

# Pride's near-surface BOP concept can increase water depth of semisubmersibles

**PRIDE INTERNATIONAL** markets all four Amethyst Class semisubmersibles for deepwater operations. All of these rigs are presently contracted to **Petrobras**, offshore Brazil, which is well-known for its ultra-deepwater drilling and production operations.

The Amethyst Class rigs were originally designed for the Brazilian market for work with Petrobras' 16 3/4-in. wellheads using 18 3/8-in. riser. This riser essentially limits the rigs to the 16 3/4-in. market whereas most operators utilize 18 3/4-in. wellheads that require 21-in. riser.

While Pride's Amethyst Class rigs are all dynamically positioned units rated for 5,000 ft, or 5,500 ft, of water, the company's market reach could widen considerably with deeper water capability.

There are several techniques that could be utilized to accomplish a rig's water depth capability beyond its original design. For example, additional variable feck load, and increased deck space, can be obtained by adding blisters to the pontoons and columns and increasing the riser tension capacity.

Utilizing a surface blow out preventer (SBOP) can also increase the water depth capability of a semisubmersible without the need for the above modifica-

tions. The SBOP option can result in wells being drilled quicker and cheaper. Mobilizing the (DP) rig to another well-site faster at a lower cost to the client is also a benefit of these rigs.

## DESIGN CONCEPT

Pride has been considering the near surface BOP concept and design since November 2004. Installing such a system on an Amethyst Class rig could occur in another 18 months or so, depending upon equipment availability. BOP availability likely would not be a problem since Pride has some equipment in stock.

"What would take the most time in terms of equipment would be the riser, if preferred over casing, stress joints and some control equipment," said **Tony Hogg**, Corporate Subsea Engineering Manager for Pride International.

Pride's objective in designing the near surface BOP was to improve the deepwater drilling economics of the Amethyst Class by increasing the rigs' versatility, allowing them to operate in water depths exceeding their original design capability and reducing well construction costs.

The near surface BOP would be operated below the splash zone and away from the influence of currents. The concept uti-

lizes a conventional telescopic joint to protect the rig from potential riser recoil in the event of a riser failure or emergency disconnect.

The purpose of the near surface BOP was to take the rig to deeper waters, perhaps as deep as 6,000 or 7,000 ft, which can be accomplished with a smaller bore riser. With the 18 3/8-in. riser currently in use on the Amethyst Class rigs, the water depth capability is about 5,500 ft. With smaller bore risers, for example, 13, 3/8-in. casing riser, the water depth capability of the rigs could increase to as much as 7,000 ft.

Some of the benefits of the near surface BOP include:

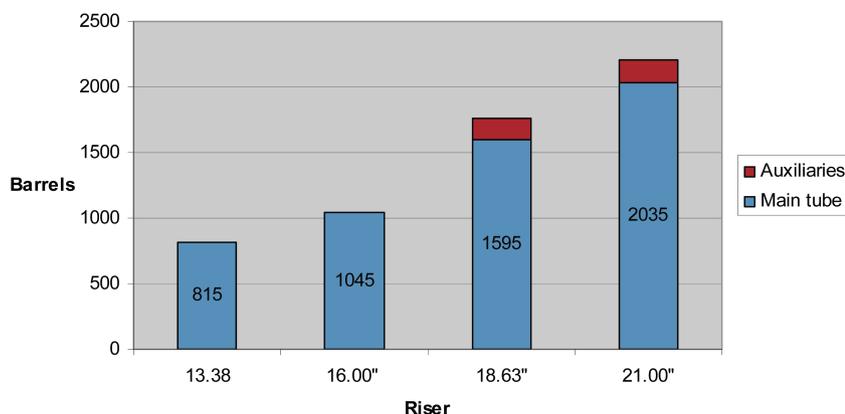
- Improved well control;
- No modifications required to the mud system;
- Existing choke and kill system is used;
- Lower mud volume requirements;
- Reduced riser running times;
- No anchor handling time;
- Fully redundant controls (MUX, acoustic, ROV);
- Less cuttings waste to dispose of.

## NEAR SURFACE BOP

The near surface BOP concept was developed to overcome several challenges posed with the Amethyst Class rigs. This class of rigs has adequate space in the moonpool area to run and retrieve BOP stacks, Christmas trees and flow-lines etc. However, the moonpool area of the Amethyst Class rigs does not have enough space to accommodate a conventional surface BOP configuration. With an air gap of less than 7 m and distance between the diverter housing and the underside of the rig only 9 m, "conventional" surface stack operations on the Amethyst Class rigs would be very difficult.

"One reason for the near surface BOP is because we don't have space in the moonpool area for a traditional surface stack," Mr. Hogg said.

Mud volume requirements for 5,500 ft



The existing 18 3/8-in. riser on the Amethyst Class semisubmersibles requires about 1,600 barrels of mud but reducing the riser to 16-in. can also reduce the mud volume by about one-third, or approximately 1,000 barrels of mud, allowing the rigs to potentially operate in deeper waters than their original design capability.

“Another reason is it allows us to use a lot of the existing surface equipment such as the conventional telescopic joint, flex-joint, tension ring and drape hose gooseneck connections.”

Briefly, Pride’s near surface BOP concept utilizes a small bore (13 3/8-in.) subsea BOP with fully redundant controls. The BOP is run down to a predetermined depth. Depending upon currents, the BOP could be hung off two joints of riser, for example, or about 150 ft below the surface.

If there was a problem with the BOP then it could be retrieved to the transporter in a matter of hours, as opposed to days to retrieve a conventional subsea stack in these water depths. If the stack was actually at the surface it would, more than likely, still be disconnected from the well before any maintenance or repair work was carried out for safety reasons if there was any rig movement.

The rig’s conventional drilling riser would be used from the diverter to the near-surface stack. Below that stack could be 16-in. high pressure riser, 13 3/8-in. casing, or whatever the client requested.

Space out, using a near-surface BOP, is not as critical as with a conventional surface BOP because of the 55 foot stroke telescopic joint, which is much longer than the telescopic joint strokes used on conventional surface stacks. The near surface BOP is installed out of harm’s way but close enough to the surface so that retrieval for repair would take a matter of hours rather than days in deep, and ultra deep, water.

The near surface BOP would be a 10,000 psi unit, appropriately sized to allow for the stresses of being run in this manner, with three rams and one annular, equipped with redundant conventional hydraulic controls and ROV intervention capability.

The near surface BOP consists of:

- A conventional telescopic joint;
- Several strings of conventional drilling riser;
- Riser adapter;
- Annular preventer;
- Single Ram preventer;
- Choke and kill equipment;

- Dual ram preventer;
- Adapter spool;
- Wellhead connector;
- Riser mandrel;
- Upper stress joint;
- Casing/Riser;
- Frame work;
- Control equipment.
- Disconnect device

A subsea isolation and disconnect device (SIDD) is installed on the wellhead to allow for hanging off the drill string, shearing the drill pipe and, therefore, enabling the rig to safely disconnect from the well. The SIDD includes two 13 3/8-in., 10,000 psi rams and a valve arrangement that will allow a closed well to be monitored and/or controlled before reopening. The SIDD will have one MUX pod for primary control and field proven acoustic digital spread spectrum controls for secondary control. There will also be ROV intervention capabilities.

The SIDD includes:

- Casing riser;
- Stress joint;
- Riser connector;
- Riser mandrel;
- Shear rams;
- Pipe (or shear) rams;
- Influx isolation equipment;
- Wellhead connector;
- Frame work;
- Control equipment.

**LESS MUD, DEEPER WATER**

With a full size riser, the riser tension capacity limits the water depth capability of the rig due to the volume of mud in the riser. A smaller riser, of course, would require a considerably smaller volume of mud.

For example, with a 16-in. riser in 5,500 ft of water, just over 1,000 barrels of mud are required to fill the riser. With a 21-in. riser at the same water depth, more than 2,000 barrels of mud are required to fill the riser.

“On the Amethyst Class rigs,” Mr Hogg explained, “the existing riser is 18 3/8-in. so about 1,600 barrels of mud are required. If we change to a 16-in. riser, we reduce the mud volume to about 1,000 barrels, or by about one-third.”

Essentially, if the amount of mud within a riser is less, there is less weight to be supported by the riser buoyancy and the riser tensioners, allowing the rig to drill in deeper waters than originally designed. With a 13 3/8-in. riser, the mud volume is even less, just over 800 barrels.

Presently, riser tension capacity on the Amethyst Class rigs is 1 million lbs. Pride intends to increase that capacity by 25%, according to Mr Hogg, who noted that that is likely the maximum increase in standard tensioner capacity on those rigs.

Running times for casing and/or high pressure riser without auxiliary lines is much faster than running conventional drilling riser, resulting in a reduction of non productive time.

This together with a decrease in mud volume, and better well control, should provide a market for this concept. ■