ROP optimization agent reduces drilling time in offshore development side-track well

An operator's planned side-track drilling project offered a perfect location for the latest machine learning agent from Exebenus. Facing a drilling environment known to cause slow rate of penetration, the operator hoped to uncover consistent and reliable ways to improve performance. The Exebenus Spotter ML™ Real-Time ROP Optimization agent's multivariate optimization while drilling did in fact provide the rig crew with the desired insight, enabling them to decrease drilling time and costs.

LOCATION

Offshore, deep water, Malaysia.

CHALLENGE

Improve formation insight and increase drilling performance in a clay and sandstone environment known to cause slow rate of penetration (ROP).

SOLUTION

Field trial real-time ROP optimization agent in a side-track well section. Run stuck pipe hole cleaning agent to understand risk of increased cuttings in suspension and cave-ins.

RESULTS

Rig crew followed the advice of the machine learning agents and increased ROP significantly.

RIG CREW FOLLOWED THE ADVICE OF THE MACHINE LEARNING AGENTS AND INCREASED ROP SIGNIFICANTLY

IMPROVE DRILLING TIME IN AN ENVIRONMENT KNOWN FOR SLOW ROP

An operator with a development well in Malaysia needed to drill a side-track to reach the gas reservoir. The field's offshore environment is characterized by interbedded claystone and sandstone, known to result in slow ROP and added cost.

The operator decided to conduct a field trial of the Exebenus Spotter ML™ Real-Time ROP Optimization agent to find out if it would improve and optimize drilling.

Specifically, the operator wanted to know if the way in which the information is provided to the rig crew would be easy to understand and implement, and if the real-time drilling parameters provided by the agent would help the crew to reduce drilling time. Longterm, the operator hoped that the insight and experience gained by the crew would be effective in improving drilling times in future projects in the same field and depth zone.

REAL-TIME ROP OPTIMIZATION AGENT IS PUT TO THE TEST

The field trial was performed in the 12¼ in section with a maximum inclination of 85 deg using a rotary steerable system BHA and a polycrystalline diamond compact bit.

The operator established guidelines for the field trial. They wanted to see if the optimization agent's drilling recommendations were reasonably consistent with the driller's existing roadmap, and with typical operational constraints, the well complexity, common drilling practices and technical limitations.

The rig crew was asked to act on the advice of the agent only when the recommended ROP was significantly higher than the baseline ROP, and only as long as the advice did not pose risks to equipment or operational safety.

The agent provides updated recommendations on drilling parameters every 50 cm of drilling, but to comply with the established communication guidelines, the real-time operations (RTO) team only advised on changes in drilling parameters two or three times per stand based on trends in the recommendations.

THE OPERATOR HOPED THAT THE INSIGHT AND EXPERIENCE GAINED BY THE CREW WOULD BE EFFECTIVE IN IMPROVING DRILLING TIMES IN FUTURE PROJECTS IN THE SAME FIELD AND DEPTH ZONE

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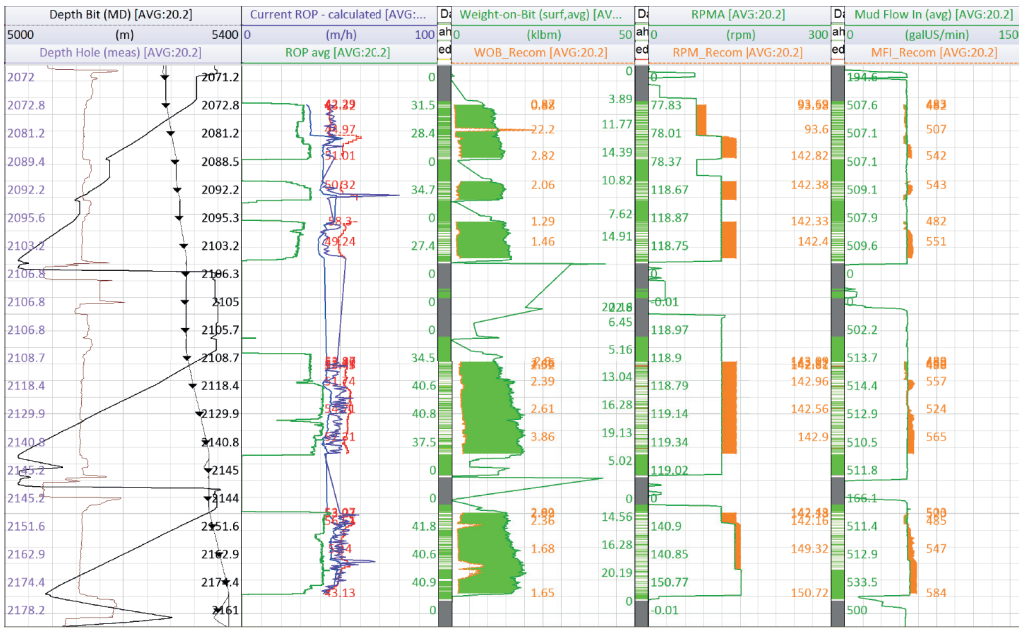
The plot shows that after following agent recommendations, the ROP optimized (red), baseline estimates (blue) and calculated current ROP (purple) all converge when the drilling is running optimally. The original gap between baseline and optimized can be used as an estimate of the realized gain (as well as current ROP before and after optimization)

ROP INCREASED SIGNIFICANTLY, AND NO STUCK PIPE ISSUES

As the rig crew started to follow the recommendations of the agent, the ROP increased from 6 m/hr to 25 m/hr. However, gaps between the actual and recommended ROP were observed, indicating parameters could be further optimized. The team continued to follow the agent's recommendations by increasing weight on bit from 1 klbm to 5 klbm, RPM from 128 to 140, and mud flow from 750 gpm to 850 gpm, resulting in an ROP of 31 m/hr. Reviewing the drilling of the 12 ¼ in side-track section between 1244 m to 1380 m, the agent's advice resulted in a significant increase in ROP from 10.4 m/hr to 31 m/hr.

The Exebenus Spotter ML Stuck Pipe Hole Cleaning agent was deployed to support the ROP agent, since running at a higher ROP can lead to hole cleaning issues and a higher risk of stuck pipe. No hole cleaning issues and no downhole losses were observed.

The rig crew was very happy with the setup and the information the agent provided. Crew members gained better understanding and confidence in their actions.

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