Drilling rigs:
The oxen of the oilfield evolve to race horses

SPE/IADC 52860

"New Generation of Semisubmersible Rigs is Engineered for Big Drilling Efficiency Gains"

Sedco Express rigs herald a new generation of deepwater semisubmersibles, designed and built for greatly improved costs and operational efficiency. Aiming for reductions of 25% in well construction time and 30% in well construction costs, the new design follows a fundamental review of the drilling process. For the first time, a semisubmersible design has evolved from a reengineering of the entire offshore well-construction process. This fresh look concentrates on eliminating activities from the well construction critical path, such as picking up or laying down pipe. The reduction in "flat time", time spent not making hole but currently considered productive because the activity involved is on the critical path, is achieved by removing activities from the critical path altogether, or by significantly reducing their impact by increasing the number of parallel activities. Mud mixing system improvements, coupled with large storage capacity and high flexibility, significantly reduce the time spent switching fluids. An improved BOP- and Christmas tree-handling system, with dedicated tree transporters and storage areas, ensures maximum efficiency when deploying subsea trees and equipment. Further efficiency improvements are gained by data integration through the Rig Area Network (RAN) and integration of services and equipment. The increase in well construction performance attributable to the Sedco Express rig design represents a major improvement over the current generation of deepwater rigs and will ensure the cost-effective exploration, appraisal and development.

—J R Kozicz, Sedco Forex

SPE/IADC 52857

"Lessons Learned During Deepwater Drilling Operations West of Shetland"

The frontiers of drilling in harsh environments are continually being pushed back. Since 1994, drilling rigs have successfully operated at all times of the year in the deep waters of the Northeast Atlantic Margin. Lessons learned from experience in these hostile waters are guiding rig development. The Sovereign Explorer was the first rig to operate year round in the area and in water depths greater than 1,500 ft during 1994-95. As a result, extensive rig riser modifications were made to facilitate operation in the stronger-than-expected currents before a second round of drilling. A riser recoil system was devised to allow a controlled retraction of the slip joint during disconnection of the lower marine riser package (LMRP), and additional tensioner lines were fitted to reduce stress levels at the top of the riser. Further modifications are planned, including active heave compensation and an improved BOP control system. Heave compensation will allow the LMRP to be relatched in 8- to 12-ft heave conditions rather than 4- to 6-ft heaves, typically saving about seven rig days per year. Improved BOP control, together with other modifications, will extend the rig's water depth limit to 4,500 ft.

SPE/IADC 52857: Sedco Forex's semi Sovereign Explorer has pioneered the Atlantic Margin since 1984, drilling 13 wells in the last 4 years, Sedco Forex says. In addition, the unit was the first to drill year round West of Shetland.

—J F Lesiuk, et al, Sedco Forex

SPE/IADC 52858

"Glomar Hull 456 Class Ultra Deepwater Drillship"

This paper describes how a 5th-generation drillship like the 456 Class from Global Marine is able to improve on conventional floating drilling operations and highlights advances that have been made to maximize efficiency and minimize downtime. The paper will document how the 456 Class uses a unique thruster arrangement and specification to greatly reduce the amount of downtime due to weather or equipment failure. In addition, Global Marine's unique horizontal/vertical enhanced pipe handling technique will be discussed in depth, with a focus on how this will increase both up time and rig efficiency.

The advantages of a fifth-generation drillship like one from the 456 Class are realized in terms of time saved through decreased downtime and increased efficiency. By using a state of the art thruster arrangement that allows the rig to stay on location in almost any weather and enables the rig crew to perform complete thruster repairs on location, the amount of downtime the 456 Class vessel will experience is greatly reduced. By utilizing the unique approach to pipe handling through the use of a horizontal and a vertical piperacker, these ships are able to increase rig efficiency by 12%.

—J A Thorson, et al, Global Marine

SPE/IADC 52859

"Multipurpose Service Vessels: Conception, Design and Ell Intervention Operations"

The development and operation of purpose-built Multipurpose Service Vessels (MPSVs) has brought significant safety, cost and efficiency benefits to offshore well intervention. The MPSV concept, first demonstrated using former single-purpose and limited-use vessels retrofit-

SPE/IADC 52858: Global Marine's 5th-generation 456 class features a unique arrangement and type of thrusters to slash weather-related downtime. The rig also employs horizontal/vertical pipe handling.

ted to enhance their capabilities, achieves even greater operational efficiency with modern purpose-built vessels designed, engineered and constructed for specific environments and ranges of well intervention services. After carefully researched operational needs are defined, safety, flexibility, cost saving and operational efficiency are the major factors considered while developing a new MPSV design capable of providing efficient and fit-for-purpose well intervention services. Automatic handling equipment, permanent equipment installations, advanced alarms, centralized well control commands and improved working environments all help to improve personnel and well safety and operational efficiency. Efficiency is further optimized by integrating power, fuel, water, air and pumping facilities for all services, and by centralizing communications networks and preventive maintenance systems. The ability of topside equipment to accommodate simultaneous operations, and to accept additional equipment and services that are not permanently installed, reduces operating time. Self-propelled jackup, monohull or semisubmersible design is chosen according to the offshore environment planned for the vessel, and a high degree of autonomy is ensured by adequate speed through the water, high-capacity cranes, large storage space and superior accommodation capacity. Integrated services selected on an a-la-carte basis, reduced logistical support and vessel manning, and the capacity for simultaneous multiple operations, all contribute to lower overall operating costs.

—M Galbrun, Sedco Forex

Wellbore stability: Avoiding hole collapse

SPE/IADC 52866

"'Keep It Simple' Approach for Managing Shale Instability"

This method considers the factors determining whether conducting a stress-induced wellbore stability analysis would be sufficient or complex time-dependent drilling fluid-shale interaction mechanisms need to be taken into account in the development of a mud weight program which would provide the required effective mud support with time.

A range of wellbore stability analytical tools, ranging from simple stress-induced to complex time-dependent which enable an efficient approach for managing shale instability are described systematically. Wellbore stability analysis and guidelines for efficient management of shale instability using the various analytical tools and design charts are described systematically.

—C P Tan, X Chen, CSIRO Petroleum, et al

SPE/IADC 52863

"Minimizing Drilling Risk in Extended Reach Wells at Valhall Using Geomechanics, Geoscience and 3D Visualization Technology"

Wellbore stability models, using offset data, indicated that drilling extended-reach wells to the resource-rich flanks of the North Sea Valhall Field would be a challenge" The initially small safe operational mud pressure window progressively narrows with increased well angle.

We developed a more detailed geological model for the overburden with geologic surfaces and 3D coherency data. We then started to correlate drilling problems along wellbores in the 3D data cube.The paper will present the geomechanical theory behind wellbore stability problems in fault zones and fractured rock mass, how the geologic model has been developed and how we use the visualization software to select a wellbore trajectory. We will also include case histories.

—T G Kristiansen, et al, Amoco Norway Oil

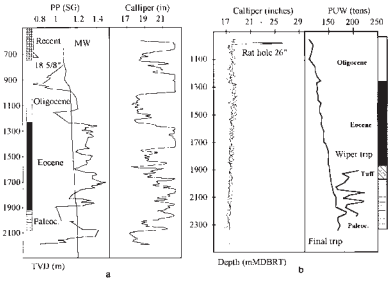
SPE/IADC 52864

"Borehole Stability Assessment Using Quantitative Risk Analysis (QRA)"

A new wellbore stability analysis method based on QRA principles is described in this paper. Limit state functions for failure (stuck pipe due to breakout) and success (operationally tolerable magnitudes of breakout) are defined as functions of well trajectory and geometry.

A field application is presented.

—S Ottesen, et al, Mobil Technology Co



SPE/IADC 52865: This paper deals with a North Sea formation that produced a highly unstable well when drilled with a conventional WBM. Use of an overbalanced silicate mud system produced encouraging results on 2 deviated wells.

SPE/IADC 52865

"How to Manage Wellbore Stability in the Vicking Graben Tertiary Shales by Using Mud Systems Environmentally Friendly

This paper deals with the drilling of the Eocene shales (17 ½-in. section) of the Dunbar field in the North Sea. In the past, this formation was systematically drilled with a conventional WBM in under balanced conditions. With such a mud system, the well was highly unstable, particularly in the Eocene. Following three remedial side tracks experienced over the last two years, an extensive study has been carried out.

A careful analysis of sonic logs allowed an estimate of the average pore pressure in the Eocene to be made and to design an adapted overbalanced silicate mud system. The results currently obtained on 2 wells (20° and 30°) are very encouraging.

However, even in the case of a perfectly stable rock and to ensure a good hole cleaning, the well had to be flowed with a high flow rate (4,000 l/min) and a properly adjusted rheology had to be used to avoid pack off problems.

—P A Charlez, V Pradet, Total Oil Marine
—M Gregoire, Total SA