# RGeoServices

ROBERTSON GEO SERVICES
Unlocking Your GeoData


With a continued commitment to provide a market leading service for geophysics, Robertson Geo has pioneered the development of the slimline wireline industry for over 40 years.

As designers and manufacturers of its own technologies it is the "go to source" for geophysical probes, supporting equipment and software that is time proven for innovative solutions for accuracy and reliability.

Robertson Geo Services offer premium quality borehole data acquisition, equipment rental facilities, training and data processing services.

www.robertson-geo.com

# ESSENTIAL LOGGING SERVICE

## Data – The Core of the Business

The provision of borehole logging services whilst often appearing to be a rather complex technical and logistical exercise is fundamentally a data business. All other elements of the service, though essential, are necessary only to ensure the provision of the highest quality geophysical data.

The delivery of high quality calibrated data necessitates that expertise and support in many areas is required to facilitate the planning, data collection and subsequent processing activities.

Robertson Geo comprehensively calibrates all its logging systems and *uniquely* uses an on-site borehole for testing at its test well and calibration facility providing customer confidence for all data gathered with its probes. Current conformance certificates are always supplied for all probes deployed, further confidence that the equipment is tested and "ready to go".

Adherence to the various applicable ASTM standards (e.g. D5434-12 - Standard Guide for Field Logging of Subsurface Explorations of Soil and Rock) is a prerequisite for all logging work undertaken.

Data processing standards are applied to all logs to ensure a professional and consistent presentation. An audit trail of the processing sequence is also available for complex data processing. Data is delivered to clients using secure links to a cloud-based repository.

The logging and rental services are complemented by an industry proven back up and support system for all probes and equipment, with access to expertise available from the Robertson Geo support desk and the development and engineering departments.

All logging engineers complete an extensive in-house training programme and are issued with competency certificates detailing their expertise on the full range of probes and ancillary equipment. Ongoing training also covers offshore emergency training (BOSIET) and Radiation Protection Supervisor as well as numerous other Health and Safety courses.

Robertson Geo Service Engineers are required to work in a variety of challenging environments, from the arctic circle; mountain regions through peat bogs to deserts and jungles and all across the weather spectrum for land-based work. Offshore and underground situations are similarly routinely encountered by engineers and service teams.

Robertson Geo is a truly global service provider with experience gained from working across the UK, Ireland, Europe, Asia, Australasia, N & S America and numerous offshore locations. Travel risk assessments are completed prior to mobilisation.

## People – The Engine of the Business

Robertson Geo Service engineers come from a variety of backgrounds including geophysics, engineering, geology, geography and electronics. The engineers are selected not only for their technical skills but also for their ability to work well as part of an effective team.

Team culture and identity are very strong and all engineers understand the objectives of the job and are highly goal oriented with mutual respect for other team members from whom they expect support.

While all team members are required to cover all aspects of the job, individual engineers may have strengths in different areas. Respect for individual skills and the synergistic benefits from combining personnel on particular projects means that the workload is balanced across the team.

Good communication skills are vital for the planning of complex projects and for liaison with clients and drilling personnel, the latter especially pertinent for the safe execution of the job.

Reliability is also vital so that team members develop trust in each other to effectively perform their share of the work.

For land-based work engineers typically work in pairs as this is necessary for safe remote working. However, for offshore work, the engineer will usually be lone working due to limitations on budget or accommodation space, but they are always working as part of a larger team i.e. the whole vessel. This requires the ability to work well under pressure and having problem solving capability on-board and being comfortable with the responsibility.

## Service Quality

Providing a quality service is paramount for Robertson Geo Services with the whole end to end business process from enquiry, through planning to data collection and delivery documented and audited to ISO 9001:2015 standards.

**Responsiveness & Knowledge –** Enquiries are handled with care ensuring that all relevant information is collected and understood before a quotation is issued. Quotations are provided in a technically friendly format offering an easy understanding of what is provided and how much it will cost. As Robertson Geo routinely quote different clients for the same project, fairness is maintained by always working from a standard price list. Whilst some clients are extremely knowledgeable and know exactly what they require, others will quite correctly lean on the expertise that the service division has before deciding which services suit their needs.

**Adaptation –** Following the acceptance of a quotation the work can be scheduled. Dates are more often than not provisional at this stage, as logging usually follows on immediately after the completion of drilling. Flexibility is the key at this stage as these dates will almost invariably move before the site work is finally confirmed.

**Reliability & Accountability –** All equipment and vehicles are fully checked before the engineers set out for a logging job. For the logging equipment a full systems test is conducted immediately prior to mobilisation and all probes are checked to ensure they have a current conformity certificate. A full life history of all probes is also maintained detailing calibrations, maintenance, repairs and job history.

For overseas work, where equipment needs to be delivered separately to site, Robertson Geo Services ensure that it is handled professionally to arrive in good time, eliminating any potential project delays; always preferring to deliver the equipment to the vessel or site, where appropriate, making sure that clients can confidently delegate this responsibility.

**Engagement –** Once on site, close liaison with clients is required to ensure that logging requirements, relevant local conditions and H & S concerns are mutually understood and agreed. An ongoing programme of Health and Safety training for the engineers ensures that all aspects of the work are conducted as safely as possible. RAMS are customised for each job and in addition most sites now require extensive inductions on site with further POWRAS being conducted at the borehole locations.

**Assurance –** The comprehensive training system and the experience of engineers ensures they are best equipped to make the correct decisions in the field relating to data quality and safety. Throughout the logging process the logs are monitored on-screen in real time as a vital part of the QC process.

Data processing can be performed in the field if time allows or more routinely back at base. Processing standards are followed to ensure accuracy of data and consistency of presentation.

## Borehole Logging Services

### Renewables

For many years Robertson Geo Services has been providing logging services to the offshore renewables sector. In an industry dominated by the UK for many years engineers have worked on many of the wind farms in and around UK waters. The expertise gained

has also seen engineers collecting data on offshore wind farms in Germany, Denmark, France, Belgium, Taiwan and USA.

The offshore environment brings its own unique challenges due to the need to minimise/eliminate costly down time and to deal with the harsh marine environment. The renewables sector has been a significant part of Robertson Geo Services business for more than 10 years, predominantly deploying the PS Logger® probe on offshore windfarms, working from jack-ups and drill ships.

As an OEM of our own equipment Robertson Geo has been able to modify equipment specifically for use offshore. This has entailed the extensive use of corrosion resistant materials and improvements in water proofing. Experience based development has standardised spares kits for the winch and PS Logger® in addition to adopting a policy of always carrying a spare probe. More recently, Caliper and Acoustic Televiewer probes have been routinely requested in addition to the PS Logger®.

The specific challenge of working from drill ships is the need for a heave compensation system to minimise disturbance due to wave motion. Wind farms are located in the windiest areas where seas are generally very rough. On drill ships this necessitates integrating the logging system with the heave compensation system usually by mounting the winch remotely on the rooster box. This solution ensures that accurate depth control is maintained throughout the operation.

## Geotechnical

Geotechnical requirements involve the collection of logging data relating to structure (bedding, fractures and dip angles), hydrogeology and material strength. Where core samples have been obtained, the televiewer logs provide the definitive method for core orientation.

The Geotechnical sector accounts for the largest proportion of land-based work undertaken. The greatest challenges that have to be overcome are generally the ground conditions, both at surface and below ground. In simple terms this means getting there and then ensuring the borehole remains open/stable.

On active building sites access is often an issue as there is often limited space available and there may be many concurrent operations taking place.

For more remote areas there has been a widespread adoption of mud mats to minimise disturbance to the site, as in UK mud and waterlogged sites can often be considered normal, especially in winter months. The provision of trackways allows more flexibility in the choice of logging vehicles as 2WD only may be required.

In mountainous terrain it is possible that even 4WD logging vehicles cannot gain access to boreholes. Given prior notice, Robertson Geo Services can take a portable system in these cases. Usually the client can provide a “marooka” or similar vehicle to minimise the heavy lifting and carrying, but in extreme cases all equipment may have to be hand carried to the borehole.

For geotechnical investigation, where boreholes can be quite shallow there is usually a requirement to fully log the borehole, including the top unconsolidated formations. Where borehole stability is an issue it is common for the logging to be conducted in stages whereby the drill string is removed incrementally. This can involve from two to ten logs being recorded for each probe maximising the chances of getting full coverage for the borehole but is far more time consuming. Processing of the subsequent logs then becomes a more complex exercise as they all need to be spliced and then combined into a single log for each probe.

**Geotechnical investigations have been conducted by Robertson Geo Services on many types of major civil engineering projects including:**

**Bridges:** Mersey Gateway Bridge at Runcorn, Queensferry Crossing in Edinburgh and the second Lake Maracaibo Bridge in Venzuela.

**Tunnels:** Lower Thames Crossing, A303 Bypass - Stonehenge, HS2 (Chalfont) and the Elan Valley Aqueduct bypass tunnels.

**Port Developments:** Haifa and Ashdod in Israel, Aberdeen Harbour, San Antonio - Chile, Lochboisdale Harbour - Outer Hebrides, Greenore Port - Ireland.

**Linear Infrastructure:** HS2, Crossrail, Western Peripheral Route - Aberdeen, Bontnewydd Bypass - Caernarfon, M9 - Ireland, A5 - Northern Ireland.

**Buildings:** Canary Wharf, Owen Street - Manchester, Paradise Circus - Birmingham.

**Nuclear Sites:** Hinkley Point C, Bradwell B, Sizewell C, Dounreay, Oldbury and Wylfa B.

**Slope stability:** A66 - Shap.

## Mining and Minerals

Geophysical logging for mineral exploration involves some of the deepest boreholes encountered outside of the oil industry. Robertson Geo Services has the capability to log to 2,000m depth.

Service engineers have regularly worked on coal mines and quarries on the UK mainland, zinc, lead and gold mines in Ireland, uranium mines in Gabon and more recently in a 1.3km deep iron ore mine in Kiruna, Sweden. For Kiruna it took the engineers over half an hour to drive down the spiral vehicle access route before reaching the borehole site deep in the mountain.

Logging can be conducted from the surface or from existing underground adits, with boreholes often angled to intersect anticipated faults and beds. Some boreholes may be drilled with several daughter boreholes diverted from the main borehole by the use of wedges. The bottoms of these wedges are a potential hazard for retrieving probes, especially in angled boreholes, further compounded if there is a disturbance directly beneath the wedge.

Given the generally small diameter of mineral boreholes (typically 76-122mm) and the fact that the rocks can be extremely hard it is always a major challenge to ensure that probes do not get stuck in the boreholes. In fractured or drilling disturbed sections it is all too easy for broken rock to fall into the borehole above the probes and cause problems.

In all cases an uncentralised 3-Arm Caliper can be run to show areas where the borehole wall has broken down. The probe has a narrow diameter, 38mm, which allows small pieces of loose rock to drop past the probe. This can be repeated several times if necessary and the traces overlaid to see if there are any changes to the diameter, indicating instability.

Robertson Geo Services has a 100% record for not losing probes over the past 12 years, but have had probes temporarily stuck on several occasions. Robertson Geo fishing tools are always available for remedial action and furthermore the Robertson Geo engineering department can custom make retrieval equipment should the problem escalate.

## Water and Environmental

Logging services are provided to the water and environmental sector for location of water tables, to characterise aquifers and aquitards, to establish potential water yields and for the routine inspection of water wells and casing condition.

Inspection of water wells and old mine shafts forms a significant part of Robertson Geo Services business in

mainland UK. CCTV inspections, water sampling and temperature/conductivity logs are the "standard" requirements for ascertaining borehole/shaft integrity, casing condition and water quality.

The integrity of mine shafts is important for safety, local subsidence and from an environmental point of view, especially regarding the impact on potable water systems and potential flows of contaminants into rivers. Regular inspections using CCTV allow the responsible authority to monitor structural changes over time.

One Robertson Geo Services client has the responsibility to maintain an estimated 200,000+ old mine workings that have ceased production and been allowed to flood. While the most important of these are the extensive mine workings in the traditional deep mine coal areas, there are also countless small pits, especially around the Birmingham area, many much older and not so well documented. CCTV surveys (capability to 1,000m) are the most common method of determining the condition of old shafts.

Water wells used for potable water and drink/food production are also inspected regularly in order to maintain flowrates and to evaluate the condition of the casing/structure of the well.

Boreholes around reservoirs and dams are also monitored for integrity and water quality.

## Equipment Rental Services

Equipment for rental is available including probes, winches and ancillary equipment all maintained to the same high standards as the borehole logging systems utilised by Robertson Geo Services. All rental probes are supplied with a current conformance certificate and will have undergone full system testing prior to despatch.

In cases where time delays would be critical (most cases for overseas clients) Robertson Geo Services can provide spare probes and spares kits to eliminate potential downtime from having to re-ship replacements.

Rental equipment is available globally to clients in UK and Europe, N & S America, the Middle East, the Far East and Africa, predominantly to the renewables sector but also for mining and geotechnical applications.

First line support for any issues that arise or for queries on data and parameter setting is provided. A QC function on client data is also provided whereby clients can feel assured that the data they are collecting conforms to standards.

Assistance with arranging for shipping and the temporary import of equipment will be provided by the shipping department who have expertise shipping to over 150 counties globally.

## Training Services

Clients renting equipment who are experienced loggers may simply need additional probes or systems and have little need for additional training as the manuals and online help available through the www.robertson-geo.com portal is sufficient. For less experienced clients renting equipment they will often require training either at the Robertson Geo base in Deganwy or at the clients own site.

The training can comprise everything from basic logging technique, through probe specific training to data processing. The availability of a test borehole (as at Deganwy) means the clients can get hands-on practice in a real world situation.

## Data Services and 3rd Party Data Processing

Robertson Geo maintain a database of over 7,000 borehole logs collected from 2001 to the present day, categorised by log type, location, depth, quality etc. This probably represents the largest collection of quality UK borehole logs available anywhere.

The data has been used by clients who want historical data from specific sites where the original data has not been retained, often through changes of ownership or responsibility for the site.

A client recently requested all temperature logs taken from disused mine shafts in order to assist in a feasibility study for geothermal energy generation. In many cases there were multiple logs from the same borehole/shaft taken over an extended time period allowing temperature trends to be evaluated.

For rental customers Robertson Geo Services offer a full data processing service to its clients. This service is most commonly adopted for the more complex data arising from sonic probes and in particular the PS Logger®.

**Graham Comber**
**Geophysical Services Manager - Robertson Geo**