

Case study: Deepwater Gulf of Mexico, United States

AccuFIT service delivered accurate downhole pressure data in real time, optimized tripping speed 60%

In the deepwater Gulf of Mexico, BP needed to drill a deep, deviated well through a challenging formation with a narrow equivalent circulating density (ECD) pressure window. The main objective was to safely drill the hole section after the formation integrity test (FIT) within the known ECD pressure window. An accurate downhole flow-off annular pressure profile was needed in real time to avoid misinterpretation of the surface-based measurements during the FIT. In addition, the operator wanted to use the flow-off annular pressure data to confirm the hydraulic model and optimize the tripping speed for the bottomhole assembly (BHA) in the open hole without swabbing the well.

During the planning phase of this well, Baker Hughes recommended the **AccuFIT™ real-time flow-off annular pressure service**. By utilizing the **OnTrak™ integrated MWD and LWD service's** annular pressure sensors, the AccuFIT service accurately acquires time-series pressure profile measurements during a leak-off test (LOT), FIT, or any flow-off conditions, such as connections or short trips.

Immediately following normal flow conditions, the AccuFIT service quickly and reliably transmitted high-resolution downhole flow-off pressure data to the surface in real time—enabling the operator to make pressure-related decisions during the drilling operation. To optimize reservoir navigation and improve borehole quality, Baker Hughes recommended the **AutoTrak™ G3 rotary steerable system** to steer in the challenging

formation and the **CoPilot™ real-time drilling optimization service** to provide advanced downhole drilling dynamic measurements and interpretation in real time.

Before utilizing the AccuFIT service at the depth interval of interest, a casing test was requested with the AccuFIT service to obtain the measured data in real time. The results of this test validated that the real-time data provided the expected pressure profile values. After a successful casing test, a FIT was performed and the real-time data from the AccuFIT service was compared to the memory data. This comparison confirmed that the real-time data values were within 1% of the memory data values, deeming the real-time measurements satisfactory for continued use.

Using a proprietary compressed data format, the AccuFIT service obtained high-definition flow-off annular pressure profiles. The first 60-point dataset of the overall flow-off annular pressure profile was delivered after the pumps resumed normal flow. Subsequent 60-point datasets were sent at a high resolution of 10 seconds or higher, starting at the base of the ramp-up in pressure. Each measured pressure point provided actual time and annular pressure information, along with calculated depth, total vertical depth (TVD), and equivalent static density (ESD) information. The service's telemetry continued to send flow-off annular pressure datasets until the entire high-definition pressure profile was transmitted. The compressed data reduced the telemetry time needed

Challenges

- Safely drill hole section after FIT within known ECD pressure window
- Acquire accurate bottomhole static pressure profile during FITs to avoid risk of misinterpreting surface-based pressure measurements
- Optimize tripping speed
- Reach all pressure profile evaluation objectives

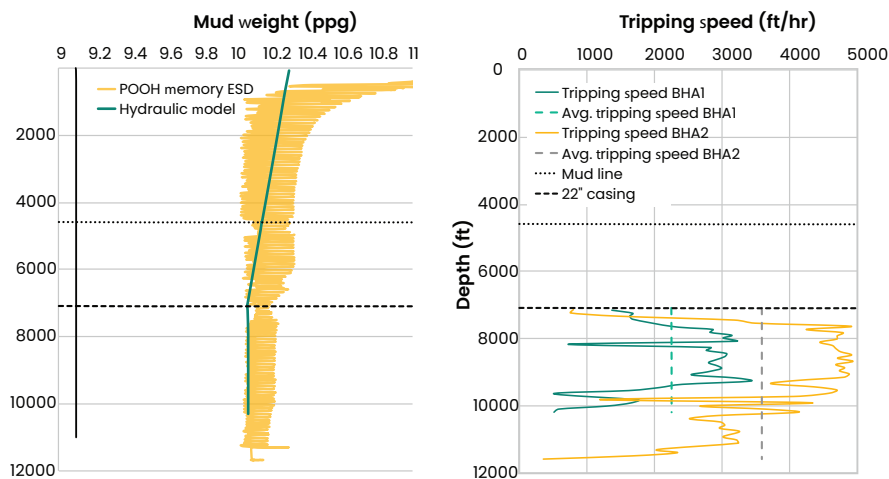
Results

- Delivered accurate real-time flow-off annular pressure profile
- Optimized tripping speed by 60%
- Confirmed precision of real-time data compared to memory data
- Reduced risk of inaccurate downhole annular pressure values based on interpretation of surface measurements

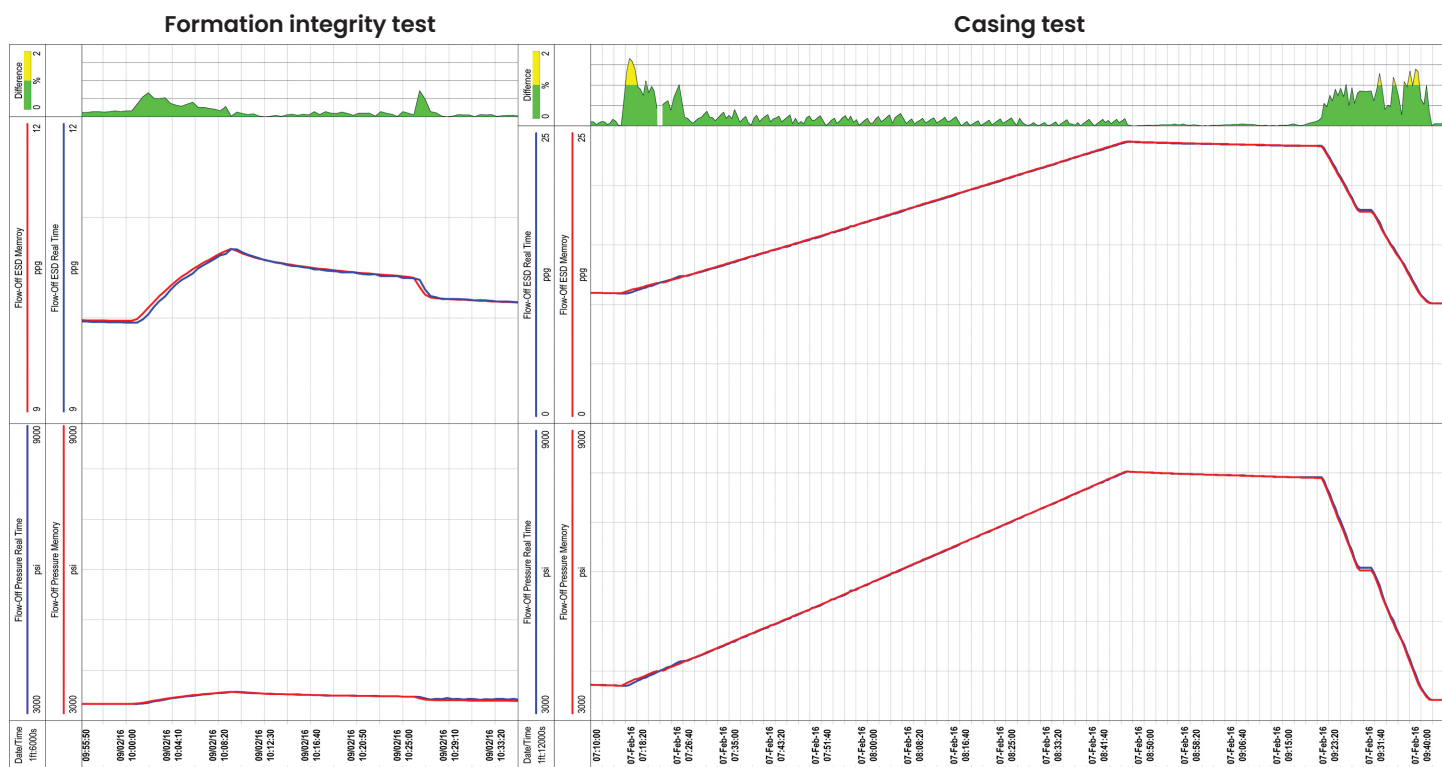
for the transmission of real-time measurements. A downlink was not required, but it is available for requesting a specific timeframe with a specific resolution for any subset of a flow-off interval.

While the first BHA run was tripped out, the AccuFIT service recorded data under flow-off conditions and was used to optimize the tripping speed for the second BHA run. The adjusted ESD hydraulic model, calculated by Baker Hughes Drilling Engineering software, indicated an original average tripping speed of 2,250 ft/hr (686 m/hr) for the first BHA run. The tripping speed was increased by 60% to 3,600 ft/hr (1097 m/hr) for the second BHA run. This resulted in saving 0.75 hours of rig time along the 4,494 ft (1370 m) open-hole interval.

The AccuFIT service enabled BP to evaluate the real-time flow-off pressure profile and achieve all objectives. BP was very satisfied with the service and expressed interest in the future use of this service.



ESD modeled (green) and measured (gold) vs. actual tripping speed. The ESD measured data was recorded with the AccuFIT service while tripping out the BHA.



Compared to the memory data values, the real-time measurements from the AccuFIT service indicated a precision within a 1% difference.