Artificial buoyant seabed aids deepwater E&P

DRILLING CONTRACTORS, OPERATORS and engineering companies continually seek new ways to accomplish deepwater E&P operations in a more cost efficient and safe manner. One company recently completed testing of its innovative concept, an Artificial Buoyant Seabed (ABS) that essentially brings the seabed to a shallower water depth.

The prototype artificial seabed is towed to a deepwater location off Stavanger for initial field trials.

Atlantis Deepwater Technology developed what it calls a unique and very simple approach for meeting deepwater and ultra-deepwater challenges in exploratory and development drilling and, ultimately, production operations. Atlantis says drilling and completion costs can be reduced by 20-40%, while well maintenance costs can be lowered by 30-60%.

SYSTEM DESCRIPTION

In a typical set up, the ABS is installed at a shallow depth, about 200-300 m below the surface. It replaces the functions of the real seabed. No equipment is installed on the seabed. A tie back of the first well casing string, typically 20-in. surface casing, anchors the ABS to the seafloor.

Before the ABS is towed to location, the top section of the well is drilled in the typical manner, and casing is set and cemented. The casing will protrude about 10 m above the seabed with a connection point for an extension to link the seabed and the ABS, which is 200-300 m below the surface.

The ABS is towed to location where a drilling rig or production vessel is already moored. A second vessel aids with the installation process. The two vessels are positioned on each side of the rig or production unit. Lines are attached to the ABS and another line is deployed vertically from the rig or production vessel to help position the ABS.

Air trapped inside the ABS, which acts like a bucket turned upside down and placed into the water, causes the ABS to float. The ABS has a buoyancy of 40 tons when all 10 of its buoyancy chambers are filled with water. Heavy chains are added to position it below the surface.

The ABS is held into place directly above the well by the extended casing, which acts as a conductor, connecting to the wellhead and BOP on top of the ABS.

The wellhead, BOP, and the Christmas tree if production results, are placed on top of the ABS. The ABS provides sufficient buoyancy and tension in the casing to keep the well in a near-vertical position. The offset of the ABS and the well is controlled by top tension resulting from the buoyancy.

Atlantis says simulations with advanced computer programs have confirmed that the offset may be sufficiently controlled with reasonable top tensions compared with the tensile capacity of conventional casing qualities.

The system has also been tested for vortex induced vibrations (VIV) and fatigue under the most extreme conditions with positive results, according to Atlantis Deepwater Technologyy.

COST SAVINGS

Atlantic says cost savings from the ABS concept result in several ways. Use of the ABS increases drilling efficiency since it would be unnecessary to run the BOP and drilling riser through the water column to the seafloor. Instead, the BOP and riser are set only to the ABS in 200-300 m of water. Running shorter riser could save 3-5 days depending upon the water depth from the rig to the seafloor.

Smaller, more readily available, and lower rated drilling rigs could be used in combination with taut leg mooring systems, according to the company, replacing higher rated and more expensive units. Atlantis estimates dayrates could be reduced by as much as 50% for most areas.

The availability of rigs will also increase for well maintenance operations during a field's lifetime. Cost will also be reduced due to smaller, less expensive rigs. Additionally, smaller well intervention vessels could perform light intervention operations.

During field development and production operations or for complete field developments in combination with floating flowlines, the ABS concept will reduce much of the costs and challenges related to flow assurance in deepwater, low temperature environments since most of the subsea installation will be located in shallower and warmer waters.

ENHANCED SAFETY

The ABS concept also results in enhanced and increased safety of operations, especially when drilling in deepwater and environmentally sensitive areas. These enhancements include a short riser disconnect time, leaving most of the riser in place with the mud hydrostatic head for well control and riser margin. Because the BOP is close to the surface, there is more time available to shut in a well if gas influx occurs. Also, there would be limited mud spill during an emergency disconnect. Additionally, conventional well control methods can be employed if necessary and there would be easy ROV access to the BOP and wellhead.

REUSABLE SYSTEMS

Using the ABS concept for field development also provides significant cost benefits. Only short flexible production lines from the subsea installations on the ABS to an FPSO or other surface vessels are required. After the ABS concept has been used in the production phase, the ABS units and associated systems can be reused in other field developments.

MARINE TRIALS

In October 2001, the ABS concept was included in the Norwegian technology program Demo 2000, organized under the **Oil & Energy Department**. The prototype ABS was initially designed for potential real applications in 1,500-2,000 m of water offshore West Africa. However, it has recently been modified for worldwide operation.

The marine trials of the first full-scale ABS unit were conducted in Gandsfjorden off Stavanger in April 2003. The operations included the use of two anchor handling vessels, two separate ROV systems and a utility vessel.

Towing was carried out under different conditions, such as variation on speed (up to 5 knots), draft and change of trim in order to monitor the ABS behavior and determine the optimum towing conditions. The towing test confirmed that the towing characteristic was very good and in accordance with calculations carried out in advance.

During testing of the control system, compressed air was pumped into the ABS compartments and vented out when the ABS was on surface and in submerged condition. This was to verify valve control, change of ABS trim and level control of the ABS compartments. A provisional umbilical was used for this test.

During the subsea test the ABS was submerged to 200 m water depth using the chain weight method. Various deployment speed rates were tested, horizontal movement of the ABS, current affect on the ABS and various ROV activities on the ABS ballast water system were carried out. The test confirmed that the ABS can be submerged from surface to 200 m water depth within one hour.

The ABS was brought back to surface condition by means of pulling up the chain weights. The ABS came up to surface in a controlled manner.

COMMERCIAL APPLICATION

Atlantis Deepwater Technology has been in discussions with **Shell** and **BP**, both partners in the project, to use the ABS system in deep waters offshore Angola. However, this particular project has not been finalized. Consequently, the company is discussing use of the system with operators in Brazil and with **ONGC** in India, which is said to be planning to drill between 30-50 deepwater wells during the next five years.

REFERENCE

This article was adapted from *The Atlantis Artificial Seabed Concept-From Concept to Reality* presented by **P Norheim**, **Atlantis Deepwater Technology Holding AS** at IADC World Drilling 2003.