



OTC 18374

## Designing High-Angle–Casing Directionally Drilled Wells

B. Borland, SPE, R. Watts, SPE, ConocoPhillips; B. Lesso, SPE, Schlumberger; and T. Warren, SPE, Tesco

Copyright 2006, Offshore Technology Conference

This paper was prepared for presentation at the 2006 Offshore Technology Conference held in Houston, Texas, U.S.A., 1–4 May 2006.

This paper was selected for presentation by an OTC Program Committee following review of information contained in an abstract submitted by the author(s). Contents of the paper, as presented, have not been reviewed by the Offshore Technology Conference and are subject to correction by the author(s). The material, as presented, does not necessarily reflect any position of the Offshore Technology Conference, its officers, or members. Papers presented at OTC are subject to publication review by Sponsor Society Committees of the Offshore Technology Conference. Electronic reproduction, distribution, or storage of any part of this paper for commercial purposes without the written consent of the Offshore Technology Conference is prohibited. Permission to reproduce in print is restricted to an abstract of not more than 300 words; illustrations may not be copied. The abstract must contain conspicuous acknowledgment of where and by whom the paper was presented. Write Librarian, OTC, P.O. Box 833836, Richardson, TX 75083-3836, U.S.A., fax 01-972-952-9435.

### Abstract

This paper discusses the design and testing of 10 ¾-in. and 7 5/8-in. casing directional drilling equipment and procedures that ConocoPhillips plans to use on a mature North Sea asset. ConocoPhillips has worked with Tesco Corp. and Schlumberger in assembling the tools necessary to complete this task. These include: downhole casing drilling tools, underreamers, positive displacement motors, MWD tools, rotary steerable systems (RSS), and high capacity winches for this work. Testing this equipment in commercial North Sea operations is prohibitively expensive. Therefore, tests were conducted at a drilling test facility near Cameron, Texas, where operations were conducted over a wide range of rotating speed, weight and flow conditions as well as inclinations from vertical to horizontal. High frequency surface and downhole drilling mechanics measurements assisted in diagnosing problems and improving the systems. The project serves as a blueprint for managing technical developments among multiple operators and service companies.

### Introduction

ConocoPhillips' successful application of casing drilling in the Lobo trend in South Texas is well documented in terms of preventing lost circulation, eliminating stuck pipe and ultimately improving efficiency.<sup>1,2</sup> In addition to over 120 straight wells drilled to date in South Texas, two wells were drilled in 2004 which combined a rotary steerable and casing drilling system to demonstrate that directional casing drilling was possible. These were not exhaustive tests but they proved that casing drilling directional wells with a rotary steerable system was a viable option. However that still did not answer a key question: "Can the straight hole benefits realized in the Lobo Field be transferred to directional drilling in an offshore working environment?"

This question can only be answered after the tools and procedures to drill complex directional wells are made available and used in offshore applications. However, in order to make offshore directional casing drilling a reality, significant technical challenges need to be overcome. Challenges beyond just the technical aspects must also be addressed before adopting this new drilling technology into a producing asset. Implementing the technology may require rig/platform equipment modifications that impact production. Consideration must be given to the possibility that the initial wells may take longer to drill as the learning curve develops.

To reduce the risk associated with implementation, tests were conducted in a wellbore profile similar in complexity (hole angle, build rate, depth) to a well to be drilled off of the Eldfisk B platform offshore Norway with 10 ¾-in. and 7 ¾-in. casing. The equipment used for the field trial included the same surface equipment required to modify or adapt the rig in Norway. This was done to mirror the activity that would be involved on the platform necessary to execute the project. Safety and training were also an integral part of the project.

An initiative was started in February, 2005, to prepare for directional casing drilling at Eldfisk. Schlumberger and Tesco partnered with ConocoPhillips on this challenge in order to prove up the suggested solution by executing two field tests that mirrored the wells to be drilled offshore.

### The Prize

Casing drilling has demonstrated operational time savings of approximately 15% in straight hole applications as compared to normal drill pipe drilling. This benefit is also expected to apply in casing directional drilling in an offshore working environment. The comparison is based on normal operating times for each case. The expected bit rotating hours from drilling below the previous casing shoe until section TD is reached for casing drilling is sometimes more, but generally not more than 10% over that experienced with drill pipe. Eliminating the need to pick up drill pipe, condition the well, and trip out of the hole to run casing can save a substantial amount of time. Routine trips for bits, underreamers and MWD's will also provide timesaving.

However, the majority of the benefit is expected to be realized in minimizing the impact of formation related problem time. Improved hole cleaning in the 10 ¾-in. section should eliminate problems getting casing washed to bottom and should improve cement jobs. This is due to the mud being