

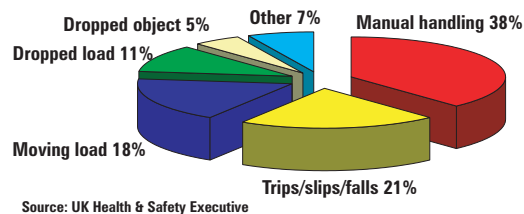
Vertical pipe racking adds tubular handling options

Phil Vollands, Varco Systems

VERTICAL PIPE RACKING is one of the new technologies that have increased deepwater capability, safety, and efficiency in new offshore rigs built in the last three years.

Automated systems such as vertical pipe racking were not conceived to merely replace man with machine or to automate a manual process—they are designed to change the very processes of tubular handling.

Figure 1: Causes of rig accidents



With 40 machines now in the field, **Varco System's** Pipe Racking Systems (PRS) range in capability from handling triple-length drill pipe and bottom hole assemblies (BHA), to racking quadruple-length stands of casing in sizes up to 20 in., to racking double stands of riser.

All these systems utilize what has become known as Foxhole technology with either a conventional X-Y fingerboard or adjustable "parallel" fingers.

PRS OFFERS NEW OPTIONS

The Foxhole is the term given to an auxiliary opening in the rig floor other than the opening for the rotary table. The Foxhole permits the makeup or breakout of stands of drill pipe or casing off the critical path of drilling operations.

This patented process requires the rig to have the ability to hoist the stand and transport it to the setback area without affecting well-center operations.

An example of this offline capability was demonstrated on the Noble Max Smith where doubles of 13 3/8-in. casing were made up in the Foxhole during a rig move and racked vertically in the derrick ready to be run later in the drilling program.

When it came time to run the casing in the hole, only half the makeup connections were required on the critical path

and the casing string was stationary for less time down hole, increasing the probability of a successful run.

MORE CASING STRINGS

As the industry continues to develop deepwater fields we see more and more intermediate strings used in casing programs.

A rig's ability to make up and rack back an entire casing string in stands of doubles or triples—in a fingerboard capable of racking a range of casing sizes—provides significant efficiency gains for the operator.

Rigs capable of racking quadruple length casing stands such as **Transocean Sedco Forex's** Enterprise drill ship and **RB Falcon's** Deepwater Horizon can potentially avoid an entire wiper trip by tripping in the hole with 135-ft stands of casing.

TRIPPING ADDS UP

What about the most basic of operations that gave rise to the first pipe handling systems—tripping pipe?

Occasionally, it is said that a manual crew can trip faster than any machine. But Figure 2, listing the lengths of each trip in even the most basic well program, shows that it requires 367,000 ft of tripping—that's 70 miles!

Although the PRS has been demonstrated to trip at a 60-sec slip-to-slip time, rarely can the drilling crew trip at such a speed, even in cased hole.

Unlike a manual crew, Pipe Racking Systems are designed to handle 6 5/8-in. drill pipe as easily as 4 1/2-in. drill pipe and can produce consistent motions at speeds exceeding operational requirements.

RETROFIT POSSIBLE

Pipe racking systems are no longer limited to newbuilds and major upgrades with the advent of the PRS-8i.

The newest member of the **Varco PRS** family can be retrofitted to any existing rig including second generation semis and jacksups.

The rig's existing X-Y fingerboard is used when possible and Foxhole technology allows offline stand building capability for drill pipe and bottom hole assemblies.

Performance and speed of installation have driven the design effort along with a new control system that eliminates onsite programming during commissioning.

A SAFETY PAYOFF

Prior to the efficiency gains demonstrated through new processes, it was safety that had driven rig floor automation.

BP Exploration statistics show that drilling accounts for 23% of man-hours,

Figure 2: Trip lengths for basic program

	Trip in	Trip out	Total trip
30 in. hanger	3,750	4,000	7,750
Drill 26 in. hole	4,250	5,850	10,100
20 in. casing	4,000	4,000	8,000
Drill 17 1/2 in. hole	5,600	10,000	15,600
Run 13 3/8 in. casing	4,000	4,000	8,000
Drill 12 1/4 in. hole	10,000	18,000	28,000
12 1/4 in. bit trip no. 1	12667	12667	25,333
12 1/4 in. bit trip no. 2	15333	15333	30,667
Run 9 5/8 in. casing	4,000	4,000	8,000
Drill 8 3/4 in. hole	18,000	20,000	38,000
8 3/4 in. bit trip no. 1	18667	18667	37,333
8 3/4 in. bit trip no. 2	19333	19333	38,667
Run 7 in. casing	18,000	18,000	36,000
Post logging wiper trip	18,000	18,000	36,000
Total Tripped footage (ft)			327,450
Estimated additional trips for bits/MWD/wiper/coring:			8
Average trip depth:			5,000
Adjusted trip depth:			367,450



Vertical pipe racking systems permit operations off the drilling critical path, expanding options and improving overall efficiency.

yet 45% of injuries are drilling related. Interestingly, it is common for top performing drilling rigs to be among the safest rigs.

The **UK Health and Safety Executive (HSE)** reported on 137 offshore drilling accidents over an 18-month period with the following results. The HSE data show that 77% of total accidents are caused by the top three categories: Manual Handling (including use of manual tongs and slips, and back injuries while manually racking pipe); Trips/Slips/ Falls; and Moving Load (includes using tigger for pipe transfer).

It is reasonable to suggest that a basic level of automation on any rig—including a retrofitted racker, a roughneck capable of breaking BHA components and

bits, and power slips—can have a significant effect on rig floor safety. Using machines to perform hazardous tasks is not new. Yet a large percentage of accidents still occur performing manual operations.

Automation is no longer applicable only to deepwater rigs. Significant opportunities exist to improve both safety and efficiency throughout our industry by embracing new technology and the new processes it affords us.

ABOUT THE AUTHOR

A graduate of Oxford University, Phil Vollands is Marketing Manager for Varco Systems and Varco BJ. Mr Vollands has 9 years industry experience working in the North Sea, Canada and the US.

New Bentec rig design is versatile and expandable

Werner Boom and Thorsten Dirks, Bentec GmbH Drilling & Oilfield Systems

A new rig design developed by **Bentec GmbH Drilling & Oilfield Systems** offers a variety of technical and commercial advantages. Named SWINGA-RIG, the concept also allows for a conventional rig to be gradually converted into a high-technology multipurpose drilling rig.

The design combines a range of technical advantages with future requirements for efficient, safe and economical drilling.

Key features of the rig include:

- An ability to perform drilling, workover and snubbing operations;
- Enhanced drilling performance;
- Modularization of the rig;
- A higher level of hands-off operation;
- High mobility for fast rig moves;
- An extremely small footprint;
- Permanent drilling operation with the Double Action version.

The SWINGA-RIG Single Action is designed using modular units. The main components consist of the box-to-box substructure that accommodates the drawworks, the closing unit, the drill line reel, and other components.

There is also a swing into which the

crown block, the top drive system with guide dolly, and the multifunctional grip have been integrated. This swing may also be fitted with a hoist which will enable snubbing unit operations.



New rig design can be used for a variety of jobs including workover and snubbing operations.

Because the drawworks is installed within the lower box, the center of gravity is at a very low level adding stability to the rig.

DOUBLE ACTION UPGRADE

From this basic version it is possible to upgrade to the SWINGA-RIG Double Action version.

The Double Action version provides a multi-task drilling rig for permanent operation that can perform workover jobs as well as snubbing operations. The multifunctional concept of the Double Action version saves time because:

- There is no waiting time to bring the top drive into the upper position;
- The upper connection to the top drive is brought into the other wing during the drilling mode;
- Pipe handling operations can be carried out while drilling is in progress;
- In case of technical faults in one of the wings the other wing can be used to ensure a continuous drilling operation;
- If two BOP stacks are installed, two holes can be fitted from one location.

Bentec offers the rig in models that can be powered by generator sets or by external power supply from the electrical grid. Various Bentec pipe handling systems can be integrated into the SWINGA-RIG single action and double action versions.

It is, for instance, possible to pick up tubulars and transport them to the drilling rig from the horizontal or the vertical position. The Bentec Mechanized Catwalk System or a conventional pipe rack can also be integrated. The rig can also be used in combination with Bentec Mud Treatment or UBD Systems.