

Robertson Geo offers wireline conveyed, slim-hole logging services for geotechnical investigation, hydrological projects, environmental studies, mineral evaluation, hydrocarbon exploration and geoscience research worldwide.

No project too small, no project too large or challenging.



**ROBERTSON
GEO**

SERVICES

Unlocking Your GeoData

Services

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As part of the proposed development of Battersea Power Station, the iconic London, England landmark, it was necessary to carry out a subsurface multi-beam survey to identify the location and structure of inlet and outlet tunnels for the historic building.

Services

Robertson Geo is truly a global operation, the market leader of slim-hole logging instrumentation with comprehensive in-house design and manufacturing facilities and a proven logging service offer to its customers.

Robertson Geo (USA) Inc provides direct support for North American and South American customers and Robertson Geo (Asia) Inc supports operations and customers in the Asia Pacific region.



Market sectors serviced include civil engineering infrastructure, nuclear, water, unconventional gas, mining, coal and renewable energy both onshore and offshore.



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Professional and committed service

Robertson Geo and senior personnel are affiliated with major professional organisations including AGS, BDA, BGA, IoM3, EAGE and the Geological Society. With a commitment to continuous Research & Development programmes, often in partnership with leading UK and overseas universities, recent pioneering developments include a slim-line oilfield quad combo logging suite, plus Optical and Acoustic Televiewers establishing new industry standards for high resolution fracture studies.

Service logging operations

Robertson Geo engineers are experienced, highly trained and fully certified for offshore working and can be deployed to any global location.

The complete catalogue of equipment is available on a service basis operated by these field crews. They are capable of prolonged service logging operations with minimum outside support and are expert in data processing and interpretation.

These are very cost effective contracting services in circumstances where projects do not justify purchasing equipment and the necessary back up facilities.

Equipment supply

All Robertson Geo probes are fully tested and calibrated at the Deganwy facility prior to dispatch, eliminating testing time on site and ensuring the probes are fully operational prior to downhole use.

Depending on customer needs operational and customised training can be provided; this for winch use, probe deployment, logging techniques, data capture and equipment maintenance and troubleshooting.

Equipment rental

Robertson Geo equipment is available to rent with a minimum rental period of 3 days in the USA or 15 days elsewhere. Full systems (including winches) or individual probes can be rented as required with borehole and classroom based training available for rental customers.

In-house processing service can be supplied for rented equipment and all offshore systems come complete with spare probes and surface units together with essential spares to eliminate problems and expensive vessel downtime.

Services Overview

- Safety focused operations performed by skilled, experienced and competent logging personnel
- Logging probes which are tested and calibrated to known industry standards in the Deganwy calibration and test well facility
- ISO certified management systems (QMS) for tool design, manufacture, calibration and execution of logging services
- Assistance with preparation of job methodology, procedures and risk assessments
- Experienced operations supervision & support backed by established ISO & QHSE management systems
- Technologies that are 'battle proven' through own use of Robertson Geo logging technologies in service operations
- Expert technical support from in-house Research and Development, Engineering & software groups
- Field proven, high-quality, in-house designed and manufactured logging probes
- Professional, standardised data processing and reporting
- Expertise and experience gained from over 40 years of logging services globally
- Modern fleet of fully equipped logging vehicles for all environments

Robertson Geo is the only logging services provider with a QMS certified to ISO 9001, comprehensively calibrating all of its logging systems and uniquely using an on-site borehole for testing at its Deganwy test well and calibration facility.

Impressive safety record of over 40 years

Safety and Quality Assurance are of prime importance in achieving a valid approach to field investigations and delivery of client requirements. Robertson Geo has demonstrated an impressive safety record of over forty years of logging services, based on the principles outlined in the International Association of Geophysical Contractors Land Geophysical Safety Manual.

These satisfy the requirements for its entire field services department, design, manufacturing and sales activities.

An ongoing commitment to certified quality management

As the world's largest provider of slim-hole logging instrumentation, Robertson Geo designs and manufactures almost all equipment in-house.

Purchasers of equipment include water authorities, mining houses, civil engineering consultants, aid organisations, drilling contractors and oil companies worldwide with logging equipment currently used in over 150 countries.

This expertise, support and experience makes for the offer of first-class services at competitive rates.

Robertson Geo has an ongoing commitment to certified quality management and our QMS is certified according to ISO 9001 by TÜV.

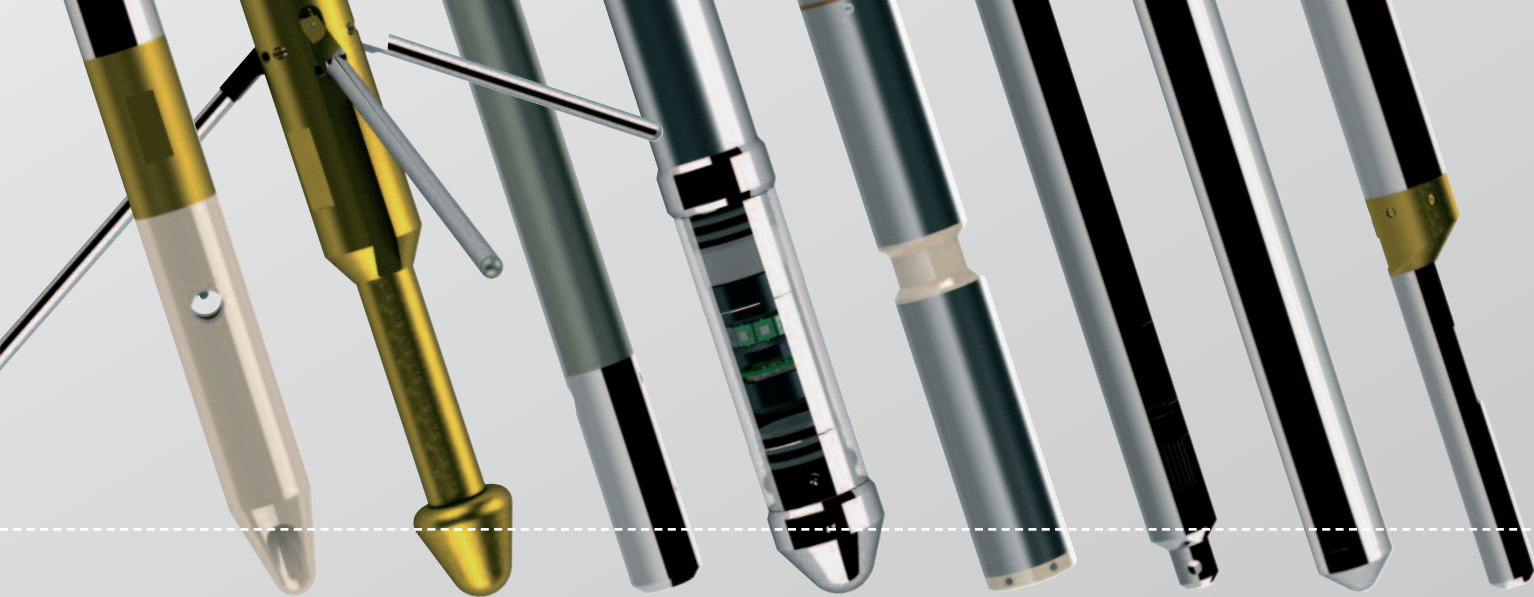
Robertson Geo is the only logging services provider with a QMS certified to ISO 9001, and the only company which comprehensively calibrates all of its logging systems. Established industry references at ELGI Hungary and the DWLBC calibration pits (API) in Adelaide, Australia provide the reference models for nuclear tool calibrations. These two references were used by Robertson Geo to establish calibration benchmarks at the Deganwy facility, and to reference the formation response in the Deganwy calibration and test well facility.

Once a nuclear tool system (Probe + tool specific source) is calibrated to these recognised Industry standards, they are then run in the Deganwy calibration and test well facility to verify that the tool response is within tight tolerances established from data gathered over many years and 1000's of runs. All other non-nuclear tool systems receive the same attention to detail and test well verification prior to deployment.

Only after verification in the test well confirming both tool operational function and measurement calibration are tools accepted for use.

Verification reports and calibration records are provided in the end of well reporting package.





Geophysical logging probe overview

High Resolution Acoustic Televiewer (HRAT):

Provides a continuous high-resolution oriented ultrasound image of the borehole wall. The probe uses a fixed acoustic transducer and a rotating acoustic mirror to scan the borehole walls with a focussed ultrasound beam. The amplitude and travel time of the reflected acoustic signal are recorded as separate image logs.

High Resolution Optical Televiewer (Hi-OPTV):

Provides a continuous very high resolution oriented image of the borehole walls using a conventional light source. A unique optical system based on a fisheye lens allows the probe to survey 360 degrees simultaneously. This information is processed in real time to produce a complete 'unwrapped' image of the borehole oriented to magnetic north. The probe offers superior resolution to the High Resolution Acoustic Televiewer (HRAT) and produces images in real colour.

Formation Density, Density Guardlog

& Iron Ore Density: The Formation Density uses dual shielded detectors to provide a borehole compensated density measurement with good bed-boundary resolution. The Density Guardlog Probe offers an additional LL3 focussed electrical measurement with good vertical resolution and depth of investigation.

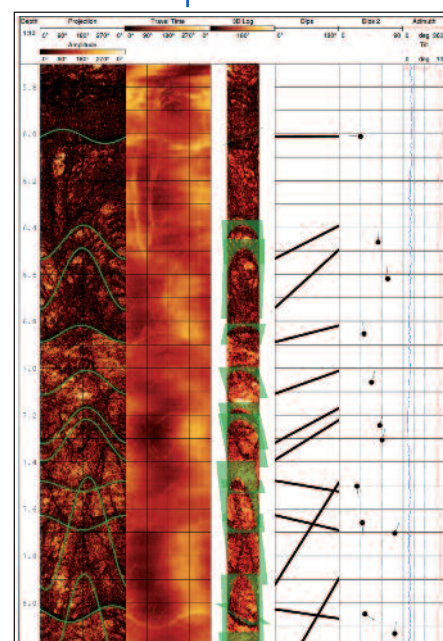
Density Gamma: Offers a convenient alternative to the standard Robertson Geo Formation Density Probe whenever borehole diameter is restricted and qualitative density measurements are acceptable. One common application is in logging through drill pipe when unstable borehole conditions prevent use of unprotected nuclear probes. The probe is unfocussed and indicates the average density of material surrounding the borehole.

Small Source Density: Stringent legislation on the transport and handling of radioactive materials increasingly prevents the use of conventional density logging probes. The small source density probe provides calibrated and borehole-compensated density logs at sensible logging speeds using a very low activity ^{60}Co gamma source that may not require a radiation licence in certain territories.

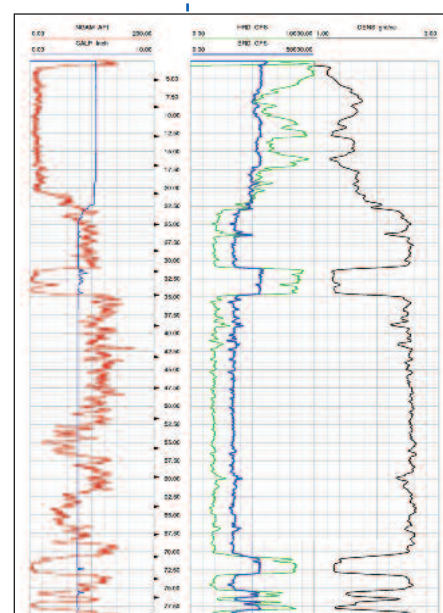
Natural Gamma: The natural gamma probes measure the activities of naturally occurring or man-made isotopes. The probes are based on scintillation gamma detectors that measure the natural gamma radiation released from potassium and the decay products of uranium and thorium in the borehole.

Neutron: Provides a calibrated borehole compensated neutron porosity measurement in mud-filled open holes. It is the probe of choice for quantitative formation fluid studies. A single-detector neutron probe is also available for qualitative porosity logging under most borehole conditions, including through steel or plastic casing and drill-pipe.

Spectral Gamma: Analyses the energy spectrum of gamma radiation from naturally occurring or man-made isotopes in the formation surrounding a borehole. The probe corrects for temperature drift in real-time by matching the acquired spectrum to base spectra of the main natural emitters, potassium, uranium and thorium determined during the tool master calibration. Available outputs are full spectrum (static mode only) and continuous log measurements of elemental concentrations. Borehole corrections are available for casing thickness, borehole diameter, formation density and mud/fluid radioactivity for both centralized and sidewalled tool positions.



Example of data created by the HRAT Probe.



Example of data created by the Formation Density Probe.

Electric Log: The classic water-well combination probe combining shallow, medium and deep penetrating resistivity measurements with Self-Potential (SP).

Focussed Electric (Guardlog): The focussed resistivity (LL3) measurement provides excellent vertical resolution and a reasonable depth of investigation. The guard log replaces the classic Electric Log Probe in conditions of low mud resistivity and high formation resistivity.

Microresistivity: Provides a focussed pad resistivity measurement with high vertical resolution combined with a caliper and natural gamma.

Dual Focussed Induction: Provides two simultaneous conductivity logs, corresponding to “medium” and “deep” radii of investigation into the formation. The two depths of penetration are useful in porous, permeable formations where the displacement of formation fluids by drilling mud creates an “invasion zone” with different electrical properties. The 1” focussed induction probe produces a single medium penetration conductivity log. It finds particular application in small diameter dry or plastic lined boreholes used for mineral exploration.

Magnetic Susceptibility: Based on the industry standard Bartington Instruments™ product. It is a low frequency device and is specifically designed for mining applications. The probe has excellent stability against pressure and temperature variations.

Temperature Conductivity: Provides a continuous, depth-based measurement of fluid temperature and conductivity. Both parameters can be output in absolute and in differential forms. A natural gamma detector is included for correlation purposes.

Impeller Flowmeter: Provides a continuous log of vertical fluid velocity within a borehole. Two sizes of high sensitivity probes satisfy most borehole size requirements and expected flow rates.

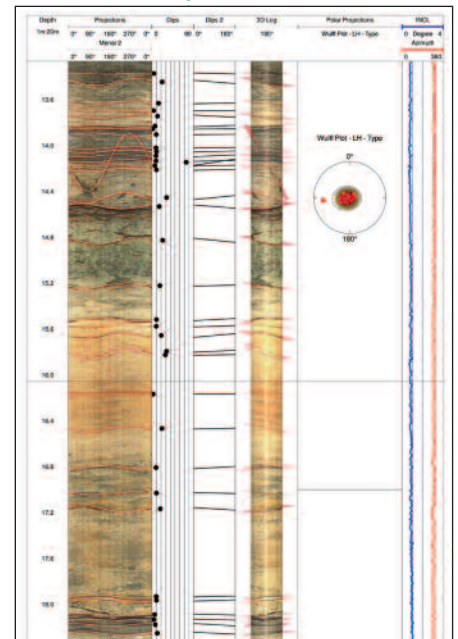
Heat-Pulse Flowmeter: Used to detect low vertical flows within a borehole, below the threshold limits of conventional impeller tools. The probe is designed for stationary measurements only. Normal logging practice involves measurements at a series of depths across the zone of interest.

Induced Polarisation: Measures the charge separation or ‘chargeability’ in porous, water-saturated, mineralised rocks caused by the passage of a low-frequency alternating current. The main cause of induced polarisation is a current-induced electron-transfer reaction between ions of an electrolyte in contact with grains of semi-conducting metallic minerals.

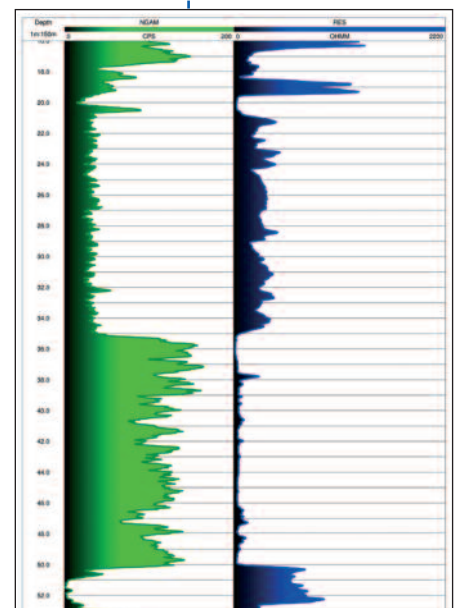
Water Quality: Based on the industry standard Ocean Seven 302™ probe manufactured by Idronaut Srl. The tool is available in ‘saline’ and ‘fresh-water’ versions with different conductivity ranges and available measurements. The probe enables a rapid, continuous profile to be taken of all the selected parameters throughout the borehole either for direct use or as a guide for subsequent sampling.

Water/Gas Sampler: Probes are used to recover discrete samples of well fluid at a particular depth and to return it uncontaminated to the surface.

3-Arm Caliper: Provides a single continuous log of borehole diameter as recorded by three mechanically coupled arms in contact with the borehole wall. A number of sizes are available to suit a range of well diameters. The caliper is a useful first log to determine the borehole conditions before running more costly probes, or those containing radioactive sources.



Example of data created by the Hi-OPTV Probe.



Example of data created by the Focussed Electric (Guardlog) Probe.



Borehole Geometry: Consists of a 4-arm caliper combined with a verticality measurement. The probe can replace the standard 3-arm caliper with advantage where the borehole cross-section departs from circular, and where directional information is required for well completion studies and formation stress analysis.

Verticality: Provides accurate, continuous measurements of borehole inclination and direction. These are output directly as log traces or may be processed further to produce tabular and graphical outputs of borehole position, borehole drift and true vertical depth.

Gyro: Acquires borehole inclination/azimuth logs in situations where metal casing or magnetic materials around the borehole prevent use of the standard verticality probe. The 3D-magnetometer version also acquires 3D-magnetic data for location of magnetic ore bodies.

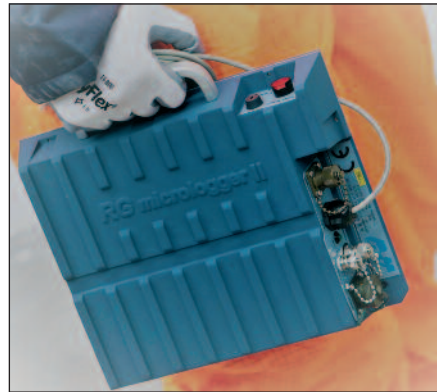
4-Arm Dipmeter: Measures microresistivity and tool orientation data. These can be processed using RG-Dip™ software to determine formation dips.

Full Waveform Sonic: Uses a dual-transmitter dual-receiver array to provide high quality formation acoustic velocity data. Options are available for display of full waveform data and cement bond data (CBL) in cased boreholes.

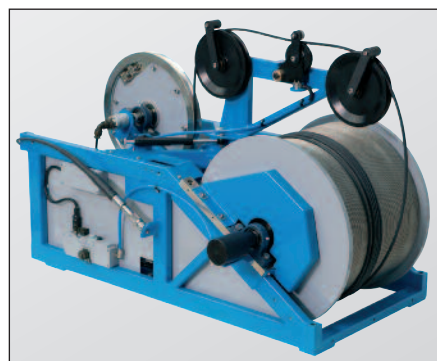
PS Logger: Provides high resolution shear wave and compressional data in rock and soils at depths up to 500m, from measurements within a single borehole.

Surface Equipment Overview

Micrologger2: surface interface system for handling logging data acquisition, which supports all Robertson Geo probes, including acoustic and imaging tools.

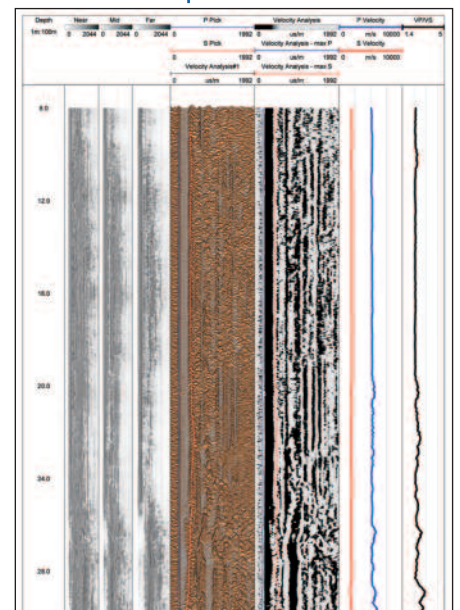


Winlogger: MS Windows based operating system for the Micrologger2, provides field acquisition capability. In-house processing, interpretation and reporting is undertaken.

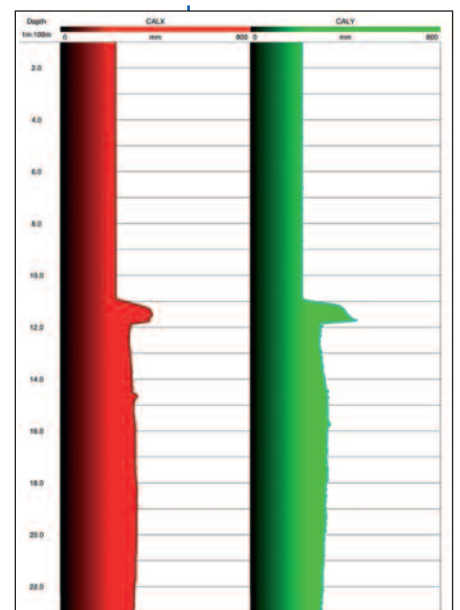


Winches: Robertson Geo designs and builds its own range of winches of varying capacities for deploying subsurface probes on 4-core or co-axial cable.

- Mini Winch
- 500m Winch
- 600m Winch
- 1000m/2000m Winch
- 2000m Marine Winch
- 3000m Winch



Example of data created by the Full Waveform Triple Sonic Probe.



Example of data created by the Borehole Geometry Probe.

Extensive UK and International Experience

| LOCATION | DESCRIPTION | CLIENT | TOOLS DEPLOYED | SECTOR |
|--------------------------------|--|------------------|-------------------------------|-------------------|
| Canary Wharf, London | Concrete pile inspection for skyscraper construction | Arup | Hi-OPTV | Civil Engineering |
| San Antonio, Chile | Harbour project | GeoQuip Marine | PS Logger | Civil Engineering |
| Bunsfield, UK | Checking water quality after explosion at oil refinery | Arcadis | Temperature Conductivity | Environmental |
| Plymouth, UK | Decommissioning oil refinery | Arcadis | Density logging | Environmental |
| Dounreay, Scotland | Waste storage investigation at nuclear power station | Fugro | Televiwers | Nuclear |
| M11 Motorway, Ireland | Geotech investigation for road construction | Priority | Hi-OPTV & HRAT | Infrastructure |
| AWPR, Aberdeen, Scotland | Geotech investigation for orbital road construction | Priority | Hi-OPTV & HRAT | Infrastructure |
| A303, Wiltshire, England | Geotech investigation for Stonehenge underpass | Structural Soils | Hi-OPTV & HRAT | Infrastructure |
| A9, Perth, Scotland | Geotech investigation for trunk road dualling | ESG | Hi-OPTV & HRAT | Infrastructure |
| Queensferry Crossing, Scotland | Geotech investigation for major road bridge construction | Glovers/Arup | Full suite inc. nuclear tools | Infrastructure |
| Lake Maracaibo, Venezuela | Geotech investigation for bridge construction | Geohidra | PS Logger | Civil Engineering |
| Le Havre, France | Seabed investigation for offshore wind turbines | Horizon | PS Logger | Renewables |
| Dudgeon Wind Farm, Norfolk, UK | Seabed investigation for offshore wind turbines | Geo | PS Logger, HRAT | Renewables |
| Vesterhav Wind Farm, Denmark | Seabed investigation for offshore wind turbines | Geo | PS Logger | Renewables |
| St. Malo, France | Seabed investigation for offshore wind turbines | Fugro | P S Logger, HRAT, Caliper | Renewables |
| Hornsea Wind Farm, UK | Seabed investigation for offshore wind turbines | DONG | PS Logger | Renewables |
| HS2 Rail, UK | Geotech investigation for major N-S rail link | BAM Ritchies | Televiwers, Caliper, Density | Infrastructure |

Robertson Geo has extensive UK and international experience of providing borehole logging services in a wide range of sectors and applications, including major infrastructure projects. Examples include:

| LOCATION | DESCRIPTION | CLIENT | TOOLS DEPLOYED | SECTOR |
|--|--|---------------------------|--|----------------|
| CrossRail, London | Geotech investigation for major cross London rail link | Concept | Density | Infrastructure |
| Hinkley Point C, Somerset, UK | Concrete investigation at new nuclear build site | Kier BAM | Televiwers, Caliper, Gamma | Nuclear |
| Wylfa, Anglesey, Wales | Offshore investigation at nuclear power station | Fugro | Televiwers, Sonic | Nuclear |
| Nottingham, UK | Geoenergy Observatory project | British Geological Survey | HRAT, Triple Sonic, Electric Log, 3-Arm Caliper, Density, Dual Neutron | Research |
| Abergele, Wales | Investigation of casing integrity in mineral water asset | Decantae | Televiwers, CCTV, Caliper, Temperature Conductivity, Electric Log | Water |
| Omagh, Northern Ireland | Gold mine exploration | Dalradian | Televiwers, Caliper, Full Waveform Sonic, Dual Neutron, Electric Log, Formation Density, Magnetic Susceptibility | Mining |
| Navan, Ireland | Zinc/Lead mine exploration | Boliden | HRAT, Electric Log, Spectral Gamma | Mining |
| Mullingar, Ireland | Zinc/Lead mine exploration | Teck | Formation Density, Full Waveform Sonic, Temperature Conductivity, Spectral Gamma, Gamma | Mining |
| Gabon, W. Africa | Uranium mine exploration | Soil Engineering | Spectral Gamma | Mining |
| S.Wales, Nottingham, Stoke, NE England, Scottish Borders | Coal mine monitoring & investigation | UK Coal | CCTV, Temperature Conductivity, Fluid Sampler | Mining |
| Yorkshire, UK | Coal bed methane exploration | Alkane Energy | CCTV | Oil/Gas |
| Bridgend, Wales | Shallow gas investigation/exploration | Coastal | Spectral Gamma, Caliper, Porosity, Dual Neutron, Televiwers, Electric Log | Oil/Gas |
| New Bedford, USA | Seabed investigation for offshore wind turbines | Horizon | PS Logger | Renewables |
| Derbyshire, Yorkshire, UK | Coal mine monitoring & investigation | Coal Authority | CCTV, Temperature Conductivity, Fluid Sampler | Mining |

Extensive UK and International Experience

| LOCATION | DESCRIPTION | CLIENT | TOOLS DEPLOYED | SECTOR |
|----------------------------|---|------------------------|---|-------------------|
| Bradwell, UK | Onshore investigation for new nuclear build site | Structural Soils | Televiewers, Borehole Geometry, Dual Neutron, Formation Density, Focussed Electric Log, PS Logger, Full Waveform Sonic, Magnetic Susceptibility | Nuclear |
| Rhondda Valley, Wales | Water well inspection | Severn Trent Services | CCTV, Temperature Conductivity, 3-Arm Caliper, Fluid Sampler | Water |
| Manchester, UK | Geotech investigation for tower block construction | GeoAssist | Televiewers, PS Logger, Formation Density, 3-Arm Caliper, Temperature Conductivity | Civil Engineering |
| Peterhead, Scotland | Onshore investigation for renewables infrastructure | Structural Soils | Hi-OPTV & HRAT | Renewables |
| Moray OWF, Scotland | Seabed investigation for offshore wind turbines | Horizon | PS Logger | Renewables |
| Porthmadog, Wales | Geotech investigation for bridge construction | WSP | Hi-OPTV & HRAT | Infrastructure |
| Lower Thames Crossing, UK | Onshore geotech investigation for tunnel construction | AECOM | Televiewers, 3-Arm Caliper, Dual Neutron, Formation Density, Focussed Electric Log, Temperature Conductivity, Dual Induction | Infrastructure |
| Nant Llesg, Merthyr Tydfil | Coal Mine Exploration | APEX/ Miller Argent | Density | Mining |
| Aberpergwn, Merthyr Tydfil | Coal Mine Exploration | Western Coal | Televiewers, Caliper, Gamma, Formation Density, Full Waveform Sonic | Mining |
| Bardon Hill Quarry | Aggregate Quarry extension | Walters | Televiewers | Mining |
| Leaton Quarry, Telford | Quarry Extension | Breedon Southern | Televiewers | Mining |
| Grange Hill Quarry | Limestone Exploration | Cotswold Natural Stone | Televiewers, Caliper, Gamma | Mining |

Services

Robertson Geo is focused on delivering high quality services and equipment with geophysical logging tools developed in-house over several decades. There is a proven record of safely delivering subsurface logging investigations in demanding environments, offering experienced personnel and mature technologies, supported by in-house engineering, manufacturing and R&D resources.

Operational Training by expert field personnel

Robertson Geo offers operational training for winch use, probe deployment, logging techniques, data capture, and equipment maintenance and troubleshooting.

These Training schedules are flexible (from one to five days) and customised, depending on the experience levels and focus of attendees.



Training certificates and electronic copies of manuals and test data are provided and whilst it is preferable that training is undertaken at the Deganwy calibration and test well facility, training can also be conducted at the customers' site, including international locations.

Here's an example of a one day training schedule for: Winch; Televiewer; Temperature/Conductivity Probe; Water Sampler; Winlogger.

HSE and Site Induction

Logging Overview

- Winch Overview/Safety
- Depth System
- Logging System Setup
- Borehole Safety
- Power Safety

Optical Televiewer

- Software Overview
- Centralisation
- Basic Usage

Data Export

Temperature/Conductivity

- Winlogger Overview
- NGAM calibration
- Depth Setup (Up/Down logs)
- Basic Usage

Water Sampler

- Basic Usage

Winlogger

- Depth Matching
- Data Merging
- Data Export
- PDF conversion

Summation and additional software overview

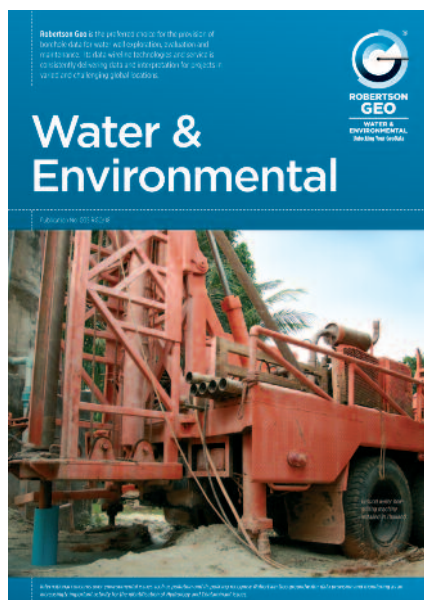
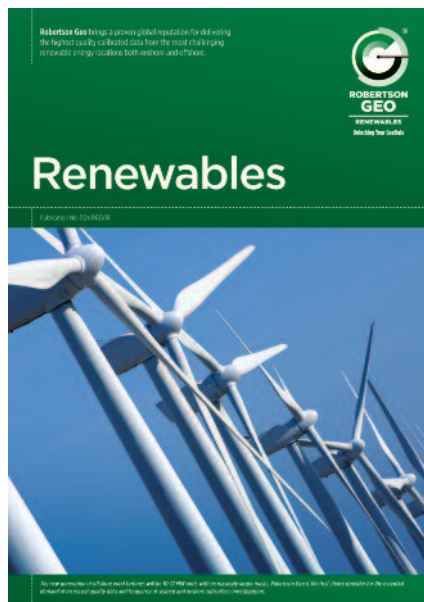
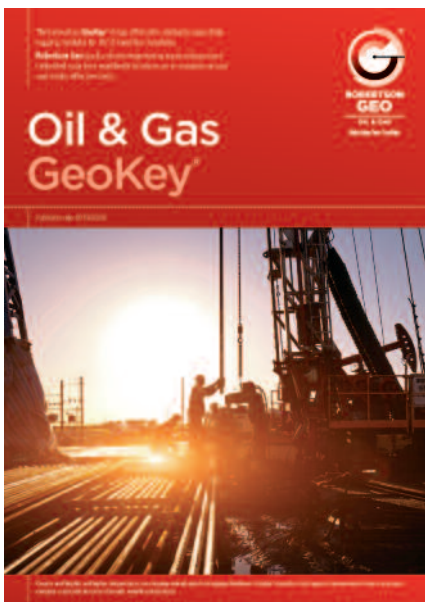
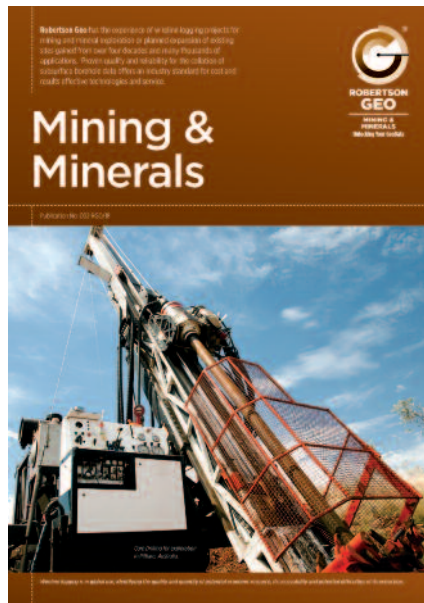
A dedicated support team can provide after training assistance for technical queries and can be contacted direct on support@robertson-geo.com



Robertson Geo has a fleet of logging vehicles ranging from Land Rovers, Land Cruisers and LWB Vans supporting Service Crews in the toughest of field applications.

Customised quotations can be obtained through Graham Comber, Logging Services Manager, at gcomber@robertson-geo.com

See our complete range of market-sector brochures:



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Robertson Geologging Ltd.

Deganwy, Conwy, LL31 9PX,
United Kingdom

T: +44 (0) 1492 582 323

E: growlands@robertson-geo.com

Robertson Geologging (USA) Inc.

1809 N. Helm Ave., Suite 4,
Fresno, CA 93727, USA

T: +1 (559) 456 1711

E: jlozano@robertson-geo.com

Robertson Geologging (Asia) Inc.

Flat 21A, Village Tower, 7 Village Road,
Happy Valley, Hong Kong

T: +852 650 33486

E: steveparry@robertson-geo.com

www.robertson-geo.com



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