



OTC 19008

Mitigating Subsalt Rubble Zones Using High-Collapse, Cost-Effective Solid Expandable Monobore Systems

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This paper was prepared for presentation at the 2007 Offshore Technology Conference held in Houston, Texas, U.S.A., 30 April–3 May 2007.

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Abstract

The reduction of wellbore diameter during well construction has been partially addressed through the use of conventional solid expandable open-hole liners. However, these systems still reduce pass-through diameters and in most cases necessitate significant deviation from the well's Basis of Design (BoD). Ultimately, the results of deviating from the BoD include increased well construction cost and an elevated operational risk profile.

For years, end users of solid expandable liners have needed a simple, cost-effective means of extending casing shoes while maintaining the same size wellbore pass-through diameter. Upon completion of current collaborative development, well construction specialists will have a means to address this technological gap. This paper describes the application of well construction techniques using a set of high-collapse, cost-effective Monobore systems.

Several well construction applications are discussed in this paper. These examples show how application of the Monobore casing extension system can reduce the cost of well construction, while addressing challenges associated with drilling through troublesome zones and the premature slimming of wellbore profiles. The use of Monobore systems can

- Serve as a contingency to effectively deal with risks associated with geologic uncertainty.
- Provide additional casing strings.
- Facilitate additional proactive well construction techniques.
- Improve well productivity.

Through the use of solid expandable Monobore casing extensions, augmented by Monobore open-hole clad systems, wells can be significantly downsized. Using solid expandable solutions, as well conditions dictate, can result in cost-effective well construction solutions.

As the total depth (TD) of wells continues to increase, the Monobore systems will become a very valuable resource to reduce well construction costs and significantly increase the chances of successfully reaching objectives with a hole size conducive to forward operations.

Introduction

Formations entrapped by salt deposits globally have been the source of significant hydrocarbons. Some of these global salt deposits have been highlighted in **Figure 1¹**, with salt deposits commonly recognized in the Gulf of Mexico (GoM), offshore West Africa, the Middle East and the North Sea. Hydrocarbons located adjacent to the salt in the GoM have been the growing focus of deepwater exploration over the past decade. Some of these salt deposits are quite thick with wells being drilled through and around these beds in excess of 30,000 feet in true vertical depth. The first drilling challenge of hydrocarbon objectives extending deeper has been just to reach the targets. The second challenge is to complete these wells with sufficient hole size to make these developments economically successful.

To address the challenge of penetrating these salt formations, operators have found that solid expandable liners have contributed highly to successful drilling operations. Even with years of successful installations, the low collapse of these thinner-wall expandable liners has caused significant concern. While the use of expandable liners slows the premature slimming of wellbores when contingency liners are necessary, end users have required a liner that afforded zero hole-loss after installation of an expandable liner. A solid expandable liner that has over twice the collapse than conventional expandable liners plus zero hole-loss post-expansion can facilitate successful and cost-effective drilling into, through, and beneath salt formations.

Drilling Challenges Surrounding Salt Formations

The majority of nonproductive time (NPT) associated with drilling for hydrocarbon deposits associated with salt formations is actually drilling the sediments into and out of the salt diaper. Examples of these hazardous drilling environments include:²

- Shale sheaths
- Suprasalt "carapace"
- Subsalt "gumbo"
- Subsalt or extrasalt "rubble" or breccia-like zones