



GAIA CABLE

PROTECTION SYSTEM

Prevent cable sticking and keyseating.



GAIA CABLE P R O T E C T I O N S Y S T E M

Maximising wireline performance: lower risk, less time & better data.

Gaia's Cable Protection System (**GCPS**) has four elements:

- Wire-pro tension modelling and sticking-risk package
- Global sticking database for benchmarking wells
- Wireline standoff and roller portfolio
- Experienced conveyance specialist, to lead job execution

GCPS enables safe and efficient wireline operations in tortuous, soft or depleted boreholes where the risk of cable sticking is mitigated through engineering evaluation.

GCPS offers compelling operational and financial benefits by avoiding the costs and NPT of stuck cable (fishing operations, pipe-conveyed logging, additional wireline runs and missing data & sample objectives).

GCPS enables the systematic evaluation of wireline conveyance risks and determines optimal well paths for lowest risk acquisition.

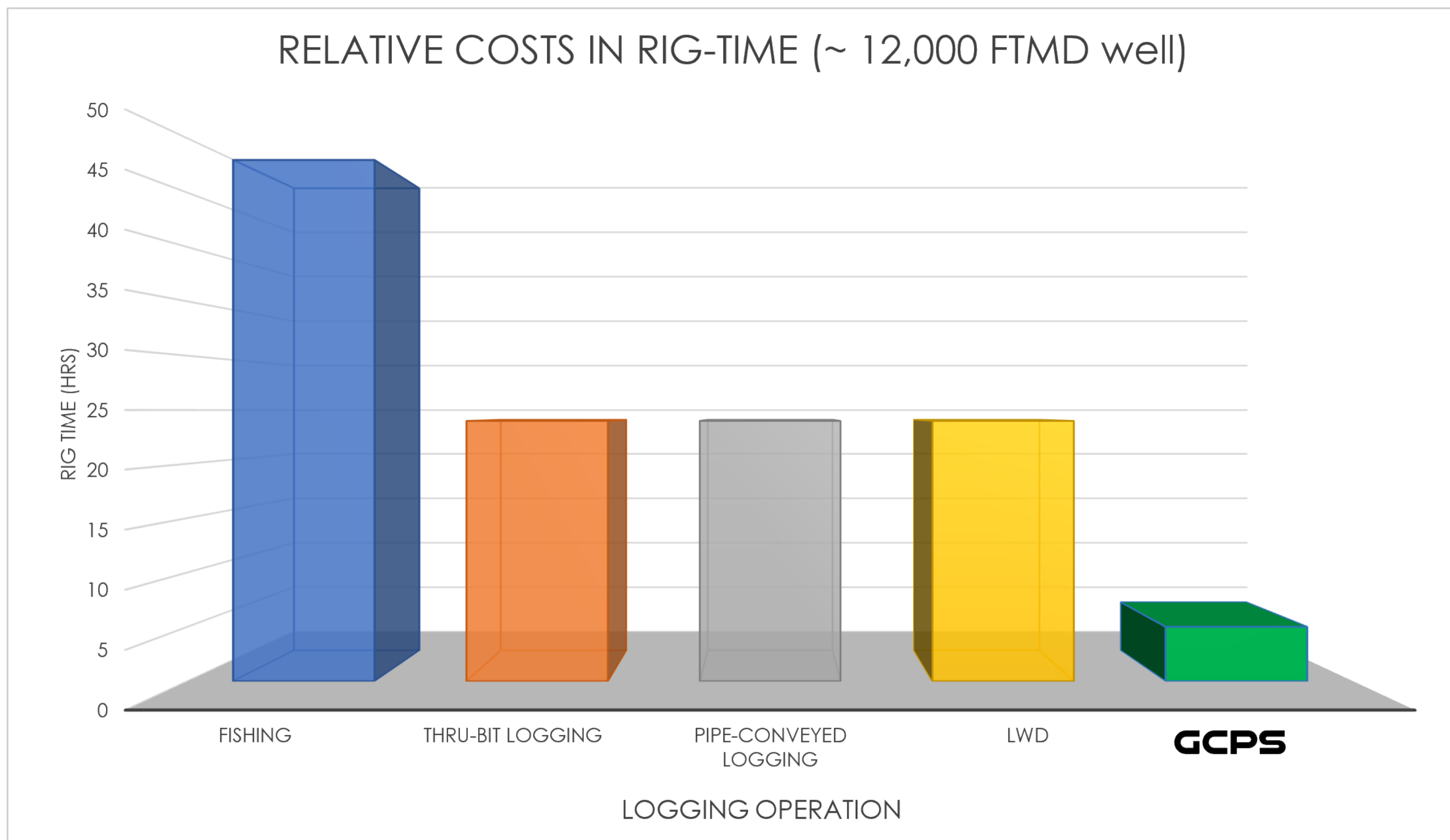
GCPS increases the effective cable rating in tortuous wells by reducing cased hole cable drag. Tension transmission and overpull capacity are improved, reducing sticking risks. Costly conveyance system upgrades may not be required.

GCPS utilizes cable dynamics and wellbore diagnostics data to drive the efficiency of formation tester surveys by “smart targeting” of thin or heterogeneous beds through statistical analysis of wireline creep.

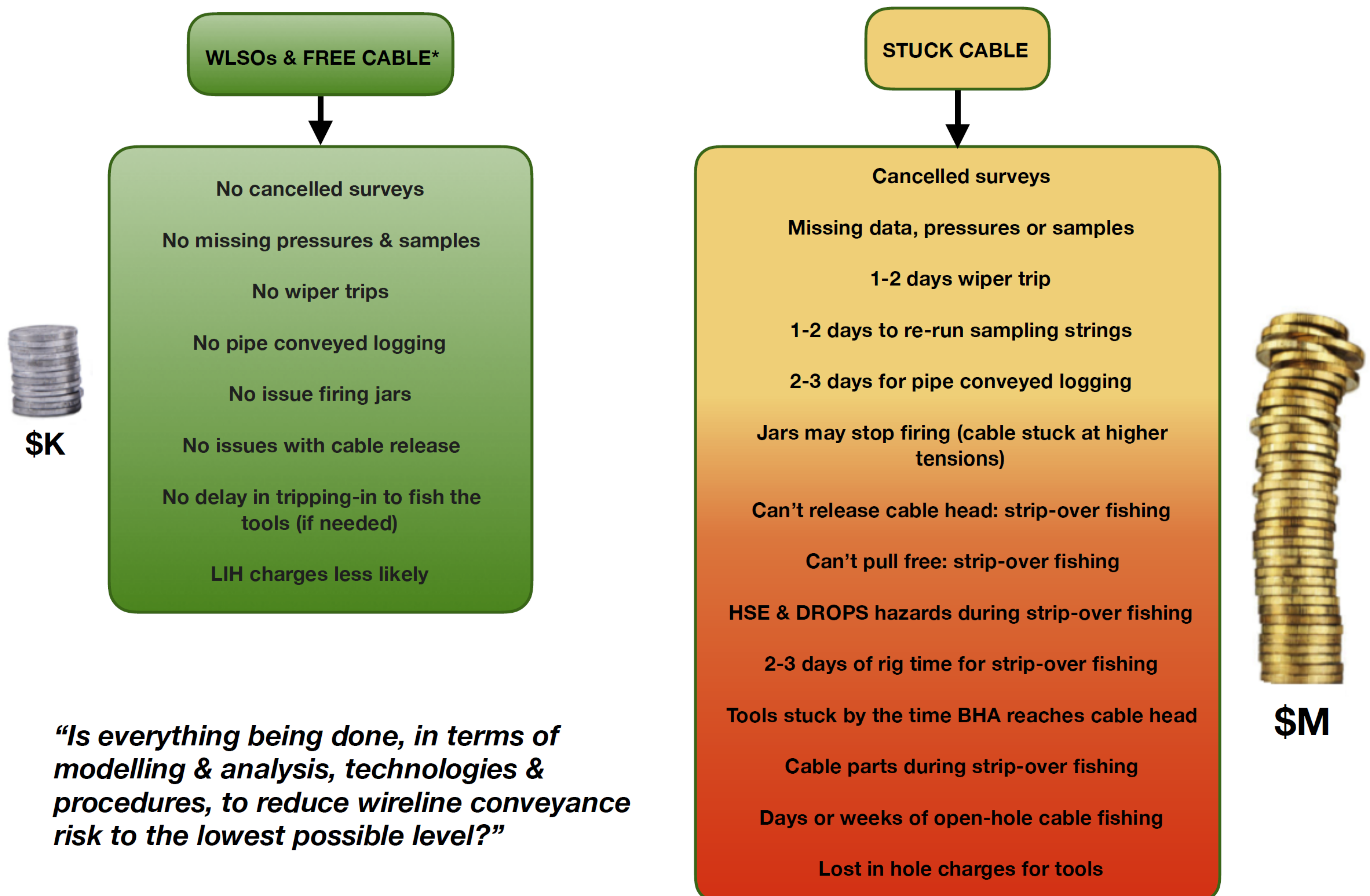
Prior to job commencement, Gaia will conduct an extensive wireline conveyance risk assessment, presenting advanced modelling results and benchmarks with a series of practical recommendations on techniques & technologies to ensure a safe and efficient logging operation.

Gaia Technologies

GCPS is a driver for cost-effective wireline acquisition. Relative costs on a typical well are displayed below:



The return on investment (ROI) of GCPS can range from 10:1 to 50:1 depending on well depth and risk profile, illustrated below:



WIRE-PRO

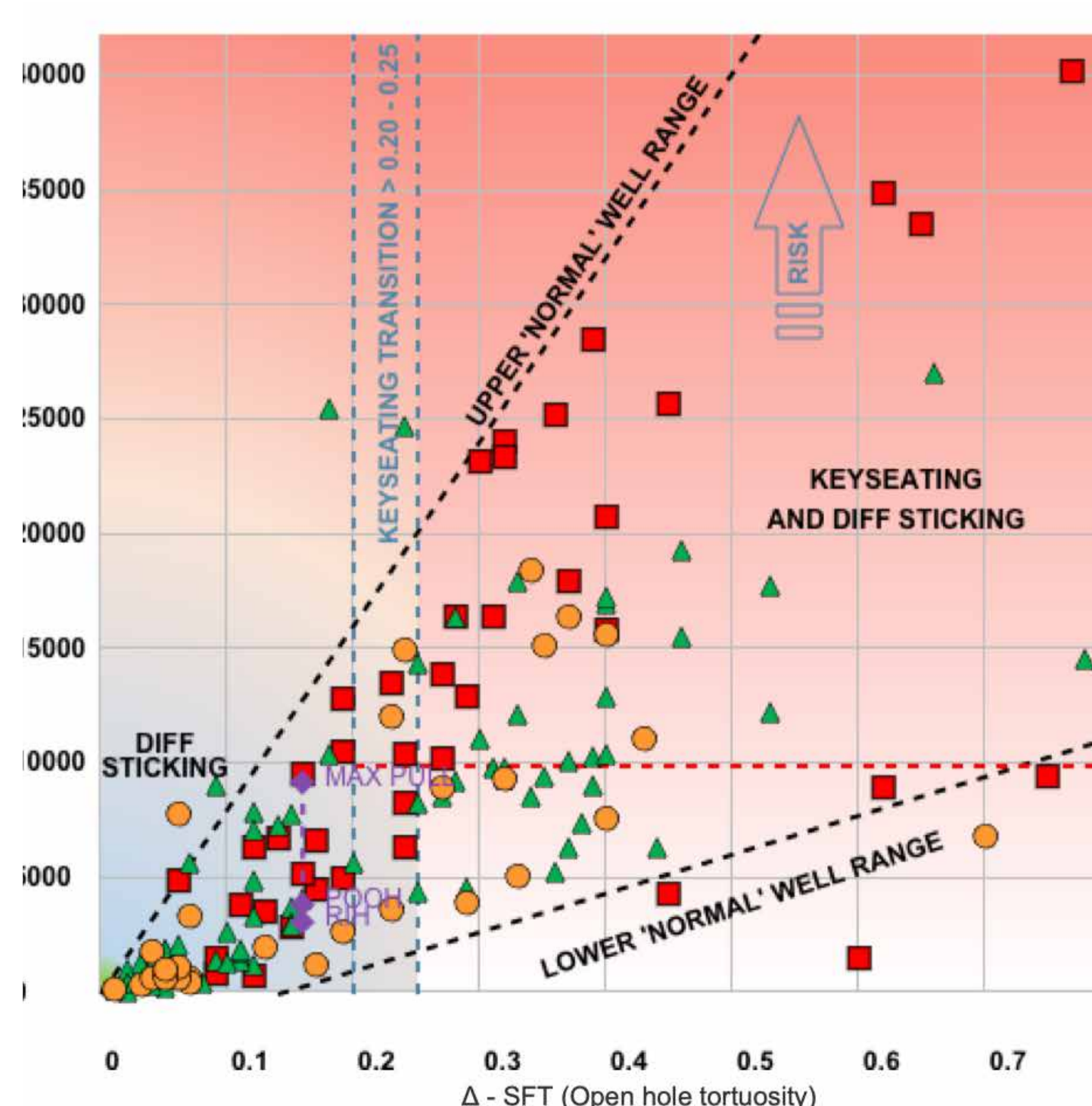
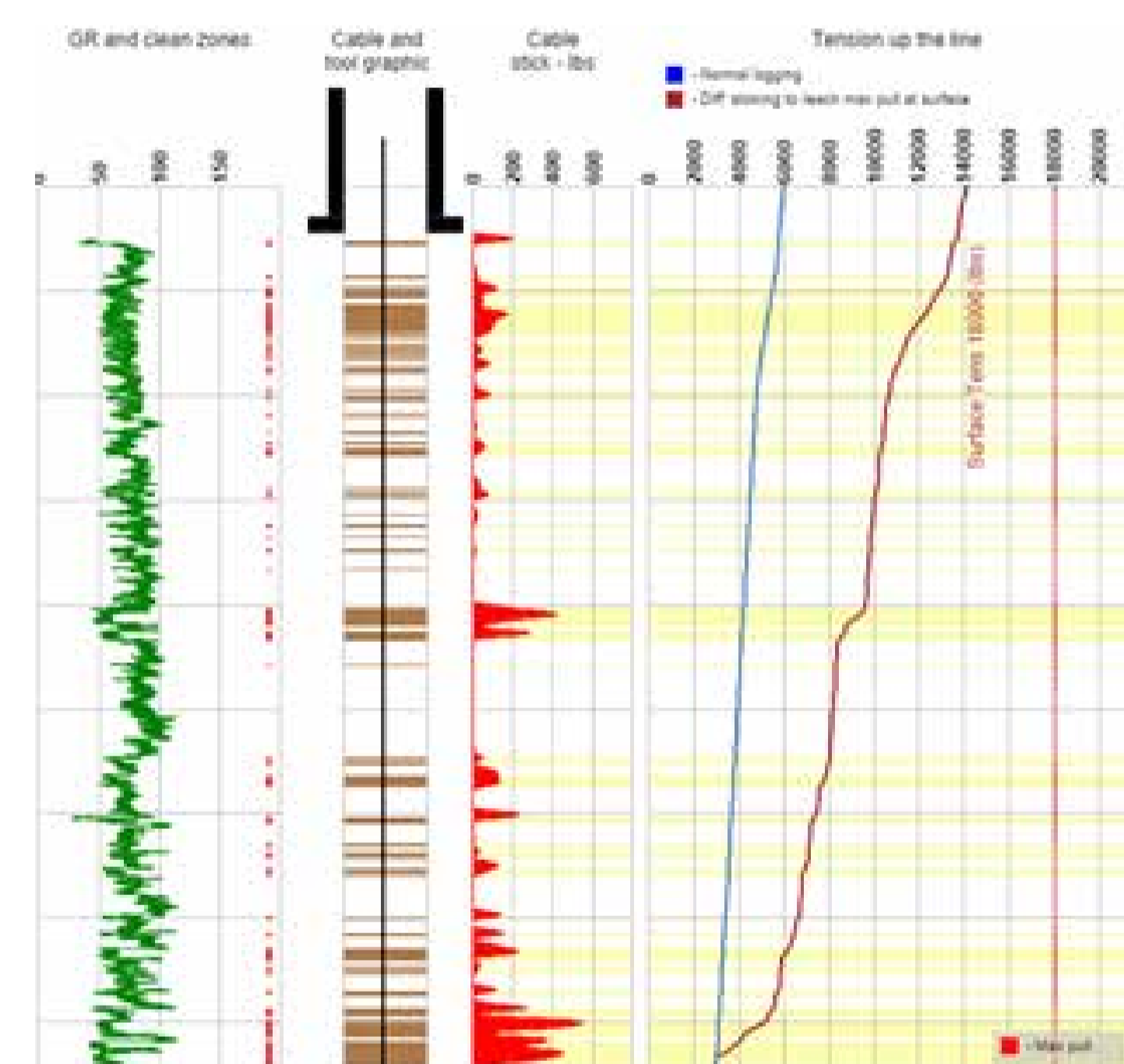
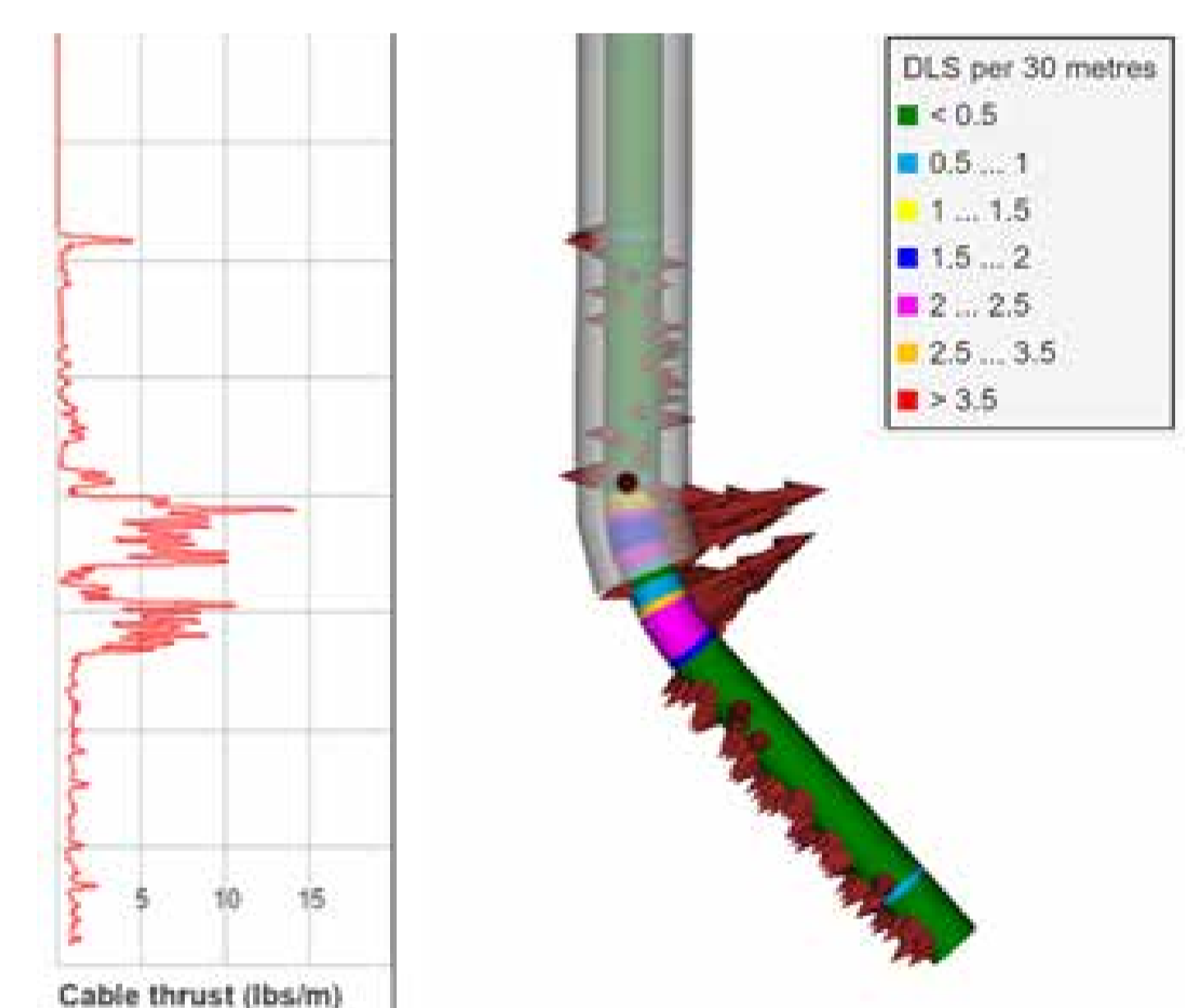
MODELLING AND BENCHMARKING

Wire-pro is Gaia's bespoke tension modelling package.

- Superior to other models on the market.
- Focused on open hole cable sticking and cable forces.
- Integration of petrophysical data and pore pressures.
- Deployment planning for Wireline Standoffs (WLSOs).
- Benchmarking of cable sticking risk via Gaia's global well database.

Wire-pro Modelling and Benchmarking

- A model is created using Wire-pro to calculate the cable thrust at different points in the well.
- Well parameters, petrophysical data and pore pressures can be incorporated to assess the risk of differential sticking.
- The Benchmark plot compares the operational risk with our local and global sticking databases, allowing the need for **Wireline Standoffs (WLSOs)** to be evaluated.



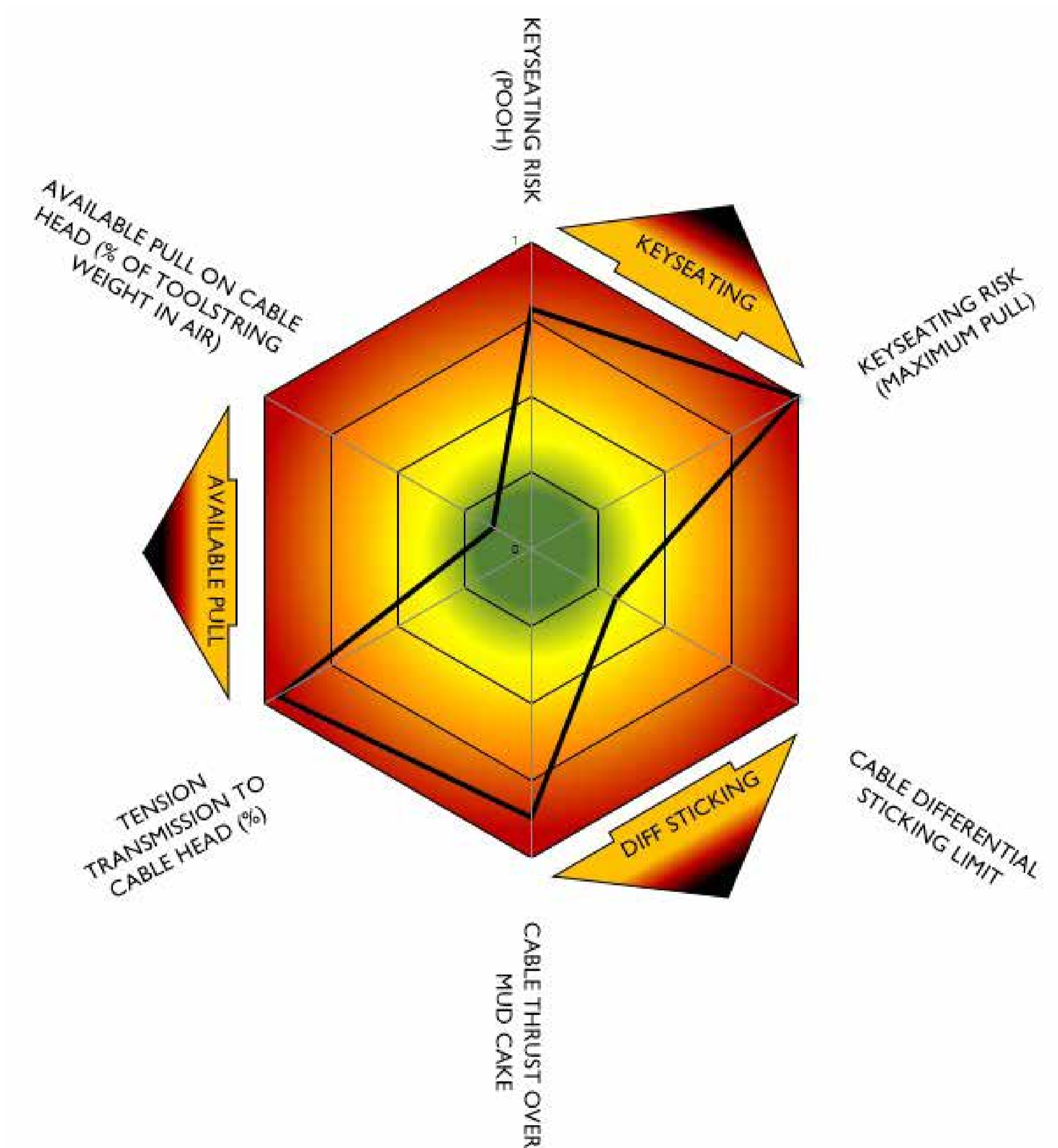
WIRE-PRO

MODELLING AND BENCHMARKING

Spider Plot

The Spider Plot summarizes the overall conveyance risk:

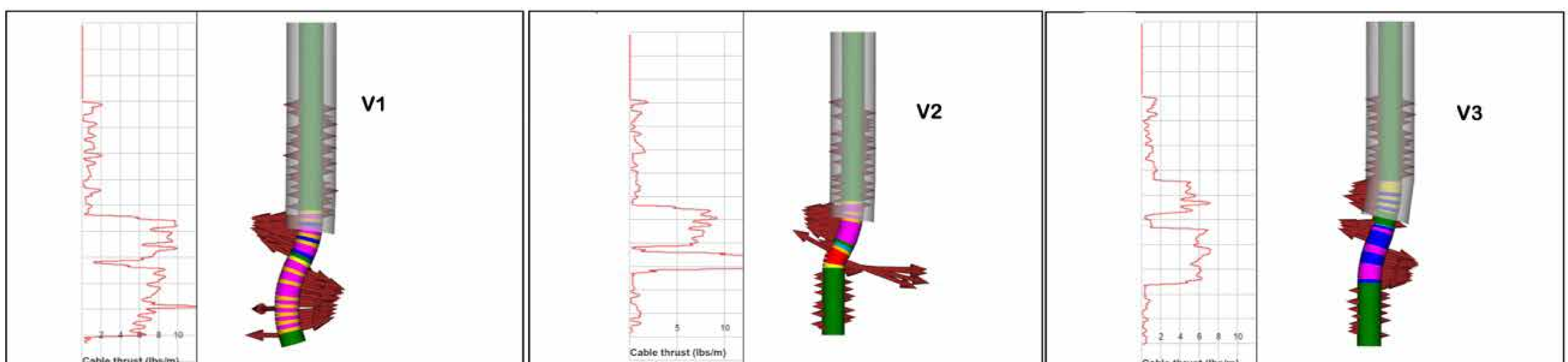
- Keyseating risk
- Differential sticking limit
- Cable thrust over mud cake
- Available pull at the cablehead
- Tension transmission to the cablehead



Well design for wireline

To de-risk wireline operations at the well design stage, Gaia works closely with drilling and subsurface teams. To determine the lowest risk option, alternate well paths may be evaluated and benchmarked.

In the example below, the v3 well path has ~50% less open hole tortuosity than v1 and presents a significantly lower risk for cable keyseating and differential sticking. Many cable fishing jobs can be avoided at the well design stage.

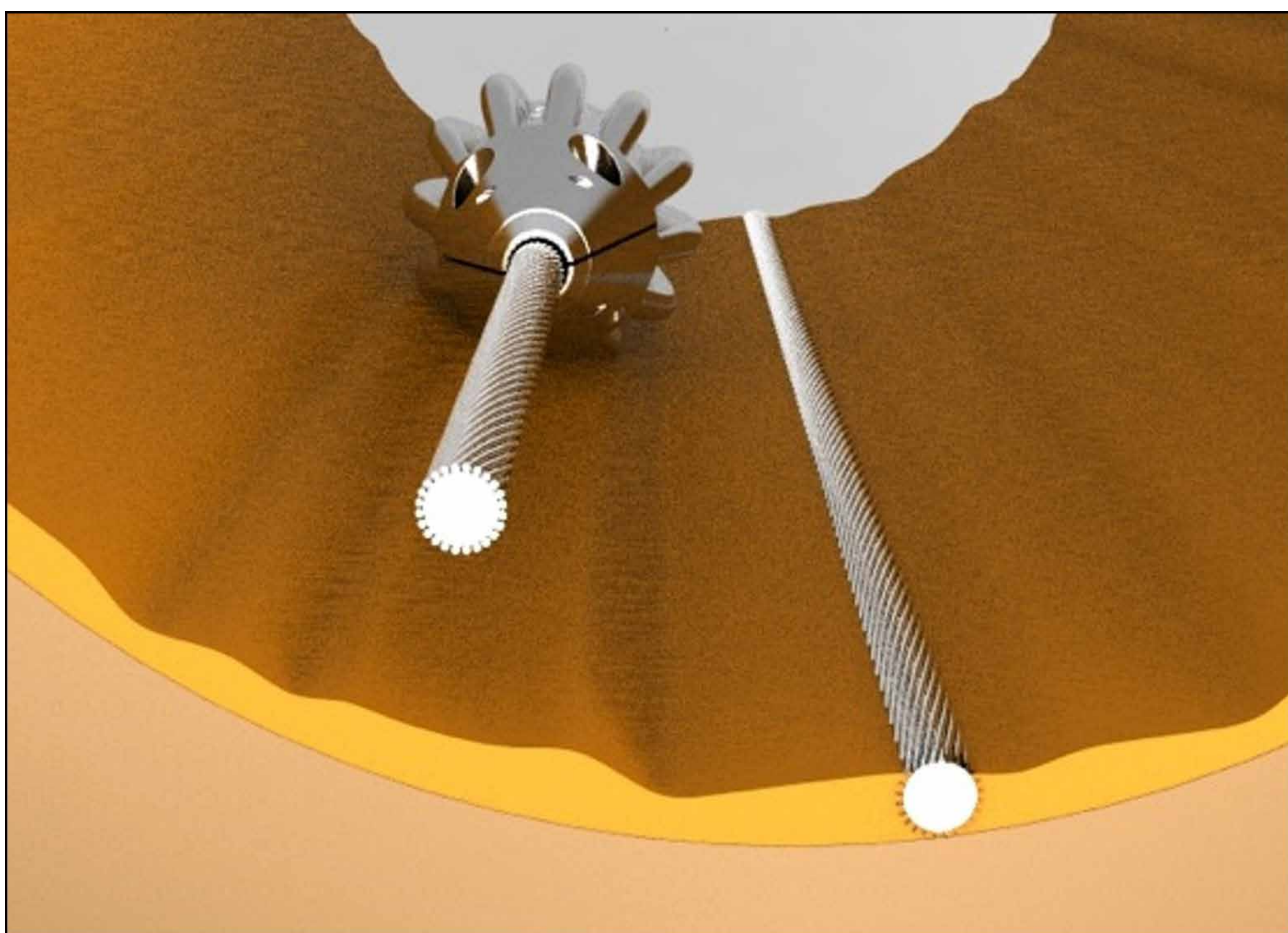


WIRELINER STANDOFFS

INTRODUCTION

Wireline Standoffs (WLSOs) are precision mechanical clamps that attach to the logging cable, to suspend the cable above mud cake, or above a cable slot, so it cannot get stuck.

WLSOs typically reduce cable contact with the borehole wall by **99%**.



WLSOs are usually deployed on around a quarter of modelled wells.

SPE papers available on OnePetro; links at www.gcps.tech:

174068: Using Wireline Standoffs (WLSOs) to mitigate cable sticking

193232: Wireline cable protection: Enabling fluid sampling in high-risk wellbores

Wireline Keyseating (PetroWiki article): https://petrowiki.spe.org/Wireline_keyseating

WIRELINER STANDOFFS

ARRAYS AND COMBINATIONS

Wireline Standoffs are deployed in arrays to cover the risk zones in the well. The average number deployed is 35, and the average space-out is 55ft.

Different types of wireline standoffs are available.

- **WLSO**: Wireline Open Hole Standoff. To prevent cable sticking.
- **WXSO**: Wireline X-ray Standoff. Incorporates a memory gauge for pressure, temperature and accelerometer readings.
- **WCRO**: Wireline Cased Hole Roller Standoff. To reduce drag and aid deployment, especially at high deviations.
- **WTSO**: Wireline Temperature Standoff. For recording maximum borehole temperature.

Wireline Standoff deployment plans are generated with Wire-pro.



WLSO

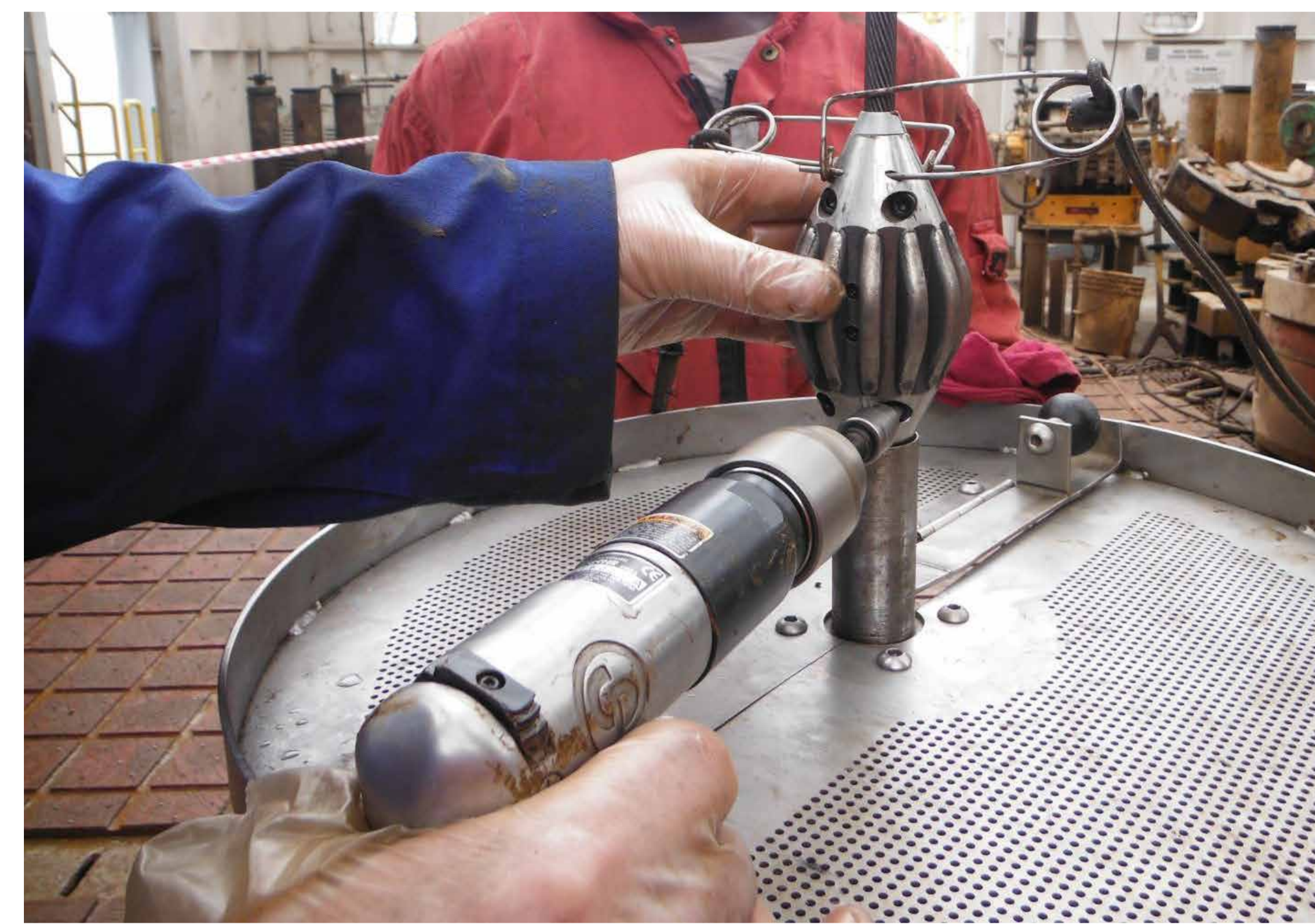
WIRELINER OPEN HOLE STANDOFF



WLSO

FACTS AND FIGURES

- WLSOs are typically deployed on around a quarter of modelled wells.
- **A WLSO takes only one minute to install**, with the Express Kit.
- WLSOs have been successfully deployed over 160 times to date.
- Proven track record: Over 6000 WLSOs have been run in hole, with no slippage or loss in hole.
- WLSOs fit all wireline cables. Precision cable inserts fit every logging cable in the industry.
- Different sizes are available to suit drill pipe internal diameter.
- WLSOs allow strip-over fishing. Procedures are well established.



WX50

WIRELINE X-RAY STANDOFF

- Continuous pressure and temperature log.
- Mud integrity log.
- Independent wireline jar firing and re-cocking record.
- Cable torque log for stranding risk analysis.
- Loss and influx zone identification.
- Wellbore transient analysis during clean-up and sampling.
- Cable creep analysis for formation testing depth control.
- Cased hole contact log for predicting wireline wear zones.

WXSO

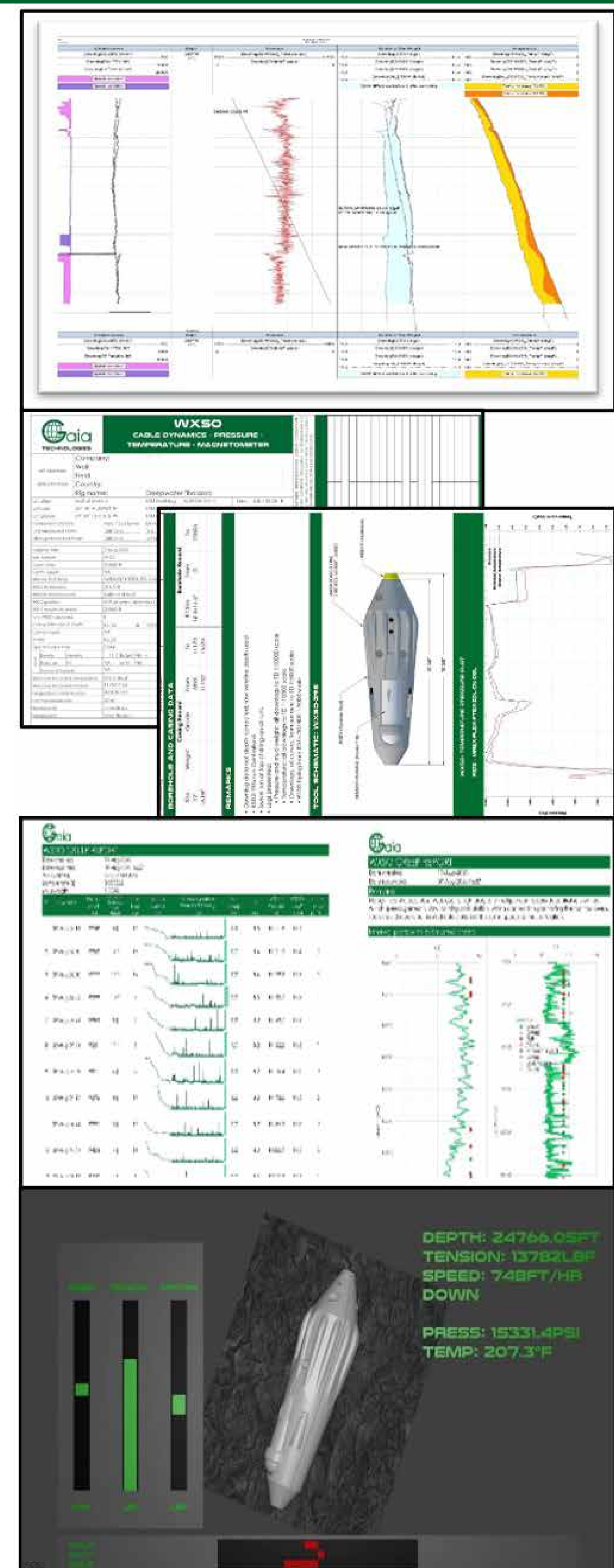
WIRELINE X-RAY STANDOFF

WXSO is the result of Gaia's ongoing R&D into wellbore and cable dynamics (drag, creep and torque) and future conveyance technologies. It can be considered a "black-box" for a logging run.

The WXSO features a memory gauge with pressure, temperature, accelerometer and magnetometer measurements, with a fast sample rate (32ms).

WXSO Products

- ✓ Mud density and thermal analysis, showing mud weight and temperature changes between runs.
- ✓ API Logs including pressure, temperature, mud weight, CCL, cable spin and cable contact with borehole/casing wall.
- ✓ Cable creep reports for station logs.
- ✓ CGI playbacks of events downhole (sticking, jar firing, etc).



Combat Wireline Casing Wear

WC50

WIRELINE CASED HOLE STANDOFF

- Reduce logging tensions
- Increase pull on cable head
- Improve tension transmission
- Increase effective cable rating

Minimize Cable Drag

WCRO

WIRELINER CASED HOLE ROLLER

- Aid wireline descent $>70^\circ$
- Extend tractor reach
- Reduce logging tensions
- Improve tension transmission
- Increase pull on cable head
- Increase effective cable rating

WT50

WIRELINE TEMPERATURE STANDOFF

- Measure maximum borehole temperature
- Open hole or cased hole
- 1 11/16" O.D. (suitable for pipe recovery operations)
- Rated to 204°C (400°F)

WIRELINER STANDOFFS

SUMMARY AND SPECIFICATIONS



	WLSO	WX50	WCSO	WCRO	WTSO
Cable keyseating mitigation	✓	✓			
Cable differential sticking mitigation	✓	✓			
Assist re-cocking of wireline jars	✓	✓			
Cable sticking sensor		✓			
Wellbore diagnostics and monitoring (P&T)		✓			
Cable dynamics and seasoning status		✓			
Image sticking events (tools and cable)		✓			
Smart targeting of formation testers and coring tools		✓			
Casing collar locator (CCL) log		✓			
Casing wear identification		✓			
Maximum borehole temperature reading		✓			✓
Casing wear mitigation			✓	✓	
Increase effective cable rating			✓	✓	
Additional overpull on logging tools			✓	✓	
High angle wireline deployments			✓	✓	
Extend tractor reach			✓	✓	
Log glass reinforced epoxy (GRE) liner			✓	✓	
Specifications					
Outer diameter (inches)	2.15-2.95	2.95	2.95	2.89	1.69
Temperature rating (°C °F)	200 392	150 302	177 350	177 350	204 400
Pressure rating (psi)	20,000	20,000	20,000	20,000	20,000

GCPS clients include:



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