SPE 125048

Deepwater Developments: Successful Application of New Technology

Håvard Brandt, SPE, and Stefan Isaksen, SPE, Det Norske Veritas, and Siri Helle Friedemann, The Research Council of Norway

This paper was prepared for presentation at the 2009 SPE Annual Technical Conference and Exhibition held in New Orleans, Louisiana, USA, 4–7 October 2009.

Abstract

The oil and gas industry continues to explore deep and ultra-deep water development. However, these deep water developments introduce both technical and operational challenges not encountered in more shallow water developments. Further, the industry is continuously evaluating novel technologies, often with limited track records, to enhance the profitability and possible enable some of these technically challenging projects. While rigorous qualification programs often are introduced, there is significant uncertainty related to the performance of these systems.

The opportunities related to applying novel technology can be significant, however the uncertainty related to the reliability of these new systems may be difficult to assess. As a consequence the business impact and commercial performance of adopting these new systems is not fully understood. For conventional systems, Reliability, Availability, and Maintenance (RAM) analysis can successfully be applied to demonstrate the commercial performance of a given concept. A RAM model is a probabilistic simulation model which represents the expected performance of a system or a process. These models can be used to evaluate different development scenarios and assess the expected performance of alternative design options. These models do however require experience data which may be difficult to obtain or justify when applying novel technologies.

To better manage and understand the commercial impact of applying novel technologies, DNV has in cooperation with the industry and with the support from The Norwegian Research Council developed a guideline which combines Technology Qualification and Reliability and Performance Simulation. This process provides a better basis for decision support when evaluating novel technologies, and builds confidence in technology which truly has a strong business potential for a given project. This paper provides an outline of this new work process, and through case examples demonstrate the additional requirements on the technology qualification process required to establish confidence in reliability performance of the novel technology.

Introduction

Deep and ultra-deep water developments are often challenging both from a technical and operational point of view and in many cases dependent on prototype and novel technologies to enhance the profitability. While the potential opportunities related to applying these new technologies may be significant, there is uncertainty related to the reliability of these systems. Even though the novel technology typically goes through a formal qualification process, these technology qualification processes are limited with respect to providing a quantitative reliability prediction of the system or technology being assessed. As a consequence there is uncertainty related to the performance of the new technology and the business and commercial impact of adopting these new systems.

For conventional technologies and systems, Reliability, Availability, and Maintenance (RAM) analysis is a powerful tool to demonstrate the commercial performance and thus the economic impact of a proposed concept. In a RAM analysis probabilistic simulation models are established to provide a prediction of the future performance of a system or component. These models can then be used to simulate different development options and scenarios and could be a powerful tool for decision support when assessing different concepts and solutions. However, the development of these models requires experience data such as failure frequencies for all the systems and components. Thus, where novel technology is applied or where conventional technology is applied in a new application the information required to construct these performance models may not be readily available.

The objective of the work presented in this technical paper has been to develop a process which combines technology qualification and quantitative reliability and performance modelling (RAM Analysis). This paper includes an overview of a research project which has been conducted by Det Norske Veritas (DNV) with funding from the Research Council of Norway.