

# Autonomous Drilling Technology Enhances Well Placement and ROP

## LOGIX® AUTONOMOUS DRILLING PLATFORM AND MAXROP SOFTWARE ELIMINATE MANUAL STEERING DECISIONS TO IMPROVE WELL CONSTRUCTION AND DELIVERY PROCESSES

EUROPE

### CHALLENGE

- » Achieve well placement consistency, with less human error
- » Increase ROP over conventional drilling methods

### SOLUTION

The engineered technology solution included:

- » LOGIX® Autonomous Drilling Platform – combines physics-based models with machine learning
- » MaxROP – provides maximum ROP limit to stay within ECD limitations and maintain annular cuttings load within limits
- » iCruise® Intelligent RSS – for a closed-loop autonomous drilling operation
- » Penta-combo LWD suite to maximize hydrocarbon recovery

### RESULT

- » Successfully applied new autonomous drilling method
- » Gathered and compared data over 2-year period, which proved the superiority of automated drilling via the LOGIX platform
- » Significantly increased ROP by an average of 43.6 percent
- » Improved well delivery time by over 30 percent

### OVERVIEW

As the industry looks to improve performance, optimize resources, and reduce its carbon footprint, additional advanced drilling automation options are needed to meet these goals. Consistent well placement starts with precise steering during well construction, which directly affects the performance of all subsequent well delivery activities.

### CHALLENGE

While drilling automation continues to improve, without comparative evidence it is difficult to show all the capabilities and benefits available through automation technologies. Operators need a way to understand the differences between conventional, manual, drilling techniques and automation, and even the differences between using a fully autonomous system and an advisory automation process.

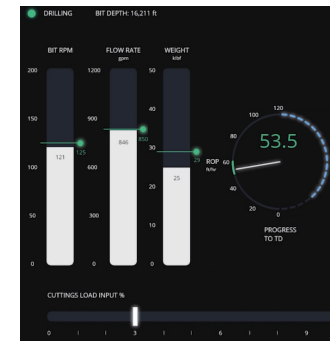
### SOLUTION

An operator in Europe participated in a pilot program with Halliburton to test the viability of fully automating their directional drilling processes. This field trial implemented the latest advancements in steering automation, featuring the LOGIX® autonomous drilling platform and the MaxROP application. The BHA included the iCruise® intelligent rotary steerable system (RSS) and a penta-combo logging-while-drilling (LWD) suite. The combination of the LOGIX platform and iCruise RSS allow a closed-loop, fully autonomous drilling operation.

This unique combination of automated drilling technologies performs previously manual tasks to completely steer three-dimensional wells autonomously—without compromising wellbore quality. The LOGIX platform's physics-based modeling and machine learning (ML) techniques make calculated drilling decisions to generate steering commands and recommend drilling parameters in real time. Steering commands can be sent directly to the BHA or used in an advisory capacity allowing the directional drillers to decide how to react to changes downhole.



LOGIX® Autonomous Drilling Platform

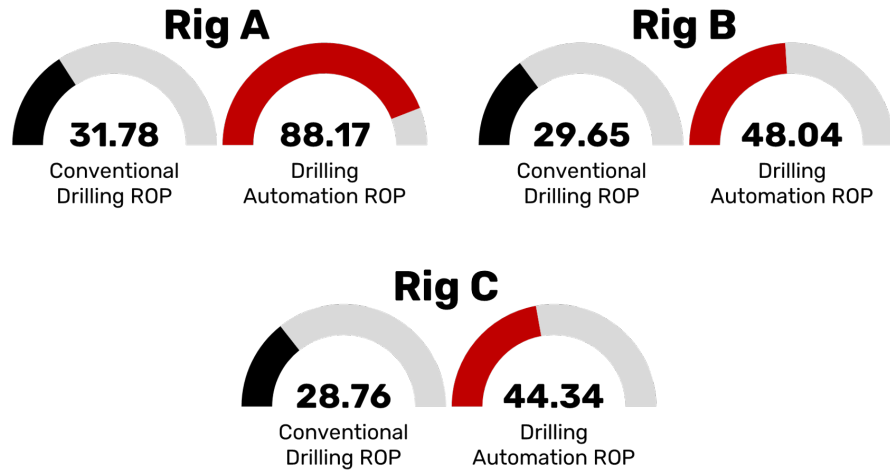


MaxROP real-time display of data as drilling progresses to total depth (TD).

Engineers in a Remote Drilling Center (RDC) and rigsite personnel use an integrated digital user interface to display all drilling data (e.g., bit speed, flow rate, weight on bit, cuttings load) and advisory information on-screen.

**RESULT**

Data collected from three automated wells over a two-year period demonstrated consistent well placement, while achieving a higher rate of penetration (ROP) than those using conventional drilling methods.



*Data showing superior ROP performance with drilling automation via LOGIX over conventional drilling method.*

The outstanding results of this pilot project illustrate the superior capability of the LOGIX autonomous drilling platform for drilling control and performance consistency over time. An overall average ROP increase of 43.6 percent across four well sections was seen during the project. The autonomous drilling solution successfully leveraged physics-based modeling and ML techniques to produce repeatable, predictable well delivery results—with a greater than 30 percent improvement in well delivery time. The implications for eliminating manual decision-making and reducing human error are also notable. Overall, the operator was able to minimize rigsite resources and maximize asset value. The operator is considering using the same solution for all their assets. Drilling automation is changing the way we are steering wells in Europe, and globally.

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