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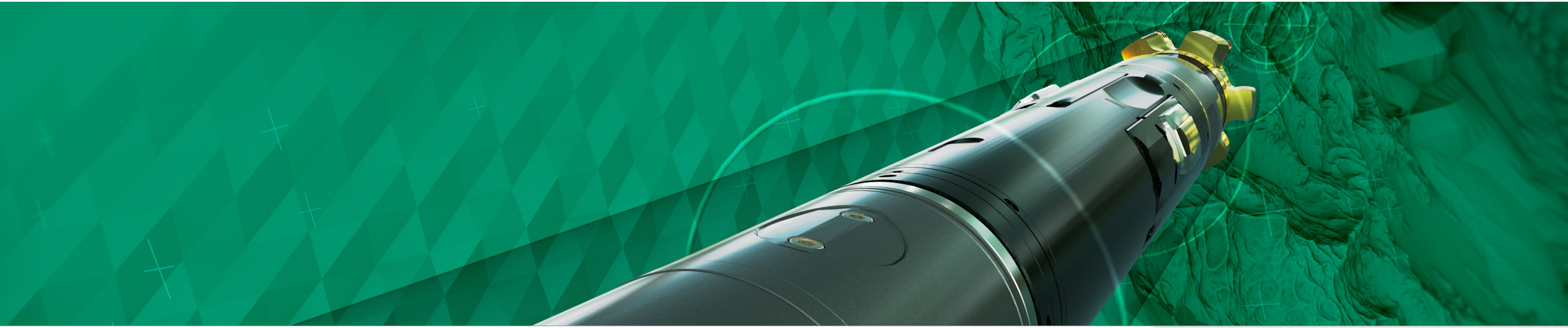


Identify stringers quickly and reliably to minimize NPT and get to TD faster

i-Trak automated stringer detection and mitigation service

Drilling complications often arise when a drill bit encounters hard stringers interbedded within softer formations like sandstone. This sudden change in rock mechanics typically deflects the drill bit and causes a well path deviation commonly referred to as a dogleg. The i-Trak™ automated stringer detection and mitigation service from Baker Hughes automates stringer identification so you can quickly and efficiently adjust drilling parameters and take corrective actions to maintain the well path without damaging the bit or BHA. The result: repeatable and efficient drilling of accurate well paths even in the most challenging geological environments.

IDENTIFY STRINGERS QUICKLY AND CONSISTENTLY

One standard approach to stringer-induced doglegs is pulling back and performing costly, time-consuming reaming operations to smooth out the well path. With the i-Trak automated stringer detection service, you can identify stringers earlier than previously possible to guide fast, corrective actions.

The service incorporates an automated stringer-detection module that has been integrated into an advanced measurement-while-drilling (MWD) sub. The sub's dynamic sensors capture a range of vibration and load measurements including tangential acceleration and dynamic torque at the bit. Then, using a physics-based algorithm that combines those critical measurements, the i-Trak service automatically identifies the occurrence of high-frequency torsional oscillation (HFTO) in the BHA. These oscillations only occur during bit-rock interactions in hard formations and their sudden appearance make them a leading indicator for real-time stringer detection.

EFFICIENTLY MITIGATE STRINGER IMPACT

Traditional methods of stringer detection, such as weight on bit (WOB) or downhole bending moment, are typically identified via changes in well trajectory and drilling parameters at surface. The automated i-Trak service's instantaneous detection is a major improvement over legacy detection methods. That's because attempting to detect stringers via surface parameters or bending moment alone typically requires several minutes for the response to even register in the sensor sub. Then signal must reach surface and be analyzed before the driller is notified—adding several more minutes to the process. During this time, a slight deflection can grow into a

APPLICATIONS

- Relatively soft formations containing hard stringers
- Interbedded formations
- Faulted formations
- Wells requiring extensive reaming runs to reach total depth (TD)

BENEFITS

- Maintains the desired well path reliably and efficiently
- Eliminates high local doglegs that could increase the risk of:
  - Stuck casing
  - Stuck completion strings
- Reduces high static loads that can damage the bit and bottomhole assembly (BHA)
- Minimizes the risk of:
  - Premature bit wear
  - Shortened run life
  - Increased trips
  - Higher maintenance costs
  - Not reaching TD

more severe dogleg that requires a costly reaming run to correct.

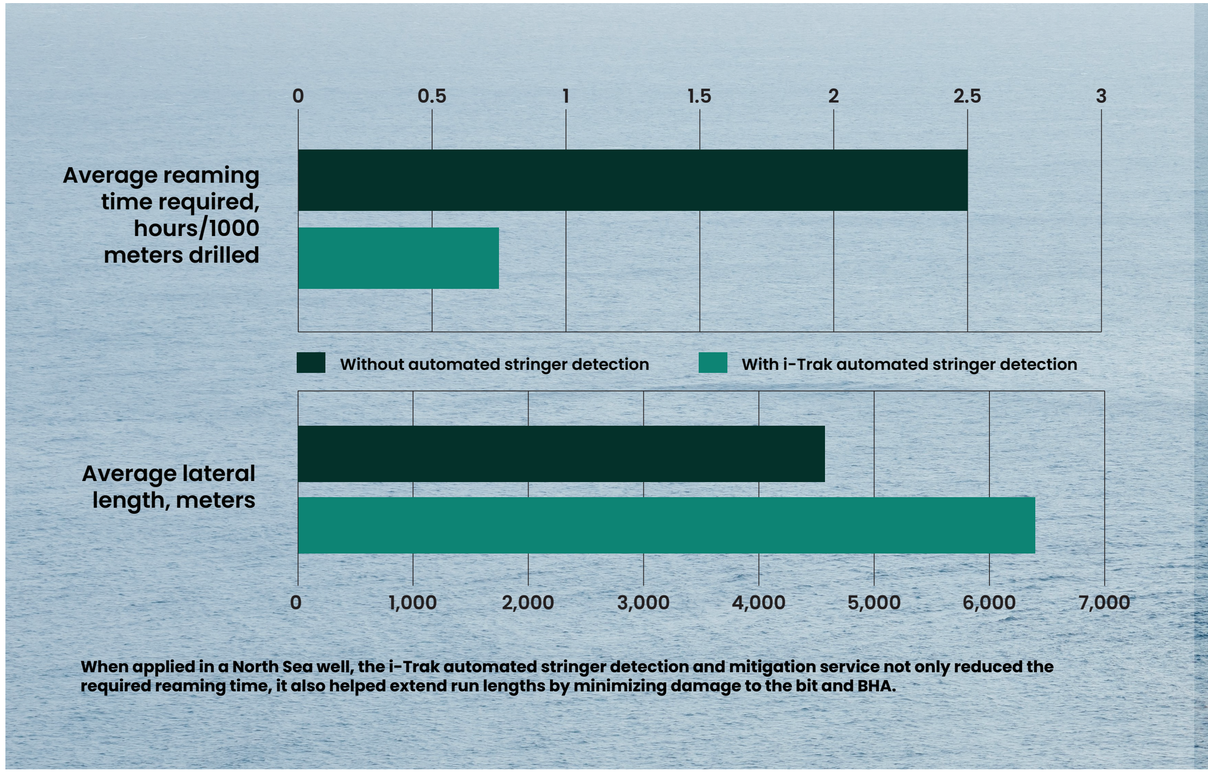
ELIMINATE UNNECESSARY REAMING OPERATIONS

The i-Trak automated stringer detection service reacts much faster upon encountering a stringer than any legacy process—automatically and immediately sending a simple, single signal indicating a stringer. Based on that information, the driller can quickly adjust parameters such as WOB and revolutions per minute (RPM) to efficiently drill through the stringer. This lets you consistently avoid the creation of excessive local doglegs that can limit your penetration rates and add invisible lost time (ILT) and cost to your well construction operations.

INCREASE ROP IN STRINGER FORMATIONS

i-Trak automated stringer detection is augmented with advisory capabilities to propose the optimum sequence of drilling parameters that ensure maximum rate of penetration (ROP) is achieved at all times throughout the stringer interval once deflection is averted. Automated drilling control systems (ADCS) provide target setpoints for RPM, WOB, and surface flow rate to fully automate the stringer drilling operation.

If you are drilling in complex geologies or spending too much time and money on reaming operations, contact your Baker Hughes representative to learn how the i-Trak automated stringer detection and mitigation service can deliver real value on your next well-construction project.



When applied in a North Sea well, the i-Trak automated stringer detection and mitigation service not only reduced the required reaming time, it also helped extend run lengths by minimizing damage to the bit and BHA.

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