Drilling equipment: Improvements from data recording to slim hole

IADC/SPE 59151

Expandable Liner Hanger Providing Cost Effective Alternative Solution

An operator and a service company are working together to develop a new liner hanger based on patented expandable-casing technology. This technology is being used to diametrically expand solid tubulars for a variety of drilling, completion, and remedial applications. The new liner system is designed to totally eliminate the liner overlap's annulus by expanding an elastomer-coated casing into intimate contact with the casing from which the liner is being hung. Preliminary results indicate the new hanger design can result in load-carrying and burst capacities that exceed the capacity of the previous casing string. Furthermore, the overlap samples tested to date have all resulted in annular seals which have exceeded 10,000-psi differential capacities. In fact, casing has always failed before any overlap leaks developed.

—P York,
Enventure Global Technology, *et al*

IADC/SPE 59152

Subsea Downhole Motion Compensator: Field History, Enhancements, and the Next Generation

Since its debut in the North Sea, the Subsea Downhole Motion Compensator (SDMC) has continued to perform faultlessly in numerous milling runs in recent Latin America and North Sea projects. This paper introduces the operating principles and new design features of the SDMC and recaps case histories of successful jobs that translate to cost savings and reduced down time to the operator.

The next-generation SDMC enables the operator to benefit from greatly increased capabilities, features, and operational performance. The tool is completely automatic: From the time it makes initial downhole contact (landed position) on the wear bushing, it never has to be retrieved to the surface. The tool is fully resettable at the wellhead for each complete stroke of the piston and continuous stroking of new pipe through the tool is achieved without retrieval from the wellhead.

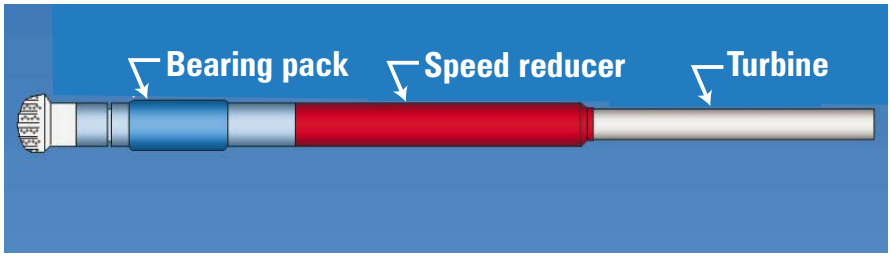
—D Durst and M Luke,
Weatherford Completion & Oilfield Services

IADC/SPE 59154

High Power Slim Hole Drilling System

Maurer Engineering Inc (MEI) has developed for the **US Department of Energy** a reliable high-power slim-hole drilling system capable of drilling twice as fast as conventional systems. This system consists of a double length PDM motor and a hybrid PDC/TSP bit. Rational for using slim-holes and historical data are presented, including data on the savings that can be achieved from slim hole drilling. Also covered is the development of the double length motor and hybrid bit.

—J Cohen and W C Maurer,
Maurer Engineering Inc
—R C Long,
Morgantown Energy Technology Center



IADC/SPE 59156: A new, advanced geothermal turbodrill uses a gear box to increase the torque 13-fold and reduce the speed of the turbodrill to 80-120 rpm, suitable for rollercone or PDC bits.

IADC/SPE 59155

Emergency Generator Operational Logic for Dynamically Positioned Drilling Rigs Working in Ultradeep Water

A new rig is available that works in 8500 ft of water and still keeps to a station within specific radius around a given point in defined environmental conditions—wind, current and sea state. Main power generation is provided by six 4400-kW main generators in the pontoons. This location for the main generation is unique to Sedco Express rig design and is covered by patent application. A 7th main engine, on the deck, is considered an emergency unit as well, as a service assist unit under certain operational conditions.

The rig has 2 service transformers topside; locating a third emergency transformer of the same rating on deck gives significant advantages in the service failure mode. Any power loss to the main high-voltage switchboards initiates a programmable logic controller. The precoded logic will open/close circuit breakers and immediately switches the topside engine to emergency status to feed the low-voltage emergency switchboard via the emergency transformer to initiate restart of the main generators from blackout recovery. Therefore, in effect, no power blackout occurs.

—D Rankin, Transocean Sedco Forex

IADC/SPE 59156 (ALTERNATE)

Advanced Geothermal Turbodrill

Turbodrills have been used for drilling in the oil and gas industries and in geothermal drilling. However, their use has been significantly less the PDM motors because their high speed and low torque characteristics are not well suited for use with roller bits. This paper describes the development of a new advanced geothermal turbodrill (AGT) that uses a gear box to increase the torque 13-fold and reduce the speed of the turbodrill to 80-120 rpm, suitable for roller and PDC bits. In addition, the gear box eliminates many of the difficulties that were previously associated with running turbines. In laboratory tests,

IADC/SPE 59154: A new high-power slim-hole drilling system, capable of drilling twice as fast as conventional systems, consists of a double length PDM motor and a hybrid PDC/TSP bit.

this AGT was able to drill a 12 ¼-in. hole in granite at 96 ft/hour.

—J Cohen and W C Maurer, Maurer Engineering Inc
—R C Long, Morgantown Energy Technology Center

IADC/SPE 59157 (ALTERNATE)

Success with Electronic IADC Report

IADC, recognizing the need for operators and contractors to gather and disseminate drilling data electronically, while still maintaining the industry standards for format and content, issued license requirements for software to meet this need.

This paper discusses the development of an electronic IADC report, utilizes field test results to illustrate the implementation, and demonstrates how the much needed new technology is cost effective and enables significant future efficiencies for contractors and operators. Creative data capture methods are detailed and field tests illustrate the cost savings, as well as the acceptance level of the new technology. Field tests results are used to quantify specific time and money savings both on the rig and in the office-how repetitive data entries are minimized, how handwriting is converted to accurate data, how the electronic DDR can be integrated into other systems, such as accounting and engineering programs, and how secure the reports are.

—S E Johnson and C Holmberg, Pentastic Systems Inc
—C M Opsal, Consultant

Coiled tubing: Advances in reeled pipe, BHAs, underbalanced ops

IADC/SPE 59160

Reeled Pipe Technology for Ultra-Deepwater Drilling Utilizing a Dual-Density Mud System

The paper will describe a "Dual Gradient" drilling system with the capability of drilling in these increasing water depths, but also has the potential to reduce well costs by up to 50% and reduce the time to drill these wells by 30%-40%. The system could either be installed on existing rigs or if required. a purpose-built rig could be provided.

"Dual Gradient" drilling is a means to de-couple the hydrostatic head of fluid in the riser from the effective and useful hydrostatic head as measured from the mud line.

An intermediate stage between a conventional riser and a future riserless system is the use of the "riser" for deploying the stack and pumping system and as an environmental barrier in the event of minor leakage between the subsea system and the rig. This seawater-filled riser may consist of steel or composite material, or a combination. Drilling fluid returns will be via 2 return lines attached to the riser joints.

The system comprises a subsea pumping system utilizing centrifugal pumps in series to pump the drilling fluids back to surface. The use of centrifugal pumps provides a method of controlling the desired bottomhole pressure by regulating the centrifugal pump speeds.

—P Fontana and G Sjoberg, DeepVision

IADC/SPE 59161

Wired BHA Applications in Underbalanced Coiled Tubing Drilling

One of the enabling technologies which has made underbalanced coiled-tubing drilling possible is the purpose-built, wireline-controlled bottomhole orienting assembly (BHA). Unlike the more conventional mud pulse telemetry systems, these wireline-controlled BHAs allow for a continuously underbalanced operation in 2-phase flow and in addition to steering, offer the opportunity for reservoir evaluation while drilling.

This paper presents the operational results from a number of underbalanced coiled tubing drilling projects with a purpose-built, wireline-controlled bottomhole assembly. The 3 most recent projects comprising a total of 5 wells were completed in Canada and the North Sea in 1999. Topics discussed include equipment performance, pressure deployment, borehole conditions, rates of penetration, reservoir evaluation and learning points.

IADC/SPE 59161: This paper presents the results of several case studies from underbalanced coiled-tubing drilling projects using purpose-built, wireline-controlled bottomhole assemblies.

—S K Tinkham and T W Staal, Schlumberger Oilfield Services

IADC/SPE 59162

High Pressure Coiled tubing Operations in Venezuela—Problems, Benefits and Procedures

This paper is based on the experience gathered during a 1.5-year period (June 1997-November 1998), while working on high pressure wells in the North of Monagas for **Petroleos de Venezuela** (PDVSA). 43 high-pressure operations were carried out, mainly concerning the cleaning of asphaltenes.

This study illustrates some operational problems and their solutions, the benefits obtained, and a series of procedures aimed at improving the overall perform-

ance of Coiled Tubing operations. These procedures should have applications in many of the world's high temperature, high pressure reservoirs.

—J M Jara,
Schlumberger Oilfield Services

IADC/SPE 59164

Research and Development of Advanced Coiled Tubing

In this paper, the effect of various factors on cyclic bending performance of parent coiled tubing materials is predicted firstly in relation to ballooning and low cycle fatigue phenomena, and then corrosion and low cycle fatigue phenomena of coiled tubing after long term exposure in mud environment is also discussed. Secondly, fatigue performance and improvement of circumferential joining techniques are discussed. Finally, advanced coiled tubing of 2 3/8-in. OD and 0.190-in. wall thickness with total length of 3,000 ft was manufactured on trial by means of joining short lengths of seamless tubing using amorphous diffusion bonding (ADB) technique. A coiled tubing drilling test at the **JNOC** Kashiwazaki test field in Japan was carried out and completed successfully.

—T Urayama,
Japan National Oil Corp, *et al*

IADC/SPE 59165 (ALTERNATE)

Mud Cap Drilling: A Naturally Fractured Carbonate Drilling Technique

Mud Cap Drilling (MCD) is a cost effective drilling technique used to drill through massively natural fractured carbonates. MCD drilling is often associated with Underbalanced drilling. MCD is not underbalanced drilling in the sense that the wellbore is not allowed to flow at the surface. But it is underbalanced from the standpoint that the drilling fluid exerts a hydrostatic head that is less than the formation pore pressure.

This paper describes why conventional drilling or drilling at balance or overbalanced is impossible as long as fractures remain open. Applications and methods of MCD are discussed. Well control issues are addressed and standpipe pressure curves for vertical and horizontal cases are described.

—J W Colbert, Signa Engineering Corp

IADC/SPE 59166 (ALTERNATE)

Case Histories of Design and Implementation of Underbalanced Wells

One of the primary design problems to be overcome in drilling underbalanced is designing a circulating "fluid" that has an equivalent circulating density below the reservoir pressure. This paper will discuss the mathematical equations used to design air drilled "underbalanced" wells. It will also show how these equations were used to design 4 separate wells. The presentation of actual field data will validate these equations and computer modeling used.

—D Griffin, Symbol Inc
—W Lyons, New Mexico Institute of Mining and Technology