By using applied acoustics, you can get real-time downhole data from previously unavailable environments regardless of fluid, flow, formation, or depth. The system captures key measurements including pressure, temperature, and torque at multiple locations along the wellbore.

XACT nodes continually sent annular and bore pressures every 20 seconds over the entire TCP run, including gun firing and tripping out of the hole. The completion fluid level was accurately calculated and monitored throughout the entire operation, thus enhancing well control and minimizing formation damage. Continuous monitoring of downhole pressures allows hydrostatic barrier verification in situ, complying with all safety standards even while tripping in or out of the hole and enabling downhole pressure transmission even below closed BOPs.

Make objective decisions

To mitigate risk and inform well and completion engineers on the status of the well after perforation, the Baker Hughes team positioned two XACT subs in the riser section as part of the work string. Bore and annular

Challenges

- Monitor completion fluid level during TCP operations
- Overcome conventional disruption to rig activity

Results

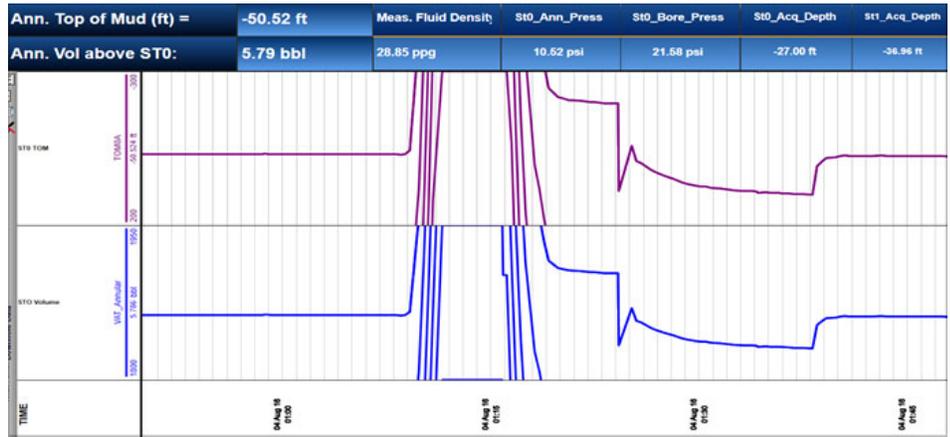
- Provided real-time telemetry data no matter hole conditions
- Incurred minimal impact to standard rig operations

pressures were transmitted to surface every 20 seconds during the operation. These measurements were converted into a top-of-fluid level using known pipe/riser volumetrics and fluid weight.

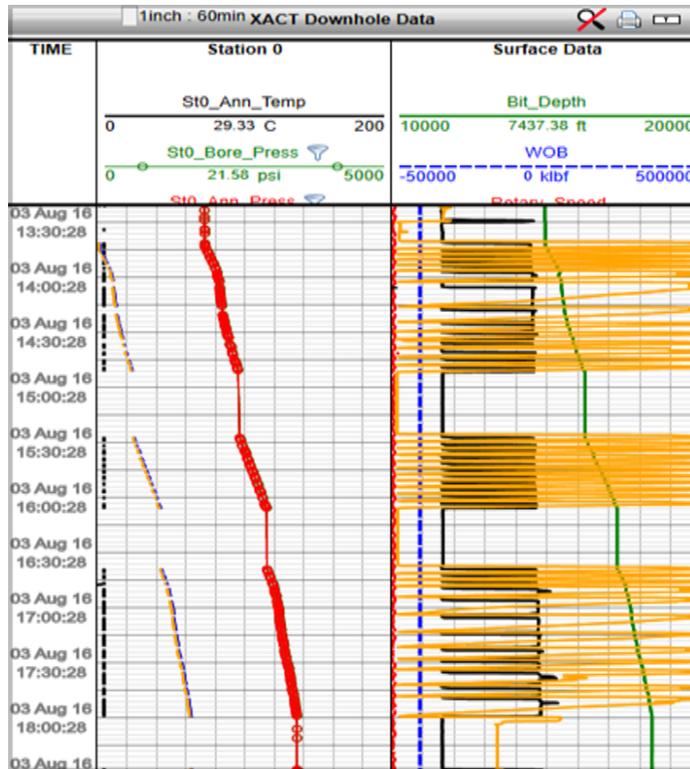
All this activity was carried out with no impact on normal well operations. The customer was able to continuously monitor the well throughout the operation, something impossible with alternative technology. The unique characteristics of the XACT service—providing telemetry with a full through bore, whatever the flow conditions or fluid levels, and while tripping—brought gains in efficiency, and improvements in the amount and quality of downhole data. This minimized risk, satisfied regulatory conditions, and enhanced operational safety.

By using the XACT service, the customer successfully engineered and safely executed the TCP run in this deepwater depleted reservoir. For the first time, fluid levels downhole were continuously measured in real time throughout the operation including during gun firing and tripping in and out of the hole.

Real-time telemetry contributed to reducing risk during a critical downhole operation. The XACT service's technology was incorporated with minimal impact to normal rig operations and provided excellent insight into the actual downhole conditions at all times, allowing the well engineers to make informed decisions throughout the process.



Real-time fluid level results transmitted during the TCP operation. The annular pressure measurements were converted to a fluid level using known volumetrics. The large increase is the pressure used to charge the guns. The sharp drop off is the drop in fluid level when the guns fired, then showing the losses over time due to the overbalance. After observing the rate of loss over time the well was balanced and put on the trip tank for additional monitoring.



Since the XACT telemetry service is fullbore through and does not require fluid or flow to transmit, it is possible to send data while tripping. Work string and annular pressures were transmitted every 20 seconds throughout the entire operation. This allowed continuous monitoring of the well, even while tripping out of the hole.