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Please fill in your manuscript title.	Pump Down Displacement Plug's from Conceptualisation, Development to Technology Maturation: An Innovative Cementing Solutions for Directional Casing while Drilling

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Abstract

Objectives/Scope

Directional casing while drilling (DCwD) has been successfully executed over 200 runs worldwide, proving up its operational reliability. In Malaysia, DCwD helps to reduce well construction costs and to mitigate wellbore issues. The paper will describe all the challenges faced and collaborations with PETRONAS, in the development of Pump Down Displacement Plug (PDDP), which has been established as part of DCwD's solution.

Methods,Procedures,Process

DCwD's cementing system includes a plug landing nipple (PLN), which is preinstalled in the casing string and a PDDP. After bottom hole assembly is retrieved, the PDDP is launched to latch into the PLN to hold pressure and complete the cementing operation. The PDDP will be drilled-out using next section drilling BHA. PDDP's development has encountered challenges on latch-ability and drill-ability since its conception. Approach used to improve PDDP: - 1) PLN profile and PDDP Design; 2) PDDP material – from aluminum to brass, and then to minimized aluminum design to improve drill-ability; 3) Drill bit compatibility; 4) Loss circulation material/Drilling Fluid; and 5) Continuous Design Improvement,and opportunities for deployment.

Results, Observations, Conclusions

DCwD requires full-bore casing access to pull and run bottom hole assemblies (BHA) through the casing, thus conventional floating equipment cannot be used. During the early design phase, a special "floating assembly" was designed to be conveyed via slick line/e-line with a setting tool. The cementing wiper plugs were released, and these plugs will land on top of the "floating" assembly. Although workable, conveying "floating" assembly via wireline can be time-consuming, thus a pump down float idea had conceptualized for operational efficiency optimization. Plug landing nipple(PLN), along with PDDP were then developed. As the PDDP mandrel was substantially made of aluminum, initial field trials suffered poor drill-ability. A dedicated drill-out trip with roller cone bit was required, increasing operational time. Alternative material, brass was utilized in the next generation's design, with drill-ability validated and verified in a lab drill-out test. However, the brass version was not strong enough to hold the pressure, coupled with a design flaw that dropped the latch-ability to only 33%. Poor latch-ability increased risk of over-displacement, and requirement to wait on cement. Further development reintroduces aluminum material minimally for better pressurerating; and centered around stabilizing the PDDP during drill-out with a compatible drill bit. The result was more than 90% success, with consistent drill-ability. Continuous improvement will be further documented and applied with more number of runs to establish DCwD as the prime solution for well design optimization.

Novel/Additive Information

Although there have been numerous challenges along the way,the PDDP technology continues to develop through long term collaboration between operator and technology provider. PDDP technology has finally matured, to help eliminate wait on cement time and dedicated drill-out trip. With increased confidence and proven track records, operators can now reap the full advantage and savings provided by DCwD operation.