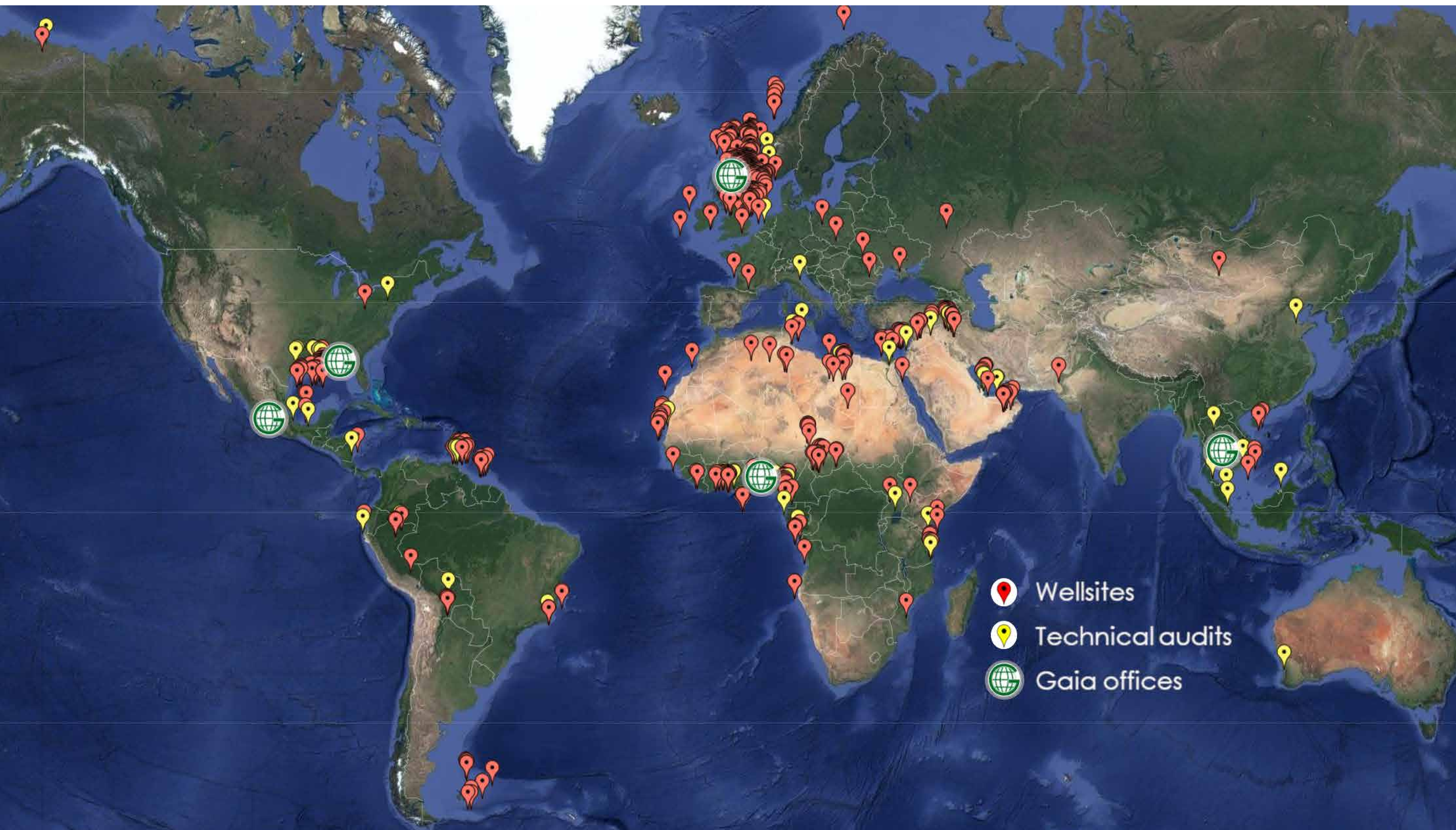




2022



Worldwide Operations and Experience



> 500 Years:

>20 consultants with an average of 25 years' operational experience each.

> 1500 QC operations performed:

Operations for more than 100 clients, with experience in deep water, HPHT and remote locations.

> 60 Countries:

A global presence: offices on four continents and operations on six.



Gaia Earth Group is an oil & gas consulting firm providing services on six continents.

We support safe and efficient formation evaluation operations and aim to reduce risk and cost for our clients.

Gaia Earth Group consists of two companies:

Gaia Earth Sciences

Founded in 2003.

Focusing on:

- **Wireline Logging QA/QC**
- **MWD & LWD QA/QC**
- **Petrophysical Services**

Gaia Earth Technologies

Founded in 2014.

Focusing on the

Gaia Cable Protection System (GCPS).

A unique system that enables safe wireline operations in tortuous or depleted boreholes.

Get the best of both worlds with **G²⁴**

Our **G²⁴** service

gives you two consultants, and full 24-hour cover for

Wireline Logging QA/QC and the **Gaia Cable Protection System (GCPS)**

giving the ultimate solution for challenging wells.



Full cycle QA/QC

QA/QC Processes:

Gaia's proven processes have been refined through years of experience and continuous improvement.

They provide a systematic approach to both Cost and QA/QC Cycles from project inception to completion.

These processes are designed to optimise vendor performance by targeting technical excellence and limits. This results in efficiencies throughout and a significant reduction in cost and risk.

Gaia has unparalleled experience working with a wide range of vendors from the "big three" to small independent service providers, in a variety of environments from deep water to remote jungle and desert.

Services:

TBE

Tenders, Bids & Evaluations

TA

Technical Auditing

TPP

Technical Planning & Preparation

WQC

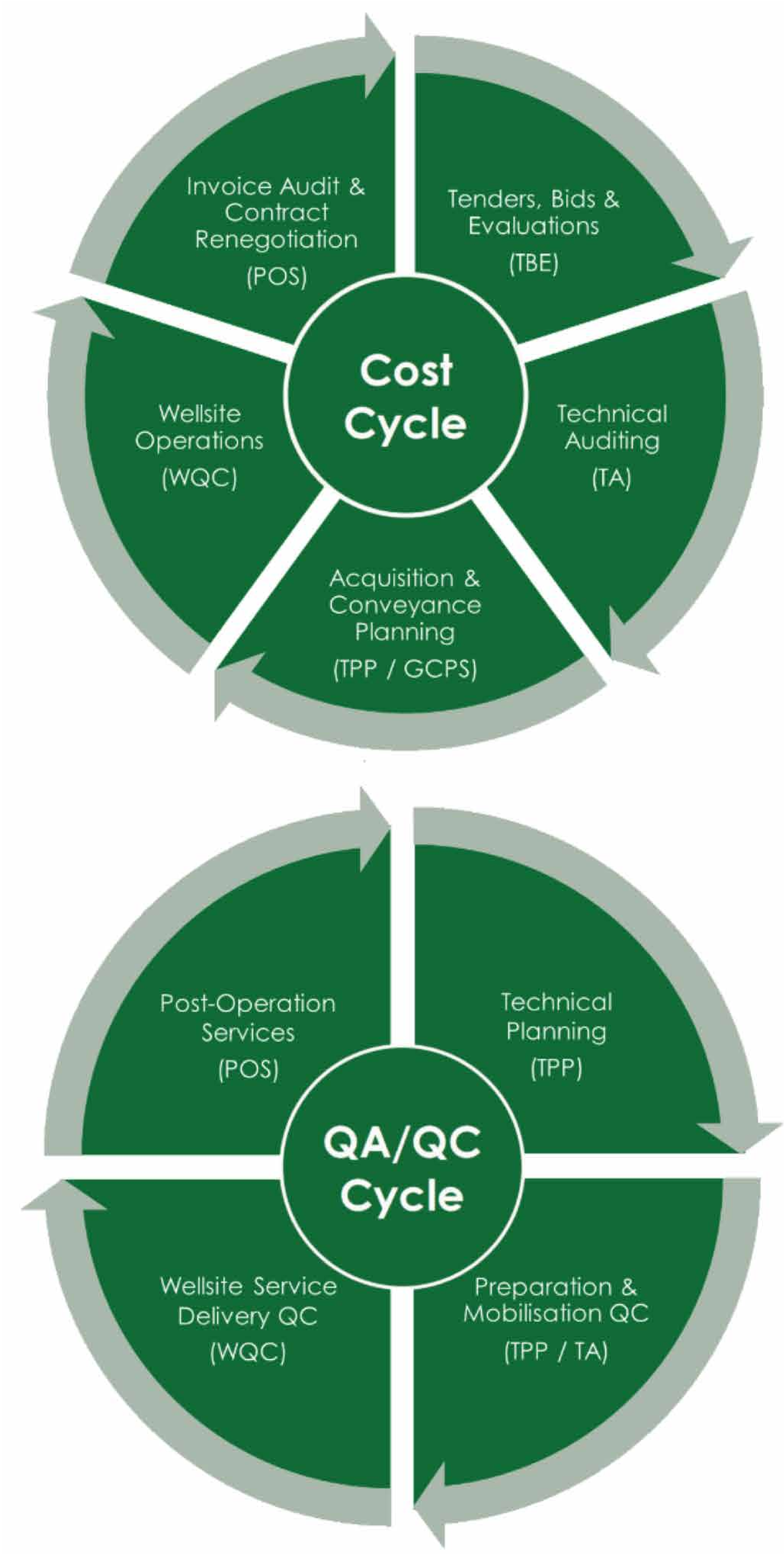
Wireline Service Delivery QC

POS

Post-Operations Services



Gaia Cycles





Wireline & LWD QA/QC

TBE

Tenders, Bids & Evaluations

A poorly designed contract can result in massive invisible losses throughout the duration of a project.

Gaia contract specialists have unique experience working in both technical and commercial positions with vendors. Their insights and approach will result in a well-designed contract, improved cost efficiencies, optimum contract value and minimal contract leakage for both Wireline and M/LWD.

Pre-qualification:

- Expression of Interest: Compile a list of potential bidders.
- Technical Questionnaire: Assess the technical suitability of potential bidders.
- Technical Audit (TA): Confirm suitability of potential bidders.

Invitation to Tender:

- Scope of Work: Define the technical requirements.
- Commercial: Define the pricing structure.
- Environment, Health & Safety (EHS): Assess EHS performance.

Tender Evaluation:

- Technical Evaluation: Evaluate technology proposed, organisational structure and personnel.
- Commercial Evaluation: Evaluate indicative well costs for each bid.
- Technical Audit (TA): Validate the bid.

Deliverables: Recommendation to Award (RTA).





Wireline & LWD QA/QC

TA Technical Auditing

Formation Evaluation may be the single most important objective of a project. A Technical Audit performed during tender pre-qualification is an invaluable tool to assess the vendor's ability to deliver a high-quality service which satisfies the scope of work.

A Technical Audit performed at tender validation stage provides assurance that vendor mobilisation plans are in line with agreed targets and expectations, and may provide advance warning that additional resources and vendor engagement are required to reduce project risk.

Once the audit objectives and scope are defined, the audit methodology is tailored to suit, ensuring a systematic approach to provide measured and detailed findings.

The audit focuses on 4 main areas:

- Personnel
- Equipment & Maintenance
- Logistics & Supply Chain
- Service Quality

Deliverables:

Detailed audit report & debrief, including any identified non-conformances, risks and suggested mitigations. This will ensure that appropriate actions are assigned to mitigate identified service delivery and operational risks.





Wireline & LWD QA/QC

TPP

Technical Planning & Preparation

A well-executed operation begins with a well planned and prepared operation, and our process is an integral part of the QA/QC cycle. Early involvement of Gaia consultants in the planning process will provide quality assurance and help deliver an acquisition strategy that prioritises clients' objectives, targets technical limits, and reduces operational risk.

Involvement during the equipment preparation phase, especially for critical well environments such as HPHT, will provide quality control and help to identify and correct deficiencies in resourcing and readiness, and ultimately reduce unwanted exposure.

Acquisition Planning:

- Data acquisition programme design that ensures the well objectives and subsurface group data requirements are met.
- Optimised run combinations that target technical limits and reduce risk.
- Advanced tension modelling and conveyance strategy (Wire-pro and GCPS).

Log Well on Paper (LWOP):

- Review the programme to ensure well objectives will be met and that priorities are understood by all parties.
- Review the operating procedures and strategies to identify risks or opportunities.
- Identify, review and plan failure contingencies in order to mitigate risk.
- Review and incorporate lessons learned from previous operations.
- Define and review data acquisition parameters and deliverables to ensure quality and consistency.

Equipment Loadout Inspection:

- Review equipment list ensuring compliance with the acquisition programme.
- In-depth review of maintenance, modification status and past failures.
- Quality control of System Integration Testing (SIT).

Deliverables:

- Data acquisition programme.
- Wire-pro report.
- Detailed TPP report.



Wireline & LWD QA/QC

WQC**Wireline Service Delivery QC**

Gaia consultants bring invaluable leadership, knowledge and expertise to your wellsite. Our aim is to fully support all aspects of your formation evaluation operation, to deliver safe and flawless execution, providing high quality data assurance with minimal operational risk.

Supervise and optimise job preparation:

- Confirm delivery of all equipment.
- Review safety documentation.
- Witness wellsite System Integration Testing.
- Communicate the data acquisition programme & identify risks.
- Several Gaia consultants are trained Marine Mammal Observers (MMOs).

Execution of Operations:

- Ensure safe and efficient execution of operations according to programme.
- Critical path time management.
- Real-time reporting & liaison with client operations team and logging personnel.
- Review of data quality.
- Capturing Service Delivery Issues (SDIs).
- Real-time tension modelling using Gaia's Wire-pro software.

Post Operations:

- Ensure timely demobilisation, minimising rental costs.
- Reporting of SDIs to allow proper follow-up and failure investigation.
- After-action review; capture lessons learned.
- Quality control of data deliverables.
- Review service ticket.

Deliverables:

- Comprehensive WQC report including KPIs.
- Daily report / Time breakdown.
- Service-specific reports (formation pressure testing, sampling, coring, seismic, etc.)
- Wire-pro tension & conveyance model report.
- SDI reports where applicable.





Wireline & LWD QA/QC

POS

Post-Operations Services

Gaia consultants have unique skills and experience which can offer valuable insights post-operation resulting in cost savings even when not directly involved in a client's Wireline or M/LWD operations.

Invoice Audit:

Service tickets and invoices for formation evaluation services may be complex, may not comply with contractual compensation schemes and are often inaccurate. Auditing of invoices by Gaia consultants will identify any inaccuracies and can result in significant cost savings.

Failure Investigation:

An audit to scrutinise the vendor follow-up and investigation in case of equipment or service failure will ensure an open and transparent investigation that correctly identifies root causes, effective preventative actions and documents lessons learned, significantly minimising the risk of similar repeat failures and additional costs.

Where a failure is attributed to well conditions, and the client is liable for repair costs, these may be very significant charges, and the audit can confirm that any costs for repair or replacement are reasonable, warranted and comply with contractual obligations.



Wireline & LWD QA/QC

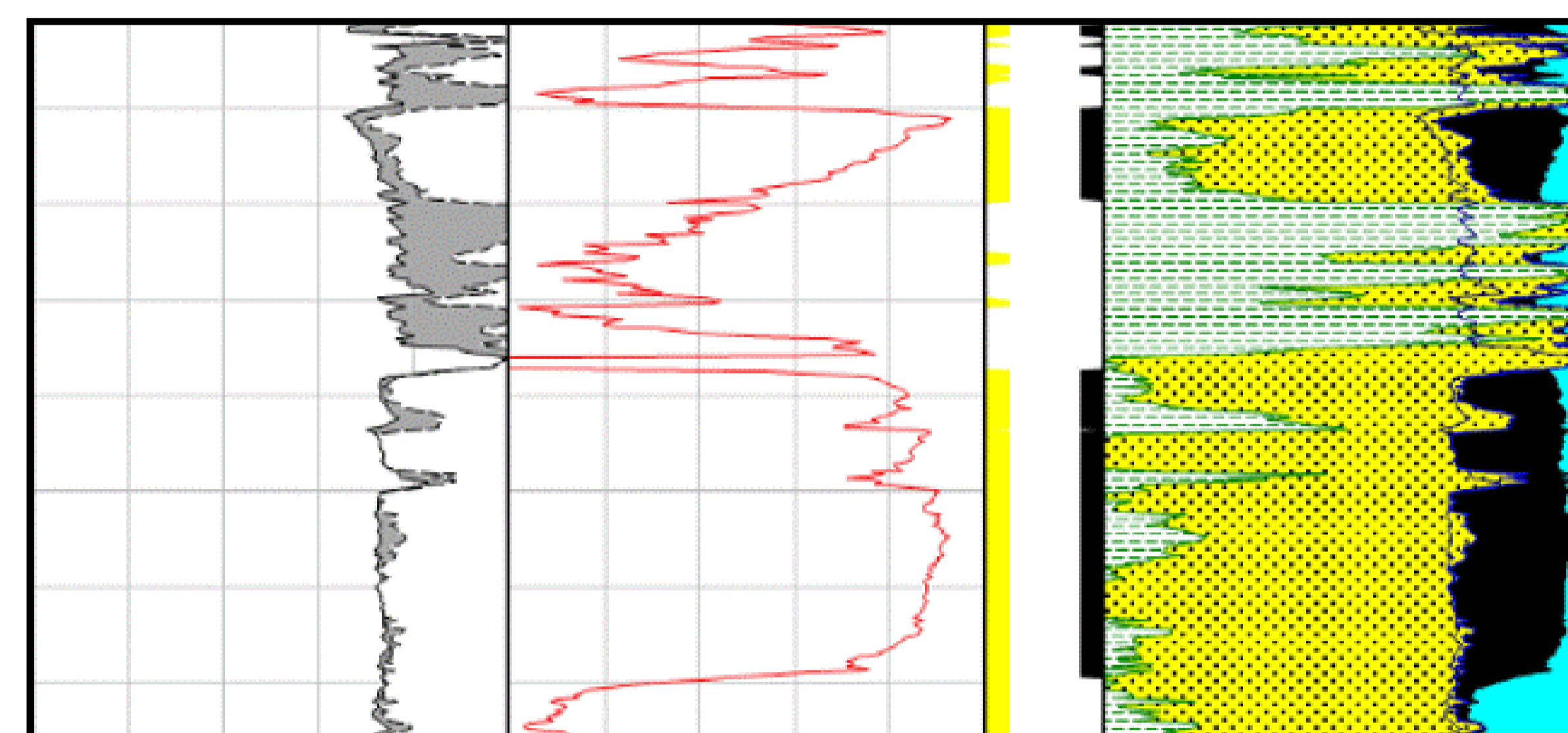
PET

Petrophysical Services

Gaia Earth petrophysicists have a wide range of experience in all formation environments providing expert data assurance and petrophysical analysis of Wireline or LWD data. For log analysis Gaia Earth uses “best in class” software.

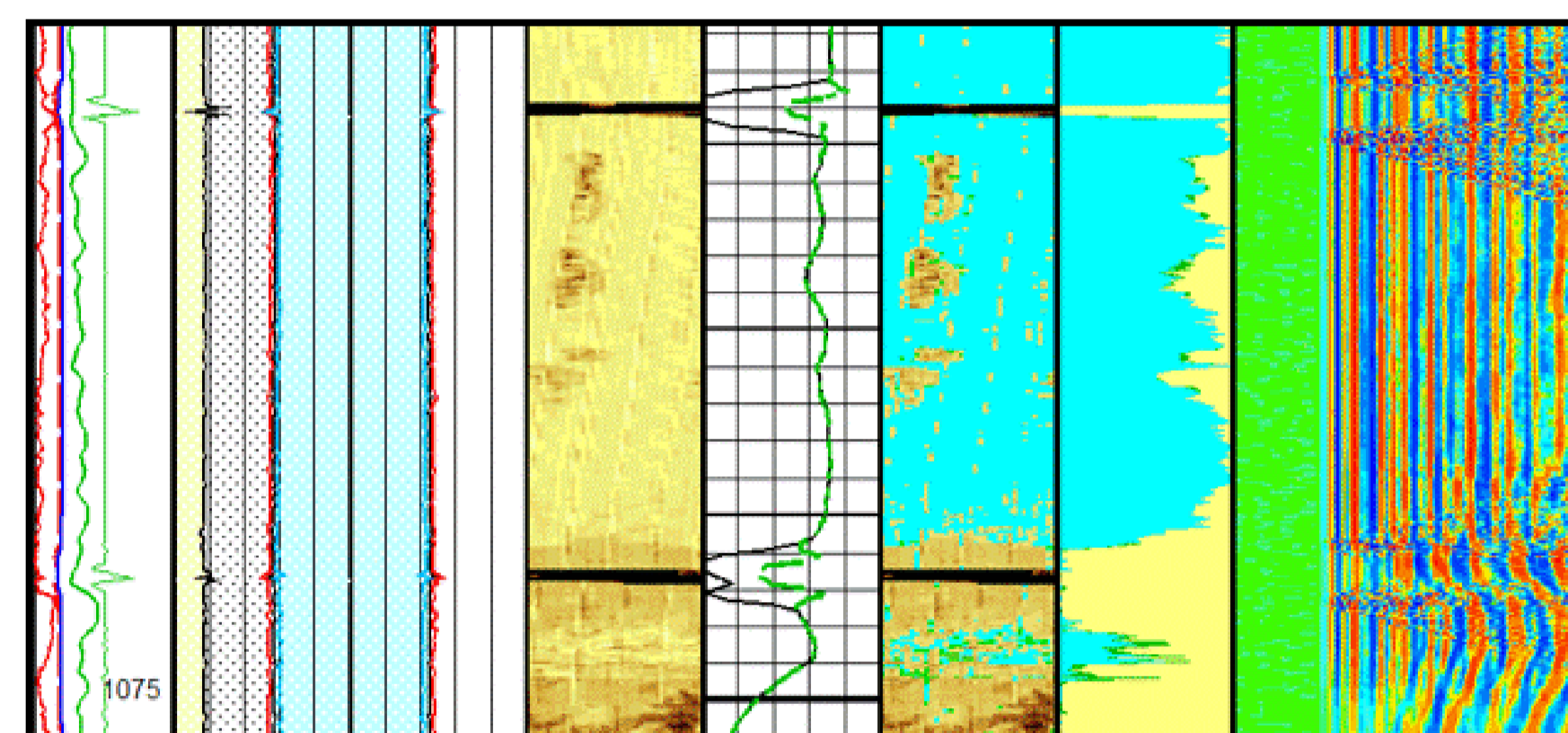
Petrophysical Interpretation & Log Quality Control

- Expert log analysis and advanced interpretation using industry standard software (Interactive Petrophysics)
- Analysis and interpretation studies from basic volumetrics to full field studies.
- Analysis and input for real-time decision making.
- Wellsite and remote real-time log quality control.
- Quality control of final data package.
- Legacy data analysis, review and re-interpretation.



Cased Hole Evaluation & Abandonment Petrophysics

- Ensure compliance with national guidelines for abandonment of wells using a combined analysis of all legacy data including well logs and operational reports.
- Support and interpretation of all cased hole measurements including cement and casing evaluation throughout the life cycle of a well.
- Interpretation and evaluation of production logs.



Training & E-learning

- Online or in-house petrophysical and formation evaluation training for drilling, geology, petroleum engineering and other related personnel.
- Wireline and M/LWD technology and operational planning.
- Advanced wireline conveyance technologies, planning and risk analysis.
- Pipe recovery technologies and techniques.





Software & Support

A key element of Gaia's approach to QA/QC is promoting collaboration and innovation within the company.

Gaia Earth Group has developed online support systems and tools, which enable Gaia Consultants to share knowledge and learnings, gained across the globe, with their colleagues.

Internal Support

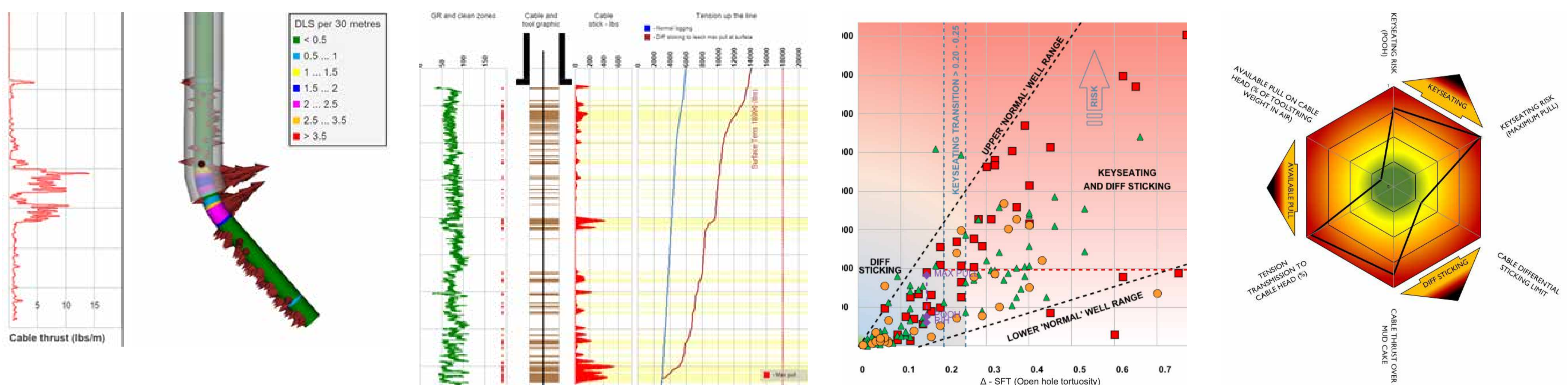
Our secure knowledge & management platform is a database that allows Gaia Consultants to access the wealth of knowledge, years of experience and previous operations accumulated by the whole Gaia team. The forum is complimented by formal internal training sessions and seminars.

QA Documentation

Gaia has authored an ever growing service-specific QA/QC set of documentation, that capture lessons learned and highlights areas of technical focus.

Wire-pro

Gaia's proprietary conveyance and tension modelling package that delivers advanced wireline conveyance and sticking risk assessments linked to a global database. See page 16 for more information.



Real-time updates

From project start to finish, Gaia ensures that the client has access to continually updated progress reports on programme design, equipment status, operations and logistics, which are essential for forward and contingency planning.



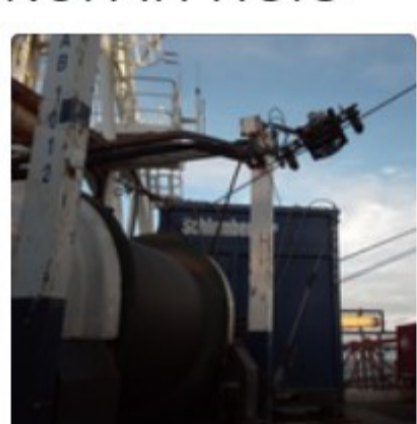
G-Portal

The new cloud-based **G-Portal** (Gaia Client Portal) allows you to follow a live job in real time.

- View time breakdowns, as they are updated
- Lost time items are clearly highlighted
- View and download run summaries and tool diagrams
- Download information in PDF or Excel format
- File browser, to access data such as Wire-pro models or formation test data
- Chat with your Gaia consultant
- View pictures and diagrams in time breakdown and chat
- View Service Delivery Issues (SDIs)
- Secure site; multiple users can be added, each with a unique login

Gaia Client Portal

ADTI - UNDEFINED - Time at wellsite: 19:48:40 10-Feb-2021 (+0000)

Time breakdown			Run summary			File browser		
Note: Times are subject to correction								
Time	Run	Description	Run	Toolstring	Status	#	Type	Description
29 Nov 2020, Sun			1.1	Quad-combo	Completed	1	Pre-job well information	Description of file.
11:30	1.1	Lift equipment to rig floor	1.2	Sonic-Imaging	Completed	2	Formation Testing	Formation Testing Spreadsheet
12:00	1.1	Rig up	1.3	Formation testing/12 tanks	Incomplete	3	Tension modelling	Wire-pro / Wire-pro model
13:00	1.1	Run in hole 	1.3T2	Formation testing/12 tanks	In progress			
			1.3T3	Formation testing/12 tanks	Planned			
			1.4	Rotary Coring	Planned			
14:00	1.1	Standby for work in derrick.						
15:00	1.1	Tool failure; troubleshoot						
15:15	1.1	Rig down						
16:00	1.2	Rig up						
17:00	1.2	Run in hole						
18:30	1.2	Main log						
20:00	1.2	POOH						
21:30	1.2	Rig down						
22:30	1.3	Run 3: Rig up						
23:30	1.3	RIH						

Service delivery issues (SDIs)			
#	Run	Description of issue	LT
1	1.1	Description of Issue.	00:00
2	1.4	Tool failed at casing shoe	08:00

G-Portal Dashboard Screen



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
- **Benchmarking** wells with a global sticking database
- **Wireline standoff** and roller portfolio
- **Experienced conveyance specialist** at the well site, 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 improves the efficiency of formation tester surveys by utilizing cable dynamics and wellbore diagnostics data for “smart targeting” of thin or heterogeneous beds through statistical analysis of wireline creep.

Through **GCPS**, our clients have achieved to date:

96% success in eliminating initial signs of cable sticking.

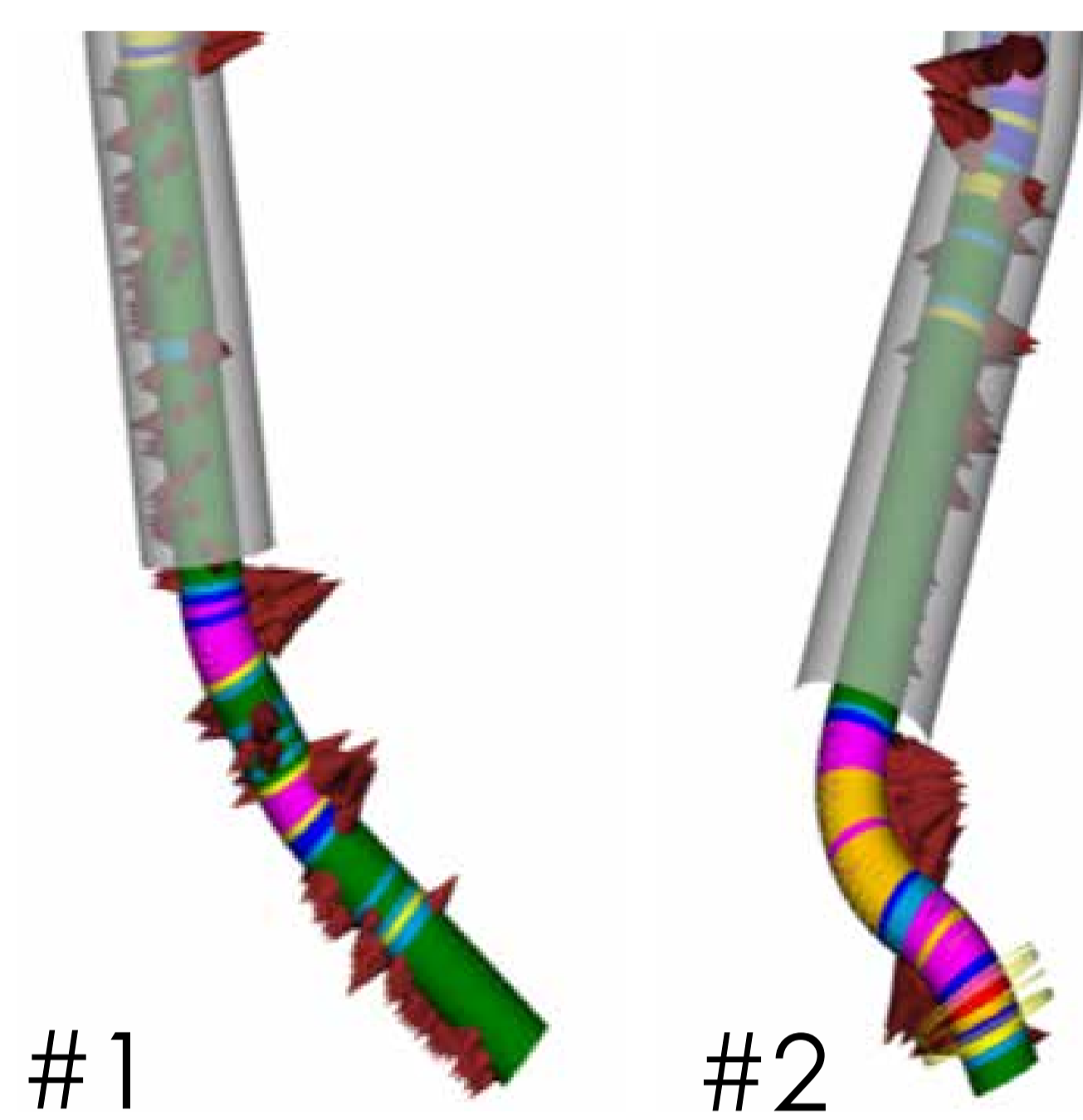
98% success in avoiding fishing due to stuck cable.



GAIA CABLE PROTECTION SYSTEM

The return on investment (ROI) of GCPS can range from 8:1 to 50:1 depending on well depth and risk profile, illustrated in the examples below:

Deepwater campaign, Gulf of Mexico



Well 1: 4 serious cable sticking events with pull to 29,000 lbs.

Well 2: GCPS was used instead of pipe-conveyed logging.

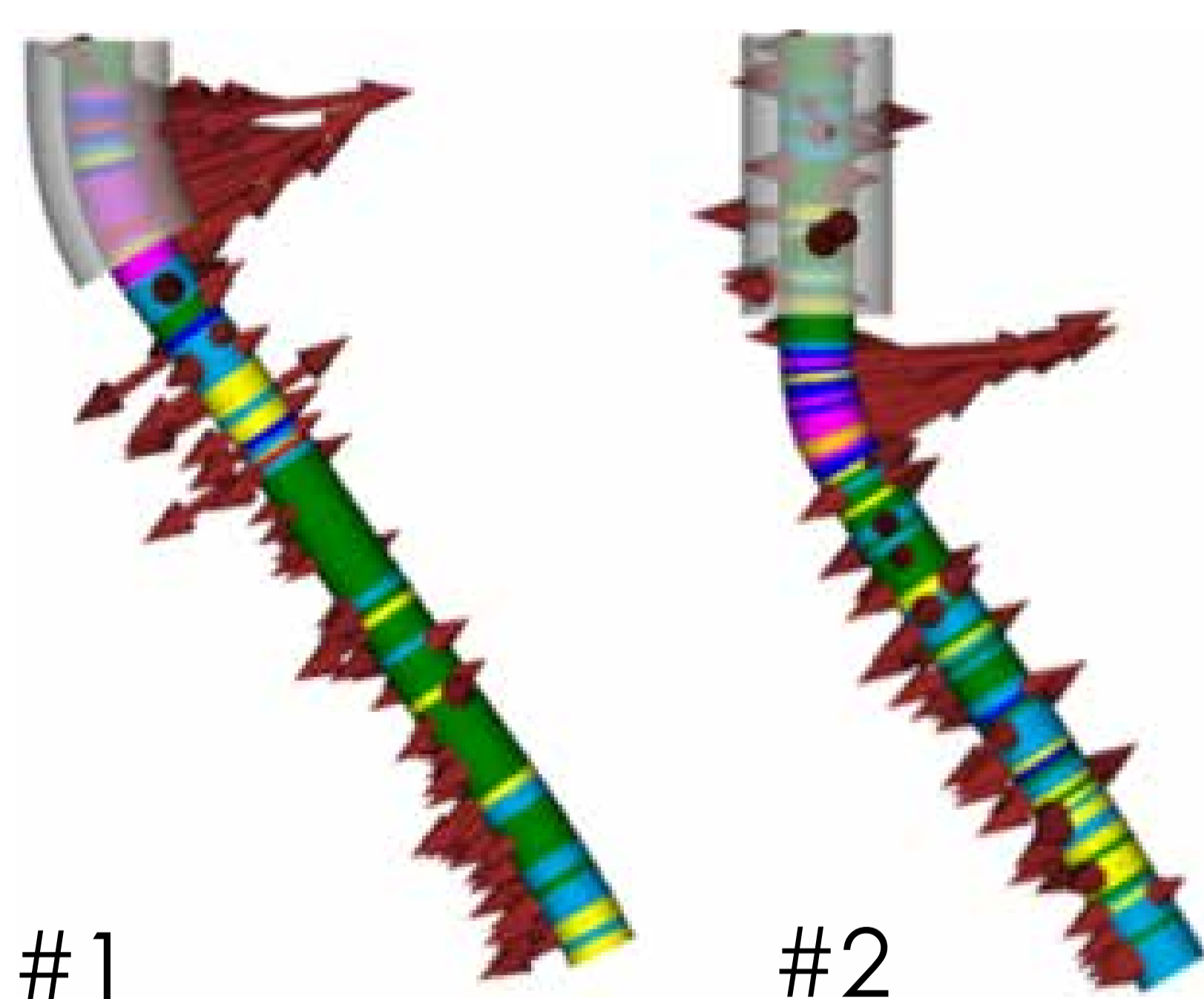
- Successful operation, 2 runs performed.
- No sticking seen.
- Over 4 days of rig time saved (\$1M).
- Lower risk and better data.

GCPS ROI 8:1

Protect against the worst-case scenario. If wireline cable is stuck, the wireline tools cannot be free-fished and the cable must be freed using cut-and-thread operations. If the cable breaks during cut-and-thread, it must then be fished using spears which can take weeks on a deepwater well, costing millions of dollars in NPT.

GCPS prevents the cable becoming stuck in the first place.

Land campaign, East Africa



Well 1: Stuck with cable and fished.

- 36 hours NPT.
- Total NPT cost estimated at US\$3.5M.

Well 2: GCPS was used (30 Wireline Standoffs run)

- Successful operation.
- No need for pipe-conveyed or thru-bit logging.
- Lower risk and better data.

GCPS ROI 28:1

GCPS was used on further wells in the campaign, with **\$500k USD saved per well.**



WIRE-PRO

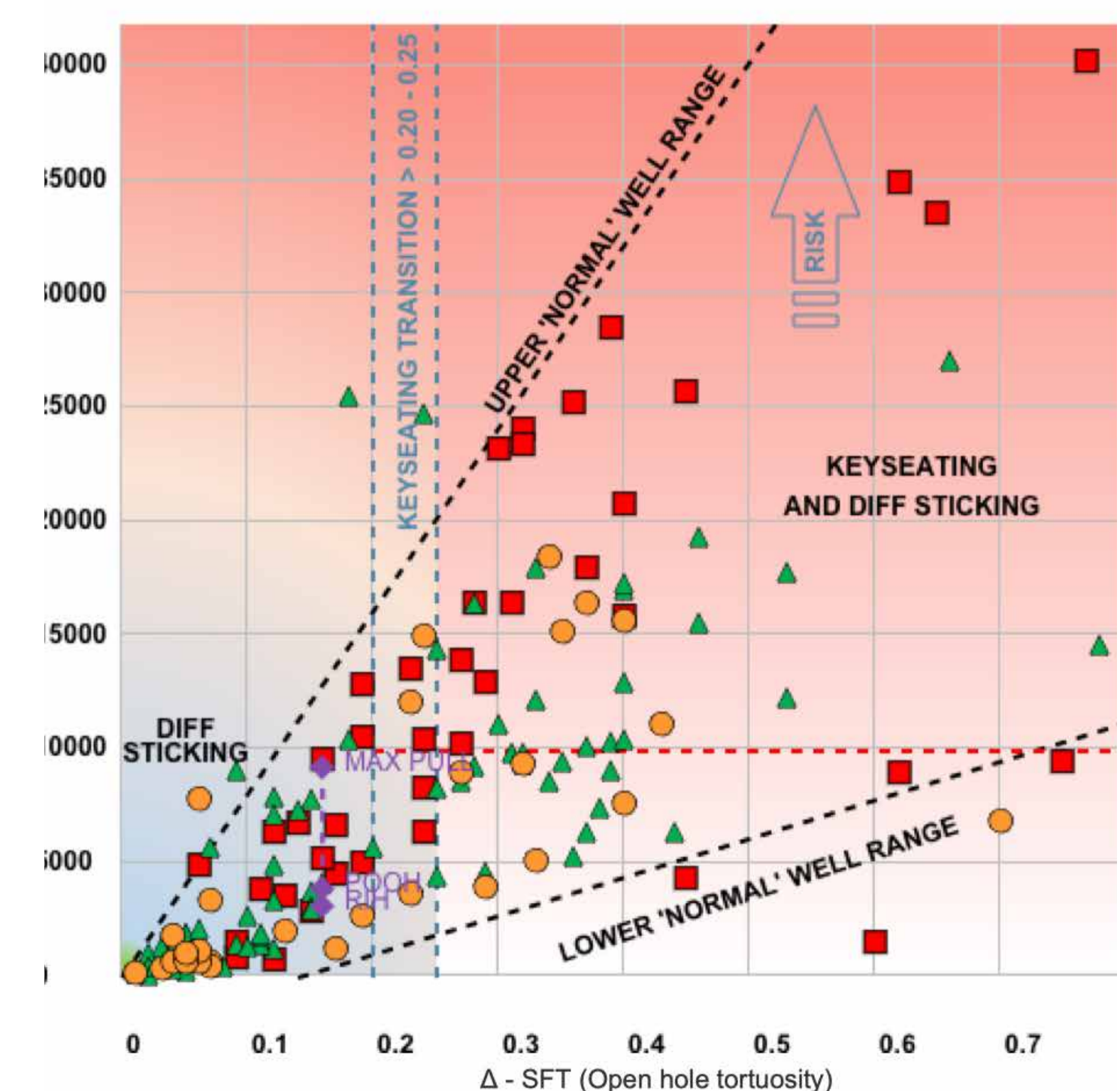
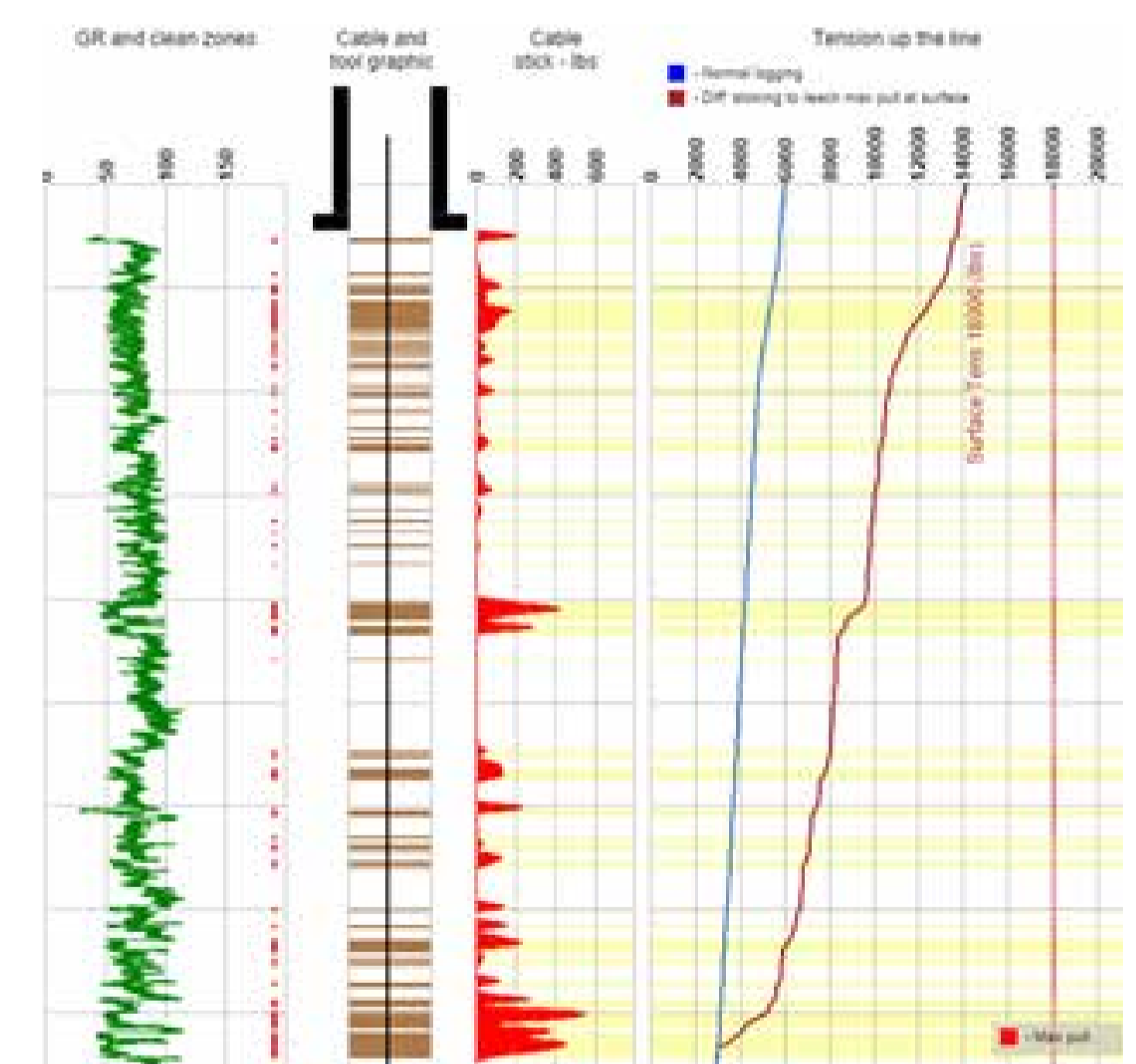
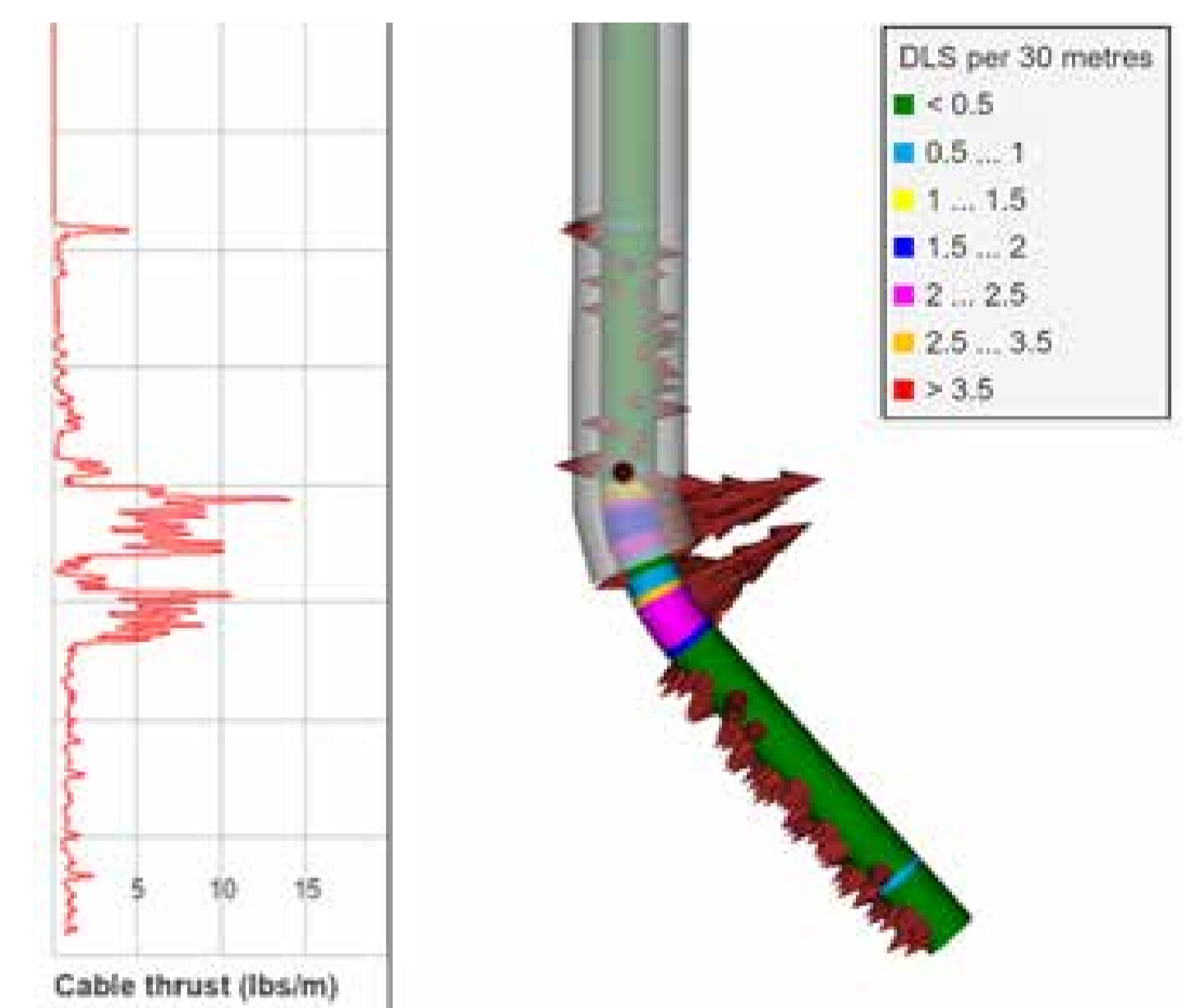
MODELLING AND BENCHMARKING

Wire-pro is Gaia's proprietary 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 are 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.



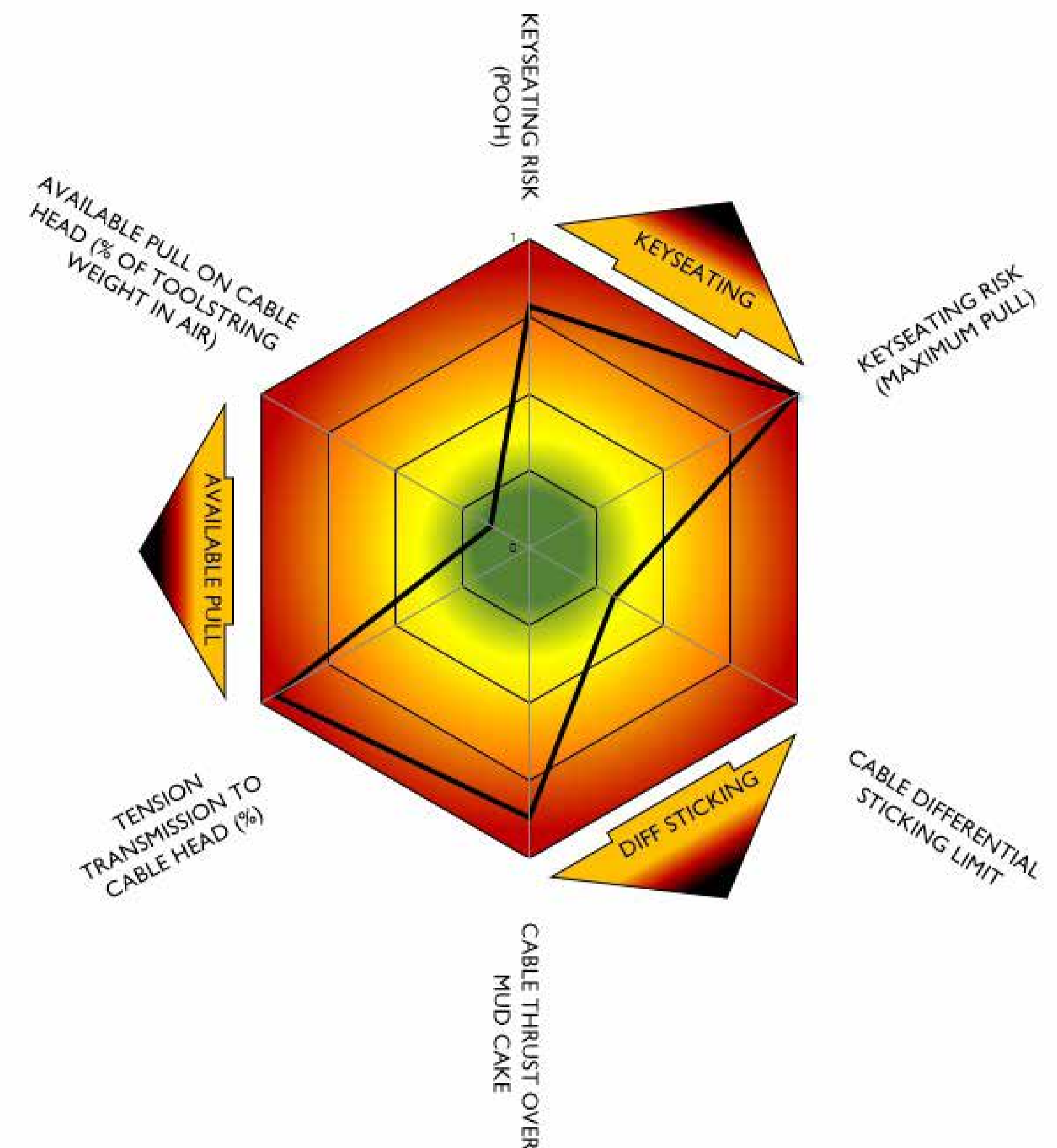
WIRE-PRO

MODELLING AND BENCHMARKING

Spider Plot

The Spider Plot summarizes the overall conveyance risk:

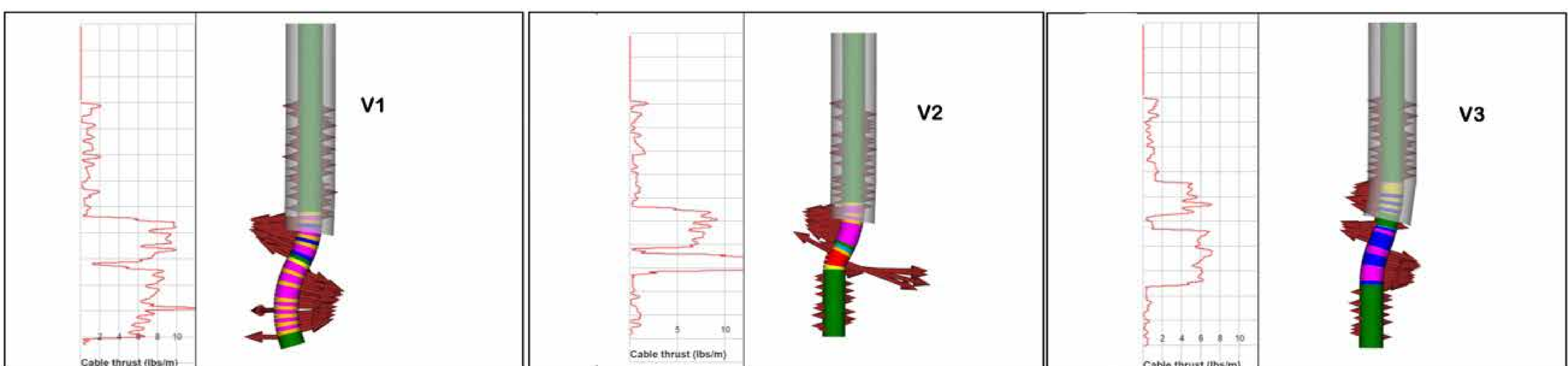
- Keyseating risk
- Differential sticking limit
- Cable thrust over mud cake
- Available pull at the cablehead
- Tension transmission to the cablehead



Well design for wireline

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

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.



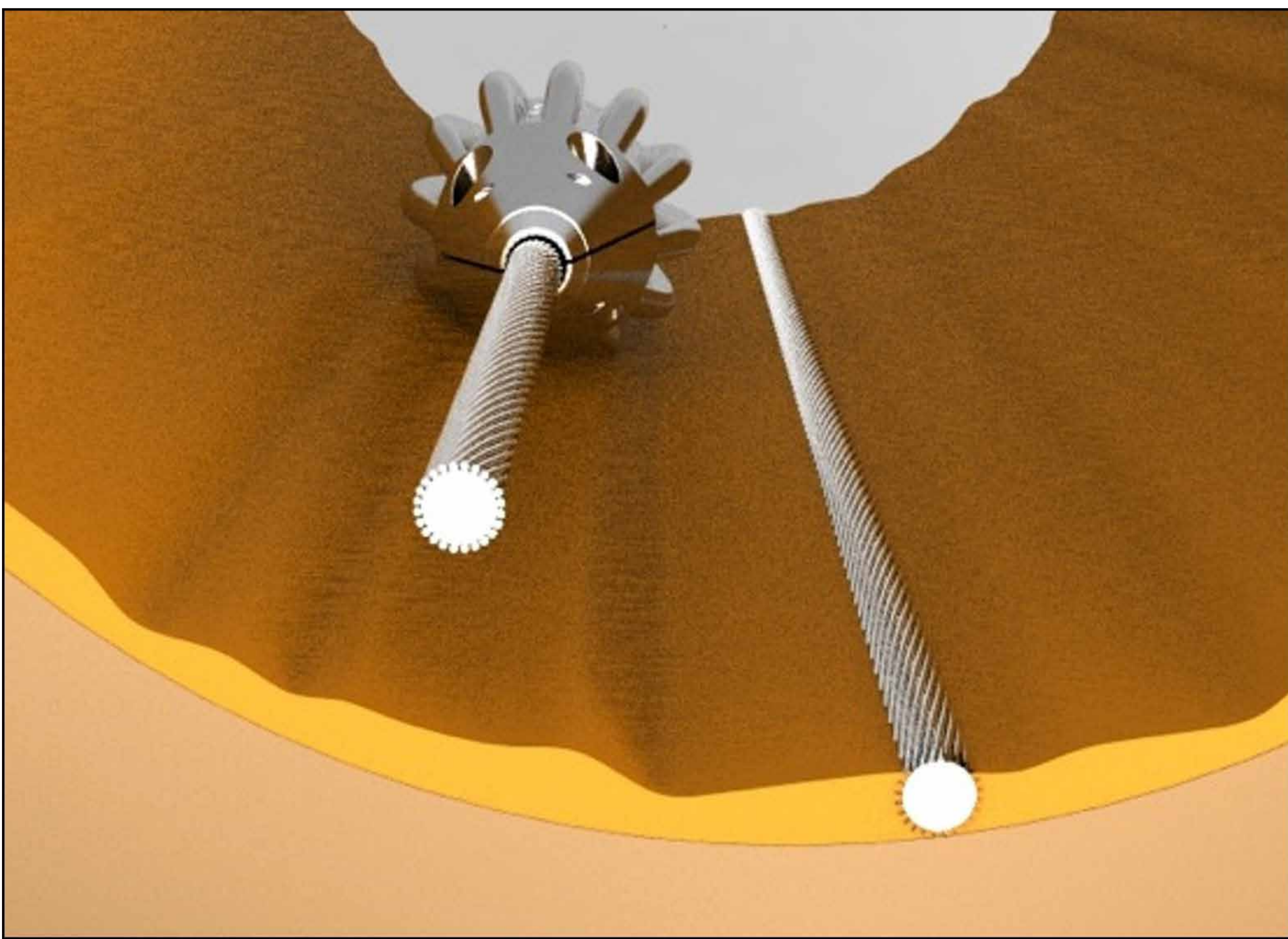


WIRELINER STANDOFFS

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%**.



Historically, WLSOs have been recommended on ~25% of modelled wells.

If WLSOs are mobilised to the wellsite, our **G²⁴** service gives you the best of both worlds:

Two consultants, and full 24-hour cover for both **Wireline QA/QC**, and **GCPS**.

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

207644: A Drilling Engineer's guide to optimizing well design for wireline operations

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

WIRELINER STANDOFFS

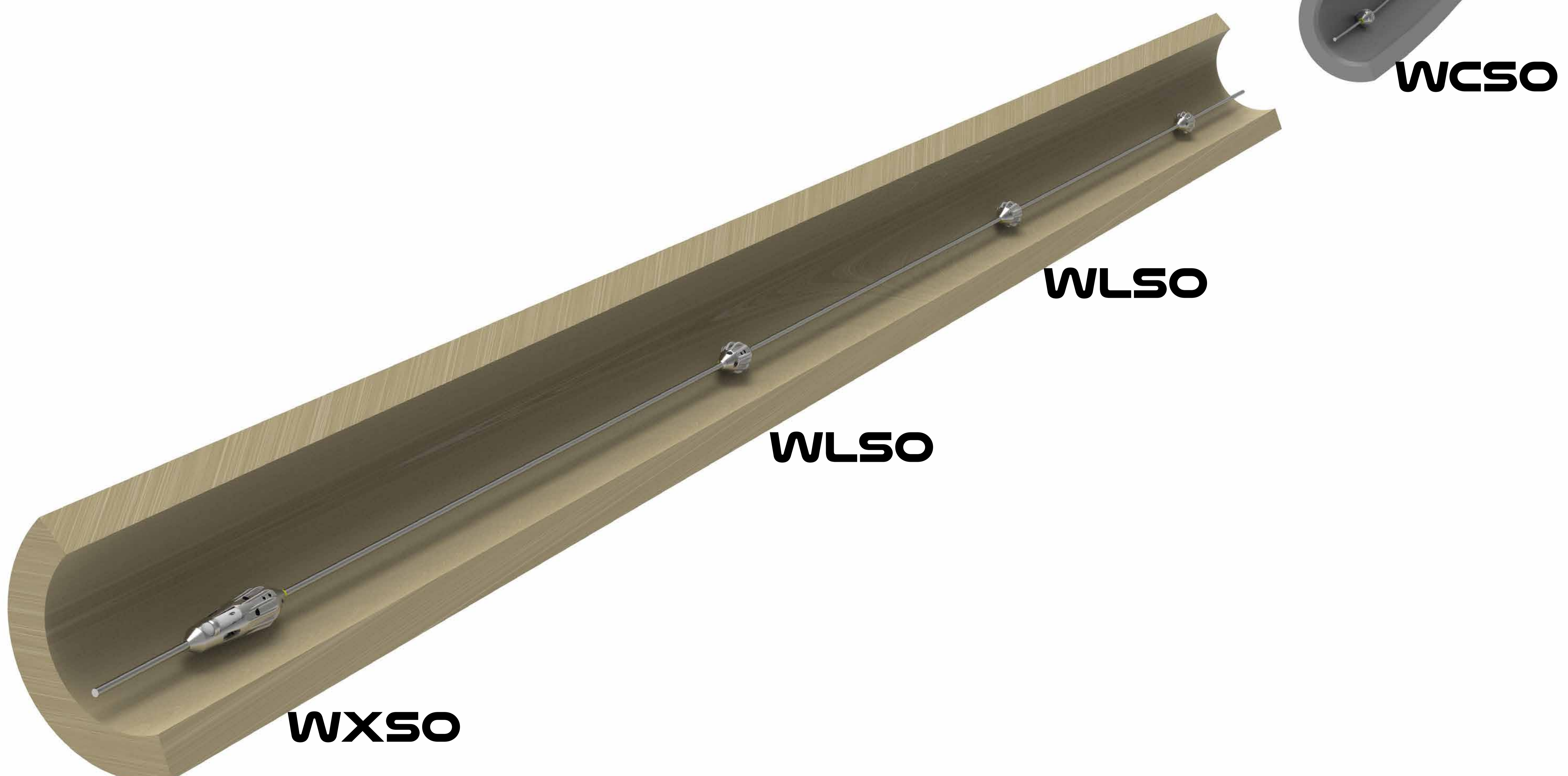
ARRAYS AND COMBINATIONS

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 (16m).

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

FACTS AND FIGURES

400+

Hole sections modelled to date

9,400+

Wireline standoffs run in hole

250+

Descents with WLSOs

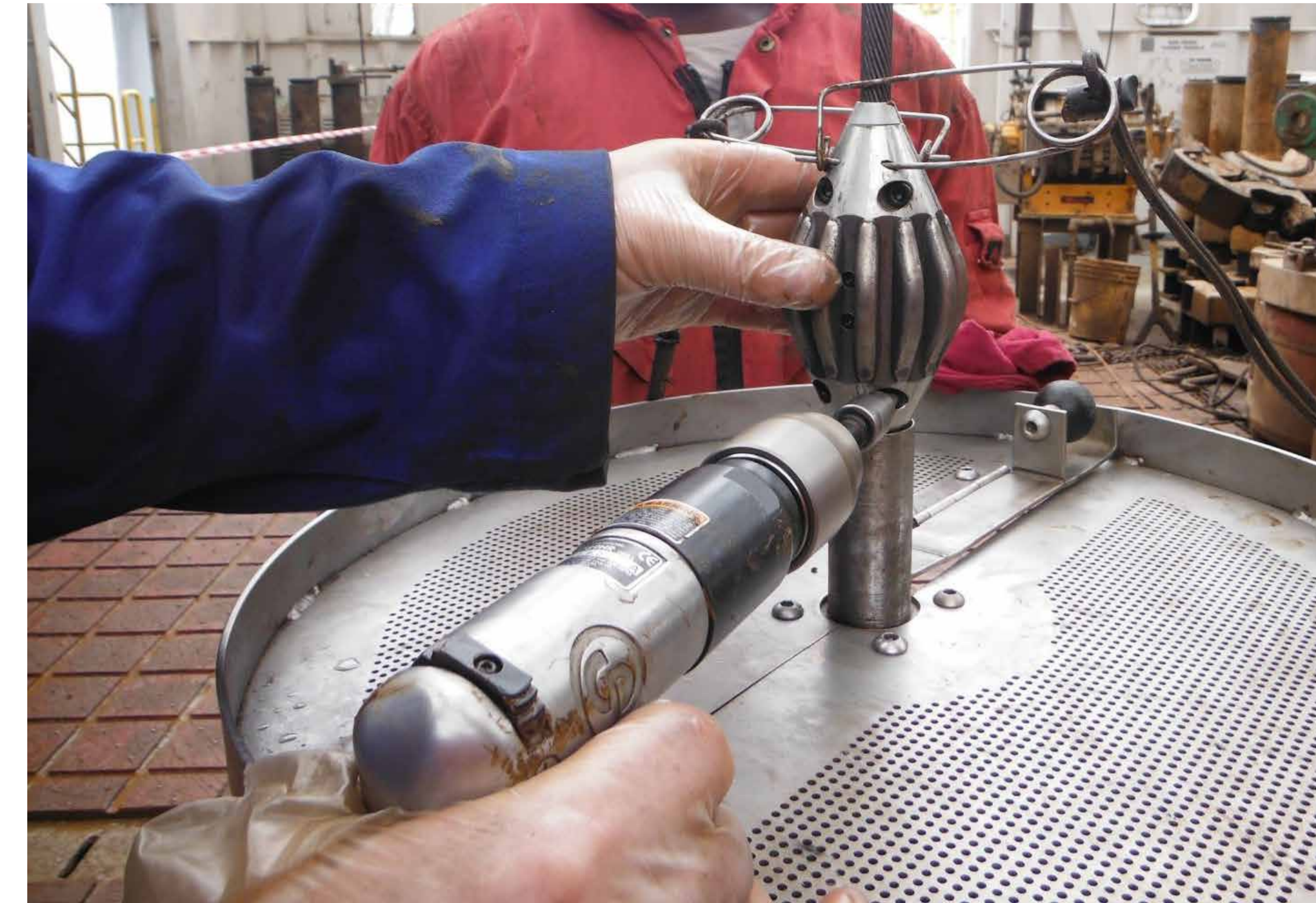
(98.8% with successful wireline acquisition)

34,880

Maximum depth reached (ft)

- WLSOs are typically deployed on around a quarter of modelled wells.
- A WLSO takes only one minute to install, with the Express Kit.
- WLSOs remain firmly attached on the wire, with no recorded slippage and none lost 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.

* Statistics updated as of 05-Jan-2022.





WXSO

DIGITAL CABLE 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 provides downhole recordings of borehole data and cable dynamics including pressure, temperature, deviation, rotation, cable movement, road noise and CCL.

WXSO Products and Deliverables

✓ WXSO Report

A comprehensive report on all the WXSO data acquired on the logging operation. Includes time and depth logs, station logs, temperature, mud weight, cable rotation and creep analysis, plus analysis of any sticking points encountered on the job.

✓ Temperature Analysis

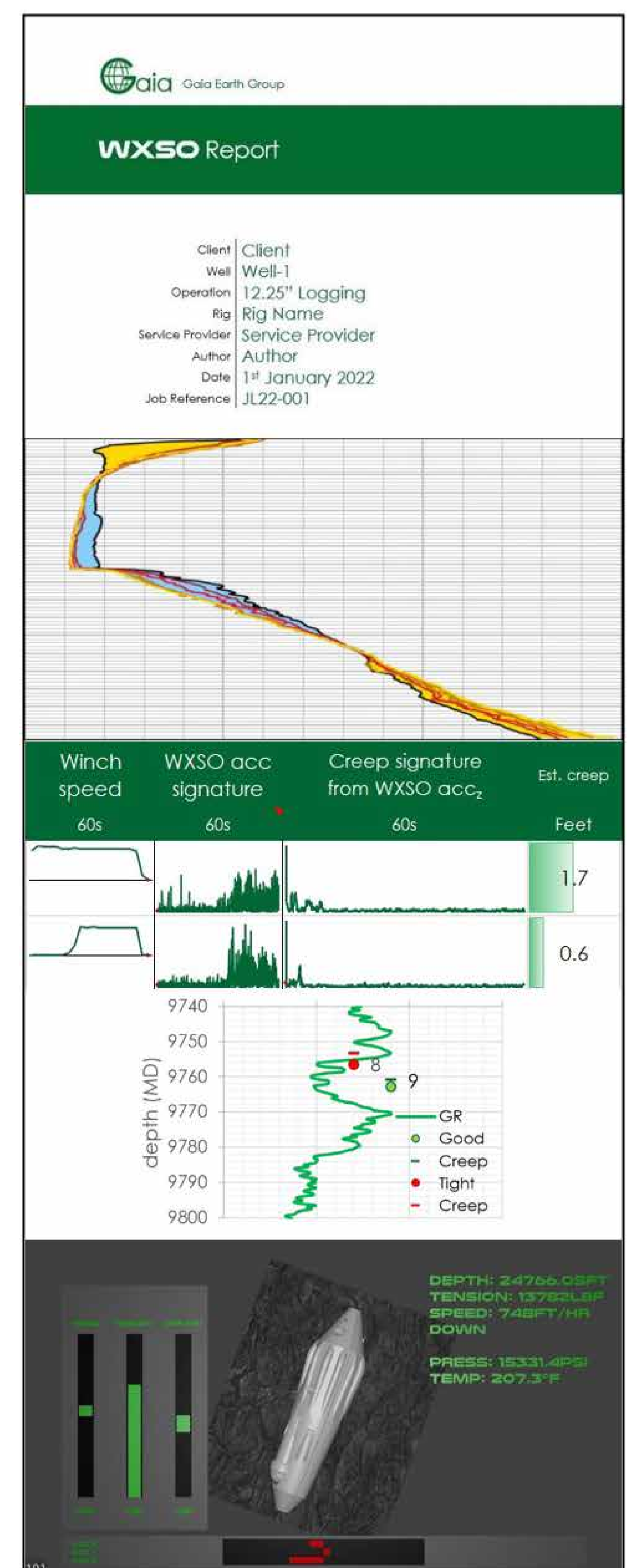
Analysis of temperatures from the WXSO's continuous-reading external temperature sensor. This includes an extrapolated bore hole temperature if multiple logs are run.

✓ Cable Creep Analysis

Analysis of cable creep for station logs using the WXSO accelerometer. Creep distance is calculated for each station, and the planned and actual depths are plotted against the GR log. Actual depths can also be used to improve pressure gradients.

✓ Event Visualisation

Events can be played back as an animation to show cable spin, jar firing, cable creep, stuck tool situations and more.





WXSO

DIGITAL CABLE STANDOFF

- Continuous pressure and temperature log
- Mud integrity log
- Wellbore transient analysis during sampling
- Cable creep analysis for depth control

WCSO

WIRELINE CASED HOLE STANDOFF

- Combat wireline casing wear
- Reduce logging tensions
- Improve tension transmission
- Increase pull on cable head

WCRO

WIRELINE CASED HOLE ROLLER

- Minimize Cable Drag
- Aid wireline descent $>70^\circ$
- Extend tractor reach
- Reduce logging tensions

WTSO

WIRELINE TEMPERATURE STANDOFF

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



WIRELINER STANDOFFS

SUMMARY AND SPECIFICATIONS



	WLSO	WXSO	WCSO	WCRO	WTSO
Cable keyseating mitigation	✓	✓			
Cable differential sticking mitigation	✓	✓			
Assist re-cocking of wireline jars	✓	✓			
Cable sticking sensor		✓			
Temperature and mud weight analysis		✓			
Cable creep analysis for station logs		✓			
Image sticking events (tools and cable)		✓			
Rotation and torque analysis		✓			
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:



Gaia Earth Group

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