

Expandable tubing adds options onshore, offshore

EXPANDABLE TUBULAR technology is another well construction tool with the potential to lower well costs and add value to the field being developed. Expandable wellbore tubulars are available in a variety of configurations that provide a range of solutions for both onshore and offshore wells.

A session on this technology, to be chaired by **P Vullingsh**, Shell UK Exploration and Production and **J Smith**, Grant Prideco, is part of the 2001 SPE/IADC Drilling Conference.

Papers prepared for the session focused on the hardware and its application.

EARLY EXPERIENCE

SPE/IADC paper 67768, "Advances in Expandable Tubing—A Case History," describes the world's first use of expandable solid tubing to close off perforations in 7-in. casing. In the two case histories presented, the methods and field implementation processes of expanding 5½-in., 17-lb/ft tubing against 7-in. casing are described.

The paper was prepared for the Conference by **M Ruggier**, e2TECH; **R Urselmann**, Shell UK Exploration and Production; **H Mosser**, Rohol-Aufsuchungs; and **M Jones**, e2TECH.

Voitsdorf 25 and P-Ost 1 were the candidate wells in the initial commercialization of the 5½-in. x 7-in. cased hole clad system. Voitsdorf 25 needed water shut off to remain economic. The expanded tubing clad system was installed using a workover hoist and the tube expanded mechanically using a pig.

P-Ost 1, a gas well, was similarly repaired using the same system. Both wells were unloaded and a collapse loading imparted on the tubing to test the seal integrity.

In both cases the seals were 100% tight.

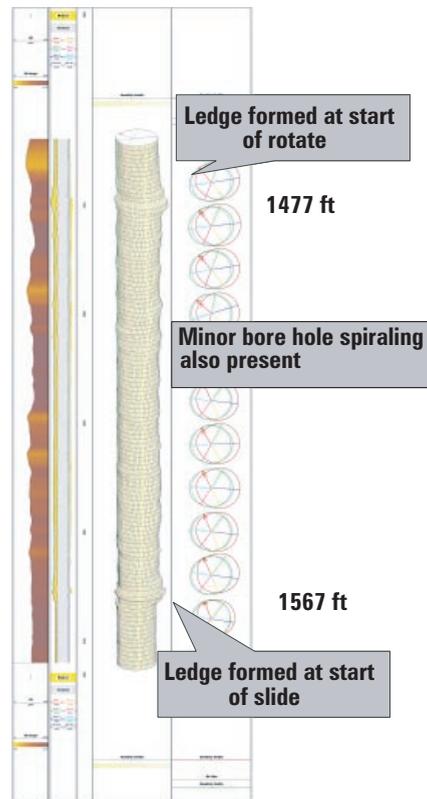
DOSRWD TOOL

As expandable casing technology develops, there is a need for improved understanding of the directional tendencies of eccentric drilling tools run on steerable assemblies and the well bore geometry and quality that can be achieved with these tools.

SPE/IADC paper 67769, "Determination of Borehole Quality, Diameter and BHA Directional Response: Eccentric Tool Test Program for Expandable Casing Application North Sea," describes the results of testing done by **Hughes Christensen**.

The testing was done for Shell UK Exploration and Production, operating in the UK sector of the North Sea on behalf of Shell UK Ltd and Esso Exploration and Production UK Ltd and e2TECH, the company developing the solid expandable drilling liner (the consortium).

Test of DOSRWD tool



This paper was prepared for the Conference by **R J Lodder**, Shell UK Exploration and Production; and **L A Sinor**, **D J Bobrosky** and **S Radford**, Hughes Christensen.

Expandable tubular technology has the potential to significantly reduce well construction costs and the telescoping effects that limit casing design programs.

Apart from resulting in large expensive surface casing, wellheads, trees and operating equipment, the conventional method can result in unworkable small hole size at the required depth.

Flexibility to cope with unexpected problems during drilling, completion or production is reduced with the conventional well construction approach.

It is expected that solid expandable tubular technology will allow wells to be drilled according to the "mono-bore" concept. In that case, the unexpanded casing (liner) string will be run through the previously installed casing string(s) and positioned prior to expanding it to dimensions identical to those of the previous string(s).

An infinite number of casing strings will, in theory, be possible to suit the requirements of each well. But only one optimal size of equipment is needed to drill and case each well from surface to TD.

To better understand this developing technology, testing described by the authors was performed.

Testing was done by Hughes Christensen for the consortium. A 9¾-in. drill out steerable ream-while-drilling (DOSRWD) tool was used in conjunction with 6½-in. pilot bits (both PDC and roller cone) at steerable motor AKO settings between 1-2° at various surface rotary speeds.

Four and six-arm calipers and ultrasonic borehole imaging (UBI) were used to characterize the drilled hole including directional tendencies and measurements of borehole diameter, quality and degradation over time.

The 9¾-in. DOSRWD met the consortium's narrow diametrical requirements for expandable casing applications in the Brent field.

The tool drilled a uniform borehole with only minor size fluctuations and had an average diameter of 10.05 in. The required size window for the expandable casing determined by the consortium was between 9.50 and 10.50 in.

The borehole image derived from the UBI tool showed a nearly circular hole with no significant ovality and only minor ledging. Slight spiraling was

noted in the borehole intervals where the drill string was rotated. Hole enlargement and key seating were measurable but minimal.

While rotating the directional assembly, 50 rpm produced the best quality hole (in the 35-75 rpm range). Doglegs generated with the DOSRWD were predictable and similar to standard directional assemblies.

No difficulties were experienced steering these tools. While sliding and rotating at 50 rpm, measured downhole vibrations were low indicating smooth drilling.

Stick-slip was more pronounced at low rpm and higher AKO settings.

Test results document that the 9 $\frac{7}{8}$ -in. DOSRWD system is capable of providing the high quality wellbore required for expandable tubular technology, insuring a good sealing mechanism between casing and formation.

SET EXPERIENCE

Solid Expandable Tubulars (SET) have been installed in both open hole and cased hole wellbores since Nov 1999.

These SET installations have been used in a variety of environments in wells on land, offshore and in deepwater to solve a range of drilling and completion challenges.

SPE/IADC paper 67770, "Solid Expandable Tubular Technology—A Year of Case Histories in the Drilling Environment," describes experience with this technology.

The paper was prepared for the Conference by **K Dupal, Shell Deepwater Development Inc; D B Campo, Shell Exploration and Production Corp; J E Lofton, Chevron Petroleum Technology Co; D Weisinger, Vastar Resources/BP Amoco; and R L Cook and P L York, Enventure Global Technology LLC.**

Maximizing hole conservation while optimizing well economics in both conventional and deepwater wells is a continual challenge.

In this paper, the authors discuss drilling case histories, including:

- Descriptions of drilling challenges surrounding the use of SETs and their next best alternatives;



Expansion cone (mandrel) is coming out of the hole on the first offshore SET installation.

- Risk analysis used in decision trees leading to the use of SETs;
- The advantages and disadvantages of using SETs;
- Operational best practices developed during the installations of the SETs.

ESS TECHNOLOGY

Expandable sand screen technology has evolved rapidly since its first commercial application in 1999.

In SPE/IADC paper 67726, "The Global Impact of Expandable Sand Screens on Reservoir Drilling and Completion," authors **P D Metcalfe and C S Whitelaw, Weatherford Completions Systems**, chronicle the rapid growth and acceptance of this technique for reservoir completion.

The authors focus on the effects that the technology has on drilling practices, borehole evaluation, well design, well costs and production performance.

Applications include virtually all well types, open and cased holes and geographically diverse areas.

The authors also describe what future technology developments will be required to optimize the use of expandable sand screens and further improve well design. ■