Anaconda drilling system nears commercial rollout

John Kennedy, Contributing Editor

IN LATE SUMMER, **Halliburton Energy Services** will move its field-tested Anaconda Advanced Well Construction System to the Gulf of Mexico to drill its first commercial well.

The Anaconda system is undergoing extensive testing at the Halliburton Research and Development Center in Duncan. The first full-scale test well was drilled with the system in Duncan, Okla; a second began in early May.

THE FIRST PHASE

Halliburton developed the first phase of the system with **Statoil** of Norway to exploit inaccessible reserves in Statoil's mature North Sea fields. First commercial use of the system will be offshore where the cost savings potential is high, but Halliburton plans to apply versions of the Anaconda system to a variety of drilling, completion, and well service operations.

Major components of the digitally controlled system are a high-tech surface control center, a carbon fiber coiled drill string with embedded conductors, and an advanced bottomhole system.

"Anaconda utilizes state-of-the-art information technology for system control, telemetry, and real-time communication which enables the oil companies to make rapid decisions in real time from either the drilling location or remotely," said **Jim Terry**, inventor and director of the Anaconda Project.

"This makes possible the efficient real time collaboration of multidisciplinary teams regardless of the proximity to the drilling operation such that reservoir assets are optimized through better decisions."

Mr Terry said this development project, which began in early 1998, was the most intensive in Halliburton's history. "It was also the most secretive," he added.

He will discuss the Anaconda system in a presentation at the IADC Annual Meeting 27-29 September in Houston.

In addition to providing a new approach to drilling, the Anaconda system will be a "platform for continued technical development." And it can be integrated with other Halliburton technologies.

Until the system has some commercial history, quantifying savings will be difficult. But Mr Terry says the system could reduce the cost/bbl to develop a field by as much as half.

At least in the beginning, Halliburton personnel will operate the system while it is on location.

THREE SYSTEMS PLANNED

Halliburton expects to develop three systems from the basic platform, each building on what is learned in the previous system. The first is a slim-hole system for which future applications will include well stimulation, testing, completion, and logging/perforating.

Continuous coil of carbon fiber laminate drill string is a feature of Halliburton's new Anaconda well construction system.

System 3, on which development will begin soon, will be capable of constructing larger well diameters and reaching measured depths of up to 50,000 ft.

System 3 will be able to minimize the number of offshore structures and associated capital expenditures, drill exploration wells in deepwater environments, and be used for subsea development wells and minimum-diameter, high-rate production wells.

In addition to the advantages of the composite drill string, the ability of this system to transmit data at high speeds and integrate other data with drilling information is one of its leading advantages, according to Halliburton. "Ultimately," said Mr Terry, "real-time seismic-while-drilling will be possible."

THE INCENTIVE

"Anaconda's breakthrough technology will enable our customers to increase recoverable reserves while reducing the cost," said **Dave Lesar**, **Halliburton Company** president.

He added that Halliburton embarked on this development project to overcome limitations of existing systems, to improve data gathering and analysis, and to lower costs.

Today's well construction techniques are constrained because the use of steel limits the well path to around 5 miles, said Mr Terry. Steel drill strings restrict both the path of today's wells and their departure from the surface location.

The ability to reach farther from a platform location with a well may mean that one or more platforms can be eliminated. In some cases, this might save as much as $1 billion in field development costs, said Mr Terry. Being able to build a longer horizontal well path with smaller and lighter equipment will require fewer structures. And reducing the force needed to direct the hole improves steering and well control.

System 1 marks the first use of composite material for a drill string and the first use of downhole self propulsion. Data rates using the system's telemetry are 2,000 times faster than existing data transfer techniques such as mud pulse.

THE PIPE

Anaconda's SmartPipe™, jointly developed by Halliburton and **Fiberspar Spoolable Products**, is manufactured in a continuous coil using a laminate of carbon fiber. Embedded in the pipe are conductors that relay data between the control center and the subsurface assembly.

Under most drilling conditions, the pipe is nearly buoyant, an advantage in extended reach drilling operations. Fatigue is not a problem, says Mr Terry.

SmartPipe can withstand 800 times more flexing cycles than steel. And the reeled pipe eliminates many of the hazards of pipe handling.

The first composite drill string for System 1 is 2⅞-in. OD, developed to meet Statoil's requirements in the North Sea where the system will work after its commercial debut in the Gulf of Mexico. System 3 will get a 5½-in. drill string.

Larger drill string sizes will use more than one reel, with a connector applied in the field to connect the reels. Steel connectors are now used for field connections, but a composite connector is being developed.

BOTTOMHOLE ASSEMBLY

The system's Advanced Drilling, Evaluation, and Propulsion Tool (ADEPT) measures borehole and formation parameters, orients the borehole in 3D space, provides the mechanical forces to drill the hole, and incorporates the industry's first open system subsurface propulsion system. The system uses a standard mud motor and standard drill bits.

With the propulsion system, no mechanical force is required from the surface equipment to move the pipe into or out of the well. Instead, the pipe can be propelled by downhole hydraulic forces applied by the ADEPT assembly.

An electronically sequenced tractor provides controlled weight on bit while drilling and pulls the tool into high angle and horizontal wells.

SURFACE EQUIPMENT

The surface system includes a control center, SmartPipe injector and reel, a tower and pipe handling system, blowout preventers, and a digital control and data acquisition system.

A three-man team operates the system: a "pilot" runs the equipment, a systems engineer maintains system integrity, and a "navigation engineer" interprets the sensor data, builds a detailed subsurface map and guides the well path.

Basically, the system "is run with a mouse," said Mr Terry.

All downhole data are available for real time decisions. Real time transfer of sensor data to the office enables geophysicists, geologists, and reservoir engineers to update their interpretations in real time using their familiar interpretation tools. The Earth Model that is the well plan is available to the drilling engineer who can re-design the wellbore geometry in real time as needed to reach the target.

The navigation system uses existing seismic data along with the downhole data through a link to Halliburton's satellite system. "This means the drilling engineer has data in time to steer *this* well," said Mr Terry.

THE IMPACT

Halliburton expects the system to have a significant impact on hydrocarbon recovery, cost, and efficiency.

According to Halliburton, the flexibility and capability of Anaconda systems will improve access to reserves and enhance drainage patterns, providing increased recovery. ■