

Transocean's 5th gen rigs efficient record-setters

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FLOATING RIG GENERATIONS

have been defined primarily on the time frame in which the units were conceived and built. The 3rd generation of the early 1980s was the most dominant, producing 44 semisubmersibles in an aggressive push into moderate water depths, particularly in the Gulf of Mexico and the North Sea. These rigs were more robust than the previous generation, with more reliable drilling packages and ancillaries.

In consequence of the overbuild of the early 1980s, the 4th generation semisubmersibles that followed numbered only 13, and they concentrated on demanding niche markets such as deeper waters of the Gulf of Mexico and year round operations in the extreme environments of Eastern Canada and the Atlantic fringe of Northern Europe.

5TH GENERATION RIGS

The mid-1990s thrust into frontier depths precipitated the upgrade of a number of units and conversion of vessels from different uses, stretching existing hulls and associated technology for program objectives in as much as 10,000 ft of water. Compromised efficiencies and constraints on space, variable

load, and handling weights motivated the design and construction of a new generation of rigs with extreme water depth capability.

The 5th generation semisubmersibles and drillships are large displacement newbuilds, outfitted with high pressure pumps, generous high-flow solids control suites, big bore drill pipe, dual mud systems with upwards of 15,000 bbl pit capacities, and automated pipe handling.

Most are dynamically positioned, drawing on upwards of 58,000 hp power plants, boasting 1,000 ton hook loads, and either dual activity or significant off-line activity. When the last of these rigs are delivered (mid-year 2004), the industry count will be 25 5th generation new builds, owned and/or operated by eight contractors.

THE TRANSOCEAN LINEAGE

The lineage of the Transocean rigs predates the recent mergers and acquisitions that define the present company. The rig designs were conceived in four different camps, each capitalizing in their own way on the efficiencies afforded with new technology.

Pathfinder Class. These DP drillships, capable of working in water depths up to 10,000 ft were the first of the ultra-deepwater newbuilds. Reading & Bates delivered the Deepwater Pathfinder in late 1998, with the sister vessels Deepwater Frontier and Deepwater Millennium following at six month intervals. As with other classes of 5th generation units, these ships were products of specific operator requirements (the first two in fact with equity participation from Conoco Shipping).

Express Class. Sedco Forex developed these high-performance semisubmersibles for efficient well construction programs, with the focus on off-line activities, particu-

larly pipe handling and tool makeup. The drill floor was the center of multiple stand-building processes, from doubles of riser joints to fourbles of drill pipe to triples of range 3 casing. Other innovations include high-powered integrated mud and cement pumping system, and built-in logging, MWD, LWD and coiled tubing capabilities.

Enterprise Class. The concept of dual drilling was first conceived for this class of vessel. With two complete well construction centers, top hole and down-hole activities can be accomplished simultaneously.

The rigs have even conducted concurrent drilling activities on adjacent wells. Onboard crude oil storage and offloading capabilities permit production testing to proceed concurrently with drilling activities.

Deepwater Nautilus and Deepwater Horizon. These semisubmersible designs were tailored to include offline efficiencies similar to the Express and Enterprise classes.

Riser/BOPs can be skid off well center to allow field moves without the lengthy delays to pull the systems in ultra-deepwater. Multiple pipe-handling abilities and ample stand capacity allow tubulars to be ready for the next activity, in addition to contingencies.

Deepwater Expedition. This unit is unique in that it incorporates a 5th generation drilling package into an existing hull (new but not complete) capitalizing on market and shipyard availability.

Deepwater Discovery. The Pathfinder Class was extended to another hull in the shipyard schedule, incorporating the drilling systems procured for a Falcon conversion that was ultimately cancelled. Though similar in hull form to the preceding Pathfinder Class, the Deepwater Discovery has enhanced off-line capability and has higher capacity lifting equipment.

TRANSOCEAN'S STUDY

Transocean has undertaken a study to evaluate the efficiencies of its 5th generation rigs in relation to earlier rig generations, and to quantify the associated commercial impact.



The Deepwater Millennium, one of the first of the ultra-deepwater newbuilds, is of the Pathfinder Class of vessels rated for 10,000 ft of water.

Representative time-line performance has been benchmarked for a selection of rigs from the IADC reports of earlier wells. To ensure a fair comparison, the following preferred criteria influenced well selection:

- Exploratory wells with some consideration for some sections of development wells;
- Wells with minimum trouble time and hole problems;
- Wells without highly deviated sections;
- Wells with minimal remedial operations such as sidetracks and bypass.

Every hour in each well is accounted for, and allocated as appropriate to a defined operational activity. Discriminations have been made between critical path and offline operations. Non-productive time has been separated out. Specific efficiency gains are evident by examining relative performance through each interval of a typical well.

Arrival Location and Positioning: Most 5th generation rigs are dynamically positioned, hence eliminating time spent in anchor handling operations. The commercial implications go well beyond the time-line influences.

Though the fuel bills on DP vessels are \$3,000- \$4,000 a day higher, moored vessels are burdened with a \$20,000-\$40,000 a day incremental increase for anchor handling vessels, and often the CAPEX on pre-set mooring systems which can run to tens of millions of dollars.

Well Spud and Top Hole Drilling. Prior to deploying the BOP, most of these rigs offer a wide range of possibilities in exploiting their offline facilities.

Transocean's Enterprise Class with a second rotary and the Horizon class with its auxiliary "mini" derrick, would typically run the entire casing string for all top-hole sections off-line while the well center is engaged in drilling operations.

The Express class rigs with their patented Tri-Act derrick make up and rack back all tubular triples of casing off-line.

Run/Pull BOP. With the riser pre-handled and racked back in doubles offline

on the Express class, the number of connections during running riser is reduced.

The 90 ft riser on the Deepwater Pathfinder, Deepwater Horizon and Deepwater Discovery rigs has contributed to better riser running rates on these rigs.

The Enterprise Class rigs typically run the BOP and riser off-line while the top hole casing is set from the other rotary.

Intermediate and Bottom Hole Sections. Those rigs with Varco PRS racking systems are able to build and rack back core barrels and all 13-3/8-in. and smaller casings off-line (this includes all but the earliest Pathfinder class rigs). BHAs and drillpipe are made-up and laid-down off-line at mousehole stations.

Trip Rates. With large bore drill pipe and four joint stands, handling weights have obligated a great deal of automation in handling tubulars.

It is a long learning curve going from brake handles to touch screens, but the crews are delivering trip times competitive with the earlier manual derricks.

Average rates have been plotted from random selections of over 100 trips. The upper range values are perhaps more meaningful as recording protocols have rarely discriminated controlled tripping, flow checks, and BHA handling.

The Deepwater Discovery, the Deepwater Horizon, and the Enterprise and Express class rigs can rack back 135 ft stands of drill pipe with about a 25% improvement in connection time at well center compared to 96 ft stands.

Penetration Rates. Larger bore drill pipe, and increased hydraulics with 2,200 hp/7,500 psi mud pumps have provided higher flow rates (hence better hole cleaning and reduced wiper trips). Higher ROPs have been accomplished, especially in the top-hole sections of the well.

This is a particularly difficult element of the well to quantify. ROPs are heavily influenced by formation differences, mud selection, bit selection, and controlled drilling.

The benefit of the higher specification equipment is more evident in the upper hole sections. ■