



A computer-aided rendering of Transocean's Enhanced Enterprise class drillship Discoverer Clear Leader shows the dual-activity derrick, with stands of pipe made up offline in one derrick while drilling ahead with the second derrick.

Latest equipment technologies on new rigs emphasize safety, performance, efficiency

By Jerry Greenberg, contributing editor

THERE ARE APPROXIMATELY 120 offshore rigs under construction or on order today that run the gamut from premium jackups to what could safely be said to be the most sophisticated offshore rigs ever to be built. DRILLING CONTRACTOR sampled several rigs under construction that provide breakthrough technology in terms of rig design and equipment.

Most of the state-of-the-art equipment technologies used on the rigs, whether it is a "simple" pipe-handling system or dual-activity derricks, are intended to increase worker safety and provide the highest performance and most efficient methods of conducting drilling and completion operations.

Drilling contractors building these rigs are also looking forward as the industry moves to deeper waters and deeper wells. Transocean's 3 drillships under construction, for example, will be capable of drilling to 40,000 ft in 12,000 ft of water. Ten shale shakers will be installed to handle mud and cuttings. Five mud pumps will be installed on the vessels, compared with 3 typically seen on offshore rigs. Three mud pumps appear to be the

norm these days for jackups, which also are designed with sufficient space to easily install a 4th mud pump.

Power is a key factor in drilling operations today and in the future. **Rowan Companies'** latest jackup design, the 240-C Class, will have 6 **Caterpillar** generator sets for a total of 12,900 hp. **Premium Drilling's** jackups also feature ratings up to 12,500 hp. Like most jackups under construction, they feature a minimum 2 million-lbs hook load capacity, compared with 1.5 million lbs for the previous jackup generation.

The following reviews several drilling contractors' latest new rig construction programs with safety and performance enhancing technologies.

TRANSOCEAN INC

In 2006, Transocean Inc announced the construction of 3 Enhanced Enterprise class drillships to be built at **Daewoo Shipbuilding and Marine Engineering** for long-term drilling contracts. **Chevron** contracted 2 of the drillships while **Hydro** signed a contract for 1 of the vessels. The 2 Chevron-contracted rigs, **Discoverer Clear Leader** and **Discoverer Inspiration**, are scheduled for delivery in the 2nd quarter of 2009 and the 1st quarter of 2010, respectively. The rigs will work in the US Gulf of Mexico initially.

The third rig, as yet unnamed, is set for delivery in mid-2009.

Revenues of approximately \$493 million are possible during the first 3 years of the **Discoverer Clear Leader** contract. The final 2 years of the contract are linked to the standard West Texas Intermediate oil price, with a floor of \$40/bbl and a ceiling of \$70/bbl that could result in potential revenues between \$292 million and \$365 million over that period.

The nearly identical dynamically positioned, double hull drillships are designed to include the most advanced drilling capabilities in the offshore drilling industry, building on Transocean's Enterprise class drillship design. The drillships will feature Transocean's patented dual-activity drilling technology, allowing for parallel drilling operations that is designed to save time and drilling costs in deepwater well construction compared with conventional rigs.

The dual-activity technology, along with a new and enhanced top drive system, an expanded high-pressure mud pump system, expanded completions capabili-

ties and other unique features of the drillship, target the drilling of wells up to 40,000 ft total depth. The rigs will have a variable deckload of more than 20,000 metric tons and will be capable of drilling in water depths of up to 12,000 ft.

The **Discoverer Clear Leader** will also utilize the company's patented dual-activity technology to work simultaneously with 2 complete BOP stacks, lower marine riser packages and pods, saving

BOP will undergo typical maintenance and testing.

Greater tree-handling capabilities will save time during completions operations. A dedicated area capable of holding 3 large trees (approximately 100 tons each) is provided with all outfitting necessary to test the trees prior to running them. Assembling these trees nearer the well center than on existing rigs will reduce handling on the rig.

Comparison of Discoverer Enterprise (Enterprise class) and Discoverer Clear Leader (Enhanced Enterprise class) drillships

	<u>Discoverer Enterprise</u>	<u>Discoverer Clear Leader</u>
Operating water depth	10,000 ft (3,048 m)	12,000 ft (3,660 m)
Drilling depth capability	35,000 ft	40,000 ft
Storage capacities: Riser storage	10,000 ft	12,000 ft
Cranes	4 each x 75 mt	4 each x 100 mt
Major drilling equipment: Dual-activity derrick Top drive Rotary Drawworks Motion compensation	2 x 1,050 tons 2 x 750 tons 2 x 60.5 in./1,000 ton 2 x 1,000 tons CE EH-V 2 x crown mounted	2 x 1,300 tons 2 x 1,250 tons 1 x 75.5 in./1,000 ton (fwd) 1 x 60.5 in./1,000 ton (aft) 2 x 1,000 tons NOV AHC 2 x Active heave drawworks
Drilling mud/completion fluids system Liquid mud/completion fluids Active mud Reserve mud Slugging tanks Mud pumps Shale shaker	15,400 bbls 6,000 bbls 9,000 bbls 400 bbls 4 x 7,500 psi triplex 8 x Brandt LCM-2D	20,000 bbls 8,000 bbls 11,600 bbls 400 bbls 5 x 7,500 psi NOV HEX 10 x Brandt LCM-3D
Subsea and well control Marine riser (21 in x 75 ft joints) Blowout preventer Diverter	Class F (2.5mm lb) couplings 1 x 15,000 psi x 18 ¾ in. 2 x 60 in. bore	Class G (3mm lb couplings) 2 x 15,000 psi x 18 ¾ in. 1 x 72 in. bore (fwd) 1 x 60 in. bore (aft)
Well test provisions: Wellbore fluid storage Tree handling	125,000 bbls 1 x 75 ton	125,000 bbls simultaneous 3 x 100 mt

up to 4 days of testing and running the BOP and riser.

"This capability is one of the first to be utilized on a regular basis, as most rigs operate with 1 BOP," explained **Mike Hall**, vice president, engineering and technical services for Transocean.

Utilizing multiple complete BOPs can save several days of maintenance and testing of the BOPs between wells, which can be particularly efficient in the Gulf of Mexico, where wells are relatively close together, even if the vessel must mobilize to another block for the subsequent well. With multiple BOPs, one will always be ready for the next well while the second

"On the newbuild rigs, fully assembled trees will be lifted onboard in a single lift, and several trees can be tested and ready to be run to the seafloor," Mr Hall explained.

The new rigs also will feature five 7,500-psi **National Oilwell Varco** Hex mud pumps, compared with four 7,500 Triplex pumps on the earlier Enterprise rigs. Additionally, the new vessels will have 10 Brandt LCM-3D shale shakers, compared with 8 Brandt LCM-2D shakers on the earlier rigs. The extra capacity will provide additional flexibility to bypass a problem with 1 shale shaker without shutting down operations. The design includes the latest cuttings-management technolo-

gy throughout the cuttings system, including sufficient storage capacity and an auger system to move dry cuttings into a container at the same level as the cuttings outflow. This process eliminates extra pumping or crane-handling operations.

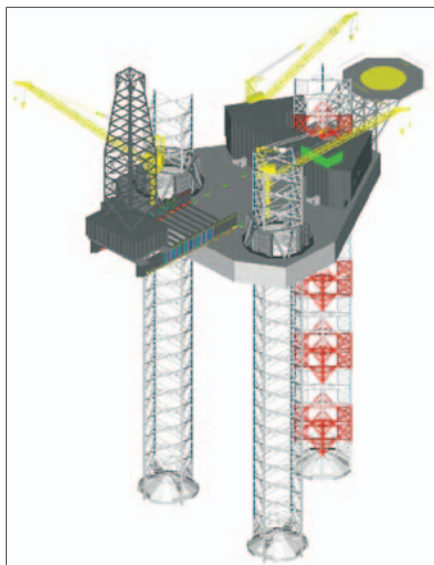
"The entire system is designed as another vehicle for reducing non-productive time," Mr Hall noted.

The new drillships will feature 1,000-ton drawworks and new, enhanced 1,250-ton top drive drilling systems being developed by Aker Kvaerner MH. Top drive systems on the earlier Enterprise class rigs were 750-ton units. The enhanced top drives are being designed with more robust components to reduce required maintenance and to make scheduled and unscheduled maintenance quicker to significantly reduce downtime.

The new 1,250-ton top drive is designed to significantly reduce non-productive time as it will be more powerful and robust than existing 750-ton top drives. It will be modular to allow repairs to be completed in a matter of hours instead of days, which is the case with present top drives.

"The new top drive will include a redundant lubrication system with online oil monitoring, an automated greasing system, work platforms to eliminate man-riding operations, dual and redundant drives, online condition monitoring and troubleshooting and offline load path inspection," Mr Hall said.

Another enhancement to the drillships is a new power-management system that



Two of Rowan's 240-C class rigs are under construction at the Le Tourneau shipyard in Vicksburg, Miss.

is being developed with Siemens for a revolutionary electrical-distribution system to provide sufficient power to every area of the rig under any operating and environmental condition. The system's enhanced fault-tolerant design aims to reduce the risk of power blackouts by providing greater power availability, compared with conventional redundant systems.

ROWAN COMPANIES

Rowan Companies, which purchased the Marathon LeTourneau shipyards and jackup rig designs several years

ago, including the industry's so-called "workhorse" rig — the LeTourneau 116-C class — recently introduced its 240-C Class jackup rig that has been dubbed "the next workhorse." Two of the 240-C class rigs are under construction at the LeTourneau shipyard in Vicksburg, Miss., for delivery in June 2008 and February 2009.

According to Rowan, there are 52 116-C class jackups in the worldwide fleet, including 31 that are over 20 years old and 21 that are over 25 years old. Of the approximately 60 jackups under construction, about 75% are in the size range of the 116-C class or slightly larger, according to Rowan, with 50% of them having identical leg spacing or transom offset to the 116-C design. Additionally, all of the 116-C replacement rigs under construction improve upon the environmental and payload capabilities of the 116-C, and all have increased drilling capacity and consumables storage, according to Rowan.

Rowan aims its various jackup classes at different regional markets. For example, jackups with water-depth capabilities in the 300-350 ft range are aimed at the deep and ultra-deep wells drilled on the US Gulf shelf, Middle East deep gas drilling, southern and central North Sea high-pressure, high-temperature drilling and on the Scotian shelf offshore eastern Canada.

The company's Tarzan class rigs are designed for shallow water Gulf of Mexico and Middle East drilling and for deep wells.

Newbuilds on order or under construction (continued on Page 46).

Owner/Manager	Build Country	Del Date	Rig Status
Aban Offshore	Singapore	2008	Under construction
ABG Shipyard	India	2009	On order
ABG Shipyard	India	2010	On order
Aker Drilling	Norway	2008	Under construction
Aker Drilling	Norway	2008	Under construction
Atwood	USA	2008	Under construction
Bluesky Offshore Group	Singapore	2009	Under construction
Bluesky Offshore Group	Singapore	2008	Under construction
CNOOC		2010	On order
COSL	China	2008	Under construction
Delba	UAE	2010	On order
Diamond Offshore	USA	2008	Under construction
Diamond Offshore	Singapore	2008	Under construction
Discovery Hydrocarbons	Singapore	2008	Under construction
ENSCO	Singapore	2008	Under construction
ENSCO	Singapore	2009	Under construction
ENSCO	Singapore	2009	Under construction
Frigstad	China	2009	Under construction
Gazflot	Russia	2007	Under construction
GlobalSantaFe	Singapore	2009	Under construction
Great Offshore	Singapore	2009	On order
Great Offshore	India	2008	Under construction
Gulf Drilling International	Singapore	2007	Under construction
Japan Drilling	Singapore	2008	Under construction
Jindal Drilling	Singapore	2008	Under construction
Larsen Oil & Gas	Singapore	2008	Under construction
Larsen Oil & Gas	Singapore	2008	Under construction
Larsen Oil & Gas	Singapore	2010	Under construction

Maersk Contractors	Singapore	2007	Under construction
Maersk Contractors	Singapore	2008	Under construction
Maersk Contractors	Singapore	2007	Under construction
Maersk Contractors	Singapore	2008	Under construction
Maersk Contractors	Singapore	2009	Under construction
Maersk Contractors	Singapore	2009	On order
Maersk Contractors	Singapore	2008	Under construction
Maersk Contractors	Singapore	2009	Under construction
Maersk Contractors	Singapore	2010	Under construction
Maersk Contractors	Singapore	2010	Under construction
Mercator Lines	Singapore	2009	Under construction
Mosvold Jackup	UAE	2008	Under construction
Mosvold Jackup	UAE	2008	Under construction
MPF	Spain	2009	Under construction
NIDC	Iran	2008	On order
NIDC	Iran	2008	On order
Noble	Singapore	2009	Under construction
Noble	China	2008	Under construction
Noble	Singapore	2009	On order
Noble	China	2007	Under construction
Noble	China	2009	Under construction
Odebrecht	UAE	2010	Under construction
Odjell Drilling	South Korea	2010	On order
Odjell Drilling	South Korea	2008	Under construction
OffRig	China	2008	Under construction
OffRig	China	2008	Under construction
OffRig	China	2009	On order
Perforadora Central	USA	2007	Under construction
Petrobras	South Korea	2009	Under construction
Petrobras	South Korea	2010	On order

Source: ODS-Petrodata

Environmental comparison		
	116-C	240-C
Leg length	477 ft	491 ft
Water depth	350 ft	350 ft
Wind speed	100 knots	100 knots
Wave period	15 secs.	14 secs.
Wave height	20 ft	51 ft
Surface current	1.0 knots	1.0 knots
Bottom current	0 knots	0 knots
Air gap	35 ft	40 ft
Elevated weight	15,100 kips	24,000 kips

While several of 240-C's criteria are similar to or identical with the 116-C design, there are some exceptions.

With 350 ft water depth capability, the 240-C class jackup was developed for deeper waters of the Gulf of Mexico, the southern and central North Sea and shallow waters of the Scotian shelf.

Leg structure and elevating system: The 240-C's leg spacing and transom offset are nearly identical to that of the 116-C design. The 240-C class rig maintains LeTourneaus' simple, durable and well-proven elevating/holding system to minimize site installation problems and reduce the time to set up on location. The

design features a 440-kip elevating unit, compared with the 116-C's 375-kip unit, and can jack up with 80% preload leg reaction. The 240-C maintains the square leg design with maximum guide restraint for high stiffness and durability while allowing for a low drag bracing design.

While several of the 240-C's criteria are similar to or identical with the 116-C design, there are some notable exceptions. The general deck arrangement of the 240-C results in greater usable space and consumables storage for deep wells. Updated crew accommodations for 108 people includes a conference room and office suite separate from the sleeping area. Accommodations are expandable to 120 persons. The rig also features LeTourneau 220VS cranes with 145-ft booms, with 55-ton capacity at 50 ft, and 26 tons at 95 ft.

Machinery and drilling equipment:

The 240-C's 6 Caterpillar 3516B-HD generator sets produce a total of 12,900 hp. Ten OEM variable frequency AC drives are rated at 1,600 amps each. Three LEWCO mud pumps are rated at 3,000 hp each for a 7,500-psi mud discharge pressure. The rig also has active and reserve liquid mud storage of 4,775 barrels and 13,800 cu ft of bulk mud and cement storage inside the hull. The 240-C includes a recessed pump pit for mud mixing and charging pumps and manifolds.

The rig's drilling equipment and systems include a LEWCO LDW4500 drawworks with a 2.5 million-lb hookload capacity

for deep and ultra-deep drilling operations. A 750-ton LEWCO direct drive AC top drive system is also installed on the rigs. The BOP handling system is 100% redundant 125,000-ton system with storage below the drill floor.

The rig's sub base can be skidded to improve towing performance by trimming without ballast. It also improves access to the BOP for handling and maintenance as well as allowing improved clearance on the main deck for open water locations. The skidded sub base also increases the flexibility for handling wellheads and flowlines for longitudinally spaced wells during combined drilling and production operations.

The 80-ft cantilever reach can be extended to allow for a 90 ft reach. The 3.5 million-lb combined cantilever drilling load provides for more than 2 million-lb capacity at 78 ft reach.

Pipe-handling equipment and system:

The 240-C's pipe-handling equipment includes a derrick bridge crane racking system with provisions for offline stand building. An automated elevating catwalk delivers the tubulars to the drill floor, which is outfitted with a pedestal-mounted iron roughneck to make up and break out the drill pipe. A 4-ton knuckle boom crane on the starboard cantilever beam handles the tubulars between the main deck and the elevated pipe racks.

ENSCO INTERNATIONAL INC

ENSCO International ordered a series of three 8500 class semisubmersibles

Newbuilds on order or under construction (continued from Page 44).

Petroserv	South Korea	2009	Under construction
Premium Drilling	Singapore	2007	Under construction
Premium Drilling	Singapore	2007	Under construction
Premium Drilling	Singapore	2008	Under construction
Premium Drilling	Singapore	2008	Under construction
Premium Drilling	Singapore	2009	Under construction
Premium Drilling	Singapore	2008	Under construction
Premium Drilling	Singapore	2009	On order
Premium Drilling	Singapore	2007	Under construction
Premium Drilling	Singapore	2008	Under construction
Premium Drilling	Singapore	2009	Under construction
Premium Drilling	Singapore	2007	Under construction
Queiroz Galvao	UAE	2009	Under construction
Queiroz Galvao	Singapore	2009	Under construction
Rowan	USA	2007	Under construction
Rowan	USA	2008	Under construction
Rowan	USA	2009	Under construction
Saipem		2007	Under construction
Saipem	Netherlands	2009	Under construction
Schahin	China	2009	Under construction
Schahin	China	2010	Under construction
Scorpion Offshore	USA	2007	Under construction
Scorpion Offshore	USA	2007	Under construction
Scorpion Offshore	USA	2008	Under construction
Scorpion Offshore	USA	2008	Under construction
Scorpion Offshore	USA	2008	Under construction
SeaDragon Offshore	Russia	2009	Under construction
SeaDrill	Malaysia	2007	Under construction
SeaDrill	Malaysia	2008	Under construction

SeaDrill	South Korea	2008	Under construction
SeaDrill	Singapore	2008	Under construction
SeaDrill	Singapore	2007	Under construction
SeaDrill	South Korea	2008	Under construction
SeaDrill	South Korea	2007	Under construction
SeaDrill	South Korea	2008	Under construction
SeaDrill	South Korea	2008	Under construction
SeaDrill	South Korea	2008	Under construction
SeaDrill	Singapore	2007	Under construction
SeaDrill	Singapore	2008	Under construction
SeaDrill	Singapore	2008	Under construction
SeaDrill	Singapore	2007	Under construction
Sevan Drilling	China	2009	Under construction
Skeie Drilling & Production	Singapore	2010	Under construction
Skeie Drilling & Production	Singapore	2010	On order
Standard Drilling	Indonesia	2008	Under construction
Standard Drilling	Indonesia	2009	Under construction
Standard Drilling	Indonesia	2009	On order
Standard Drilling	Indonesia	2009	Under construction
Stena	South Korea	2007	Under construction
Stena	South Korea	2008	Under construction
Stena	South Korea	2009	On order
Tanker Pacific	South Korea	2009	Under construction
Tanker Pacific	South Korea	2009	Under construction
Thule Drilling	UAE	2007	Under construction
Thule Drilling	UAE	2008	Under construction
Transocean	South Korea	2009	Under construction
Transocean	South Korea	2009	Under construction
Transocean	South Korea	2009	Under construction
Uni-Arab	China	2009	On order

Source: ODS-Petrodata



Just beginning to resemble a semisubmersible in this photo, the ENSCO 8500 is the first of 3 nearly identical rigs due for delivery between May 2008 and December 2009. The 8500 Series class rigs feature offline activity centers that the company says can deliver 70%-80% of the capability that a dual-activity vessel can deliver.

in 2005 and 2006 that are enhanced iterations of the company's successful 7500 class semi. The company says that the ENSCO 8500 Series rigs takes cost-efficiency to new depths by enhancing an already proven low-cost design and expanding its operational capabilities.

Each 8500 Series rig will include a 201-ft, 2 million-lb quad derrick, 6,000-hp drawworks, 4 2,200-hp mud pumps and accommodations for 150 crew members. The rigs also feature offline pipe-handling capability, increased drilling capacity to 35,000 ft, variable deck load capacity of 8,000 tons and improved automatic stationkeeping capability.

The rigs can operate in up to 8,500 ft of water but can be upgraded to 10,000 ft of water with relatively little effort and without having to bring the rig into a shipyard for the upgrade. The upgrade would consist primarily of additional riser joints and riser tensioners.

Construction of the 8500 Series semisubmersible is relatively "simple" with flat plate steel and simple curvatures utilized whenever possible, eliminating the complex and more expensive rolled steel typically found on semisubmersible columns and braces. The rig utilizes common steel grades and modular construction, which results in faster delivery times and lower costs. Additionally, ENSCO is utilizing equipment upgrades consistent with genuine technological improvements and lessons learned.

While the 8500 Series rig does not have dual-activity derricks such as those employed by Transocean on their latest deepwater rigs, ENSCO's 8500 Series rig is capable of conducting offline activities, many of which compare favorably in capabilities to a dual-activity derrick.

The offline activity center includes a horizontal-to-vertical pipe handling

machine, an automated pipe racking system and a dedicated iron roughneck that is used to make up tubulars offline. Also, according to ENSCO, the 8500 Series rigs will have the ability to pick up large OD casing offline, suspend casing for cleaning, pick up casing and rack it in the derrick and pick up drill string, both offline, make up and rack the bottom hole assembly offline, break out and lay-out BHAs and rig up subsea completions. All of these features are comparable to operations performed via a dual-activity derrick, according to ENSCO.

In addition, the 8500 Series features a BOP system inclusive of a test RAM and a BOP trip saver system. "We have a riser trip saver system," said **David Hensel**, director — marketing for ENSCO. "It allows us to hang off our riser and BOP offline and utilize the main well center for other activities. We can also make short rig moves without pulling our riser.

"We don't have a secondary well center," Mr Hensel continued, "but with the offline capabilities that we have, we can deliver about 70%-80% of the capability that a dual-activity vessel can deliver."

A dedicated main deck area can handle a minimum of 2 subsea trees and their umbilical controls. The area also has the ability to keelhaul templates, manifolds and guidebases through the 20 ft-by-120



Diamond Offshore's newbuild jackup Ocean Scepter, being built at the Keppel AmFELS shipyard in Brownsville, Texas, is scheduled for delivery in February 2008.

ft moonpool that expands to 30 ft at the well center. The rig also has a state-of-the-art driller's cabin. "Our focus is increasing the efficiency of rigs," said **Richard LeBlanc**, ENSCO vice president of investor relations. "We are not focused on all of the automation that some contractors are as we seek greater reliability. With some of the more sophisticated equipment, the more of a challenge it is to keep it operating full time."

ENSCO's 8500 Series rigs are veritable bargains among the semisubmersibles being built today. The ENSCO 8500,

ordered in September 2005, will be delivered in the 2nd quarter of 2008 at a cost of about \$312 million. The ENSCO 8501, ordered in January 2006, will cost approximately \$338 million while the ENSCO 8502, ordered in September 2006, will cost about \$385 million. The ENSCO 8501 and 8502 will be delivered in the 2nd quarter of 2009 and 4th quarter of 2009, respectively.

PREMIUM DRILLING

In April 2005, **Awilco ASA** and **Sinvest ASA** jointly formed Premium Drilling to

market, manage and operate a fleet of up to 16 newbuild, high-specification jackup rigs that both of the companies have under construction at **Keppel FELS** and **PPL Shipyard** in Singapore. The rigs under construction at PPL are Baker Marine Pacific class designs while the rigs at Keppel FELS are either KFELS MOD 5 Class units or KFELS Super B Class designs, the latter of which is an enhanced iteration of the KFELS MOD 5.

Three of the Baker Marine design rigs have been delivered, with 5 additional units to be delivered between the 2nd quarter 2007 and 1st quarter of 2009. Of the KFELS design jackups, 2 were delivered in 2006, with the remaining rigs under construction scheduled for delivery between the 2nd quarter 2007 and 1st quarter 2009.

Drilling equipment and systems: The rigs are state-of-the-art, with automatic pipe-handling and pipe-racking capabilities and the latest National Oilwell Varco Driller's Cabin with Cyberbase operator station. Premium's WilCraft jackup has a 2-chair Cyberbase system for the driller and assistant driller, who would operate the pipe-handling and racking equipment. The company's other rigs are equipped with a single chair Cyberbase system.

"All of our rigs have the Cyberbase chairs, AC drawworks and either a National Oilwell Varco PRS-8 or Bridge Racker pipe handling system," said **Anirudha "Sunil" Pangarkar**, vice president-operations for Premium Drilling.

"The PRS-8 is probably the most sophisticated system," he continued, "being much more automated, but it also brings more challenges because we have to make sure everything is synchronized, that there are not many tools hanging in the derrick, but that is manageable. And it is basically a hands-off operation."

A traditional X-Y fully latched finger-board layout is used with the PRS-8 system to maximize the available drill pipe storage area. The PRS-8 also provides automated tripping capabilities.

Several other Premium Drilling jackups under construction utilize NOV's X-Y HydraRacker pipe-handling system. This column racker is designed to rack, build stands and pick up or lay down tubulars. The semi-automatic system is operated from the driller's cabin and reduces or eliminates drillfloor personnel for increased safety. The system supports offline stand building during drilling

operations, with the ability to rack back complete bottomhole assemblies. The system is also capable of handling up to 20-in. tubulars. An iron roughneck torques the pipe.

Cyberbase learning curve: Operating a Cyberbase system could prove challenging to some drillers while a new generation of drillers should readily adapt to the system

“There is a lot of training that goes with the Cyberbase system,” Mr Pangarkar noted, “because a lot of drillers today still are more familiar with manual drilling. However, now there is the generation of people that are very comfortable with joystick operations.”

He also noted that time and cost savings would result from use of the Cyberbase system following a learning curve.

Mr Pangarkar emphasized the advantage of increased horsepower available on today’s rigs compared with earlier generations. Premium’s rigs utilize up to 6 Caterpillar or **Wartsila** engines that generate from 10,750 hp to 12,900 hp.

“Power is the most underrated item,” he explained. “If you look at power in the past, a standard jackup would have around 6,000-7,000 hp. As a minimum today, it is around 10,000 hp, and we are increasing that to about 12,500 hp.”

A major advantage of increased power on today’s rigs is that there will be no power constraints to hoisting and pumping, Mr Pangarkar noted. The equipment will be operating in the mid-range of power capabilities for most of the time, he said, providing power redundancy and resulting in less downtime.

In addition to having the available horsepower necessary to drill certain types of wells, having additional power is useful if the contractor wants to modify equipment in the future.

This same type of thinking also applies to a greater number of more powerful mud pumps. Previous generations of jackups utilized 2 1,600-hp mud pumps rated at 5,000 psi. Today’s rigs typically have 3 2,200-hp mud pumps minimum, rated to 7,500 psi. Some rigs have 4 mud pumps or room to add an additional mud pump in the future.

The additional mud pump capability means the equipment will operate in the mid-range most of the time, resulting in less wear on the equipment and more power redundancy, Mr Pangarkar said.

Finally, today’s latest iterations of top drive drilling systems are significantly more powerful than earlier generations of the tool. The maximum torque of top drive systems when they were introduced in the 1980s ranged from approximately 42,000-64,000 ft-lbs. This compares with the latest versions with torque ratings in the range of about 62,250-115,000 ft-lbs. The high torque is advantageous when drilling the long-reach and horizontal wells that operators are drilling more of these days in order to reach difficult geological objectives.

DIAMOND OFFSHORE

Diamond Offshore currently has 2 jackups under construction, the Ocean Shield at Keppel FELS in Singapore and the Ocean Scepter at Keppel AMFELS in Brownsville, Texas. Cost of each rig is approximately \$155 million, and both are scheduled for delivery during 2008. They are essentially identical rigs being built to the KFELS Mod V “B” (Super) design capable of working in up to 350 ft of water in most regions, including the North Sea.

The rigs will have a 70-ft cantilever reach with a significantly greater load capacity than other jackup designs with similar rated depths, according to Diamond, enabling the rigs to handle the heavier drill string and casing loads more efficiently. The rigs have 2 million-lb derricks with crown blocks rated at 2.12 million lbs. Traveling blocks and power swivel are also rated to 2 million lbs. Additionally, each rig will have an NOV HPS 2 million-lb capacity top drive drilling system. The rigs also have 2 million-lb drawworks with pipe-handling equipment that includes an NOV BR6 Bridge Racker pipe-handling system and hydraulic roughneck. The Bridge Racker consists of a bridge on a main support in the derrick to transport stands of drill pipe, drill collars and casing from the fingerboard.

The Bridge Racker system runs on bridge end trucks on 2 off-derrick mounted guide beams driven by hydraulic actuators. A horizontally running trolley with a rotating vertical column runs on top of the bridge beam assembly. A racking head handles the tubulars guided by a vertical column to perform lifts with a Standlift-cylinder.

Three National Oilwell 2,200-hp mud pumps (with space for a 4th mud pump) provide flow rates of 2,000 gal/min (GPM). The rig has liquid mud capacity of 5,000 barrels.

In addition to the 2 newbuild jackups, Diamond Offshore is continuing its semisubmersible upgrade program, with the Ocean Endeavor and Ocean Monarch its 2 latest projects. Ocean Endeavor was recently delivered from Keppel FELS and is en route to the US Gulf of Mexico. The Ocean Monarch was delivered to Keppel FELS earlier this year for its upgrade.

The Ocean Endeavor, initially outfitted to work in up to 8,000 ft of water, now is capable of drilling in 10,000 ft using augmented moorings. The rig can easily be upgraded to a 12-point mooring system, according to Diamond Offshore. The rig's original water depth rating was only 600 ft when it was delivered in 1975.

Following its upgrade, the rig will feature a 6,000-ton variable deck load capacity. It also has enhanced developmental capabilities, including a large 25 ft-by-90 ft moonpool, a high-capacity subsea tree handling system and additional mud and completion fluid storage capacity.

Additionally, the rig employs Tripsaver technology that also was installed on the Ocean Rover and Ocean Baroness during their upgrades. Tripsaver provides for offline capabilities to carry out multiple tasks without interrupting the primary drilling operations, including setting aside the BOP to save a trip in subsea tree installations and suspension of casing in the moonpool while running anchors.

Other offline capabilities include making up and laying down drill pipe during drilling operations; 1,500 kips of set back while in transit, allowing drill pipe make up and setback during rig moves; picking up drill pipe while drilling; preparing tools while drilling; and making up shoe, float collar and centralizers to casing joints.

For deep drilling and the use of larger pipe and greater hydraulics required for development drilling, the Ocean Endeavor and Ocean Monarch will have 4 2,200-hp mud pumps as well as a dedicated 1,700-hp pump for the riser to ensure that heavy cuttings can be returned to the surface. ♣