

New rig designs, revamps fill special drilling needs

FLEXIBILITY AND EFFICIENCY are two key goals of rig designers as cost pressures continue on both operators and contractors.

In the session, "Rig Design," at the 2002 IADC/SPE Drilling Conference, 26-28 Feb in Dallas, the focus is on better handling of tubulars, station-keeping ability for offshore rigs, land rig versatility and other rig design issues.

The session is chaired by **M B Stone, Big 6 Drilling Co** and **C N Springett, GlobalSantaFe**.

IADC/SPE paper 74453, "Considerations Given to Land Rig Design for Versatility of Operations," discusses the progression of a drilling rig design by a drilling contractor to a successful new generation "Super Single" drilling rig. The paper is authored by **R Isinger, Precision Drilling Corp.**



Versatile new rig design can be used from vertical to slant in a variety of drilling operations.

The "Super Single" rig design is versatile enough to be used in several drilling applications, from vertical to slant, from shallow gas to medium vertical gas or oil wells, to shallow TVD SAGD heavy oil wells in varying climates ranging from Mexico to Venezuela and Northern Alberta in the winter.

TUBULAR HANDLING

Safety and productivity of the well construction process are key responsibilities of the well construction team.

Drilling contractors can contribute significantly to safety and productivity improvements by reducing the number

and duration of well construction activities performed on the critical path.

A key area in which a contribution can be made to this effort is in the handling of drilling and well tubulars. In IADC/SPE paper 74450, "Smarter Tubular Handling on a Jackup Drilling Unit," authors **M Simpson** and **C J Davidson, GlobalSantaFe**, focus on tubular handling operations.

One drilling contractor's efforts to boost safety and productivity to the next level on its latest jackup units led to the development of a new solution in tubular handling. The result is a system that can make up and run stands of drilling and well tubulars from the jackup cantilever deck to the well.

The authors report that the system offers time savings by picking up and laying out drilling strings off the critical path and by running stands of well tubulars instead of singles.

The system also, compared to other industry alternatives, offers reduced risk exposure to drill floor personnel by reducing the level of simultaneous drill floor tubular handling activity.

NEW NORTH SLOPE RIG

A "typical well" on the North Slope is a thing of the past. Twenty years ago a rig would sit on a Prudhoe pad and drill dozens of 10,000-bopd wells. Today, the same rig might drill multilaterals one month and exploration wells 70 miles from infrastructure the next.

These diverse well types and changing economic drivers warranted a new look at North Slope rig designs, according to IADC/SPE paper 74451, "Design, Specification, and Construction of a Light Automated Drilling System (LADS)." The paper was prepared by **M D Dunn, Phoenix Alaska Technology**; **P Archey, BP Alaska**; **E Opstad, Phoenix Alaska Technology**; **M Miller, BP Alaska**; and **T Otake, NI Energy Development Inc.**

Beginning in 1997, BP Alaska began researching what the drilling machine of the future should look like. First, the rig had to be safer and more automated. Second, it had to reduce well costs. Third, it had to be lighter and smaller.

Fourth, it had to be better suited for cross-tundra rig moves.

In May 2000, BP chose Phoenix Alaska Technology (PAT) to mature the design, and build and operate the rig. In March 2001, PAT began constructing a state-of-the-art, fully automated drilling rig that is expected to commence operations on the North Slope in early 2002.

The rig weighs less than half that of a conventional North Slope rig of equivalent horsepower. A single operator controls all drilling, tripping and horizontal setback operations from a computerized control station.

STAYING ON LOCATION

When the submersible Mr Charlie, the world's first purpose-built MODU, went to its first location in 1954, it initially slid off location. Since that time anti-scouring skirts, small piles, shell pads and other efforts have helped keep submersibles on location.

However, in severe weather with weak soil conditions the units have often continued to slide.

In IADC/SPE paper 74452, "Finally, a Solution for Keeping Submersibles on Location," author **M A Childers, Atwood Oceanics Inc.**, describes a new design.

The Atwood "Richmond" has had an excellent record since returning to the Gulf of Mexico in 1988, successfully drilling 82 locations. But unfortunately, 8 locations had sliding problems and of those, 2 wells were unable to be completed, reports the author.

In 2000, after the Richmond slid off one of the locations, it was decided to use the new technology of suction piles in shallow water.

A design basis was developed to hold the unit on location in a 10-year hurricane event with the hull sitting on 100-psf-shear strength soil. To meet this criterion, 4 self-contained and self-installable/retractable piles were located on the 4 outer columns.

Calculations resulted in the 31-ft long piles located in chucks being 10 ft in diameter and capable of penetrating to 19 ft under the most severe conditions.



Suction pile system designed for the Atwood Richmond to prevent sliding proves successful.

Jet nozzles were placed at the foot of each of the 32-ton, 1 ½-in. thick piles, allowing them to be jetted in or out of the soil with the high-pressure mud pumps.

Four 35-hp variable speed AC pumps were installed, allowing finite control of the evacuation (suction installation) or extraction (pumping the pile out of the soil) of water.

Suction piles had previously never been used in this application.

Since installation in late summer 2000, the system has been used successfully on over 9 locations with the unit maintaining location in severe weather up to a collinear 45-knot sustained wind, 4-7-ft waves and a 1 ½-knot current.

These conditions far exceed previous environmental and soil conditions where the unit had slid, but the Atwood Richmond held location with no movement.

The suction pile system (patented) has been an unqualified success.

SEISMIC ASSESSMENT

The API Task Group on Well Servicing Structures responsible for API Specification 4F is working towards providing improved guidance on the design and

assessment of drilling structures. The effort will provide supplementary guidelines on how to assess drilling structures for forces arising from earthquake loading conditions.

IADC/SPE alternate paper, "Seismic Assessment Procedures for Offshore Drilling Structures," summarizes the proposed guidelines. Authors of the paper are **J W Turner, ExxonMobil**

Development Co; M Effenberger, Stress Engineering Services; and J Irick, Consultant.

The guidelines provide a methodology for performing seismic assessments of offshore drilling rigs. The procedures assume that other engineering analysis will have been performed to determine the seismic response of the supporting deck structure. ■