Mooring, risers, SBOP examined in Deepwater I

BEST RISER CONCEPT

THERE ARE THREE basic ultra deepwater (over 5,000 ft) subsea drilling systems available to the industry. The conventional 21-inch riser/18-in. BOP stack used with 5th Generation MODUs; surface BOP (SBOP) located directly under the rotary with high pressure casing riser to the seafloor; and the Slim Riser Concept (SRC) using a 16-in. standard riser with a 3rd or 4th generation semi-submersible and 18-in. BOP. The SBOP has an option to use a Subsea Disconnect System (SDS) at the ocean floor consisting of two hydraulic connectors and two shear rams.

The author provides a detailed description of the three systems and provides guidance to which of the three concepts for drilling ultra deepwater wells is best suited for a given well and situation.

Surface BOP, Slim Riser or Conventional 21-Inch Riser - What is the Best Concept to Use (SPE/IADC 92762) **M A Childers**, **Atwood Oceanics**.

DRILLED-IN CASING

A new type of seabed support system that incorporates a subsea shut-off system has been designed to enable slim “finder wells” to be drilled in deepwater by minimizing the loads that must be supported by the drilling vessel. The system is aimed at “simple” deepwater wells such as those found in West Africa. The impact of the approach described in this paper is to reduce exploration well costs by more than 50%.

Use of Drilled-in Casing in Slim Deepwater Exploration Wells (SPE/IADC 92560) **C P Leach**, **Argonauta Drilling Services**; **T Bamford**.

MOORING, RISER MANAGEMENT

In recent years, offshore oil and gas exploration has rapidly expanded, with the 10,000 ft water depth barrier recently hurdled in the US Gulf of Mexico. Drilling equipment design and capability to achieve this record has grown to meet increased capacity requirements.

The authors will present scenarios for moored and dynamically positioned vessels to demonstrate the requirements for successful operation and management of mooring and marine drilling risers in ultra-ultra-deep water depths.

Mooring And Riser Management In Ultra-Ultra-Deepwater (SPE/IADC 92616) **D Pelley**, **Transocean**.

ALUMINUM ALLOY RISER

As drilling activities extend further offshore, the need to drill in deeper water increases. When conventional steel risers are used to increase drilling depth, the structural support of existing rig decks must be improved to support the additional weight. The modifications to allow for deeper drilling are both cost-prohibitive and time-consuming. The answer to this industry problem is a riser that is manufactured from an aluminum alloy.

Drilling offshore Brazil and in the Gulf of Mexico confirmed that replacing conventional line pipe of high-strength steel with a lighter weight aluminum alloy riser allows existing rigs to drill in deeper water without incurring extensive and expensive modifications. SPE/IADC 92559.

Aluminum Alloy Riser Allows for Deeper Drilling on Existing Rigs (SPE/IADC 92559) **H H J Deul**, **T E Prosser**, **Noble Drilling Services**.

SOFTWARE SCREENING TOOL

Since Annular Pressure Build-up (APB) is a problem in most deepwater wells, one of the first steps in casing design is the determination of loads caused by APB. If APB-induced loads compromise string integrity, the next step is the selection and design of a suitable APB mitigation strategy.

Generally, deepwater APB candidates must be identified during the early phases of field development, so that APB mitigation strategies are chosen and designed before the wells are drilled.

The authors present the development of a software program known as the APB Screening Tool (APBST).

Development of a Software Screening Tool to Identify Deepwater Wells at Risk for Annular Pressure Build-up (SPE/IADC 92594) **U B Sathuvalli**, **S M Rahman**, **P V Suryanarayana**, **Blade Energy Partners**; **P D Patillo**, **BP America**; **M J Payne**, **BP**.

WELL CONTROL PRACTICES

As ultradeep water (5,000 ft) drilling becomes more commonplace, drilling technology has advanced accordingly. However, well control processes have not advanced at the same pace. An industry and governmental agency sponsored research project is underway at Texas A&M University addressing these issues. In this particular portion of the project ultradeep water wildcat and development well control issues were studied. The first task was testing a blowout and dynamic kill simulator developed earlier in the project that would simulate a typical wildcat well blowout.

Modeling Ultradeep Water Blowouts and Dynamic Kills and the Resulting Well Control Best Practices Recommendations (SPE/IADC 92626) **S F Naynaert**, **J J Schubert**, **Texas A&M University**.

FATIGUE EVALUATION

The recent increase in the deepwater drilling fleet has led to the use of longer riser joints, many of which contain single sided butt welds and high strength low alloy steels. Drilling experience has shown some unexpected and extreme environmental loading.

Traditionally, weld defects are expected at outer weld cap toes, however, extra long deepwater riser joints have identified potential root defects that can also be a significant problem. Recent review on the effectiveness of inspection methods has indicated that manual procedures can be prone to error and that fatigue assessments may have to account for larger defects than originally considered.

The authors will review the research that has been undertaken to evaluate critical defect size using a fracture mechanics approach, but initial results may indicate that this approach is overly conservative. Further work on the methodology is ongoing and will be reviewed. A greater understanding of critical defect sizes, recording individual riser joint history, riser analysis based on real environmental conditions and riser joint management will allow maximum time between inspections and optimize riser use.

Fatigue evaluation of Drilling Risers for Harsh Environments and Ultra Deepwater Developments To Allow Optimized Riser Life and Inspection Plans (SPE/IADC 92696-Alternate) **J Peter**, **R Robinson**, **ABB Vetco Gray**; **L Foyen**, **Det Norske Veritas**.

DYNAMIC LOADING

The initial treatment of heave-induced dynamic loading (SPE 87152) introduced a mathematical model for estimating the dynamic axial loads imposed on a deepwater landing string by a drilling vessel's response to ocean waves.

The landing string was treated as an open-ended elastic steel column with allowable variations in cross-section as a function of depth inside a vertical wellbore.

The authors extend the investigation of heave-induced dynamic loading on deepwater landing strings. Statistical validation is presented for the original assumption that drilling vessel resonance behavior exhibits a narrowband response to ocean waves with a resonance frequency near 0.125Hz. This original assumption (based on limited MRU data) suggested good dynamic load approximation without having to consider high-order harmonics.

To statistically validate this assumption, a spectral analysis was performed on sampled heave data from several floating drilling vessels. The results of the analysis suggest that the original assumption is well-founded.

Additionally, software model predictions are compared to actual landing string load cases to establish default values for the model's adjustable parameters.

Finally, the original mathematical theory is extended to account for the added mass of the internal mud column in a resonating closed-end system (i.e. the use of a float shoe or other component which can maintain the fluid within the landing string); the bottom-hole pressures (ECD) induced by the dynamic motion of such a system; and the effects of varying contact friction forces resulting from a deviated well bore.

Evaluation of Heave-Induced Dynamic Loading on Deepwater Landing Strings, Part II (SPE/IADC 92309-Alternate) **S D Everage**, **J M Baker**, **T H Hill Associates**.

ROTARY STEERABLE

Concurrent drilling and reaming techniques have been successfully used to mitigate the effect of non-uniform, transverse loading of salt formations on completions as well as improve hole quality for higher wireline log success rates.

The authors demonstrate a significant improvement in hole quality while drilling with a new generation rotary steerable system in combination with concentric reaming devices compared to conventional directional drilling and hole opening combinations.

Fully-Rotating Rotary Steerable and Concentric Reamers Technology Combination Eliminates Wellbore Threading in Deepwater (SPE/IADC 91929-Alternate) **C P Leonard**, **Schlumberger**.