



## STUCK PIPE AGENTS

### Increase productive time with real-time prediction of high-risk conditions

Making informed decisions requires clear, moment-to-moment awareness of the situation downhole. Exeбенus Spotter stuck pipe machine learning agents use data available in all well operations to signal trends and leading indicators that can lead to stuck pipe events.

#### STUCK PIPE IS A KEY COST DRIVER

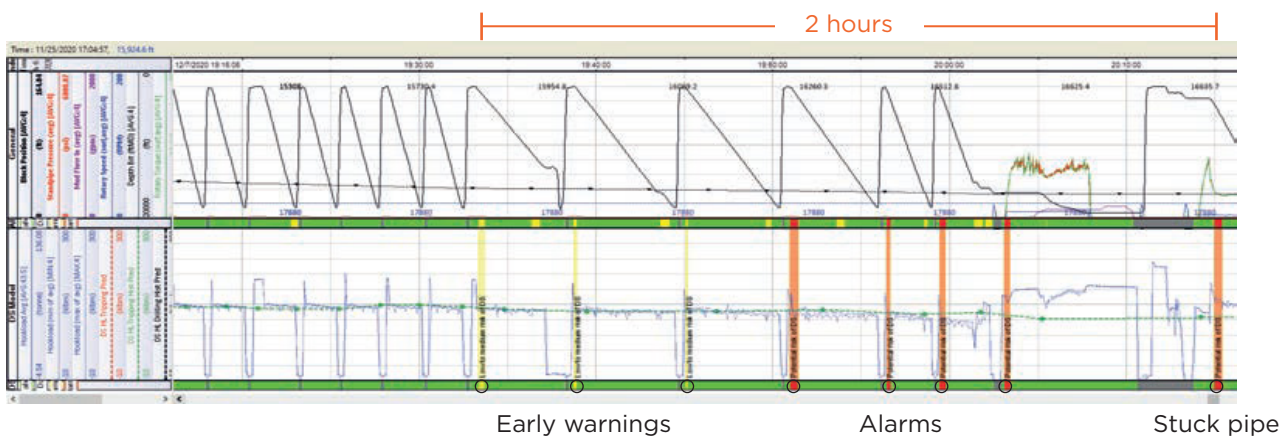
Stuck pipe costs the industry billions of dollars in non-productive time (NPT) annually. The problem can occur in all types of well operations, from tripping and reaming to steady drilling.

#### PREDICT AND PREEMT HIGH-RISK CONDITION

Exeбенus Spotter Stuck Pipe Agents predict, in real time, high-risk conditions such as pressure differentials, poor hole cleaning and mechanical sticking issues that, without intervention, typically result in stuck pipe situations. Exposing these hazardous conditions early gives your rig crew time to mitigate the situation and ensure uninterrupted safe operations.

#### EXCEPTIONAL BENEFITS

- > 1.5 - 24 hours predictive awareness
- > 95% success rate in drilling risk prevention
- > Identifying the likely mechanism for stuck pipe
- > No custom pre-training of models required
- > Minimal false warnings, less than one per day on average



The Differential Sticking Agent provided three warnings (yellow) before issuing an alarm (red). The first warning was given two hours before the pipe got stuck.

**OUT-OF-THE-BOX AND INTO PLAY**

Exebenus Spotter **Stuck Pipe Agents** have been run on over 1000 wells of various types located in different basins and regions around the world. Our machine learning agents are an out-of-the-box solution. They are supplied in one package but work independently to solve a variety of stuck pipe scenarios.

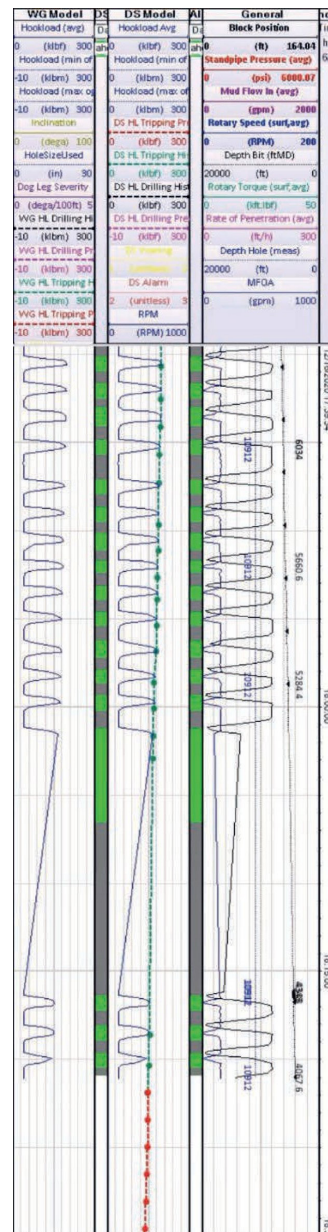
The **Stuck Pipe Agents** consume real-time or historical WITSML data and provide log curve (WITSML data) output. To minimize user training, they integrate with existing real-time WITSML viewers and operation center workflows to monitor, analyze and advise your rig crew.

Limited configuration data and fast setup for new wellbores makes Exebenus Spotter perfect for monitoring large drilling fleets. Exebenus Spotter agents are available as standalone or bundled solutions. When working together, they support each other's predictions or recommendations.

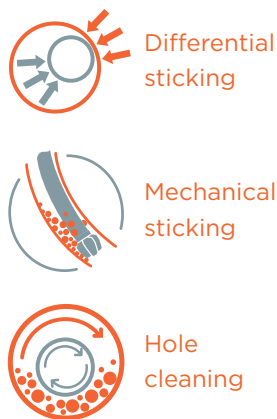
**SMART USE OF REAL-TIME DATA**

To support easily understandable predictions, the machine learning agents use parameters that are familiar to engineers and have easy-to-read color coding and text information. As the agents provide predictions, their analysis is presented in the monitoring display as trends, warnings and alarms related to the predicted problem.

The sensitivity level of each agent's warning and alarm setting is configurable to provide engineers with the best possible risk awareness. An agent's predictive time depends on the nature of the operation, the sensitivity configuration, and the type of look-ahead signs that exist.



Data gaps occur during operations for various reasons. The Exebenus Spotter agents are developed to handle such situations.

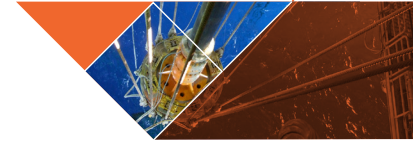


**Input data**

Time, bit depth, hole depth, hookload, flow rate, RPM, torque, block position


Time, bit depth, hole depth, hookload, flow rate, RPM, torque, block position, trajectory

Time, bit depth, hole depth, hookload, flow rate, RPM, block position, trajectory, mud density in, ROP, standpipe pressure



## POWERFUL INDIVIDUALLY. STRONGER TOGETHER.

The Exebenus Spotter suite includes three targeted AI/ML agents.

Stuck Pipe Agent including supporting models for			ROP Agent	Vibration Agent
Differential sticking	Mechanical sticking	Hole cleaning		
				

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Combined, the agents address interconnected challenges, leading to even better results that any can achieve alone.

## INTELLIGENT DRILLING WITH EXEBENUS SPOTTER AGENTS

Exebenus Spotter is a cloud-based, standalone software as a service (SaaS) solution. The agents can be hosted on any public cloud, installed on your corporate cloud or on your premises.

Exebenus Spotter agents are designed based on our deep understanding of drilling and completion operations and data sciences.

