

Case study: Drilling, North Sea

i-Trak automated stringer detection service improves gross ROP and reduces ILT by 63% in multilateral well

The operator of a mature North Sea field was struggling to drill multilateral wells on schedule due to the hard calcite stringers interbedded within the sandstone reservoir.

These stringers would deflect the drill bit, creating localized doglegs that lowered drilling efficiency by generating high static loads that often led to premature bit wear, shortened run life, slower rate of penetration (ROP), and more trips downhole. This, combined with the fact that the dogleg can often redirect the well path out of the most-productive reservoir zone, contributed to higher-than-planned lifting costs.

Historically, the operator would resolve these stringer-induced dogleg issues by pulling the drill string back and performing a time-consuming reaming operation to smooth out the well path. This solution added significant invisible lost time (ILT) to the drilling operation, lowered gross ROP, and increased the per-well lifting costs.

The operator approached Baker Hughes for a solution that would identify stringers earlier to minimize local doglegs, reduce stringer-related ILT, and increase gross ROP.

Advancing automated stringer detection

Working with the operator, Baker Hughes implemented the **i-Trak™ automated stringer detection and mitigation service** in the field. Part of the proven portfolio of **i-Trak™ drilling automation services**, the automated stringer detection service uses real-time MWD vibration and load measurements

to automatically calculate a high-frequency torsional oscillation (HFTO) value in the bottomhole assembly.

These HFTO values change dramatically as the drill bit transitions from soft formations to hard stringers—making HFTO a faster and more accurate stringer detector than weight on bit (WOB) or downhole bending moment.

When a stringer is encountered, the i-Trak service automatically sends an alert to the driller. Once received, the driller can immediately adjust drilling parameters like WOB and revolutions per minute (RPM) to maximize ROP through the stringer.

Early stringer detection minimizes ILT

The operator initially deployed the i-Trak stringer detection and mitigation service while drilling several 8½-in. lateral sections and compared the results with previous laterals drilled using conventional detection methods.

Prior to the i-Trak automated service, the operator recorded an average of 2.7 hours of reaming-related ILT for every 1000 m (3,300 ft) drilled, even after the operator had implemented multiple procedural changes aimed at improving stringer detection speed and accuracy. While some improvements were realized due to these changes, ILT and gross ROP both plateaued and no further performance gains were achieved until the i-Trak service was deployed.

On just its first deployment in January 2021, the i-Trak service improved the speed and accuracy of stringer detection—consistently

Challenges

- Minimize local doglegs resulting from interbedded calcite stringers and deliver well to plan
- Increase gross ROP through reservoir sections
- Eliminate ILT associated with reaming operations
- Quickly and efficiently identify stringers

Results

- Automated stringer detection and a rapid response minimized local doglegs and improved drilling efficiencies
- Significant time and cost-savings of half a day and \$100,000 USD of rig costs for every lateral drilled
- Lower ILT by reducing reaming activities 63% compared to offset wells

detecting stringers in multiple laterals within **just 15 to 25 seconds**. This was a fraction of the time required for traditional indicators and it allowed the drilling team to quickly implement its stringer mitigation plan.

As a result, the new service dropped the average reaming ILT to **50 min/1000 m**, a 63% reduction compared to the previous nonautomated wells. This translated to an **average savings of half a day and \$100,000 USD of rig costs** for every multilateral drilled.

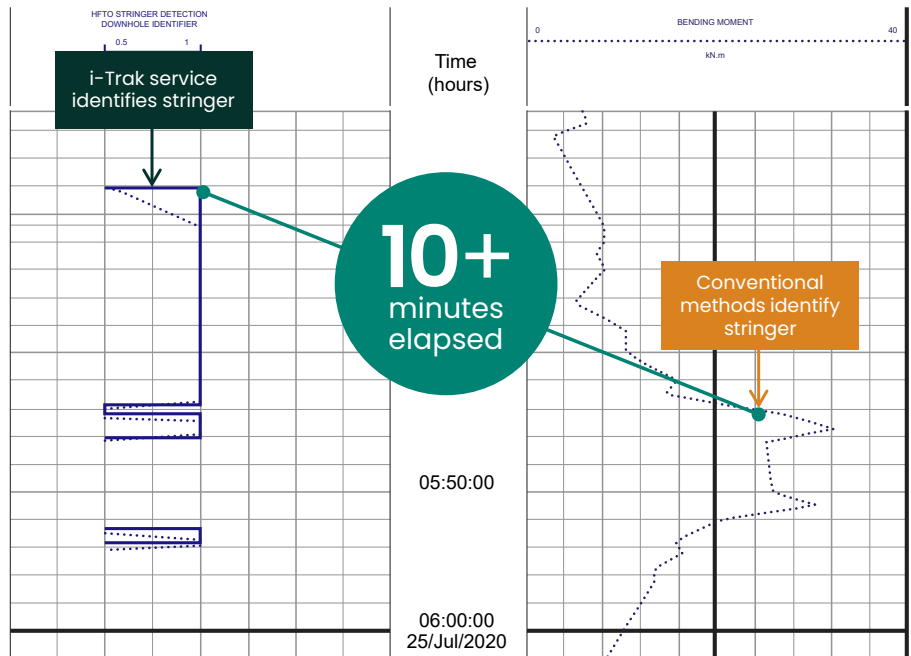
Extended lateral length

The average lateral length of sections drilled without the automated i-Trak service was 4914 m (16,122 ft). But for the sections drilled with automated stringer detection, the extended operating life of the BHA and drill bit are believed to have helped increase the average lateral length to 6486 m (21,280 ft).

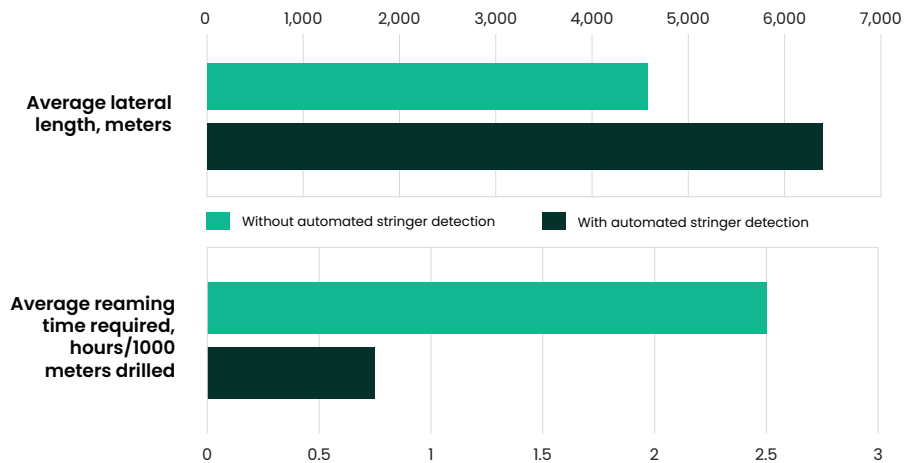
Ultimately, the automated stringer detection and mitigation service improved the operator's well-delivery efficiency by providing:

- Reliable, rapid detection of every stringer, every time
- Streamlined drilling operations with fewer rig days and delays
- Accurate well placement with fewer doglegs and faster ROP
- Industry-leading automated stringer detection and mitigation with 24/7 support from expert personnel

The operator was pleased with these results and is investigating other well applications that can benefit from the i-Trak service's reliable, efficient, and accurate stringer detection capabilities.



The i-Trak service was able to detect stringers more than 10 minutes faster than conventional methods.



The i-Trak service reduced reaming ILT by 63% and helped boost lateral length by an average of more than 1570 m (>5,150 ft).