instances of BHA whirl and severe acceleration and deceleration caused by stick slip.

To enhance overall bit/BHA stability, a new style 8 ½-in. PDC was implemented with innovative depth of cut (DOC) technology and enhanced stability features. The result was a significant reduction in stick slip, lateral vibration and BHA whirl.

**SP/EADC 105906**


Wells drilled in the Tuscaloosa Trend near Baton Rouge have long been recognized for the extreme nature of the HPHT operating environment and potential for well control problems. The current local point concerns drilling the highly abrasive formations contained within the intermediate and drilling liner sections to depths of about 20,000 ft. These sections are a major cause of bit, directional tool and drill string failures. The directional complexity of the wells has increased exponentially in recent years; new drills are therefore primarily directional.

This paper focuses on the improvements which have been achieved over a 5 year period due to the implementation of Powered Rotary Steerable System (PSSS) coupled with Rotary Steerable Technology. The step change in performance has been evidenced by a 1/4' reduction in hole deviation from 96 to 55.

**SP/EADC 105885**


This paper will present laboratory-measured drilling performance of full-scale bits at 10,000 psi borehole pressure, cuttings volume estimates, apparent cuttings size distributions, mud properties and the influence of bit and mud design on drilling performance, cuttings and near borehole characteristics. Findings include:

- Modded up decreased PDC drilling efficiency and penetration rates in sandstone by 90% for both water- and oil-based systems with little sensitivity to end mud weight or blade count.
- TCI and impregnated bit penetration rates at these pressures were an additional 70-50% slower than PDC bits.
- Cuttings from Carthage Marble and Monterey Shale appear to be compressed agglomerates of fine particles. Carthage Marble cuttings had low compressive strengths.
- Test results indicated that opportunities for improvements in bit design and smart HPHT drilling fluids are possible.

**SP/EADC 105522**

*Drilling Without WOB, Dream or Reality? An Effective Field Test by Total Angola, C. Simon, DrillScan; D. Goyallon and J.P. Paulot, Total; H. Sellami and L. Gerbaud, Ecole des Mines de Paris; A. Duflayre, Varel Europe.*

PDC bit modeling and single cutter analysis have enabled a new generation of cutting structure based on the optimization of a specific interactive cutting mode that generates, by the only drilling action of the cutters, an axial force oriented in the drilling direction, a negative weight on bit. This paper presents the application of this new PDC bit design and show that WOB can be strongly reduced in a large range of formations. This new bit technology has the potential to increase bit performance, specifically in operating conditions where power is available but WOB is limited due to friction, buckling or reduced vertical depth.

**SP/EADC 105898**


The drill bit is often assigned as the cause of downhole vibration/instability and frequently bears the scars of dynamic drilling problems. Historically bit manufacturers have used a combination of dull grades and surface data to speculate on cause and effect of downhole events with insufficient attention to what may be occurring in between. This paper discusses the implementation of a vibration logging tool and its flexibility for placement of multiple tools in various locations. Specific field cases will be presented, including validation of pre-run dynamics modeling software, up to 6 distributed measurements in one drilling string, rotary steerable tools, concentric and eccentric hole opening tools, and response of different BHA configurations.

**Technical Session 8: Tubulars I**

**SP/EADC 105026**

*Catastrophic Drill String Failures Caused by Downhole Friction Heating — An Increasing Trend.* L. Hehn, M. Jellison, K. Wylfe and R.B. Chandler, Grant Priddo; J. Shepard, GlobalSantaFe.

Drillstring failures caused by friction heating of BHA components and drillpipe have increased dramatically over the last several years. In one failure mode, the drillpipe is heated above a critical transformation temperature accompanied by a rapid decrease in tensile strength. Subsequently, the component fails under a tension loading, well below the rated strength of the drillstring.

This paper addresses the features of a downhole heating failure, including the material attributes that can be used to identify the phenomena. Guidelines and operating practices that can be employed to minimize the occurrence of these costly and potentially dangerous failures are discussed.

**SP/EADC 105930**

*Special Issues in the Stress Analysis of Casing Strings in Steam Injection Wells: Mathematical Development and Design.* B. Lepper, Shell.

The design and development of steam injection wells is a mature subject. Since the strings in these wells invariably experience inelastic loading, issues such as the effects of temperature on the static and cyclic material properties become important. Due to the high temperatures involved, miscellaneous issues such as wellhead loading and gage pressure. Data on the cyclic thermal properties of OCTG steels is rare in oil field literature.

This paper presents a comprehensive mathematical model of casing strings subjected to thermal loads in steam injection wells. The model includes the effects of temperature on material properties and the effects of wellbore curvature and pre-stress during the heating cycle. Several counter-intuitive aspects of the casing stress state during cooling/unloading are examined by an analytical model and finite element analyses. Test data and the mathematical model are used to determine the stresses in the casing at different points in the life of the well via a generic example design.

**SP/EADC 104497**

*C125 Casing — A Viable Solution for HPHT in Mid, Sour Service Applications.* R. Purdy, Grant Priddo; C. Morey, BP.

A considerable demand for exploring and developing deep, HPHT reservoirs has brought forth the need for high-strength tubulars with adequate sulfide stress cracking (SSC) resistance.

This paper details the results of testing to explore the possibilities of using 125 ksi specified minimum yield strength (SMYS) casing in sour or mildly sour environments. The SSC resistance of the 125 ksi material was evaluated utilizing the NACE TM0177 96 t Test Method A and Test Method B. This paper also details the key manufacturing steps necessary to produce a high-strength SSC-resistant tubular product.

**SP/EADC 105717**

*Strain-Based Design of Tubulars for Extreme Service Wells.* J. Nowinka and T. Kaiser, Noetic Engineering; B. Lepper, Shell.

This paper presents fundamental concepts for strain-based design of tubular strings in extreme temperature applications and HPHT wells. Strain-based design utilizes material capacity beyond its elastic range to overcome economic and technical hurdles. The relevant concepts are illustrated by examples from analytical and experimental investigation of casing material for thermally stimulated wells operated by Shell Canada Ltd in Western Canada.

**Technical Session 9: Geomechanics**

**SP/EADC 105405**


The paper describes state-of-the-art approaches for ensuring wellbore stability in high-angle extended-reach wells. While the step-out lengths of proposed ERD wells are becoming more challenging, wellbore stability assurance technologies are developing at an equal pace. Incremental step-out increases are no longer required, and it is now quite reasonable to plan 10 km ERD wells on the basis of a limited number of vertical or near vertical appraisal wells. The paper reviews the prior art of ERD wellbore stability, focusing on the Wythe Farm, Valhall and