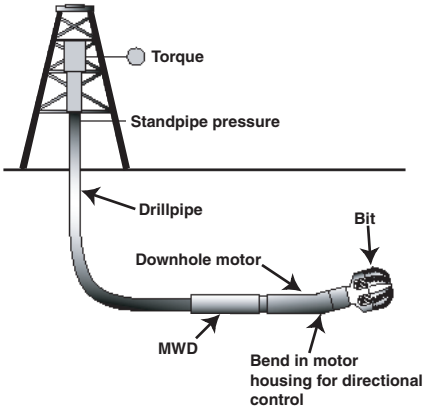
Rotary drilling, LWD, MWD mean efficient drilling

UNDERSTANDING TORQUE

FIELD TESTS IN the Austin Chalk showed that the surface system increased sliding rates of penetration from 60-200%, for estimated savings of 11-23% of total well costs.

Hardware and software components in the new system integrate surface and MWD data to provide the following benefits in the sliding mode:



A new technology of applying torque when slide drilling a directional well includes a surface system that significantly increases the efficiency of a downhole motor/MWD directional system. IADC/SPE 87162

• Improved ROP and horizontal reach capability through automatic rocking, using torque as an input;

• Improved tool-face correction through a torque pulse method, using the drillstring;

• Improved well trajectory through a step-change in tool-face correction while on bottom;

• Improved motor life since stalling is practically eliminated;

• Elimination of orientation time losses through a semi-automatic transition from rotating to sliding.

The technology provides any downhole motor/MWD system today with competitive cost advantages compared with more expensive rotary steerable systems.

Understanding Torque - The Key to Slide Drilling Directional Wells (IADC/SPE 87162) **E E Maidla**, **M Haci**, **Noble Engineering and Development**.

LOW COST ROTARY STEERING

ExxonMobil continues to expand utilization of 3D rotary steering systems in its daily drilling operations. In today's lower cost market, the operator believes it should also take advantage of the benefits realized such as hole cleaning; increased rate of penetration; precise well placement; directional control.

The author will describe the strategy ExxonMobil used to identify the most promising of the lower cost systems and its efforts to assist bringing it to market. Highlighted are many hurdles that were overcome to deliver a low cost yet reliable system. The authors will also discuss the development plan that was followed to ensure the system would have the highest COS in achieving ExxonMobil's stated objective.

An Operator's Targeted Development of Low-Cost 3D Rotary Steerable Systems (IADC/SPE 87165) **J T Travis, Jr**, **J H Moss**, **ExxonMobil Development Company**.

GRAVITY MWD

Measurement while drilling (MWD) is the preferred method of surveying a well bore when drilling deviated wells. MWD has an advantage over other types of surveying in that the tools are part of the bottom hole assembly (BHA) and surveys can be obtained quickly without the need for interrupting the drilling operation to run a separate surveying tool. However, like all magnetic survey instruments, MWD is susceptible to magnetic interference. The directional azimuth information becomes unreliable when in close proximity to sources of magnetic interference such as casing strings or adjacent wells.

The authors will describe a new method of MWD surveying that includes a second accelerometer sensor package to measure azimuth rather than using magnetometers and thus not prone to magnetic interference and the same drawbacks as conventional MWD.

The First Use of Gravity MWD in Offshore Drilling Delivers Reliable Azimuth Measurements in Close Proximity to Sources of Magnetic Interference (IADC/SPE 87166) **A E Matheson**, **ConocoPhillips (UK) Limited**; **G McElhinney**, **R Lee**, **Pathfinder Energy Services**.

CLEARANCE LINER

Installing a long, tight clearance liner through a milled window is a critical operation that presents many technical and operational challenges. Recently in the US Gulf of Mexico, ConocoPhillips Gulf Region Deepwater Exploration milled a window in 13 5/8-in. casing and subsequently ran 9,551 ft of 11 ¾-in. liner through a 12 ¼-in. window to 24,382 ft MD. Planning to mitigate the risks associated with running a tight clearance liner through a milled window, equipment selection and proper execution were the keys to success.

The authors will illustrate the level of planning and detail required to successfully install a long, tight clearance liner. A case history of the planning and execution will demonstrate the effort needed to successfully implement such a challenging operation.

Planning and Execution of a Long, Tight Clearance Liner Through a Whipstock Milled Window (IADC/SPE 87167) **G L Faul**, **L B Dooley**, **ConocoPhillips**; **D H Harrell**, **Smith Services**; **J Shipley**, **T H Hill & Associates**.

INTEGRATED BHA

During the past seven years rotary steerable drilling technology has emerged from prototype status to a standard application worldwide. The authors focus on the latest generation integrated rotary closed loop system that now enables the industry to benefit from this technology in hole sizes from 5 7/8-in. to 18 ¼-in. The authors will also discuss the integrated BHA concept and the sequential implementation of additional BHA components.

Insight will be provided into applications where the integration into the rotary closed loop BHA, of real-time logging while drilling (LWD) formation pressure measurements and real time

acoustic property services has eliminated the need for wireline logging runs.

Integrated BHA Concept of the latest Generation Rotary Closed Loop System for Hole Sizes from 5 ⅞-in. to 18 ¼-in. (IADC/SPE 87168) **U Hahne**, **Baker Hughes INTEQ**; **S Dotson**, **ExxonMobil Development**.

DRILLING FLUID

Drilling fluid is one of the factors that may contribute significantly to errors in directional surveying of wellbores for petroleum production because the magnetic properties of the drilling fluid affect the sensor readings in MWD magnetic directional tools. The phenomenon appears briefly as a damping of the measured cross-axial components of the earth magnetic vector, which very often

The authors will present the results from analysis of survey data from several Norwegian oilfields and laboratory tests. The major trends in the variations of the magnetic properties of the drilling fluids and the effects on sensor readings correlate with what is expected when considering the actual drilling fluids and drilling operations. The author will also describe in detail how the choice of drilling fluid weight material gives a significant impact for these magnetic properties.

Drilling Fluid Affects MWD Magnetic Azimuth and Wellbore Position (IADC/SPE 87169) **T Torkildsen**, **Statoil**; **I Edvardsen**, **S McColloch**, **A Fjogstad**, **Baker Hughes Inteq**; **A Saasen**, **T H Omland**, **Statoil ASA**; **P Amundsen**, **Stavanger University**.

OPEN HOLE LOGGING

Log-derived formation evaluation data is conventionally acquired with LWD or wireline tools. A third alternative, open hole memory logging, was introduced in 1999 as a lower-cost and more robust alternative to pipe conveyed wireline logging. The early designs were subsequently developed into the compact well shuttle, a system that has some similarity to LWD. It protects the logging tools inside drill pipe while running-in. It can be configured with an open-ended reamer bit and can be rotated and circulated to bottom.

The original design used a dart pumped from surface to release the logging tools from a latching sub and to move them towards the open hole. The dart approach was chosen because of its inherent simplicity and robustness, and has been used in over 150 commercial operations.

A new development has now replaced the dart with an electro-mechanical pressure activated release mechanism that eliminates the time needed to pump the dart. It is also capable of simple two-way communication.

A Pressure Activated Deployment System for Open Hole Memory Logging Tools and its Application in Directional Wells (IADC/SPE 87170 – Alternate) **P A Elkington**, **M C Spencer**, **Reeves Oilfield Services**. ■