

# eVolve streaming downhole data improves Total E&P Norge drilling operation

## Technology

NOV's eVolve™ Optimization Service equips existing rigs and rig crews with a toolkit that improves performance and real-time decision making through advanced data acquisition, software, and analytics capabilities. Based on the specific parameters of Total E&P Norge's project, we incorporated our BlackStream™ along-string measurement (ASM) tools, which are part of the AUTOMATE tier of the eVolve service. The BlackStream ASM tools acquire temperature, annular and bore pressure, rotational velocity, and three-axis vibration data at high frequencies. When coupled with the IntelliServ™ high-speed wired drillpipe telemetry network, our BlackStream ASM tools provided streaming visualization of the downhole data.

## Performance

We improved the wellbore pressure information and provided the support required to incorporate this new and additional information into performance improvements across multiple phases of Total's drilling operation.

Operators have conventionally relied on annular pressure measurements at the bit and hydraulics models to estimate the equivalent fluid density (EFD) along the string. By using our BlackStream ASM tools, an extended dataset was collected in real time, providing a detailed picture of the pressure and equivalent circulating/static density (ECD/ESD) distribution both in the open- and cased hole. The ASM tool data successfully eliminated uncertainties about the pressure profile and wellbore conditions, allowing Total to make informed decisions.

## Results

The project has had many successful value-adding benefits for Total, including, but not limited to, the following:

- Real-time ECD and ESD data in the open- and cased hole enabled timely and precise optimization of drilling parameters, fluid properties, and section length, resulting in Total's well drain being extended by approximately 656-ft (200-m) measured depth.
- When total losses were encountered while drilling, real-time annular pressure trends helped in estimating the relative height of the annulus fluid column. The flow-off information enabled continuous monitoring of the wellbore conditions and stability, even while waiting on cement.
- After Total encountered losses, a cement plug was pumped and our BlackStream ASM tools were run as part of the cement stinger. After an injection test was performed at a low flow rate, our BlackStream ASM tools were used to monitor annular pressure trends and ultimately confirmed that the losses were sealed off. Real-time information describing the hole condition enabled Total to resume drilling operations without further delays.
- When a packoff occurred, the annular pressure measurements provided by our BlackStream ASM tools helped Total understand where the string was stuck. The information helped Total find the optimal location to cut the pipe without having to run a wireline free-point indication tool, enabling them to safely manage a critical situation.

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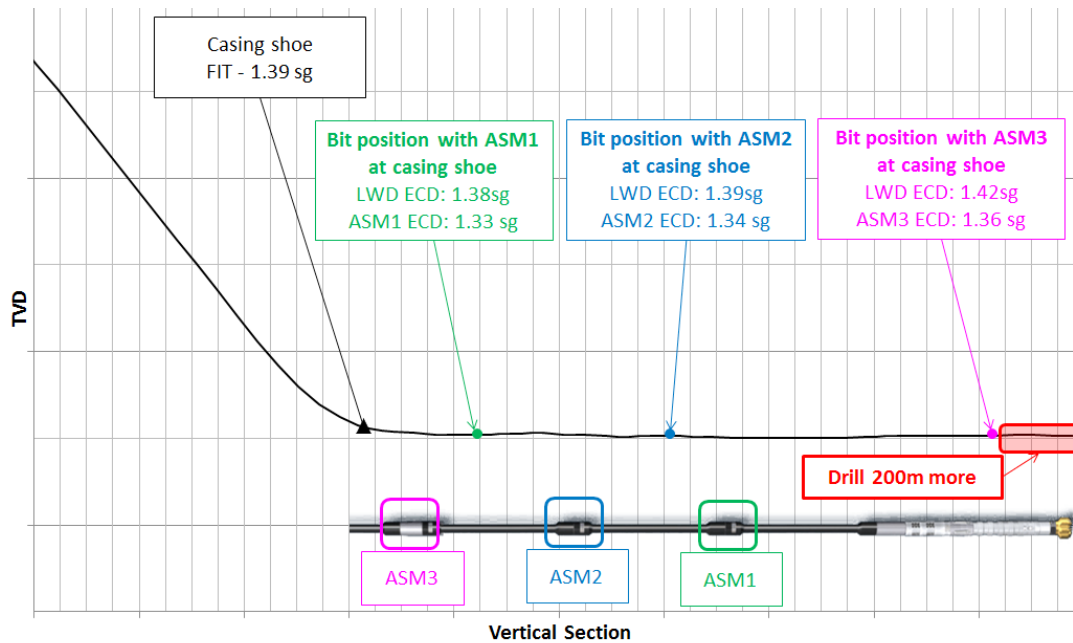


Figure 1 – This trajectory profile highlights how the ECD measurements along the string provided by our BlackStream ASM tools helped in monitoring wellbore conditions, not only at the bit, but also in critical parts such as the casing shoe.

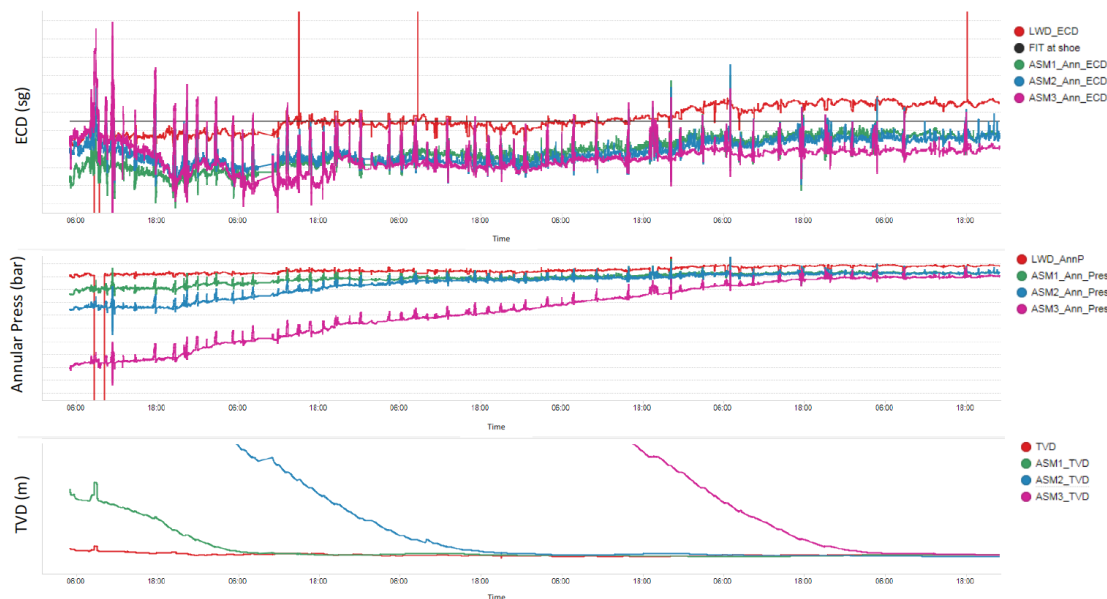


Figure 2 – The time-based log shows the annular pressure, as measured at the bit by the LWD tool, and also by the three BlackStream ASM tools placed along the string. If only using the LWD tool, Total would have to rely on modeled hydraulics calculations to estimate the ECD at the casing shoe. Using our BlackStream ASM tools the EFD is measured along the wellbore and at the casing shoe, eliminating uncertainties and allowing Total to make an informed decision.