

As operators offshore Africa look to take their exploration efforts into ever more remote and demanding areas, so have the challenges increased in mobilising, moving and mooring the offshore exploration drilling rigs they are so dependent on. Duncan Cuthill, Viking Moorings looks at some solutions

How total mooring solutions are supporting offshore drilling activity

AS OF FEBRUARY 25 2011, according to ODS Petrodata, there were 18 semi-submersible drilling units off the coast of West Africa. EICDataStream, the market intelligent database from the UK-based trade association, the Energy Industries Council, estimates that there are currently 63 future and current projects taking place offshore Africa, with the Gulf of Guinea and offshore Angola receiving the majority of attention.

A number of challenges need to be met to ensure that moored rigs can be operated efficiently in West Africa's offshore oil and gas fields, which may be located in deep water or, increasingly, where complex seabed infrastructure has been installed.

Semi-submersible drilling rigs move regularly – an exploration well, for example, may be drilled and completed in 30 to 60 days and the rig is then required to move to the next location. Maximising the use and value of the rig therefore requires highly efficient logistical operations. There is a significant danger of delays and spiralling costs – especially with the huge amount of resources required to move and safely moor such rigs.

For the operator, every day that a rig is not engaged in drilling means a day of expending considerable resources without benefit. The rig day rate alone may be in the region of US\$400,000 and the additional services required can easily double the daily cost of a rig move operation.

Anchor Handling Vessels (AHV), for example, can easily cost as much as \$100,000 a day and, generally, three such vessels are required for mooring operations in deepwater or congested areas. Such rigs therefore have to be moved quickly, seamlessly and safely as even small delays can impose a significant cost burden.

Field infrastructure, such as pipelines, umbilicals, wellheads and templates and FPSO mooring systems, provide additional challenges for the safe installation of moorings whilst ensuring the integrity of the field's subsea assets. A few years ago, this was not such a significant issue in the frontier regions offshore West Africa but the growth in production systems in fields around the

Gulf of Guinea, for example, makes this a real factor in exploration and development drilling today.

With the typical mooring spread for a semi-submersible rig being between 8 and 12 anchor lines, each with a horizontal range of up to 3,000 m from the rig, mooring solutions providers need to be highly adept at accurate mooring installation to avoid existing infrastructures.

So how are these challenges being met through total mooring solutions?

Firstly, there is an increased focus from mooring providers on innovation with a variety of new products coming to market that can speed up and simplify operations as well as provide real-time monitoring. Many of these new solutions are based around new automation techniques which are playing a key role during the mobilisation and demobilisation of rigs – a time when assets are particularly vulnerable.

Maximising the use and value of the rig requires highly efficient logistical operations

For example, working with Vryhof Anchors, Viking Moorings recently brought Stevtrack to market, a smart anchor system which provides a real-time view of the anchor installation process. Based on an acoustic modem transmitting data, the system can provide precise anchor location data – everything from roll, pitch, water depth and pull-in force through to the angle of penetration to within 0.1° to 0.5°.

The system can help to ensure complete confidence in anchor installation and embedment and avoid the incorrect positioning of anchors. This minimises the risk of costly and lengthy delays, for example, due to incorrect anchor

Anchor Handling Vessels (AHV) can easily cost as much as \$100,000 a day



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embedment leading to anchor drag and mooring line failure under tension.

Another example is in the recovery of pre-installed mooring lines. Here, acoustically activated buoys connected to the mooring system can be released from the seabed. The buoy is forced to rotate to the surface, due to its shape, paying out a fibre recovery rope attached to the mooring line on the seabed. In this way, the buoy can be used to retrieve anchor lines and offers an alternative to grapnel hooks (which increase the risks of equipment damage) and ROV release mechanisms. ROV intervention also generally increases the overall operational cost.

Alongside these new innovations, a second key driver in addressing mooring challenges offshore Africa today is the increasing use of pre-installed mooring systems. This is where the mooring system components – anchors, chain and wire or fibre rope – are deployed in advance of the rig's arrival.

A pre-installed mooring strategy can facilitate much reduced rig move time, ensure greater precision and control over the positioning of the mooring system in proximity to existing infrastructure, and also enables a more strategic approach to operational planning for drilling rig activities.

Cost savings when using a pre-installed mooring strategy can be significant – especially when used on development drilling operations, taking full advantage of the efficiencies possible when using batch drilling techniques.

Pre-set mooring, offshore Côte d'Ivoire

One example of a pre-laid mooring solution we recently installed was for Noble Drilling's Homer Ferrington semi-submersible drilling rig which was to be moored at the Baobab oil field, off the Côte d'Ivoire.

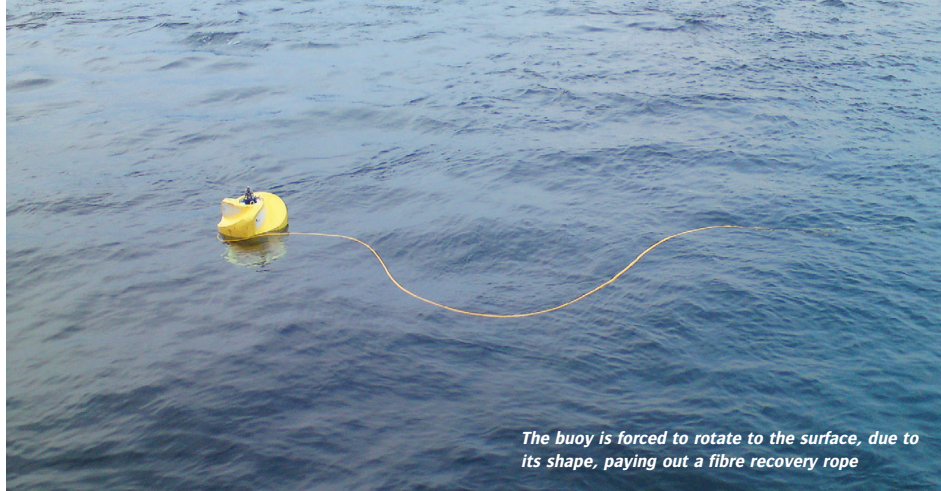
Using a 'standard' strategy, two completely separate mooring systems would have been required that would have been a thousand meters apart to access the two drill centres. Operational rig move requirements would have also used a considerable proportion of rig time and AHTV time.

Other challenges included significant differences in water depth between the shallowest and deepest anchors (600 m), positive and negative seabed slopes and an uneven depth in soft soil at each anchor location. Historically, this had caused delays in rig move operations, due to anchor embedment problems.

Viking developed a pre-set mooring solution where the anchors would be positioned such that the rig could skid between the two drill centres one thousand meters apart. The mooring system was also switched from a catenary mooring system to a taut leg mooring system which used much shorter synthetic fibre ropes and Vertically Loaded Anchors (VLA) and has a more compact footprint.



Anchor installation and embedment requires complete confidence



The buoy is forced to rotate to the surface, due to its shape, paying out a fibre recovery rope

The result was significantly reduced rig move time and improved mooring system performance with less riser downtime, less interruption to drilling, and the optimisation of drilling services using batch drilling (BOP remained deployed during skidding operations).

In addition, no Anchor Handling Tug (AHT) was required on location and was replaced by a Platform Supply Vessel (PSV), resulting in significant savings. The client confirmed that the final savings attributable to the mooring strategy (based on well delivery) were up to \$75mn over the duration of the project.

As offshore exploration continues apace across the continent, effective, seamless and innovative mooring solutions are likely to be in demand more than ever.

Pre-set mooring, offshore Ghana

In December 2010, Viking Moorings supervised the installation of a pre-laid mooring system on behalf of Kosmos Energy, a privately held international oil exploration and production company with a focus on Africa, in the Teak prospect, offshore Ghana. The prospect is close to the Jubilee field.

Working with its local partner in Ghana, Seaweld Engineering, and with all equipment mobilised from its Takoradi base, Viking planned the entire pre-laid operations from anchor embedment calculation and preparation of procedures through to supervising the installation of equipment.

The challenge for Kosmos and their drilling unit – the semi-submersible rig, 'Atwood Hunter' – was that the proposed Teak 1 and Teak 2 wells lie about 400 meters apart. Additional constraints were that the water depths were between 870 and 890 m and the prospects were in close proximity to a gas injection line from the Mahogany 2 well, closeby.

Against this backdrop, it was decided to drill both proposed wells from within one mooring spread. Kosmos didn't, however, wish to take the risk of relying on a traditional horizontal spread with a potential range from the rig to the anchor of up to 3,000 meters – especially with other subsea infrastructure in the vicinity.

Viking therefore delivered a single taut leg pre-laid mooring system rather than a traditional catenary system with the range reduced from 3,000 to 1,200 m. The system consisted of a vertically loaded anchor (VLA) and included an 800 m fibre rope section which was connected to the rig's own mooring line.

In this way, the rig was able to skid 400 m between Teak 1 and Teak 2 with no danger to existing infrastructure.

Today, through its partnership with Seaweld and an operational base in Takoradi, Viking Moorings has a strategic, operational presence along the entire coast of West Africa from Senegal to Congo, with a particular focus on offshore mooring operations in the oil rich Gulf of Guinea.

The result for West African operators will be reduced transportation costs, a fully resourced and highly skilled local mooring solution, and access to Viking Mooring's entire portfolio of mooring equipment.

And it is not just West Africa, of course, which is likely to be the sole focus of Africa's offshore exploration over the coming years. In August 2010, the first deepwater oil was discovered offshore East Africa in Mozambique's Rovuma Basin.

As offshore exploration continues apace across the continent, effective, seamless and innovative mooring solutions are likely to be in demand more than ever. As our examples from Ghana and the Ivory Coast show, it's encouraging to see that such exploration drilling rig challenges are being met. ■