

# First Fully Automated Run in Kuwait Delivers Landing Section in Record Time

## LOGIX® AUTONOMOUS DRILLING PLATFORM, ICruise® INTELLIGENT RSS, PULSESTAR® HIGH-SPEED TELEMETRY, AND GEOTECH® GTI DRILL BIT WITH CEREBRO® IN-BIT SENSING HELP DELIVER BEST-IN-CLASS SECTION

KUWAIT

### CHALLENGE

- » Different lithologies with different build capability index
- » Restricted DLS during the curve section
- » Low-power rig and inefficient mud pumps
- » Maintaining tangent section below 1 deg DLS
- » Deliver a best-in-class section

### SOLUTION

Engineered drilling automation solution package:

- » LOGIX® Autonomous Drilling Platform – combines physics-based models with machine learning to create digital twins of a reservoir, reducing geological uncertainty
- » PulseStar® High-Speed Telemetry Service – fast delivery of real-time data to support drilling efficiency
- » iCruise® Intelligent Rotary Steerable System with Cruise Control® technology – an automation-enabled platform for enhanced directional drilling and precise well placement
- » GeoTech® GTi drill bit with CEREBRO® in-bit sensors – to capture weight, torque, and bending measurements directly from the bit

### RESULT

- » Met KOC objective to reduce human intervention and improve drilling performance
- » Landed 8½ in. section in record time for Bahra Field
- » Achieved 30% faster ROP than the best offset well
- » Set record for best casing run time in the field

### OVERVIEW

The Bahra Field was the first structure discovered in Kuwait with the first well being drilled in 1916. Located near Kuwait Bay, this is a key field for Kuwait Oil Company (KOC) to achieve aggressive production goals, as it is one of the highest potential fields with over 200 wells drilled to date. Most of those wells are unconventional and require horizontal drilling to target a tight carbonate reservoir.

### CHALLENGE

Bahra Field's distinctively complex geology makes the implementation of remote drilling risky, even for the most experienced directional drillers. A recent benchmarking exercise showed the rig used to drill the existing wells is the slowest-performing rig in the area. Pump efficiency has been historically low, and only by following and measuring hydraulics parameters in real time could efficient hole cleaning be done. The interbedded formations in the 8½ in. section of interest had different formation indexes, potentially causing vibration and varying bottomhole assembly (BHA) behavior. Another challenge was to avoid abrupt changes in dogleg severity (DLS) response to ensure a smooth hole profile, essential for a smooth liner run. To combat these challenges and uncertainties, the Halliburton Drilling Engineering Solutions team proposed a comprehensive, automation-driven package in line with KOC's 2040 vision to drill faster while maintaining consistency without compromising safety.

### SOLUTION

The proposed drilling automation solution was comprised the latest drilling technology tools. The LOGIX® Autonomous Drilling Platform was run to drive the automation-enabled iCruise® intelligent rotary steerable system (RSS), and the smart PulseStar® high-speed telemetry system provided downhole measurements delivered to surface in real time for effective decision making.

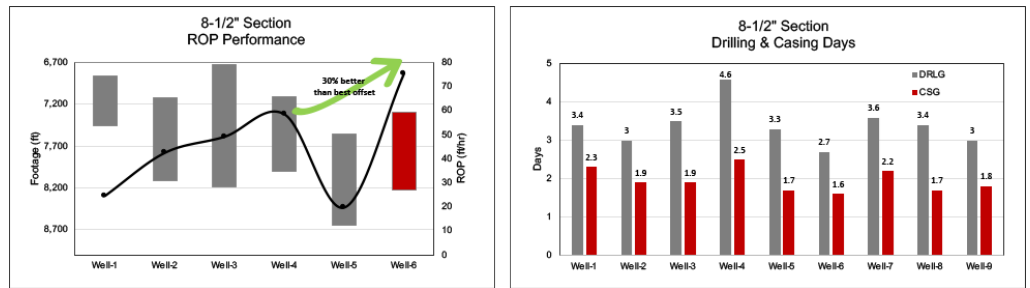
### PRECISE AND CONSISTENT WELL PLACEMENT

Several automation functions were executed—directional steering, trajectory control, vibration, and hydraulic management—with various control levels and limitations posed by the drilling rig. The PulseStar service accommodated the increased amount of data needed for LOGIX to close the communication loop of the automation bundle. A unique GeoTech® GTi drill bit was designed for the application and run with CEREBRO® in-bit sensing. The in-bit sensors provide direct measurements of weight-on-bit (WOB), torque-on-bit (TOB), bending-on-bit (BOB) vibration, and rotational speed as close to the bit-rock interface as possible. Utilizing these measurements, along with Design at the Customer

Interface (DaTCl™) bit customization, helped reduce or eliminate inefficiencies caused by the previous bit, BHA design, and parameter selections. Improved drilling efficiency increased the rate of penetration (ROP) and run length, ultimately lowering overall well construction costs. The WOB, TOB, and BOB measured at the rock interface mitigated surface measurement uncertainty, provided a better understanding of the downhole environment, and enabled more accurate calibrations of drilling torque and drag models. The in-bit parameter sensing device integrated with the high-speed telemetry system provided a complete closed-loop workflow.

**RESULT**

The integrated, highly engineered solution helped KOC move toward its 2040 vision to achieve target production with reduced human intervention and optimized efficiency and performance, while reducing HSE risks. This automated solution delivered a record-breaking 30% faster ROP than the best offset well in the field, seamlessly achieving a required 7deg/100ft DLS. The LOGIX Autonomous Drilling Platform controlled and drilled the planned section 100% without the need for drilling engineer involvement. The result was a significant improvement in overall performance, providing a smooth hole and landing the well perfectly in the reservoir target. Notably, this goal was accomplished despite one of the historically slowest rigs in North Kuwait. The drilling dynamics and vibrations were recorded to assist in future well modeling to achieve higher accuracy and further improve the performance roadmap.



Real-time display of drilling data from the LOGIX platform, steering the complex 3D well with the iCruise RSS autonomously.

**SUMMARY**

The autonomous drilling platform orchestrates the rhythm in which the RSS executes commands to stay on the planned well path, enabling a virtually seamless workflow. The LOGIX Autonomous Drilling Platform, in combination with other carefully selected tools and remotely controlled, delivered multiple record-breaking results for the field, in addition to lower overall well construction costs for the customer. This project raised the bar by showcasing the first-ever autonomous directional drilling run in Kuwait.

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