MATURE FIELDS

CASE STUDY

Using Artificial Intelligence to Redevelop Declining Brownfield

LOGIX® AUTONOMOUS DRILLING PLATFORM, ICRUISE® INTELLIGENT RSS, AND GEO-SPAN® DOWNLINKING SYSTEM CONTRIBUTE TO SAFE, FLAWLESS EXECUTION IN A COMPLEX 3D HIGH DDI OIL WELL

MALAYSIA, SOUTHEAST ASIA

CHALLENGE

- Re-develop underproducing brownfield oil wells efficiently and at minimal cost
- Follow complex 3D and high DDI well plan to tap into multi-stacked reservoir sands
- Avoid close proximity wells on a congested multi-well pad

SOLUTION

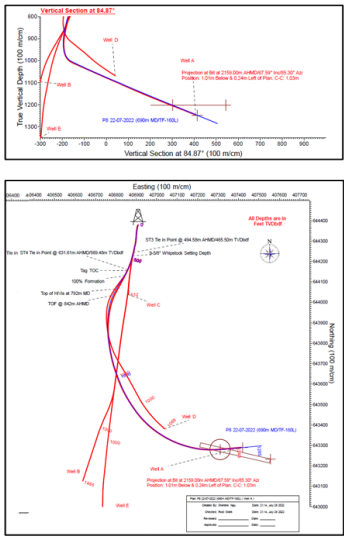
- LOGIX® Autonomous Drilling Platform – with AI and physics-based ML algorithms
- Geo-Span® downlinking system – to generate and send commands downhole for added 3D steering control in real time
- iCruise® Intelligent rotary steerable system (RSS) – to precisely execute on-bottom, closed-loop autonomous steering

RESULT

- Autonomously steered 97 percent of the 8½-inch wellbore, with 84 flawlessly executed, closed-loop downlink steering commands while drilling on bottom
- Achieved 32 percent faster rate of penetration (ROP) compared to offset wells
- Successfully drilled wellbore on target, as planned
- Saved the client 14 hours of rig time (or USD 122,500) compared to traditional drilling methods

OVERVIEW

A customer in Malaysia was planning a brownfield redevelopment project to replenish declining oil production. The plan consisted of two oil producer wells and one water injector well, sidetracking off a whipstock from the donor well's casing. This project required a complex, three-dimensional well trajectory with a high directional drilling index (DDI) due to the congested platform with many existing wells, further complicated by multi-stacked reservoir sands targets and close proximity of some older wells.



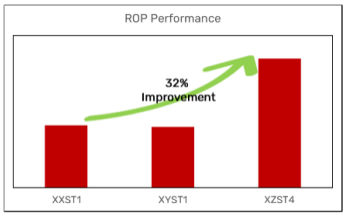
Plan View and Vertical Section plot showing precise wellbore positioning compared to previously drilled offset wells (other red traces).

CHALLENGE

Notwithstanding the complex nature of the 3D well trajectory, the challenge was to deliver consistent, quality, and optimal wellbore placement to meet the client's drilling conditions and geological targets; while taking special care to avoid nearby wells on the same drilling pad. This also needed to be accomplished in an efficient, cost-effective manner. It was an ideal situation to summon the Halliburton Sperry Drilling's expertise and advanced technology services, featuring automation and artificial intelligence (AI).

ENGINEERED DRILLING SOLUTION – ARTIFICIAL INTELLIGENCE

Referencing the digital twins of a vast global database, the LOGIX® Autonomous Drilling Platform applied a machine learning (ML) algorithm to compute the directional tendency ahead of the bit, based on past and future tool yields. Referencing the digital twins of a vast global database, the LOGIX® Autonomous Drilling Platform applied a machine learning (ML) algorithm to compute the directional tendency ahead of the bit, based on past and future tool yields. With constant assimilation and swift analysis of the real-time downhole measurement data, the algorithm, adapts to the formation's constantly changing downhole environment. It adjusts based on the drill bit interaction, the bottom hole assembly (BHA) forces, and the various components that drive directional performance.



Bar graph showing 32% faster ROP with LOGIX Autonomous Drilling Platform and iCruise intelligent RSS.

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Meticulous well engineering and BHA analysis performed during the pre-drilling Design of Service (DOS) planning stage helped illuminate various risks based on offset data to ensure optimal iCruise RSS directional performance when drilling the 8½-inch wellbore.

PRECISE AND CONSISTENT WELL PLACEMENT

The careful planning, well engineering, and BHA analysis coupled with the right drilling tools culminated in successful execution of the sidetrack. The wellbore precisely tracked the planned well path, practically painting over it, positioned 1.01 m below and 0.24 m to left of plan. This represented an outstanding achievement, with 97% of the run steered by the Logix Autonomous Drilling Platform, 80% autonomously. The high level of automation was made possible by steering commands sent directly from on-surface software and downlinked via the Geo-Span system to the downhole iCruise RSS. The directional driller initiated the side-track at 843 m by manual steering at the rig site. After that, there was no further human intervention onsite or from the remote drilling center personnel, for the remainder of the section—from 843 m to 2159 m of well's target depth.

The on-bottom drilling rate of penetration was 32% faster, compared to the earlier two wells drilled in this redevelopment campaign, either by conventional methods or with partial autonomous steering. The successful execution of 86 closed-looped, downlinked steering commands from the Geo-Span system enabled the client to realize a rig time saving of 14 hours, which equates to USD 122,500 less expenditure (compared to other drilling partners of this client).

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

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