Drilling with casing ready for deepwater application

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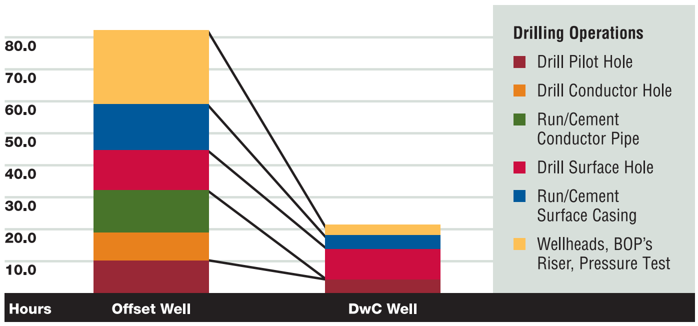
DRILLING WITH CASING (DwC™) technology advanced significantly in November 2002, when Weatherford successfully completed the first DwC operation from a floating drilling unit. Combined with another emerging technology, the surface blowout preventer (BOP), the operation reduced the total dry-hole costs of a well in the Madura Strait offshore Indonesia by more than $1 million.



DwC uses a casing string that terminates in a special drill bit to drill and case a well simultaneously. Some areas of the world have used basic applications of the technology since as early as the 1950s.

Until recent years, DwC was strictly non-mainstream; but considerable efforts have developed, and are further developing, this promising technology to make it increasingly practical and cost-effective for a wide range of oilfield applications. Perhaps the most impressive benefit of DwC will be the lower deepwater oil and gas development costs achieved through reduced rig time and simplified well architecture.

TO DRILL WITH CASING

The decision to drill to the deep, abnormally pressured objectives of the Madura Strait well using DwC technology initiated with safety considerations. Any well plan for this area must make provision for escaping with the drilling unit in the very likely event that shallow gas is encountered.

The DwC option would mitigate the risk of blowout while tripping or running casing; however, Weatherford recommended a thorough engineering review of the application to allow the operator, Santos Madura Offshore PTY LTD, to make a fully informed decision.

Well engineering considerations for the Madura Strait job would be important for any potential DwC application.

The casing drilling string must reach the required total depth without having to be pulled.

DwC is a cement-in-place process, leaving nothing in the hole that has to be removed and requiring no placement of hardware in the casing before cementing. The float valve is placed during drilling, and, once the hole is clear of cuttings, cementing can begin. The time associated with tripping pipe and running casing is eliminated from the process and is an integral factor in the overall economic evaluation.

Knowing the casing thread strengths is a prerequisite for determining tubular strength.

Reduced, "monobore" annulus is an inherent benefit of DwC and means higher annular velocities. The combination of the fluid velocity needed to remove cuttings, the fluid volume that must be pumped to clean the bit, and erosion possibilities can preclude DwC in certain situations.

On the other hand, conventional drilling results in annular velocities that vary around the drillstring components. This variation can lead to wellbore erosion around drill collars and inefficient cutting transport around the smaller-diameter drill pipe.

The annular space along the entire wellbore that is drilled with casing is virtually equal, so hydraulics can be optimized according to fluid properties, cuttings concentration, and flow rate.

DwC bypasses some of the time-consuming steps of conventional drilling and casing operations, eliminating some of the usual opportunities for problems. DwC leaves the wellbore in better condition than conventional drilling and casing operations.

The impermeable "filter cake" that this technique builds and maintains on the wellbore wall seals against permeable zones, reducing the potential for lost circulation and differential sticking. In addition, the inherent stiffness of the casing string in the wellbore makes the hole smoother and less susceptible to key-seating, mechanical sticking, and vibration.

As a cement-in-place system, DwC requires no modifications to the conventional drilling rig. Nothing has to be removed from the casing, so neither wireline nor special pipe handling equipment is required. A top drive system is optional.

QUANTIFYING THE BENEFITS

After a careful review of these factors, Weatherford recommended the DwC approach for the Madura Strait well. Fortunately, shallow gas was not encountered during the operation.

Drilling and casing the Santos Madura Offshore well with DwC technology and using surface BOP operations:

- Saved the operator more than $1 million in total dry-hole well costs;
- Saved 2 ½ days of rig time, more than 79% overall running time;
- Simplified well construction by eliminating 30-in. casing and downsizing 20-in. casing string to 13 ³⁄₈-in.;
- Enhanced safety by reducing rig floor headcount during casing running operations.

A comparison of the DwC project to another conventional drilling project in the same area (also owned by Santos Madura Offshore) highlights the sources of significant time and cost savings for this project.

OFFSET WELL

The operator had drilled the offset well five months earlier using conventional subsea operations, which included drilling and cementing a pilot hole (10 hours), drilling and running casing (58.5

hours), and installing and testing a standard 18 3/4-in. subsea BOP system (23.5 hours). In all, work time totaled 82 hours.

DWC WELL

The DwC and surface BOP technologies, individually and combined, saved considerable time on this well. The combination of technologies eliminated the need for drilling and cementing an offset pilot hole for the second well (a savings of six hours).

DwC significantly reduced structural casing requirements, eliminating the 30-in. casing string and replacing the usual 20-in. casing string with 13 3/8-in. casing that was drilled and cemented in a single trip. The cement-in-place operation also minimized the risk of having to swab the well while tripping and running casing.

The operation took advantage of Weatherford's DrillShoe™ technology, a drillable drill bit with TSP diamond and tungsten carbide cutting structure. The DrillShoe bit eliminated the time-intensive step of retrieving bit and bottom-hole assemblies so that, once the casing setting depth was achieved, cementing operations could begin immediately. The surface BOP operation also added savings because it used a subsurface BOP suspended by the riser tensioners in the moonpool area of the floating drilling unit.

Work on the DwC well totaled 21.5 hours, an overall savings of 60.5 hours, or 74%, from the conventionally drilled well.

From spud until the casing was drilled down to a depth of 886 ft and cemented in place required only 17.5 hours. Only four hours were needed to latch the surface BOP on the wellhead, nipple up the slip joint, and pressure test the H-4 connector.

TRENDS IN DWC

Early applications of emerging DwC technology have been used in selected niche markets for many years. However, in the past, applications engineers often recommended against DwC for challenging situations that involved, for example, hard formations, sections where steering was required, wildcat wells, deepwater wells, and rigs equipped with a kelly rather than top drive.

Recent advancements are expanding the safe, efficient use and cost-saving value of DwC to broader applications worldwide. One example, which contributed to the success of the Madura Strait well, is the DrillShoe™ 3, a drill bit capable of drilling even through hard formations. Many view DwC technology as the next step change in reducing wellbore construction cost. The most obvious opportunities for realizing the greatest benefit will be deepwater applications, where the stakes are higher. The DwC application in the Madura Strait represents a major milestone in this direction. ■