Drilling lessons feed back into management

SAKHALIN ISLAND DRILLING

THE EXPLORATION WELL drilled by the Rosneft/BP joint venture in summer 2004 was the first rank wildcat offshore Sakhalin Island for almost 20 years.

Wells in Sakhalin involve a permitting cycle that lasts for 9 months and a logistical supply chain that extends 3,500 miles back to Singapore. The ice-free weather window lasts from late June to mid-November, with severe storms building from September onwards.

Environmental restrictions stipulate that all mud and cuttings from below the 30-in. conductor must be recovered for disposal. These requirements result in a near record-breaking scale cuttings skip-and-ship operation.

The paper will describe the organizational, logistical, regulatory, environmental and technical challenges overcome by the team to drill the well in 2004 and how the lessons learned were fed back into the 2005 operation.

Exploration Drilling in the Russian Far East: 2 Years of Experience and Learning Offshore Sakhalin Island (IADC/SPE 99044) JL Thorogood, TW Hogg, AG Kalshikov, CJSC Elvary Neftegaz.

99044: Heavy weather hits the Sedco 600 in the Sea of Okhotsk, Sakhalin Island, in August 2004. The exploration well drilled by the Rosneft/BP joint venture was the first rank wildcat offshore Sakhalin Island for almost 20 years. Results from this operation were fed back into planning for 2005.

PROBABILISTIC METHODS

There has been limited published work involving the applications of probabilistic methods in drilling engineering, especially for the estimation of drilling times and costs. This fact is even more acute when considering the evaluation of new drilling technologies. Traditionally, drilling costs have been estimated using deterministic methods, where little scope exists for incorporation of risks and nonproductive time (NPT) in a meaningful manner. In deepwater drilling, the value of using probabilistic methods of risk analysis enables the economic evaluation of risks in a quantitative and understandable manner. Within such a probabilistic framework, it is possible to more accurately evaluate the economic impact of new technologies for work and process improvement for drilling cost reduction.

This paper presents a new approach and a tool for estimation of drilling time and costs. It uses a commercially available software package capable of conducting Monte Carlo simulation and analysis. The well is modeled using a user-friendly interface, with the two primary variables being the timings for drilling activities and individual cost components, both of which are defined as probabilistic distributions rather than a single number.

Nonproductive times (NPTs) are also incorporated and described as distributions where applicable. Cases are presented to illustrate the benefits of using probabilistic methods compared with deterministic methods. The benefits become clearly evident while trying to gauge the usefulness of novel technologies where very limited historical information is usually available.

The paper will also include a survey conducted through the SPE that shows the prevalence of (or lack of) the use of probabilistic methods in the drilling industry today.

The Use of Probabilistic Analysis for Estimation of Drilling Time and Costs When Evaluating Economic Benefits of New Technologies (IADC/SPE 98695) PR Hariharan, RA Judge, DM Nguyen, Hydril.

ELECTRICAL BOREHOLE IMAGES

Recent developments in technology have led to the ability to acquire high-resolution electrical borehole images while drilling as both memory data and with real-time transmission along with azimuthal caliper data.

The implications of this technology for the driller are reduction in NPT, well positioning, drilling hazard mitigation and maintaining borehole stability because of the immediate identification of breakout. For the geologist, the real-time interpretation of structural and sedimentary information from electrical images can be used to proactively steer the drill bit in order to:

1. Stay inside a desired sedimentary package based on the rapid interpretation of sedimentological criteria;

2. Give warning of approaching features in the proposed drill path; and

3. Avoid or mitigate adverse features that may have a negative impact.

High Quality Electrical Borehole Images While Drilling: Increased Confidence in Well Positioning and Drilling Hazard Mitigation From Real Time Data (IADC/SPE 99275) S Morris, JC Lofts, G Lindsay, C Fulda, J Dahl, Baker Hughes INTEQ.

ONSHORE OPS CENTERS

One recent management trend is the establishment of onshore operations centers by oilfield operators that are currently developing offshore assets. Unfortunately, the formation of such centers has typically been a niche activity within many companies and, as a result, some may fail to consider the lessons learned from earlier operation center failures.

While these onshore centers have often delivered on their anticipated benefits, robust business and organizational models are necessary to ensure these efforts' long-term viability.

Norsk Hydro and Baker Hughes INTEQ have implemented changes to the industry's longest continuously running remote drilling operations center. Supporting some of the Norwegian Continental Shelf's most technologically challenging drilling operations, the center is delivering improved financial results, reduced POB, enhanced service quality and supporting work process changes within both organizations.

The revised organizational and business models are designed to promote viability through the industry's business cycle by addressing the pitfalls faced by earlier centers and address the challenges facing an industry undergoing various structural changes.

The center's technological design is flexible, allowing it to be less dependent on the North Sea's advanced telecommunications infrastructure, creating opportunities for global implementation as the operator's activities shift from established fields to emerging oil and gas markets.

This paper will outline the technical and commercial models that have been developed, provide insight to the challenges encountered and document successes.

Proven Commercial Implementation of Second Generation Integrated Remote Drilling Operations Center (IADC/SPE 99066) E Nathan, J Dagestad, Baker Hughes; T Lilleng, T Pedersen, Norsk Hydro A/S.

WELLBORE INSTABILITY

Wellbore instability remains a leading cause of drilling NPT. For the most part, this is not caused by a lack of understanding of the mechanics of wellbore instability. Rather, it is caused by the limitations of pre-drill subsurface predictions.

In other words, it is the drilling surprises often encountered in reality, but not predicted prior to drilling, that give rise to wellbore instability problems. These surprises include formation tops and pressures occurring at different depths than predicted and the presence of unexpected faults or other fractured or fissile zones.

Typically, while drilling today, downhole data useful for understanding wellbore stability is scarce. Much of what we have to go on is indirect measurements — torque and drag observations, cavings, and annular pressure measurements. In order to unambiguously understand and therefore mitigate the wellbore instability problem, more information is needed.

Real-time wellbore stability modeling goes some way toward this goal. However, the missing piece in almost all cases is some direct observation of the state of the hole to determine where and how the wellbore is failing. LWD calipers and/or wellbore images can provide such information, and the option of transmitting the information to surface while drilling is now often possible.

This paper will present the results of a trial conducted on two wells that were being batch drilled in the UK North Sea. These wells were drilled to evaluate the available real time and memory density images and acoustic caliper information and how these measurements would be incorporated into the existing wellbore stability monitoring service. The information and its conclusions are to be made available to a larger team.

Evaluation and Application of Real Time Image and Caliper Data as Part of a Wellbore Stability Monitoring Provision (IADC/SPE 99111) JA Greenwood, Halliburton; ST Edwards, BP. ■