# EXEBENUS
◤ CURRENT ML

STUCK PIPE AGENTS

Real-time predictions and risk awareness help prevent nonproductive time

Nonproductive time caused by stuck pipe represents a high—and usually avoidable—cost to operators. Although many wells have been drilled in the mature Magdalena River Valley basin, stuck pipe remains the cause of significant downtime. Seeking a new solution, one operator decided to introduce machine learning to provide real-time risk awareness during operations. The operator chose the Exebenus Spotter ML™ solution, which predicts and prevents stuck pipe situations and thereby reduces cost.

LOCATION

Magdalena River Valley basin, South America.
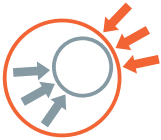
CHALLENGE

Differential sticking is a known risk in the depleted reservoirs of the mature Magdalena River Valley basin, causing operators significant nonproductive time (NPT) during drilling and tripping operations.

SOLUTION

Monitor real-time feed remotely using Exebenus Spotter ML. Provide risk awareness of situations that can cause stuck pipe and advise rig crew of preventative actions.

RESULTS

Avoided downtime of potentially three to four hours. RTO team observed differential sticking warnings prior to reaching critical depth where previous operation encountered restrictions. The rig crew was advised to ream as well as to rotate through the critical depth zone.

> AVOIDING STUCK PIPE SAVES THE OPERATOR FOUR HOURS COMPARED TO OFFSET WELL ANALYSIS

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OBSERVED RESTRICTION RAISES THREAT OF STUCK PIPE SITUATION

The operator was working in an area of Colombia that has many mature and depleted reservoirs. Differential sticking is a known cause of stuck pipe during drilling and tripping in depleted reservoirs, and because it is such a common problem, it is often under reported in daily drilling reports.

Offset well reviews showed that downtimes of three to four hours caused by differential sticking were not uncommon in these wells. The real-time operations (RTO) team therefore anticipated differential sticking issues during the well operations and opted to use the Exebenus solution to identify potential risks and provide the rig crew with recommendations for preventative actions.
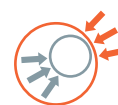
MACHINE LEARNING AGENTS PLUG AND PLAY INTO EXISTING REAL-TIME SETUP

The operator's RTO team recommended running all three of the Exebenus Spotter ML predictive stuck pipe machine learning agents—differential sticking, hole cleaning and mechanical sticking. The agents were plugged into the operator's existing Halliburton InSite (WITSML 1.3.1) installation and quickly put into operation. No customized training of the agents was required, and only standard real-time surface data was used to provide predictive warnings. Communication between the RTO and the rig crew followed established communication protocols.

PREDICTIVE MACHINE LEARNING AGENTS REDUCE RISK OF STUCK PIPE

During tripping in, four warnings were issued by the agents suggesting a risk of differential sticking. The RTO intervened and recommended back reaming as well as rotating through the high risk zone. The corrective action removed the filter cake buildup, and the operation continued without any further risk of differential sticking.

DOWNTIMES OF THREE TO FOUR HOURS CAUSED BY DIFFERENTIAL STICKING WERE NOT UNCOMMON IN THESE WELLS

All three of the Exebenus Spotter ML predictive stuck pipe machine learning agents — differential sticking, hole cleaning and mechanical sticking—were deployed

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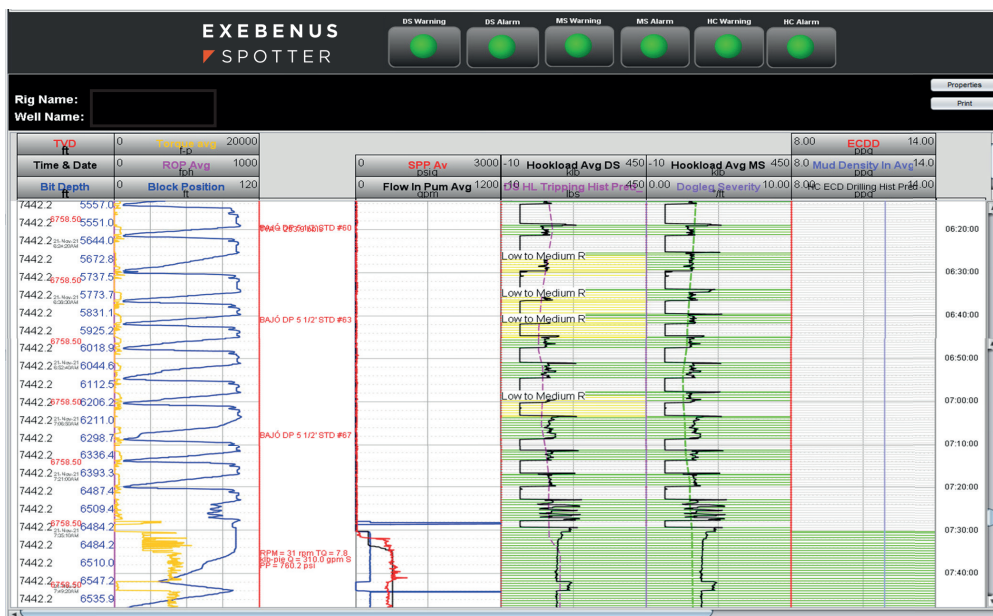
Prior to reaching the restrictive zone observed during drilling, the Exebenus Spotter ML differential sticking agent issued three consecutive warnings. RTO engineers intervened following these warnings and recommended back-reaming as well as rotating through the depth zone. No restriction was encountered

MACHINE LEARNING AGENTS' PERFORMANCE

After completing a successful operation with no stuck pipe incidents, an evaluation of the setup and the agents' performance was carried out. The agents were set up in Halliburton InSite to run a historical well analysis. The analysis showed satisfactory warning responses by the agents throughout the well operation, and no stuck pipe misses.

NONPRODUCTIVE TIME FOR TIGHT HOLE AND STUCK PIPE EVENTS

1–3 hours — 36%

>3 hours — 9%

55% — **30–60** minutes
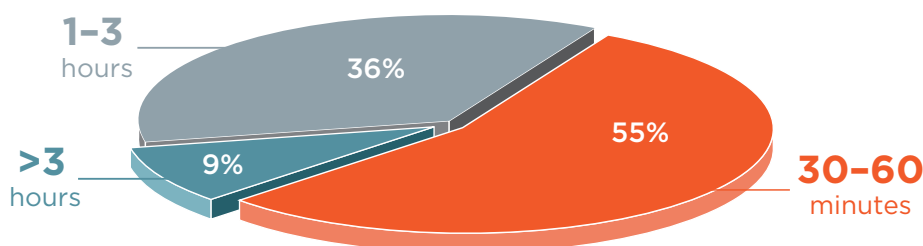
Low-risk scenarios statistically have a lost time potential of 1.6 hours. Predicting even low-risk scenarios can reduce downtime and provide signifi cant cost containment

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