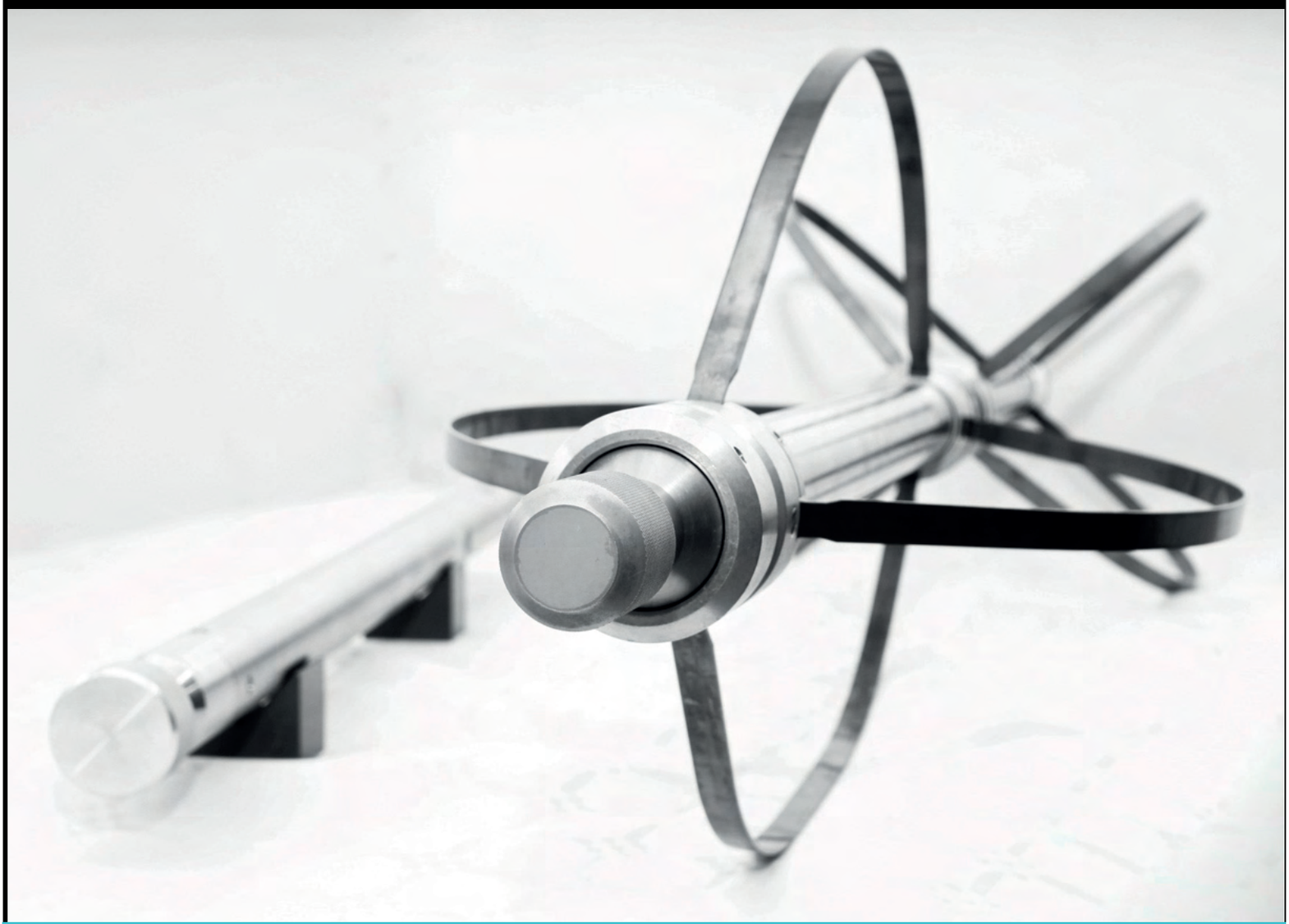
WASSARA EXPLORER™

STRAIGHT FORWARD SURVEYING

System Overview & Featured Articles



WASSARA EXPLORER™

High speed surveying in Continuous Mode

This durable and versatile tool designed for demanding performance and environments, comes in different diameters, powering options and with a range of accessories.

Well suited for different types of holes and drilling setups such as open holes, blast holes, and variants of in-rod configurations.


5
Years
Warranty
EXPLORER

WASSARA EXPLORER™

The Wassara Explorer™ is a durable rate gyro instrument for survey of boreholes in magnetically disturbed formations in all inclinations.

It combines reliable performance, design simplicity and exceptional value for the customer.

The following are some of the key benefits:

High speed surveying in Continuous Mode

Live survey data in Wireline Mode

High positioning accuracy and survey repeatability

Component and data redundancy

High-rate capability of up to 2000 °/s

40mm / 25mm OD housings

Wireline or Battery configurations

GROUND ENGINEERING & GEOTHERMAL

Whether for geothermal, ground engineering or exploration holes, the Wassara Explorer is available and configurable in a variety of ways; winch hoisted and/or pumped in-rod.

Our experience from the largest iron ore mine in the world and other challenging applications within ground engineering has taught us how to develop and make the Wassara Explorer effective, user-friendly and to get the job done.

PRODUCTION BLASTHOLES

The versatility of the Wassara Explorer makes it ideal for easy attachment to existing surveying-vehicles using hose feeder reels fitted with varied types of injection type hoses and adapters.

Both battery and wireline versions of the Explorer may be used and depth counters/encoders are supplied separately. Alternatively, it is viable to manually run in and out of the blast holes.

The flexibility using push-rods assures that holes of any inclination may be surveyed and data may be made available continuously in real time.

DIRECTIONAL DRILLING

The most commonly used set-up is the 25mm Explorer version. This configuration is intended for use in directional drilling where a hammer and a steerable bent sub arrangement are being used to drill holes towards a target. Interval surveys and subsequent adjustments to the drill string are made to ensure reaching the target.

Specially designed accessories and features are available for these configurations, which makes this an easy and quick job to perform with the Wassara Explorer.

EXPLORATION / CORE DRILLING

Surveying with the Wassara Explorer system in the LKAB iron ore mines is performed with our 40mm Battery version and 25mm Wire version.

Using the Wassara Navigator Software, the system continouosly provides data in high-speed such as azimuth, inclination and roll, to mention a few.

With borehole deviation being a crucial part of the Exploration/Core drilling operations, the Explorer performs with high accuracy and repeatibility.

WASSARA EXPLORER™ GYRO PROBE

The Wassara Explorer™ is a durable rate gyro instrument for survey of boreholes in magnetically disturbed formations in all inclinations. Some key benefits of the Wassara Explorer™-system and its probe is a High-speed surveying in Continuous Mode, with a Live survey data in the Wireline Mode.

With high Positioning Accuracy and Survey Repeatability, coupled with Component and Data Redundancy, the Wassara Explorer™ delivers a reliable and repeatable performance.

The high-rate Capability of up to 2000 °/s, in both Wireline and Battery Configurations, as well as 25mm and 40mm OD housings, makes this system durable and versatile. Designed for demanding performance and environments, our Borehole Surveying System is suited for different types of holes and drilling setups such as in-rod, RC (reverse circulation), open holes, blast holes etc.

Wassara Explorer ™ - Accuracy	
Typical Positional Accuracy	0.2 % (~2 m/1000 m)
Inclination	± 0.1 °
Azimuth	± 0.5°
Roll	± 0.5°
Repeatibility	2 sigma
Rate Capability	± 2000 °/s

WASSARA NAVIGATOR™ SOFTWARE

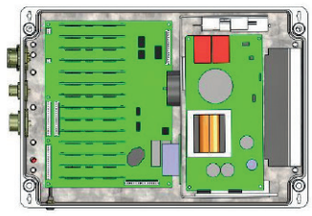
The Wassara Navigator ™ is a user-friendly, intuitive software designed in conjunction with and using operator feedback.

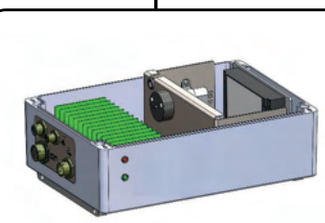
Styled as a Step-by-step flow wizard program it affords the user LIVE data for wired Explorer models and seamless synchronization for battery/memory versions.

Plan, Perspective, Deviation Views and Raw Data + Custom Plots cover just about all user needs. Data may be Subsampled to desired intervals and exported as Excel, CSV or .data export files aswell as reports for Single/Multiple-hole patterns.

The software is regularly updated and constantly improved.

Wassara Field Computer+ Wassara Navigator™ Software	
Computer	Algiz 10 - Rugged Tablet PC (MIL-STD-810G)
Computer OS	Windows 10
Software	Wassara Navigator™ (For Surveying, QC, Reports)
Communications	LKAB Wassara - Communcations Box MKIII





WASSARA COMMUNICATIONS BOX

The Survey Winch Controller is to be used with one-core/four-core logging-winches and relay data to/from Wassara Gyro probes via a serial or PLC link.

A USB connection to a survey computer running the Wassara Navigator will receive and send said data and commands. A second connection to the winch control electronics will receive the depth reading to send alongside the gyro data to the survey computer.

The unit shall be externally powered and in turn power and communicate with Wassara Gyro probes. The unit shall also be mechanically de/attachable to the winch chassis top.

Technical specifications - Communications Box	
Model	SWC MkIII
Dimensions	330 mm x 230 mm x 110 mm (12.99 in x 9.05 in x 4.33 in) *w/o rails + catch
Weight	3.7 kg (4.90 lbs)
Mounting	Plate with guiding rails
Operational temperature	-10°C to +40°C (14°F to +104°F)
Storage temperature	5 to 90% RH
Storage humidity	Low humidity and without corrosive gas

Technical specifications - Electrial	
Max power consumption	Max allowable 40W
Power supply voltage	Switch mode 100-240 VAC, 50-60 Hz
Indicators	One LED; recessed, daylight visible; green; min 6mm OD, side/up visible
Power connectors	MIL 3-pin MIL-DTL-26482 Series I female connector
Power cables	MIL 3-pin male-to-female cable for connection to winch AC out or MIL 3-pin to 2-prong with CEE 7/7 European male supply end
Power on/off	None
Reset button	None

Technical specifications - Data Ports	
Ports	3
Probe + Winch ports	Two MIL-DTL-26482 Series I, MIL 18-pin, panel mounted with dust caps. One for serial communication, one for PLC (Only used with special configuration of controller box)
Computer Data Port	PX0848/B Panel Bulgin Buccaneer panel mount USB connectors designed to mate with PX0840 and PX0841 connectors.
Computer Data Port Speed	19200 baud

WINCH

The Wassara Explorer System is compatible with multiple third-party winches.

Wassara Explorer is a Continouos Mode multiple gyro instrument, capable of very high-speed surveying.

However, when using third-party Winches, we do not recommend exceeding the spooling speed stated by the Winch manufacturer, or their maximum allowed payload.

CENTRALIZERS

For holes not exceeding inclinations of 30° from vertical, use of spring-blade centralizer assemblies is strongly recommended.

The tool may position itself askew resulting in wrong attitudes being used for trajectory calculations yielding erroneous results, if not using centralizers.

WEIGHT RODS

Eccentric weight rods reduce the possibility of the instrument rolling during runs and are suggested for use in inclined holes where the instrument is expected to glide under its own weight.

Solid weight rods are suggested for use in vertical or near vertical holes in tandem with centralizers.

DEPTH TRACKER

For situations where a winch-mounted depth tracker is not available, the Wireless Depth Tracker is suitable. It is connected to the Wassara Explorer Computer via Bluetooth and sends highly accurate depth data to the Wassara Navigator software.

The Depth Tracker can be used for wires up to 12mm and has an accuracy of 0.1m/100m.

It is packaged in a watertight and dust proof case and runs on a rechargeable battery.


LKAB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Surveying service

WASSARA EXPLORER KIT - 25 mm Wire

The Wassara Explorer 25mm has primarily been designed for efficient surveying of narrow diameter holes. The weight and size of the system make it safe and easy to maneuverer and run in and out of blast holes using a conductive fiberglass rod reel for holes of up to 120m. Live data is received in real time from the Explorer probe, saving time and effort especially in projects involving steered drilling.

In combination with the Wassara Navigator Multiple Hole Surveying Mode, this Explorer configuration is the obvious choice for surveying of blast holes, injection holes, jet-grout holes, and pilot holes especially in steered drilling projects where real time data availability is crucial.

Typical application accessories include Bluetooth Depth Tracker, Custom-made fiberglass rod-feeder, plastic type Centralizers and Mule-shoe Connectors.

Wassara Explorer Kit - 25 mm Wire - 7000001 - Includes the following parts:	
Probe 25mm Wire	1503840
Carrier Case	1003690
Field Computer + Wassara Explorer Software	1003657

Available Accessories	
Communications Box - Required for online surveying (Wire)	1003721
Survey Winch - *Contact Wassara for winch options*	N/A
Weight Rod Solid	1503967
Weight Rod Eccentric	1503968
Depth tracker (Bluetooth) - alternative to winch for depth tracking	7000009

WASSARA EXPLORER KIT - 40 mm Wire

The flagship and original configuration of the Wassara Explorer is designed for the surveying of medium/large diameter inclined/downward holes, be they exploration, geo-thermal, pilot or piling holes, in both open or in-rod scenarios.

In tandem with the Wassara Communications Box and our recommended conductive wire-line winches of lengths up to 1200m, this configuration is intended to be the sure way for a quick in-and-out survey of such holes.

Typical application accessories include Weight rods, Non-magnetic Centralizers, Pumping sleeves and Swivels.

Wassara Explorer Kit - 40 mm Wire - 7000002 - Includes the following parts:	
Probe 40mm Wire	1503821
Carrier Case	1003690
Field Computer + Wassara Explorer Software	1003657

Available Accessories	
Communications Box - Required for online surveying (Wire)	1003721
Survey Winch - Contact Wassara for winch options	N/A
Weight Rod Solid *	1503941
Weight Rod Eccentric	1503942
Weight Rod Solid Aluminium	1503943
Centralizer kits (3” to 16”) **	7000004-XX
Depth tracker (Bluetooth) - alternative to winch for depth tracking	7000009
** At least one Weight Rod is needed to use Centralizers*	
*** Includes two complete centralizers, hook wrench*	

WASSARA EXPLORER KIT - 40 mm Battery

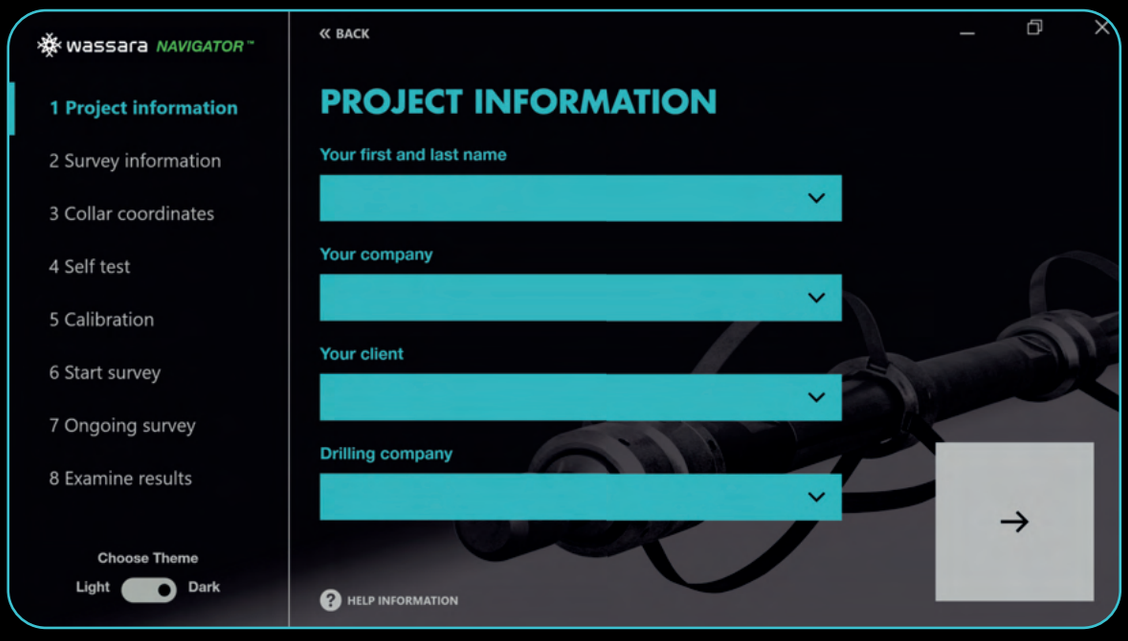
The Wassara Explorer 40mm Battery has primarily been designed for efficient surveying of boreholes where conductive wireline connections are not possible, viable or available. Typical applications include exploration, coring rigs, upwards blast-hole fan surveys and any other application where recommended logging winches may not be deployed or wireline conductivity is not sufficient.

With a battery lifetime of 8hrs and a memory capacity of 8GB as well as data and component redundancy, this configuration guarantees the survey(s) will be safe.

Typical application accessories include Centralizers, Bluetooth Depth Tracker (or custom alternative), Weight rods and a serial Jack-type connector for data download.

Wassara Explorer Kit - 40 mm Battery - 7000003 - Includes the following parts:	
Wassara Explorer Probe 40mm Battery	1504017
Carrier Case	1003690
Field Computer + Wassara Explorer Software	1003657
Additional Battery Pack	1504032
Charger	1003696

Available Accessories	
Weight Rod Solid *	1503941
Weight Rod Eccentric	1503942
Weight Rod Solid Aluminium	1503943
Centralizer kits (3” to 16”) **	7000004-XX
Depth tracker (Bluetooth) - alternative to winch for depth tracking	7000009
** At least one weight rod needed to use centralizers*	
*** Includes two complete centralizers, hook wrench*	


wassara NAVIGATOR™
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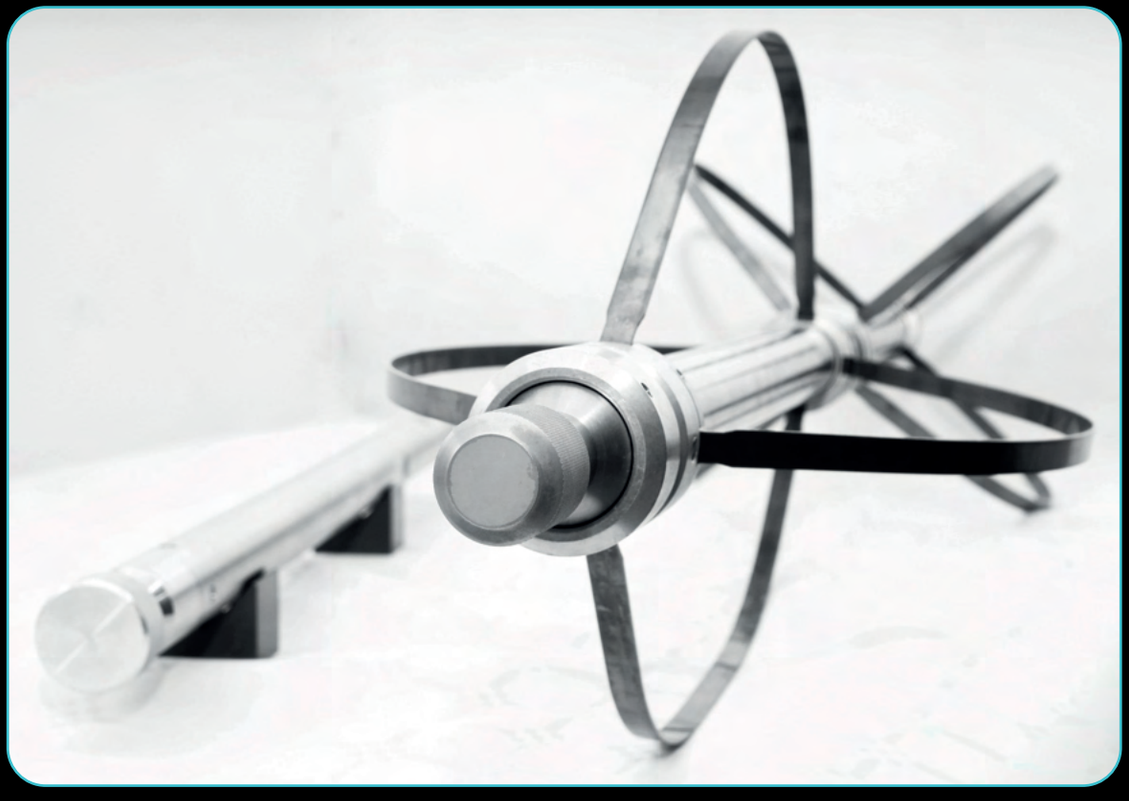

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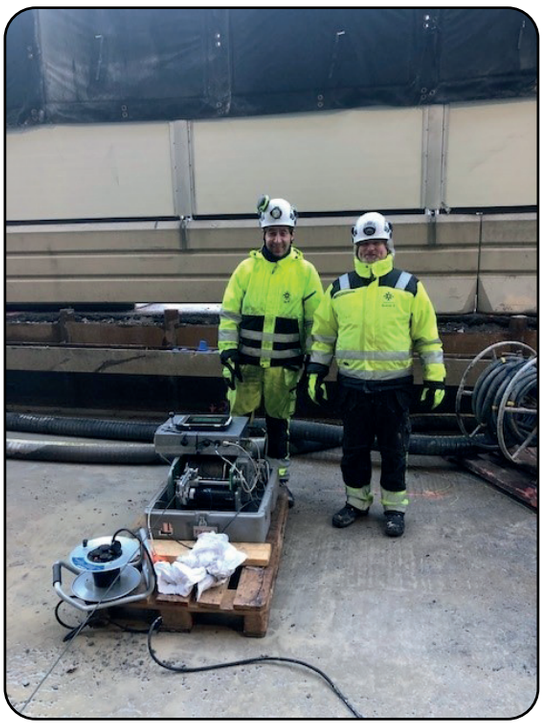

LKAB WASSARA LAUNCHES NEW BOREHOLE SURVEYING SERVICE - AVAILABLE IN SCANDINAVIA

The Wassara Borehole Surveying technologies, the gyro Wassara Explorer and its user-friendly software Wassara Navigator, has long been used in the LKAB mines for surveying services.

Since 2021, LKAB Wassara has been performing surveying services all over Scandinavia for external customers.

The technology

The Wassara Explorer™ is a durable and versatile tool designed for demanding performance and environments, comes in different diameters, powering options and with a range of accessories. The system is well-suited for different types of holes and setups such as in-rods, RC (reverse circulation), open holes, blast holes etc.

Together with its user-friendly software, The Wassara Navigator™, the system is designed with the needs and demands of the end user in mind. The easy and intuitive design, together with use of unique and patented technology and continuous survey mode, makes the Wassara Explorer™ the most attractive gyro system out there.

Our offer

The Wassara Surveying Team are available for on-site surveying projects all over Scandinavia and Finland, within short notice. A Surveying Technician will travel to your drill site with the Wassara Explorer and all its necessary accessories and perform the surveying of the boreholes of your choosing.

Documentation

After the completion of the Surveying operations, the Wassara Technician is able the provide the documentation and borehole measurements within 24 hours.

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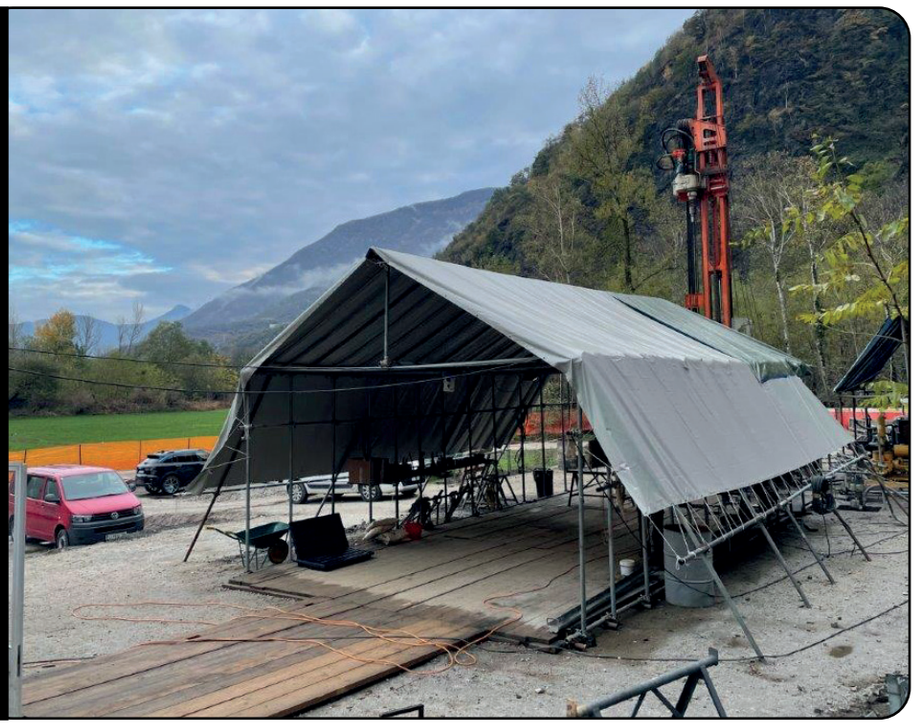


SERVICES EXPANDING - LKAB WASSARA SURVEYING IN THE ITALIAN ALPS

With a successful launch of the LKAB Wassara Surveying Services during 2021, the operation has now expanded outside of Scandinavia.

LKAB Wassaras surveying system, the Wassara Explorer™, has now been demonstrated in an international drilling-project in the Italian Alps. It was used for a 300m deep vertical hole.

Background

An International drilling project is taking place in the Italian Alps. The project, DIVE (Drilling the Ivrea-Verbano Zone E), is performed only 3km from LKAB Wassara's Italian distributors head office. DIVE aims to gain new insights into the characteristics of the lower continental crust through targeted drilling, sampling, and borehole logging.

After contacting the drilling team of DIVE and offering them the LKAB Wassara surveying system, Wassara Explorer™, they liked the idea of performing a demo of the system.

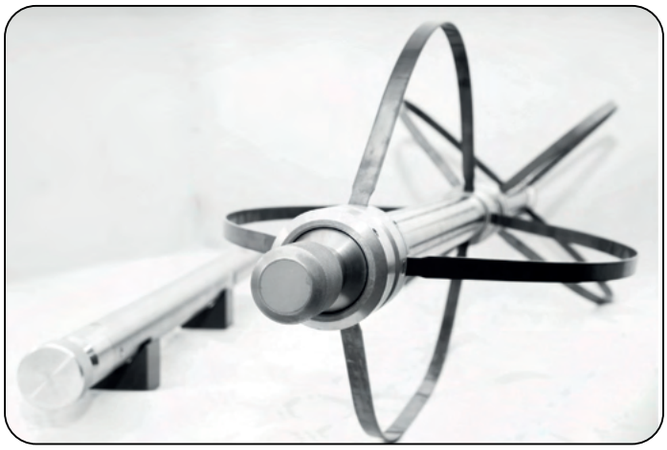
About Wassara Explorer™

The Wassara Explorer™ is a durable rate gyro instrument for survey of boreholes in magnetically disturbed formations and in all inclinations.

It combines reliable performance, design simplicity and exceptional value for the customer. It provides benefits for the customer in form of: High speed surveying in Continuous Mode, live survey data in Wireline Mode, high positioning accuracy and survey repeatability.

This durable and versatile tool is designed for demanding performance and environments.

It comes in different diameters, powering options and with a range of accessories, well-suited for different types of holes and drilling setups.



Wassara Explorer™

The Wassara Explorer™ comes together with its user-friendly software, The Wassara Navigator™, designed with the needs and demands of the end user in mind. The easy and intuitive design, together with use of unique technology makes the Wassara Explorer™ a very attractive gyro system on the market.

Wassara Explorer™ in the DIVE project

The DIVE-project used the Wassara Explorer™ to investigate the deviation of their hole.

The outcome of the survey was presented with data from the Wassara Explorer™ system. An LKAB Wassara Service Technician was onsite, providing surveying and support services.

The Service Technician also provided in-field training regarding the Wassara Explorer-system and the accompanying software, Wassara Navigator.

Survey procedure

The drilling-program in the DIVE-project had completed drilling down to 300 meters when it was a good opportunity to survey with the Wassara Explorer™.

The surveying probe was lowered into the hole with the help of a winch on the drill rig. A battery version of the Wassara Explorer™ was used. An accessory in the form of a Bluetooth depth tracker was used to get depth data into the portable field computer that generated the survey results.

The location of the DIVE-project, Italian alps

Wassara Explorer™ in action

Wassara Navigator™ software displayed on field computer

Notes

LKAB Wassara – Sustainable water-powered DTH Drilling and Borehole Surveying

LKAB Wassara is a Swedish company developing and manufacturing unique water-powered drilling systems for high performance in surface- as well as underground drilling operations. The heart of the Wassara drilling system is the world patented water-powered down-the-hole hammer. The drilling systems have been used for more than 20 years in various applications within many industries; mining, exploration, ground engineering, dams, geothermal, marine, oil & gas storage. Our experience covers more than 25 million drilled metres working in different locations around the world. Reference studies can be found on our website.

LKAB Wassara was founded in 1988 and is owned by LKAB. LKAB is an international high-tech minerals group that produces iron ore products for the steel industry and other mineral products for many other industries and applications.

Explore more at www.wassara.com

LKAB Wassara AB | Elektronvägen 6, SE- 141 49 Huddinge | www.wassara.com