Surface BOP operations examined in Deepwater I

DEEPWATER ALTERNATIVE

TFE INDONESIA HAS performed surface BOP drilling using an additional barrier at the seabed. This innovative approach, used for the first time anywhere, should expand the range of application of surface BOP drilling while still keeping an acceptable risk level.

A high pressure drilling riser similar to a tension-leg platform (TLP) or spar drilling riser has been used to drill an exploration well in 2,000 m of water.

The system includes stress joints, air can and riser monitoring devices. Additionally, a BOP shear ram between two connectors was run at the seabed.

This device, called Environmental Safe Guard, was designed to allow the well to be isolated from the environment in case of riser failure.

The authors will discuss the main lessons learned during the course of project and operations and concludes on the potential of this innovative technology

A Deepwater Well Construction Alternative: The Total Surface BOP Drilling Concept (IADC/SPE 87108) **Gerald Ragnes**, **A Simondin**, **D MacPherson**, **N Touboul**, **Total**.

SURFACE BOP

The water depth operating capability of a dynamically positioned semisubmersible normally rated for 8,100 ft, has been extended to 10,000 ft by deployment of a Surface BOP, a 13 $^{3}/_{8}$-in. casing riser and a Subsea Disconnect System (SDS).

The rig and equipment package recently successfully drilled an exploration well in 9,474 ft of water, representing a new record for both the operator and the host country Brazil.

The authors will focus on the main features of the equipment package concept design, development and deployment, including:

• Setting up the operator-service provider joint team and alignment of goals;

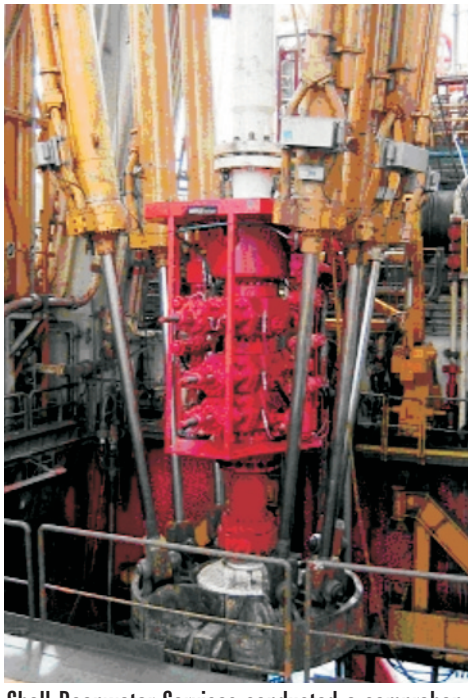
• Defining the functional requirements;

• Combination of new technology and off the shelf components;

• Description of system units: surface BOP, subsea disconnect system, surface and subsea control systems and broadband digital spread spectrum acoustic system;

• Rig interfaces.

The authors will also describe the output from early hazard assessment exercises used to define the basic design parameters, the selection of appropriate acoustic communication technology to provide the opportunity for future developments, risks and how they were managed and integration testing and deployment.



Shell Deepwater Services conducted a comprehensive risk assessment and management program with the objective of introducing surface BOP operations to a number of deepwater regions around the world. IADC/SPE 87112

Surface BOP: Equipment Development for Extending the Water Depth Capability of a DP Semisubmersible by 1,900 Feet (IADC/SPE 87109) **Tim Newman**, **Shell International Exploration and Production Inc**; **Graham Brunt**, **Stena Drilling Ltd**; **Scott Elson**, **Nautronix Inc**; **Paul Toudouze**, **Cameron Drilling Systems**.

SURFACE BOP RIG

Drilling deepwater wells using a rig equipped with surface BOPs has been successfully carried out in Brazil. Many deepwater development projects require lower costs to meet internal economic thresholds. Shell studied testing and completion techniques for deepwater wells to identify methods for carrying this out.

Although a number of surface BOP wells have been drilled, notably in the Far East, a Brazil well is a milestone in terms of both depth and environment. Part of the success has been the Subsea Disconnect System (SDS). The authors will focus on the following aspects:

• Testing using surface BOPs. Shell has developed a testing configuration to carry out a DST essentially using standard equipment. This was ready for a deepwater well test recently, although not used.

• Completing using surface BOPs. A variety of possible surface stack completion configurations has been identified. The availability of a high pressure riser simplifies a number of operations that should result in some time savings.

The authors will describe the output from conceptual studies, early hazard assessment exercises used to define the basic design parameters and more detailed HAZOP studies.

Surface BOP: Testing and Completing Deepwater Wells Drilled with a Surface BOP Rig (IADC/SPE 87111) **Tim Bayko**, **Curtis Wilie**, **D L Mason**, **Shell International Exploration and Production Inc**.

RISK MANAGEMENT

During 2002 and 2003, Shell Deepwater Services conducted a comprehensive risk assessment and management program with the objective of introducing surface BOP operations to a number of deepwater regions around the world.

Based on the experience from using surface BOP for benign areas in the Far East, a concept was developed for oper-

ations in relatively harsh environments, deeper water, and from a dynamically positioned rig.

The authors will address the key elements of the risk management process used including:

• HAZID and HAZOP;

•Quantitative Risk Assessments (QRA);

• Study on reliability of acoustic BOP controls;

• Study on risk comparison of surface BOP versus subsea BOP for deepwater drilling;

• Riser analysis and vortex induced vibration (VIV) studies;

• Riser recoil studies;

• Operational procedures and training programs;

• IADC joint industry project on surface BOP operations.

Following the conclusion of this risk assessment program, an ultra-deepwater drilling campaign was carried out, including wells setting new water depth records in Brazil and Egypt. These wells have been drilled from a dynamically positioned rig with surface BOP in combination with a Subsea Disconnect System (SDS). In parallel to the ongoing exploration campaign, a similar risk management process is being pursued for testing and completing wells with surface BOP.

Risk Management Process for Ultra-Deepwater Surface BOP Operations from a Dynamically Positioned Drilling Rig (IADC/SPE 87112) **Graham Brander**, **Eric Magne**, **Tor Taklo**, **Shell International Exploration and Production Inc**.

SURFACE BOP FROM DP RIG

During May and June 2003, Shell Brasil successfully drilled an exploration well in 2,887m of water using a surface BOP drilling system deployed from the dynamically positioned semisubmersible Stena Tay.

Using such a system in this extreme water depth in a relatively harsh environment with a dynamically positioned rig posed many significant challenges for the design and installation of the equipment and for its safe operation. The authors will briefly address some of the key issues which had to be addressed in order to make this work, including:

• Rig modifications;

• Development of safe system running and operating procedures;

• Station keeping requirements;

• Emergency procedures.

The authors will also discuss the actual operations as they occurred on the rig.

Operating a Surface BOP System from a Dynamically Positioned Rig in 2,887 m of Water (IADC/SPE 87113) **Charlie Mitchell**, **Shell Brasil E&P**; **Graham Brander**, **Tim Newman**, **Tor Taklo**, **Eric Magne**, **Shell International Exploration and Production Inc**; **Fred Foreman**, **OPT International LP**.

SUBSEA MUDLIFT DRILLING

A conventional large diameter riser requires drilling rigs with huge weight and space capacities, large mud volume to circulate through a riser, and many casing points due to narrow gap between pore and fracture pressures. The many casing points also require a larger wellhead and a larger marine riser. These problems are inter-related and intensify as the water depth increases.

Subsea mudlift drilling (SMD) is an unconventional technique using a relatively small diameter pipe as a mud return line from the sea floor instead of a large diameter marine riser. A joint industry project (JIP) was formed in September 1996 and carried out with successful field test in the Gulf of Mexico in December 2001.

Due to the JIP, SMD can be one of the promising alternatives for economically exploring oil fields in deep water because of reduced weight and space requirements, casing points reduction, and possible upgrading of smaller rigs.

There are few papers on kick detection simulation and its well kill procedures. For successful well control operations, timely kick detection is one of the crucial factors. The authors will present detailed mathematical analyses and simulation works for kick detection and its procedures. It includes the study on the following:

• SMD hydraulics analyses including transient U-tubing effects and a drill string valve;

• Analyses on kick detection and its procedures;

• When circulation rate is greater than the maximum free fall rate;

• When circulation rate is less than the maximum free fall rate;

• With and without a drill string valve;

• Operational considerations;

• Construction of kill sheet and drill pipe decline schedule.

Analyses and Procedures for Kick Detection for Subsea Mudlift Drilling (IADC/SPE 87114) **J Choe**, **Seoul National University**; **J J Schubert**, **H C Juvkam-Wold**, **Texas A&M University Department of Petroleum Engineering**.