Industry continues to set world records

TTRD WELL ON NJORD FIELD

THIS PAPER WILL describe the concept study, pre-planning and drilling of well 6407/7 A 9 AH, the world's first TTRD well drilled from a floating platform, where specific technology developments for a TTRD BHA were required. The challenges to maintain the integrity of the existing subsea well completion and pass through the DHSV with an ID of 5 7/8-in., together with the specific requirements for a BHA to drill in this highly depleted reservoir were addressed by the application of Bi centre Bits, a 3D RSS system, real-time hole caliper, enhanced bit rotation from a modular PDM motor, pressure and vibration monitoring, low flow BHA with a DL capability of 6 8B0/30m.

The Hydro-operated Njord field is located approximately 130 km northwest of Kristiansund and 30 km west of the Draugen field, on block 6407/7 and 6407/10, being developed from a floating steel platform (Njord A). Production started in 1997, but the field is already mature, with a rapidly declining oil production. TTRD is therefore the most important measure to increase oil recovery by infill drilling.

This paper will include the results and conclusions from the drilling of a test well in Tulsa, Okla, in March 2004 through to the eventual drilling of well A 9AH in May 2005..

The World's First TTRD Well Drilled From a Floating Platform on the Njord Field, North Sea From Concept Study to Reality (IADC/SPE 98880) E Saeverhagen, Baker Hughes; TL Flatekval, Norsk Hydro; OE Eng, Baker Hughes; J Oyovwevotu, Hydro; JF Namtvedt, Hughes Christensen Co; N Jepson, Baker Hughes.

VISUALIZATION TOOLS

The drilling industry demographics predict a significant loss of expertise in the upcoming years as a high percentage of the drilling personnel reach retirement age. At the same time, drilling activity is predicted to grow, driven by high oil prices based on strong demand. As rig rates go up, failures in downhole drilling equipment as a result of downhole conditions will become even more costly, resulting in an increased demand for experienced personnel.

Over the past few years, the service industry has developed downhole and surface data acquisition systems that can record drilling parameters at a level of detail and accuracy not available before. In particular, on the downhole side it is now possible to store significantly more data at a fraction of the cost compared with earlier years. However, while more data are now available, the analysis is still done in the traditional manner via logs or special data processing systems, requiring a high level of expertise. As a result, large amount of data are acquired but never looked at.

Visualization tools can be a solution to this dilemma. They can provide a much faster learning curve about downhole conditions while drilling. Computer animations facilitate replaying data recorded downhole at a high rate, displaying the motion of a downhole tool inside the borehole. Combining downhole data with BHA modeling software allows the user to review the mechanical loading of the BHA in the section just drilled and to focus attention on special events or sections as necessary.

The paper will review data available today and present example displays and animations that show how visualization can aid the process of analyzing large amount of data.

Visualization of BHA Dynamics Improves Understanding of Downhole Drilling Conditions, Speeds Up Learning Curve (IADC/SPE 99181) G Heisig, P Jogi, JD Macpherson, M Neubert, H Reckmann, Baker Hughes.

WHIPSTOCK OPERATION

ConocoPhillips pre-drilled wells for the Magnolia TLP development in 2003 using a dynamically positioned semisubmersible drilling vessel. The Magnolia field is located in 4674 ft of water at Garden Banks (GB) block 783 in the Gulf of Mexico. During the pre-drilling phase, two wells were successfully sidetracked out of 13 5/8-in. casing in one trip using an extended-gauge, one-trip whipstock system.

The first whipstock operation was through cemented pipe, and the second was through uncemented pipe with communication to a shallower, weak formation. This paper focuses on whipstock operations through uncemented pipe and describes the planning and execution of the first successful attempt at setting a whipstock, milling the window, squeeze cementing the window, and drilling out cement and rat hole all on one trip while using synthetic-based mud.

On the GB 783 A 4 well, window milling/cementing operations through uncemented casing were conducted in one trip. The whipstock was oriented and set at 11,071 ft MD in a 54-degree angle hole. The window was milled, the assembly pulled above the window, and squeeze cemented. The cement was drilled out, and a successful formation test was achieved. An additional 130 ft of rat hole was then drilled with the mills to bury the next drilling assembly below the whipstock.

This paper highlights whipstock installation and window cutting operations; safety and operational best practices for removing, handling and monitoring metal cuttings that can be problematic for subsea BOP systems; equipment modification made to mitigate risk for cementing through a milling assembly; and design considerations for achieving a successful squeeze.

Lessons Learned From Combined Whipstock Operation: Set Whipstock/Mill Out/Cement Squeeze/Drill Out All In One Trip (IADC/SPE 98120) RN Williamson, LF Eaton, ConocoPhillips; D Harrell, DF Courville, Smith Services; J Long, Schlumberger.

LIGHTWEIGHT SOLID ADDS

This paper describes the first phases of development of a drilling system for offshore wells based on the use of lightweight solid additives (LWSA) to reduce the density of the drilling fluid within the riser above the seafloor. Equipment and procedures were tested to pump LWSA to the bottom of the riser without damage, separate them from the mud after the fluid mixture returns to the surface and recycle the LWSA for immediate re-use.

In offshore wells, especially deepwater, the problem of maintaining a safe range of mud weights is compounded by the additional pressure that the drilling mud in the riser exerts on the formation. If the effective weight of the mud in the riser can be reduced, the range of safe mud weights is widened at the formation. Mud with high concentrations of LWSA might be pumped down from the surface and injected into the riser at the mud line. The mixture of mud and LWSA flowing up the riser then weighs less than pure mud.

LWSA were developed and tested as spheres produced from different materials, including glass, composites and epoxy resins. LWSA were manufactured that withstand high pressures existing at the bottom of risers. The LWSA were able to be separated from oilfield muds using conventional oilfield shale shakers and hydrocyclones.

Muds with LWSA could be pumped with conventional mud pumps without excessive pressure losses. LWSA were recirculated many times with minimal breakage, demonstrating that they could survive in commercial operations.

Significant cost savings will be possible in drilling offshore wells if all remaining problems with LWSA can be addressed. In addition to reducing the number of casing strings required, drilling with LWSA would reduce tension load requirements on the riser and mud storage requirements on the drilling vessel, which will reduce the size of drillships or increase the depth capability of exisiting drillships.

Use of Lightweight Solid Additives To Reduce the Weight of Drilling Fluid in the Riser (IADC/SPE 99174) JH Cohen, WG Deskins, Maurer Technology Inc.

AUTOMATED MAINTENANCE

The last years, an automated system for continuous collection of operational and environmental data from drilling equipment has been used. The goal has been to optimize operation, reduce downtime and improve maintenance planning by employing condition analysis techniques.

There are two main roads into condition analysis. One is based on advanced engineering and mathematical modeling. The more common situation is that there is no known model or theoretical knowledge on the equipment. In that case, empirical analysis of trends and patterns in large amounts of collected data will over time provide better interpretation of equipment conditions.

There is a “wear map” for each part of any machine. By combining this wear map with operational data, a figure for remaining lifetime can be estimated for wear parts. This will form the basis for an RCM approach, where condition and remaining lifetime dynamically estimate service and inspection intervals and spare part requirements.

The installed system is a solution where equipment onboard drilling facilities are communicating vital parameters to a central database. Drill floor equipment is equipped with autonomous units capable of measuring, transmitting and displaying information. Analysis is performed at the central database, and results are made available to the operators.

This paper will share experiences on how equipment producers and owners can use this information to improve performance.

Experiences and Lessons Learned From Utilizing Automated Reliability Centered Maintenance on Drill Floor Equipment To Optimize Operation and Maintenance Planning (IADC/SPE 99076) A Holme, Natl Oilwell Varco. ■