Technical Session 1: Mature Fields

SPE/IADC 105509

Design, Construction and Optimization of Big-Bore Gas Wells in a Giant Offshore Field. B.M. Clancey, A.S.D. Khemakhem and T.F. Bene, RasGas; M.H. Schmidt, ExxonMobil.

An extensive big bore gas well drilling and completions program is in progress to develop the giant North Field offshore Qatar. This is the world's largest non-associated gas field and contains approximately 900 TCF of abnormally pressured natural gas producing from Khuff carbonate reservoirs at 8,500 to 10,000 ft TVD. Benefits of the big bore concept, compared with the prior 7-in. monobore design, include reduced development costs by requiring fewer wells and deferred installation of compression by providing higher flowing wellhead pressures.

This is the widest-known application of big bore wells in a single field and will involve up to 60 wells. More than 25 of these wells are drilled and completed and are believed to be among the world's most prolific gas producers. These wells are the first offshore wells to incorporate the big bore well design, combined with complex multi-zone completions and high-angle drilling into individual wells.

Challenges presented by the big bore wells include optimization of casing and tubing designs to provide the necessary flow conduit; development of large bore, high-pressure completion equipment not previously used in the industry; selection of materials suitable for the fluids environment and high flow rate; development of drilling practices to manage hydraulics and reduce casing wear for conventional and extended reach wells; implementation of equipment design reviews, performance testing, and quality programs to target design reliability on all components greater than 25 years. The adopted solution is a unique tapered tubing design known as the optimized big bore (OBB). This paper will discuss the challenges of planning and executing these OBB wells, incorporating state of the art enhancements to achieve outstanding results.

SPE 104522 PP

Evolutionary Well Construction Method that Challenges Convention. P.D. Howlett, M.T. Wardley and C. Black, Caledus; D. Reed, Senergy; G. Begg, Talisman.

This paper will describe the development, prototype testing, test well full system test and first field trial of an evolutionary well construction system. The system is a method of constructing oil and gas wells from close clearance flush jointed cased and cemented liners from top to bottom to form the entire well. IIn old wells through sidetracking or redrilling, the system can deliver a larger size of tubular across the zone of interest. In new or complete/full wells the system can significantly reduce the top hole sizes and with a bottoms up design and place the optimum size of pipe at TD but significantly reduce the diameter of the starting casings and reduce the telescoping effect in the well. The paper will describe the technical hurdles to overcome to make the system safe and practical to deploy, allowing drilling and completions engineers to plan the wells using accepted engineering methods.

SPE 105088 PP

A Systematic Approach to Drilling and Delivering Wells in Severely Depleted Sands at Ram Powell (GOM). D.R. Algu, E. van Oort, S. Landgrave and L. Grant, Shell; D. Hillburn, MI-Swaco.

SPE/IADC 104522: An evolutionary well construction system uses close clearance flush jointed cased and cemented liners from top to bottom to form the entire well.

Re-development drilling at Shell's Ram Powell prospect in the Gulf of Mexico targets profitable delivery of remaining hydrocarbons present in lower-volume reservoir pockets. Marginal economics drive a strong focus on efficient operations, which are complicated by the technical challenges posed by severely depleted reservoirs.

Specific challenges include high differential pressures and effective downhole pressures above minimum horizontal stress in depleted formations, thus raising the specter of catastrophic losses and complete loss of well(s); negotiating very narrow drilling margins with a mud weight strategy to satisfy borehole stability requirement posed by high deviation wells while preventing fracturing and losses; drilling the wells at optimum efficiency and favorable economics, but with a thorough appreciation for time-consuming measures such as good hole cleaning in deviated sections, minimizing the impact of temperature on lost circulation, leaving an existing stress cage around the wellbore intact through ECD and surge control, etc.

SPE 105782 PP

Beryl Alpha — Reaching Out to Recover: An Extended-Reach Drilling Upgrade Project on a 30-Year-Old Rig. R. Cutt, ExxonMobil.

To date, 81 wells have been drilled in the Alpha field. The field is faulted, generating numerous drilling opportunities with geological uncertainties. Extended reach wells are planned to develop resources beyond the reach of the current platform rig capabilities.

Costs of semisubmersibles have risen dramatically, and rig availability is an issue; the traditional concept of subsea satellite development is now problematic in terms of economic viability and control of schedule. The Beryl field has a number of satellite and in-field development opportunities beyond the platform's drilling reach. The concept of upgrading the Alpha drilling rigs to enable these resources to be developed by means of extended reach drilling (ERD) was conceived. The approach taken was to maximize ERD while remaining within the constraints of the existing derrick structures. This involved an innovative approach to retrofitting enhanced drilling capabilities on a 30-year-old rig extending horizontal displacement from 15,000 to 25,000 ft. This paper will address project planning from inception through the development of a rig upgrade execution plan and address the well design issues for the ERD program envisaged.

Technical Session 2: Drilling Fluid

SPE/IADC 105809

Further Development, Field Testing and Application of the Wellbore Strengthening Technique for Drilling Operations. G. Fuh, D. Beardmore, ConocoPhillips; N.Morita, Waseda U.

Based on theory and earlier test results, a significant increase in formation fracture resistance could be achieved due to fracture sealing or plugging mechanism induced by a particle "screen out" effect resulting from the drilling fluid loaded with an adequate amount of narrowly sized granular materials. We have shown in laboratory and field tests that such an increase in formation fracture resistance is particularly valuable in helping well operations do the following: drill through depleted zones without losing fluid even when a much higher mud weight is used; strengthen the weaker formations that usually require additional casing strings for protection; avoid lost circulation during cementing operations as the strengthening operation also improves the strength of the cement sheath; and drill high-angle well sections with high mud weights that would normally not be possible due to low formation fracture gradients, etc.

Several wellbore strengthening treatments were conducted using a special type of LCM material, in terms of particle size range and loading density, for increased formation fracture resistance (or increased apparent fracture gradient) during normal drilling operations. A wide variety of wellbore problems encountered have been addressed by this technique.

SPE/IADC 105449

Design of Well Barriers to Combat Circulation Losses. B.S. Aadnoy, M. Belayneh and M. Arriado, U of Stavanger; R. Flateboe, BP.

In a 10-year research program at the U of Stavanger, novel fracturing cells and mud cells were built to better understand the mechanisms that lead to circulation losses. The paper presents a new mechanistic model for fracturing called "the elastoplastic barrier model." It defines optimal barrier filtrate loss to place particles in the loss zone and the mechanical strength of the particles required to resist losses. It define new parameters that must be controlled to reduce circulation losses. Selected lab experiments will be presented demonstrating that borehole fracturing resistance can be significantly improved by changing the mud composition.

SPE/IADC 105567

Improved Method For Use of Chelation to Free Stuck Pipe and Enhance Treatment of Lost Returns. J.K. Montgomery, S.R. Keller, N. Krahel and M.V. Smith, ExxonMobil.

This paper will describe how intentionally increasing the permeability of a non-aqueous fluid (NAF) filter cake can enhance treatments to free differentially stuck pipe and recover from lost returns. NAFs are well known for their ability to deposit thin, low-permeability filter cakes that reduce the risk of differential sticking. Yet differential sticking still occurs, and techniques to free the pipe have largely been ineffective. ExxonMobil has developed an improved technique to increase the permeability of a NAF filter cake. It involves locally soaking the cake using a combination treatment that first conditions the cake, then removes a significant amount of the