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The Value of Process and Application Consistency in Drilling Automation

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Abstract

The drilling industry has undergone significant changes in recent years, leading to increased efficiency, lower costs, and reduced emissions per production unit. As unconventional well construction complexity continues to increase, the next wave of innovation lies in process automation, offering improved consistency and the opportunity to enhance drilling engineering designs.

Effectively automating drilling a stand while minimizing human variability requires a scalable control system, providing adaptability, seamless implementation, and improved operational outcomes. The system requires high- and low-level process control components to effectively control rig machinery within the bounds of the machine limit controls. By using automation sequences while engaging and disengaging the drill bit, operational states such as breakover, optimal weight on bit (WOB), steady state hookload, and zeroing become easier to distinguish.

Through consistent implementation of process automation in drilling operations, the impact on operational outcomes became evident. Analysis of bit disengagement in a series of automatically drilled stands in the lateral revealed a consistent breakover range of 18 to 22 ft. This is particularly noteworthy as breakover is typically more challenging to identify and prone to variability in manual operations.

Zeroing WOB in the lateral at a predetermined drilling interval is common practice to calibrate the drilling system, and procedures provided by the operator are often conservative due to human variability resulting in slower process execution. While drilling automated stands in a lateral, it was determined the lowering sequence of the process could be reduced by half to effectively zero the WOB and differential pressure, reducing invisible lost time.

Not all invisible lost time and variability is human related; variability due to equipment design was reduced. Torquing drillpipe connections is essential to drilling a well. Development of high spec automated floor wrenches improved make-up connection torque accuracy and consistency primarily associated with fundamental tool design. These improvements led to a connection integrity paradigm shift, reducing manual tong usage by 99%, effectively eliminating the need for high torque tongs at a wellsite, leading to improved tripping time and safety.

As drilling automation continues to evolve, the outcomes obtained through consistent process execution provide valuable insights. Additionally, this contributes to a decrease in emissions per unit of hydrocarbon production. Consistency through automation reveals new avenues for in-depth technical discussions on achieving safe and efficient drilling of progressively complex wells.