

Evolving CTD technology aids underbalanced drilling operations

Companies are realizing the full potential for CTD in underbalanced conditions.

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Sourcing robust coiled tubing drilling (CTD) tools always has been a concern, especially for operators seeking to drill in underbalanced conditions. The tools must withstand the rigors of the vibration produced when drilling with aerated fluids while simultaneously responding to changes in direction and speed.

To address the need for robust, easy-to-use CTD bottomhole assemblies (BHAs), AnTech created COLT for the re-

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The team rigs up COLT BHA during the first well test. (Images courtesy of AnTech Ltd.)

entry and thru-tubing markets and currently is developing POLARIS, which is set to debut in 2011. The POLARIS tool targets the commodity drilling markets such as shale gas, coalbed methane, and underground coal gasification.

To assess COLT's field performance, tests were carried out on two wells in the northeastern US Marcellus shale. The primary aim was to perform a basic

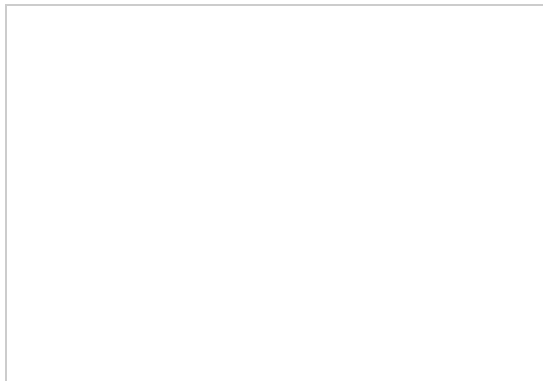
functional field test to assess using, controlling, and steering the tool. The secondary aim was to gauge its reliability and ability to drill with gaseous drilling fluids in high-vibration environments.

Rapid deployment

Following thorough design and testing in the laboratory at company headquarters in Exeter, England, COLT was put through its first field test. The well originally had been drilled conventionally with jointed pipe, but well problems meant casing could not be run to total depth. To remedy this, AnTech could re-drill the reservoir section, which would require drilling out a cement plug at the bottom of the casing, creating a new well trajectory, and drilling a new horizontal section.

In temperatures as low as -4°F (-20°C), the team of engineers and technicians from AnTech and a local coiled tubing

service company gathered at the well site. Necessary equipment was assembled, including a rig with 2 3/8-in. diameter coil with e-line, surface infrastructure, and fluid tanks; a workshop trailer; and a crane. The team



carried out preliminary procedures, calibrated

The first well test shows preliminary results.

and assembled the equipment, and lowered the tool into the hole with the crane. Correct alignment of the BHA would be important to the success of the operation, so AnTech designed custom alignment tools and tool-handling equipment with hydraulically powered pistons to ensure controlled deployment. By using the crane, the system was set up and deployed in just over two hours.

Drilling operations were performed in three stages:

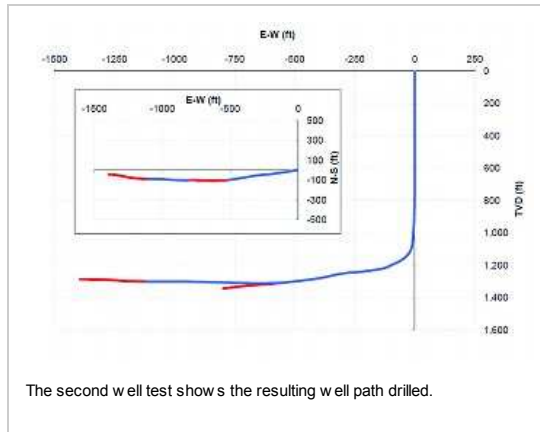
1. Drilling the plug at the casing shoe.
2. The curve or "build" section.
3. The horizontal.

First, COLT was run into the hole; drilling commenced upon reaching the plug. COLT drilled through the plug and continued drilling for 165 ft (50 m) with a straight motor and a tri-cone bit.

Build section

After drilling the plug, the operator set a well path for the team to follow. The challenge was to drill a build section that would bring the well into a horizontal configuration

effectively. Setting a bend angle of 1.5 degrees on the motor and aiming the tool face toward the desired direction, a build rate of 20 degrees/100 ft (30 m) was achieved, which is within the operational limits of the tool.



The operation was carried out

successfully using formation water as the drilling fluid. A 3 1/8-in. motor and a PDC bit were used to drill 460 ft (140 m) to bring the well bore horizontal at the desired depth, demonstrating that the tool was easy to control and that it changed direction as intended.

Horizontal lateral

The third and final stage of the well test was to drill horizontally until the well bore intersected the gently dipping formation above. With the previous two sections drilled using formation fluid, the challenge was to see how the tool performed when drilling underbalanced with nitrogen.

Aerated fluids, while creating a desirable underbalance condition, increase vibration and make it difficult to see motor stalls by monitoring surface pressures.

The immediate effect of the underbalance condition was to double the rate of penetration as the overbalanced pressure was reduced. The wireline telemetry used in COLT meant the signal transmission was not affected by the change in fluid, and the fast signal transmission and downhole weight- and torque-on-bit sensors allowed stalls to be avoided by monitoring downhole signals. The tool's performance was not adversely affected by the increase in vibration, which was monitored in real time. The borehole target was reached as planned.

Drilled in one run

Following the success of the first operation, another operator provided an opportunity for AnTech to use COLT to extend and drill a sump in a commercial well near the first well site. The well was drilled successfully in

one run, with an extension and an openhole sidetrack for a sump carried out as planned.

COLT was used in combination with a 3 1/8-in. motor that had a 3 3/8-in. bearing section. It was drilled with an air-foam mix at an initial flow rate of 700 cf/min and 10 gal/min, which was increased to 900 cf/min and 10 gal/min. At a true vertical depth of 1,340 ft (408 m), the lateral was extended by 215 ft (66 m), and a 255-ft (78-m) sump was drilled successfully.

New market

Both well tests demonstrated a new directional CTD BHA that provides new options for the developing CTD market. With the knowledge gained from these operations, the team has implemented design improvements and created a new simplified tool called POLARIS that is suitable for projects that do not require a highly specialized tool such as COLT. The aim is to manufacture the new tools for use in operations in early 2011.

With the commercial advantages they provide, the next generation of CTD tools could open up CTD to opportunities that currently are not commercially viable. Making CTD a reality for more operators is AnTech's aim, and these tests illustrate that this is an achievable goal.

True underbalanced drilling

CTD is the only drilling technology that can guarantee that underbalance is maintained 100% of the time. There are no joints to make and break, and downhole pressures easily can be monitored on a continuous basis to ensure that they do not fall above or below the planned values. In addition to the fast running speeds, continuous pressure containment, and no personnel required on the rig floor, CTD is a safe and proven option. In some cases it may be the only viable way to drill a re-entry.