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Near-Surface BOP Drilling System

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ABSTRACT

The idea of using a surface BOP located on the deck has received much attention in recent years. Despite the numerous benefits provided by a surface BOP drilling system in comparison with the conventional subsea BOP system, its safety remains a concern. This paper presents a hybrid, freestanding "near-surface" BOP drilling system that combines the better features of the surface and subsea BOP configurations.

The near-surface BOP drilling system is described together with the structural analysis and operational assessments that have been performed to demonstrate its feasibility.

KEY WORDS: Deepwater; BOP; Drilling; Riser; Freestanding

INTRODUCTION

Offshore drilling in water depths beyond the reach of a mobile jack-up drilling unit is conventionally carried out from a ship-shaped or semi-submersible floating units using a subsea BOP system isolating the well at the seabed. The drilling riser is almost always of 21 in. outer diameter, offering a 19 ½ in. minimum bore and a low pressure design tensioned from the drilling unit. In increasing water depth, however, the drilling riser becomes longer and heavier, eventually requiring an upgrade to the derrick facility and riser tensioning system to install and operate it. The main advantage of a subsea BOP system is the ability to shut-in the well at the seabed and disconnect the drilling riser in an emergency. However, in a deep water depth, a long length of riser needs to be retrieved before the vessel can move off location.

Some operators and drilling contractors then revert to a surface BOP approach in deepwater locations with a benign environment and when they can drill the larger holes in open water leaving only the deeper high pressure holes to be drilled through a smaller bore drilling riser. The smaller bore riser is lighter in water, and less the weight of a subsea BOP during deployment, extensive upgrade of the derrick facilities can thus be avoided. The main problem with a surface BOP on a floating drilling unit is that well shut-in is at the surface and the high pressure riser, usually made up of threaded casing joints suitable only for short term dynamic usage, can not be disconnected for the vessel to move off location in an emergency. To overcome this problem, an acoustically controlled emergency subsea disconnection package complete with a shear ram is normally added to a point just above the seabed wellhead.

Various solutions have been proposed in the past to address the afore-mentioned deepwater drilling issues associated with subsea and surface BOP systems. Many of them favour a freestanding riser configuration whereby only a short length of the drilling riser is disconnected and retrieved, leaving much of the riser freestanding below the wave and high current zone.

Majority of these systems retain the use of a subsea BOP located at the seabed (e.g. Nguyen et al, 2006). Two systems, to the authors' knowledge, propose the use of a subsea BOP located at an elevation substantially above the seabed (Moutrey and Lim, 2006, and Horton, 1985), both likening their systems to a "raised seabed" so that a shallow water drilling rig can drill using its shorter riser and lower capacity derrick facility. However, both systems suffer from significant installation issues. The more recent Atlantis system described in the Moutrey paper involves towing of an artificial buoyant seabed to site, holding it in mid-water while the "tieback" riser is threaded through it, and completing the artificial seabed before the conventional drilling riser can be run. The earlier 1985 Horton system involves the installation of a substantial buoyant structural tower freestanding above the seabed before any "shallow" water drilling operations can be carried out.

This paper presents a near-surface BOP drilling system that negates the installation pitfalls associated with the Atlantis and Horton systems, and advocates the philosophy of putting a surface BOP in shallow water rather than raising the seabed to support a shallow water subsea BOP.