



OTC 20108

Emerging Roles for Subsea Trees: Portals for Subsea System Functionality

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This paper was prepared for presentation at the 2009 Offshore Technology Conference held in Houston, Texas, USA, 4–7 May 2009.

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Abstract

This paper reviews the role of subsea well systems in the light of advances in broader subsea systems technology. This will facilitate a better understanding of the changing role of subsea trees in particular, and how they may still exert significant influence on the performance of subsea production systems. The premise for this is that tree systems as a whole are very mature technology, but the capabilities of the systems which they support have and continue to change significantly. The tree may now be considered as having a more subservient role than was the case 20-30 years ago. Its' function may best be considered as a portal for total system functionality in addition to the historical role of pressure control equipment configured specifically for the subsea environment.

The paper will embody a systemic technology driven approach to new subsea well / tree systems that are applicable in a wide range of applications, including deepwater, HP/HT, Arctic and Brownfield alike. A significant aspect is how to assure that the benefits of standardisation at equipment level are married with a necessarily adaptive approach at systems level, thereby enabling optimised system solutions that efficiently cater for real and widely varying application specific demands. Enabling the benefits of advances in drilling, intervention, data monitoring and subsea processing to be effectively achieved is a key driving parameter.

The major result of the work will be to reveal novel and innovative approaches to system design, and how these can be implemented, whilst mitigating the risk of introducing new technology. Demonstration of new system concepts that exemplify such outcomes will be revealed.

The significance of the work may be characterised as offering a systemic model for new technology introduction and a number of system concepts will be aired with a view to provoking views on the merits of future implementation.

Introduction

The demand for subsea systems has been increasing for a number of years, to the point that subsea tree systems in themselves are considered as mature technology. However, the technical demands for subsea systems continues to evolve, and advances in subsea systems technology are becoming established in response to the needs to develop assets in ever more technically demanding and commercially challenging environments. As a result, the role of subsea trees has been changing and significant influences from the subsea system must be taken into account. Accordingly, a systemic technology driven approach to new subsea well / tree systems is needed to ensure that the tree system is optimised with the rest of the system.

Whilst tree systems are mature, and therefore candidates for standardisation, it is clear that there is a need for less rigid and more adaptive standardisation that is geared towards supporting new and evolved tree configurations. This must enable efficient implementation of innovative subsea system designs, driven by both technical and commercial challenges.

The purpose of this paper, therefore, is to offer thoughts towards establishing optimised tree system configurations in the light of emerging subsea and well construction technologies, and to provide a demonstration of system concepts, for consideration in the near future.