Atlantis deepwater concept development updated

THE ATLANTIS DEEPWATER concept has been under development for about 5 years and during the last 2 years the exploration drilling (AE) version has been regarded as ready for construction. Further refinement of the concept has taken place in recent months.

Terje Magnussen, **Atlantis Deepwater Technology Holding AS**, updated the work in a presentation at the IADC Drilling Northern Deepwater 2001 conference, 31 May-1 June in Stavanger.

THE CONCEPT

Atlantis represents a unique and very simple approach for meeting the deepwater challenges of the offshore drilling, field development and production industry, said Mr Magnussen.

An Artificial Buoyant Seabed (ABS) is installed at shallow depth and replaces the functions of the real seabed (Figure 1). No equipment remains on the real seabed. A tieback of the first well casing, the 20-in. surface casing, is used as anchoring for this "new seabed." The system is a well concept and should not be confused with the various concepts of freestanding risers, though it may look similar to those.

The offset of the ABS, caused by the sea currents, is controlled by the top tension resulting from the ABS buoyancy. Numerous simulations with advanced computer programs have confirmed that the offset may be sufficiently controlled with reasonable top tensions compared to the tensile capacity of conventional casing qualities.

The system has also been checked for vortex vibrations (VIV) and fatigue with very positive results.

Several third parties have been involved in the concept verification, including scientific institutes, oil companies, analysis specialists and equipment manufacturers.

All results indicate that Atlantis may be used even under the toughest deepwater conditions, including the northern Atlantic. In areas with moderate sea currents, there is hardly any limitation to the water depth at which Atlantis may be used with a conventional anchor casing, said Mr Magnussen.

Under extreme conditions with both very deep water and strong currents, an anchor casing section of a light and strong material—a composite, for example—may be used.

The high tensile strength of the anchor casing (conventional casing and connector quality) will secure the integrity of the part of the well above the seabed. If necessary, a "weak point" will be used in the riser in order to ensure that no excessive tensions are transmitted into the anchor casing.

Due to the possibility of having uncontrolled rig offsets, the weakest point in the riser-well arrangement will always be located above the BOP regardless of whether Atlantis or a long deepwater riser is used.

Atlantis may either be used as a single well version for exploration drilling or as multi-well versions for field development and production.

In all aspects, the deepwater operations will be changed to become like 100-300 m operations, except for the station keeping of the vessels, which still will have to manage the deep water. Consequently low cost second and third generation drilling vessels may be used for drilling exploration wells and for drilling, completion and workover on production wells.

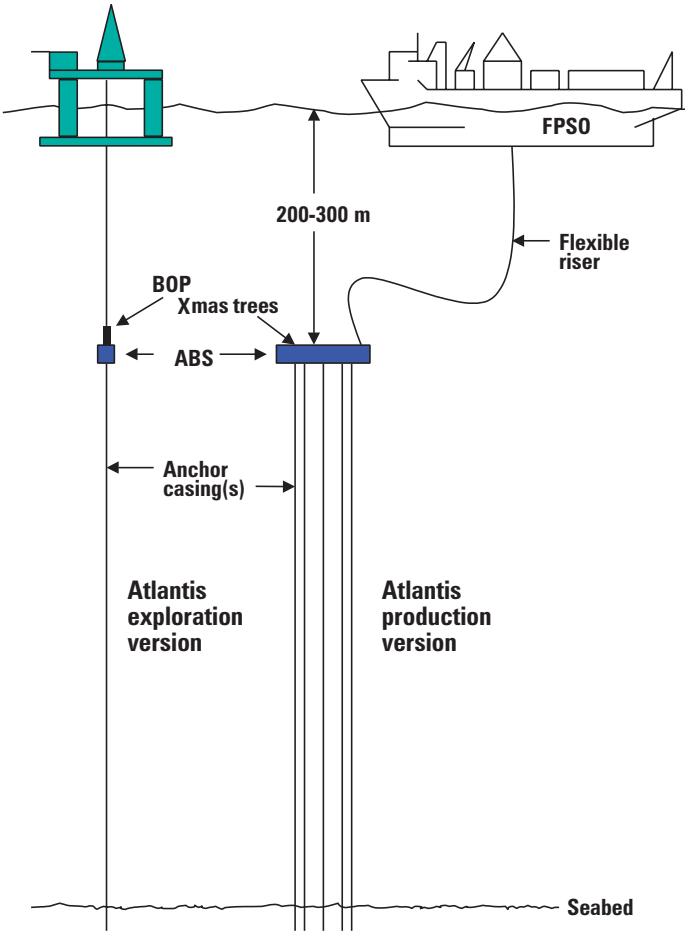
Real case drilling time studies show that AE will have a cost saving potential in the order of 20-40% since many time-consuming deepwater operations are avoided.

The production drilling, well completion and workover time will also be reduced and the cost of the deepwater operation will be close to the cost of an operation in shallow water.

The rig and short riser may be easily disconnected from the Atlantis well and well control may be conducted according to conventional procedures since the BOP is placed on the shallow wellhead at the ABS.

The probability of accidentally discharging the riser mud volume to the sea will be significantly reduced with Atlantis. This will contribute to improved safety, especially in harsh environments, said Mr Magnussen.

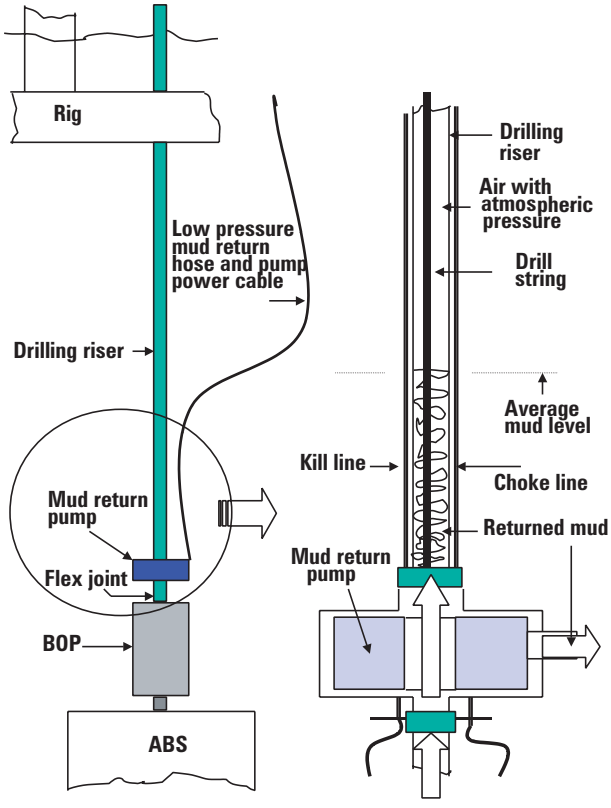
Figure 1: The two Atlantis versions



GROWING INTEREST

The Atlantis technology is owned by Atlantis Deepwater Technology Holding AS in Grimstad, Norway, a company whose owners include **Andreas K L Ugland**, **Tønnevold Venture Invest** and **Aker Maritime**. The technolo

Figure 2: Atlantis dual gradient drilling



gy is patented in about 25 countries, including Norway and the US, and will be patented in more than 100 countries.

The present owners, **Statoil** and **Norsk Hydro** have sponsored the development of the Atlantis technology with about $4.5 million and major oil companies are currently looking at Atlantis with great interest for deepwater projects.

A feasibility study was recently completed for one of the major operators in West Africa on use of Atlantis for a specific field development.

The primary advantage with Atlantis, said Mr Magnussen, is the possibility to use any rigs for deepwater drilling, provided they have the drilling capacities necessary for the actual wells and the station-keeping capability needed for the actual water depth. However, in many cases the station-keeping capability may be obtained by use of rented taut line mooring systems.

The specialized and expensive deepwater rigs may also benefit from using Atlantis due to the potential safety and drilling efficiency improvements. It is believed that the two versions of Atlantis may be economical at water depths from approximately 800 m.

DUAL GRADIENT

In some deepwater regions weak top-hole formations cause challenges in reaching the well target when using conventional casing programs and without much rig time spent on hole conditioning.

The "dual gradient" drilling method has been suggested as a way to overcome such problems and is now being developed by a group of oil and manufacturing companies. With this technique the return mud from the well is pumped to surface via a pump on seabed. The drill string is run inside a slim riser and a rotating BOP controls the backpressure on the hole.

A similar effect may be obtained with Atlantis and an air-filled riser with atmospheric pressure. The return mud also may be pumped to the rig in this case, but with the pump on the ABS at, say, 300 m and a short hose and no rotating BOP (Figure 2). The pump sucks mud from the riser, regulated by the mud level.

Conventional drilling risers will withstand the collapse load from 200-500 m of seawater depending on its design.

If 300 m of riser is run air filled and the mud weight is 1.10 specific gravity, the down hole hydrostatic pressure is reduced by 32 bar. If the drilling depth is 1,800 m, this is 1/6 of the total hydrostatic pressure at bottom of the hole, which with a full mud column would be 194 bar. Now it is reduced to 194-32=162 bar, which corresponds to an equivalent mud density of 162/(0.0981 x 1,800)=0.917 specific gravity.

The length of the air-filled part of the riser could be increased or decreased as needed as drilling proceeds in order to adjust the downhole pressure to what the hole is able to carry.

The dual gradient effect will not be the same with Atlantis as with the return mud pump on seabed. But it is a far simpler way to obtain a dual gradient effect, which in many cases may be sufficient to prevent overloading of the formation.

FOR FIELD DEVELOPMENT

Studies for oil companies show that there may be significant cost savings by using Atlantis for field development, said Mr Magnussen.

In a case study for Norsk Hydro on a field at 1,400 m water depth, 29 conventionally completed subsea wells were replaced by Atlantis wells completed on ABS buoys at 300 m. The life cycle cost assessment, which was carried out for a variety of field layouts, showed that the Atlantis option reduced the capex by 12-15% and improved the net present value by 8-13% even when a 25% contingency was added to the Atlantis costs. The opex (mainly sub sea equipment and well interventions) was reduced by as much as 51-60% due to the easier access to the wells and use of cheaper intervention vessels.

The study also included an evaluation of the flow assurance aspects of the two alternatives. Atlantis may in this context benefit from easier access to the well and the subsea equipment and preventive measures may be easier to implement. The production equipment will also be located in a warmer environment, which may be an advantage. Some pumping and processing equipment may also be installed on the ABS for flow assurance purposes.

Transfer of production from the Atlantis ABS to surface or to another Atlantis installation may be done by conventional means such as seabed flow lines and rigid or flexible risers. However, Atlantis also offers a unique basis for use of floating flow lines, which may support flow assurance.

In most field applications Atlantis clusters containing 3 wells will be used since that is the basis for the simplest ABS design. When more wells are needed at one surface location, a required number of 3-well Atlantis clusters will be placed with enough distance to enable safe simultaneous operations. This means that intervention may be carried out on one cluster while the others are producing.

A feasibility case study of this approach was recently carried out successfully for an operator in West Africa.