UDC 622.243

Dayabu A.J. student of the group 185-17-1 IC, МІБО(д)
Supervisor: Pashchenko O.A., PhD, associate professor.
(Dnipro University of Technology, Dnipro city, Ukraine)

NEW TECHNOLOGIES IN DRILLING

Advances in technologies used for well drilling and completion have enabled the energy industry to reach new sources of oil and natural gas to meet rising demand around the world.

New technologies have also helped reduce the environmental impact of energy production by allowing more oil and gas to be produced with fewer wells.

Advances in technologies will play a critical role in meeting global energy demand because they enable the discovery of new resources, access to harsh or remote locations and the development of challenged reservoirs that previously were not economic to produce.

Well completion is the final step of the drilling process, where the connection to hydrocarbon-bearing rock is established.

Companies are pushing completions in excess of 3,000 meters (9,842 feet) in length, compared to a typical completion of 30 meters a couple of decades ago.

These types of drilling and completion technologies have also enabled the recent growth in production from shale and other unconventional oil and gas reservoirs in many parts of the world, using a combination of hydraulic fracturing and horizontal, extended reach drilling.

Some examples of advancements in drilling technology are presented below:

Extended Reach Drilling

An extended-reach well is one in which the ratio of the measured depth (MD) vs. the true vertical depth (TVD) is at least 2:1.

Extended-reach wells are expensive and technically challenging, however, they can add value to drilling operations by making it possible to reduce costly subsea equipment and pipelines, by using satellite field development, by developing near-shore fields from onshore, and by reducing the environmental impact by developing fields from pads.

Extended Reach Drilling allows producers to reach deposits that are great distances away from the drilling rig and this help producers tap oil and natural gas deposits under surface areas where a vertical well cannot be drilled, such as under developed or environmentally sensitive areas.

Offshore, the use of extended reach drilling allows producers to reach accumulations far from offshore platforms, minimizing the number of platforms needed to produce all the oil and gas.

Directional control, hole cleaning. torque and drag, and casing flotation play a fundamental role with ERW.

Drilling in the sliding mode results in several inefficiencies that are compounded by extreme distances. The motor must be oriented and maintained in a particular direction while drilling to follow the desired path. This orientation is achieved through a combination of rotating the drill- string several revolutions and working the pipe to turn it to the desired direction.

At several km far, the pipe may need 15 to 20 turns at surface just to turn the tool once downhole, because the drillstring can absorb the torque over such a long distance.

After the tool is positioned, drillstring torque is required to hold the motor in proper orientation against reverse torque created by the motor as the bit drills.

Today, as the Horizontal Drilling, also the Extend Reach Drilling use the technology of the “RSS: Rotary Steerable System” that permit to steer an hole continuing the rotation of the drilling string with an improvement of the safety and the drilling efficiency.

Moreover, the selection of a drilling fluid must balance a number of critical factors.

The fluid must provide

- a stable wellbore for drilling long open- hole intervals at high angles, maximize lubricity to reduce torque and drag, develop proper rheology for effective cuttings transport, minimize the potential for problems such as differential sticking and lost circulation, minimize formation damage of productive intervals.

Pipe rotation is another critical factor in hole cleaning.

The objective of the hole- cleaning program in ERW is to improve drilling performance by avoiding stuck pipe, avoiding tight hole on connections and trips, maximizing the footage drilled between wiper trips, eliminating backreaming trips prior to reaching the casing point and maximizing daily drilling progress.

Automated drilling

Automated drilling is one of the oil industry's most important innovation targets.

The sources now being tapped, such as shale gas and coal-bed methane, require a very large number of wells, and automating the drilling process would be an obvious way to keep the costs under control, and also gets around a problem which many sectors of engineering are experiencing

Automated drilling would be faster, more efficient, and safer, as it reduces the number of workers on site.

In this R&D sector, Shell has developed an automated drilling system called SCADAdrill (SCADA being the acronym for supervisory control and data acquisition, a type of software used for automated factory and process control), and is a component of a new well manufacturing system that it is currently trialing in Europe and North America.

Based around a central hub, the well manufacturing system uses three different types of drilling rigs mounted on trucks to construct the complex of wells needed to extract gas from shale or coal bed reserves. One rig drills the 'top hole', the vertical upper portion of the well through which gas is extracted.

Two intermediate bores are then drilled, starting at an angle and proceeding horizontally to meet at the base of the top hole; these are used to dewater the rock and encourage the gas to flow.

The third type of rig installs the tubing and downhole pumps needed to operate the well.

The SCADAdrill system is used on the horizontal dewatering bores.

Through sensors mounted on the drillbit, the system monitors the trajectory of the drill and its performance as it travels through the site geology, and controls its path to ensure that it meets the top hole precisely.

Automating drilling takes in three stages of autonomy:

- The first is to mechanise the drilling equipment, such as the machinery which connects lengths of drill pipe.
- The second is to monitor torque and weight on the drill bit, and control these parameters to achieve optimum rate of penetration and the route of the bore-hole.
- The third level is to automate the entire process, including the speed of the pumps controlling drilling mud.

The SCADAdrill computer system connects to the existing instruments and controls of a drilling rig.

This technique would have a number of advantages:

- First, it reduces the amount of energy needed to drill the bore; wider bores need more energy because they have to displace more material, so for a given depth of bore, less rock has to be removed.
- It also uses less steel, less cement grouting, and less drilling mud; as well as a smaller drilling rig.
- It also allows greater depths to be achieved.