

Making up pipe on deck can improve efficiency

RECENT TUBULAR HANDLING studies concluded that, for a jackup drilling unit, the relationship between drillfloor layout and tubular handling cycle time on the critical path can be optimized by utilizing the cantilever pipe deck for horizontal make up and transfer of the made-up drilling and well tubular stands to the drillfloor. Conceptual study results were proven out through the use of computer animations, which along with calculations showed that casing running time could improve by as much as 80%.

A significant commitment by the drilling industry has seen the design and successful final acceptance test of the first Deck Stand Make Up and Run Technology, Deck SMART. This system is now being installed on a new jackup, and will be operational in early 2003.

The latest tubular handling systems now incorporate highly automated make up, racking and running of both drilling and well tubulars within the derrick. However, they are still based on the convention of handling tubular singles from the deck to the derrick.

The evolution of these systems has driven the need to increase derrick size, set back capacity, and concurrent work activity on the drill floor its self, which is clearly a disadvantage for a cantilever jackup.

A large proportion of flat spot time is associated with tubular handling. The advantage being sought is the improvement in the flat spot times on a traditional drilling time/depth curve, or, more simply, drilling productivity.

Improvements in flat times not only lowers the overall well construction time and cost but also reduces the duration that the hole is left open and therefore reduces the risk of hole conditions deteriorating.

This reduction in flat spot time associated with tubular handling is achieved primarily through the reduction of the number of tripping (hoist) cycles 'slip to slip', and the reduction in the duration of each tripping cycle.

The selected Horizontal to Vertical (HTV) machine design has a number of key parameters.

The HTV cart is designed to carry two triple drill pipe and double casing stands without inducing any bending load on the tool joint or casing couplings that could cause possible down hole problems. There are no electrical pneu-



National Oilwell's Star Racker is being assembled as part of the overall pipe handling system dubbed Deck Stand Make Up and Run Technology (SMART).

matics or hydraulics lines that travel with the cart. There are four latches for holding each 95-ft long pipe stand in the cart. Each latch when closed is capable of supporting 10 kips

Single drill pipe or single casing may also be transported, two at a time. The maximum weight to be transported by the cart is 21 kips.

The cart and pipe are hoisted into the derrick using a variable frequency drive motor connected to a gear reducer driv-

ing a double drum. The drum has two hoist lines each capable of carrying the full load. Under normal operation only one of the lines carry the load. Should the load line part, the safety line will catch the load.

The hoist drum has two spring-applied brakes that are electric pneumatic released when the cart is moving. Each of the brakes can carry the full load and can be operated manually in the event of a power failure.

The entire HTV system always knows what the cart is doing through electrical proximity switches, motor encoder and pressure transducers providing data to a PLC to provide an extremely safe operating system.

Performance of the HTV machine was verified during a Final Acceptance Test of the completed system carried out at the equipment manufacturer's plant during March 2002.

The concept allows drill string stand assembly, disassembly, and to and from transfer between the drill floor and the cantilever deck to be scheduled out with the normal well construction critical path.

The flexibility of the system to handle drill string stands in parallel with other well construction activity offers potential time savings of 10 to 15 hours during the course of a 20,000-ft well.

The philosophy behind the Deck SMART concept is to add significant value to the well construction process by adapting tubular handling technology to fit the specific attributes of a given jackup design.

The concept will realize value by shifting part of the normal tubular handling activity from the drill floor to the cantilever deck. Specific benefits include:

- Drill string (excluding BHA tools) stand make up and breakdown activity moved off the drill floor and off well construction critical path;
- Drill string (excluding BHA tools) pick up and lay down activity moved off the critical path;
- Well tubular (casing and tubing) stand make up activity moved off the

drill floor and off well construction critical path;

- Well tubular (casing and tubing) string running times reduced by handling stands instead of singles;
- Concurrent drill floor tubular handling activities (drilling while picking up drill and casing strings are reduced thereby reducing drill floor personnel risk exposure;
- Direct exposure of personnel to tubular running activity is minimized;
- More effective work planning;
- Derrick and drill floor tubular racking area sized for drill string requirements only;
- Cantilever tubular racking area sized for well tubular strings stored in stands;
- Deck tubular handling equipment contributes directly to both well construction time and personnel safety;

- Stand transfer flexibility provides more effective tracking and inspection of drill string.

The assembly of well tubular stands on the cantilever is normally undertaken off the critical path. For example, as the well hole section is being drilled, well casings are being transferred to the jackup and assembled as stands. However, there may be instances where, due to rapid drilling rates, well casing stands must be assembled as well as casing being run. In such cases there may be an impact on well critical path timing.

There is still room for innovation within tubular handling system design. A rigorous, value based, holistic approach to tubular handling that is focused on removing and reducing flat spot times steers the designer to make the best utility of the inherent characteristics of the basic jackup drilling unit design.

For a given drilling unit design considerable capital expenditure and work plan-

ning benefits can be realized by shifting part of the normal tubular handling activity from the drill floor to the deck. Innovation in tubular handling requires equal contribution from both the drilling contractor and the drilling equipment manufacturer. Working with industry in constructive and complementary interaction provides better outcomes.

A methodical modeling process involving the use of value analysis, workstudy, planning tools, along with animations proved invaluable to the concept development. The application of sound modeling processes are essential to informed investment decision making.

REFERENCE

This article was adapted from the technical paper "Horizontal to Vertical (HTV) Tubular Handling on a Jackup Drilling Rig" presented at IADC World Drilling 2002 5-6 June in Madrid, Spain, by **Mike Simpson** and **Colin Davidson** with **GlobalSantaFe**, and **Chris Agner** with **National Oilwell**. ■