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Holistically Leveraging Automation Technologies Across a Uniform Suite of Rigs

Aaron Hausher; Drew Felton; Sarah Kern; Tyler Quarles; William Chmela

Abstract ❯

The driller on the rig performs a number of complex tasks including engaging and disengaging the bit, determining subsurface bit location in real-time, orienting the toolface to steer the bit, adjusting pumps and rotary, and deciding set-points to maximize performance, all while managing the rig crew to ensure safe operations.

There is always a potential for dynamic dysfunctions that, if not addressed quickly, could have destructive outcomes. Stick-slip, bit whirl, excessive downhole vibration, and oversteering can each quickly lead to problems. Human response time to address these phenomena varies greatly. Further, the methods in which drillers address these dysfunctions are not standardized. This human variability can increase well costs, decrease production potential, and increase safety risks. Under the direction of experienced drillers, a suite of software applications has been developed to provide a holistic, automated solution to many of the tasks previously performed manually by humans. Reducing human variability bridges the gap between past performance and maximum theoretical performance.

Deployment of these "apps" within an autonomous drilling platform enables operators to easily study and improve the drilling process and, in turn, accelerate and improve well programs.Utilizing multiple automation technologies simultaneously improves consistency, reduces operating costs and lowers risk potential. Higher quality wellbores are delivered with maximum hydrocarbon production potential. New processes have been developed to deploy the apps in a coordinated way, changing roles both in the field and in 24/7 remote support centers. The apps automate or augment many processes, such as making connections, making slide/rotate decisions, determining bit position in relation to local geology, reengaging the bit to bottom, and controlling both rotating and sliding sequences in an efficient manner.

Individual automation technologies have demonstrated measured benefits independently. However, the utilization of an entire suite of automation tools designed to work together within new workflows has demonstrated a substantially higher benefit potential to the operator not typically achievable by individual automation technologies in isolation. These human/machine workflows were refined in pilot deployments and are now being deployed at various levels across a uniform fleet of rigs.

Individual tasks can be automated in relation to acquiring and analyzing data, making decisions, and implementing those decisions as part of the drilling processes. Automation empowers the operator by allowing significantly larger volumes of data to be digested and interpreted more rapidly than is possible by humans alone, while taking economic factors into account during the automated decision making.

The deployment of the automation technologies presented in this paper requires novel work processes both in the field and in the office that are only possible across a uniform suite of rigs, demonstrating the value of scaling and leveraging expertise and experience.

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