PS Logger® – Commissioning and Training in Manila Bay

Heritage Shaft Inspection at East Pool Mine in Cornwall

Offshore Wind Farm Client Training

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India

Major Robertson Geo water-well system for the Irrigation and Public Health Department, Himachal Pradesh.

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RGUSA NOW BASED IN PHOENIX, ARIZONA

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LIFE OF A LOGGING ENGINEER - WORLDWIDE TRAVEL

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GETTING TO KNOW GEOPHYSICAL LOGGING SYSTEMS
An understanding of the principal components of Robertson Geo systems

PS Logger®

COMMISSIONING AND TRAINING IN MANILA BAY

The client purchased a complete logging system to be deployed on board a heave compensated drill ship. A package of commissioning and training was provided by a senior logging engineer from Robertson Geo Services over a period of 10 days.

The job involved commissioning a comprehensive PS Logger® system and training six operators in its use at their chosen South East Asia location. This was in preparation for a major project in Manila Bay, Philippines, where they would be conducting ground investigations for an upcoming bridge construction project.

The training consisted of probe theory, calibration, essential maintenance (probes and surface equipment), logging procedures and data processing. The first five days of training were carried out in port, simulating logging scenarios on deck in addition to classroom training. Working on heave compensated drill ships requires the winch to be mounted on the rooster box. This requires the fabrication of a frame to mount the winch and recommendations on how to fabricate the frame were provided.

Following fabrication of the frame, the winch was mounted in it and the setup successfully tested. Once the team understood the fundamentals of logging the engineer joined them on their next short project offshore. A short section of borehole was logged as training continued, running through the setting up of their equipment, logging, safety matters, preventative maintenance and the processing of their own collected data.

Upon conclusion of the training, certificates were issued to the six operators confirming they had achieved the necessary competency.

Slope Stability in the Midlands, UK

Robertson Geo Services recently successfully completed a small slope stability project in the West Midlands, with five boreholes logged across four visits.

The logging was conducted in a remote location down a steep slope in the middle of a forest. This required the use of a portable Mini Winch and tripod setup ideal for the difficult conditions.

The probe suite required consisted of High Resolution Optical Televiewer®, High Resolution Acoustic Televiewer® and 3-Arm Caliper probes. The data from these probes assisted the client in determining bed boundaries, fractures and cavities and any areas potentially causing slope instability.

The team of experienced logging engineers combined with the highly portable logging equipment and a forward-thinking, problem-solving mentality were able to work safely and successfully in this toughest of environments.

If it can be drilled, Robertson Geo Services can log it!

Irrigation and Public Health Department, Himachal Pradesh

INDIA

Our exclusive Indian representatives Aimil recently commissioned a major Robertson Geo water-well system for the Irrigation and Public Health Department, Himachal Pradesh, for use in their ongoing geophysical logging activities in the bottom of the Shivalik hills, Una district, Himachal Pradesh.

The Irrigation and Public Health Department are responsible for the district's drinking water supply schemes, irrigation systems and the boring of tube wells. The Northern State is located in the Himalayan region. Despite the difficult geographical conditions, Himachal Pradesh has become the first hilly state in the country to provide water to every household.

The 500m logging system is used for the qualitative and quantitative assessment of every water-bearing zone of the borehole. The logging data is vital to ensure the most efficient construction of the tube well to provide the best quality of water to society.

The system was installed in the client's vehicle by Aimil and commissioned by the local Robertson Geo trainer with over 30 years of logging experience. The system consisted of a Micrologger2, a 500m Winch and an Electric Log with Natural Gamma and Temperature.

Aimil has been at the forefront of the instrumentation industry in India since 1932. They are distributors for many "best in the world" leading-edge technologies and state-of-the-art instruments used across a broad range of industries. In addition, they manufacture test equipment and provide consultancy services to help instrumentation users through a team of highly qualified professionals. This customer-focussed approach, especially in the fields of geotechnics and geophysics, makes them an ideal representative for Robertson Geo.

Offshore Wind Farm Client Training

TAIWAN

One of our major Offshore Wind Farm (OWF) clients in Taiwan recently purchased a comprehensive PS Logger® system for their extensive ground investigation works in the Taiwan straits.

They required in-depth 'onboard' training for their operators, and this was provided by one of Robertson Geo Services' team's highly experienced logging engineers joining them onboard their drilling vessel for eight days during drilling works on their current Formosa 4 OWF project 18 to 20 kilometres off the coast of Miaoli County in north-western Taiwan. Formosa 4 and neighbouring Formosa 5 will have a potential installed capacity of over 2.6 GW, which will be able to power up to nearly 3 million households upon completion.

By joining the operators onboard, the Robertson Geo Services (RGS) training engineer could give them first-hand training in probe theory, probe and surface equipment maintenance, calibration and logging during a real ground investigation scenario. After collecting PS Logger® and caliper gamma data from three 100m boreholes, our engineer provided training on quality control, processing and presentation of the data acquired.

RGS training engineers' vast experience of logging in many different scenarios and conditions allows them to provide training tailored to the client's needs and teach them tips and techniques to enable operators to collect the best quality data and show ways to operate efficiently while keeping downtime to a minimum.

All competent trainees were given a certificate at the end of the course.

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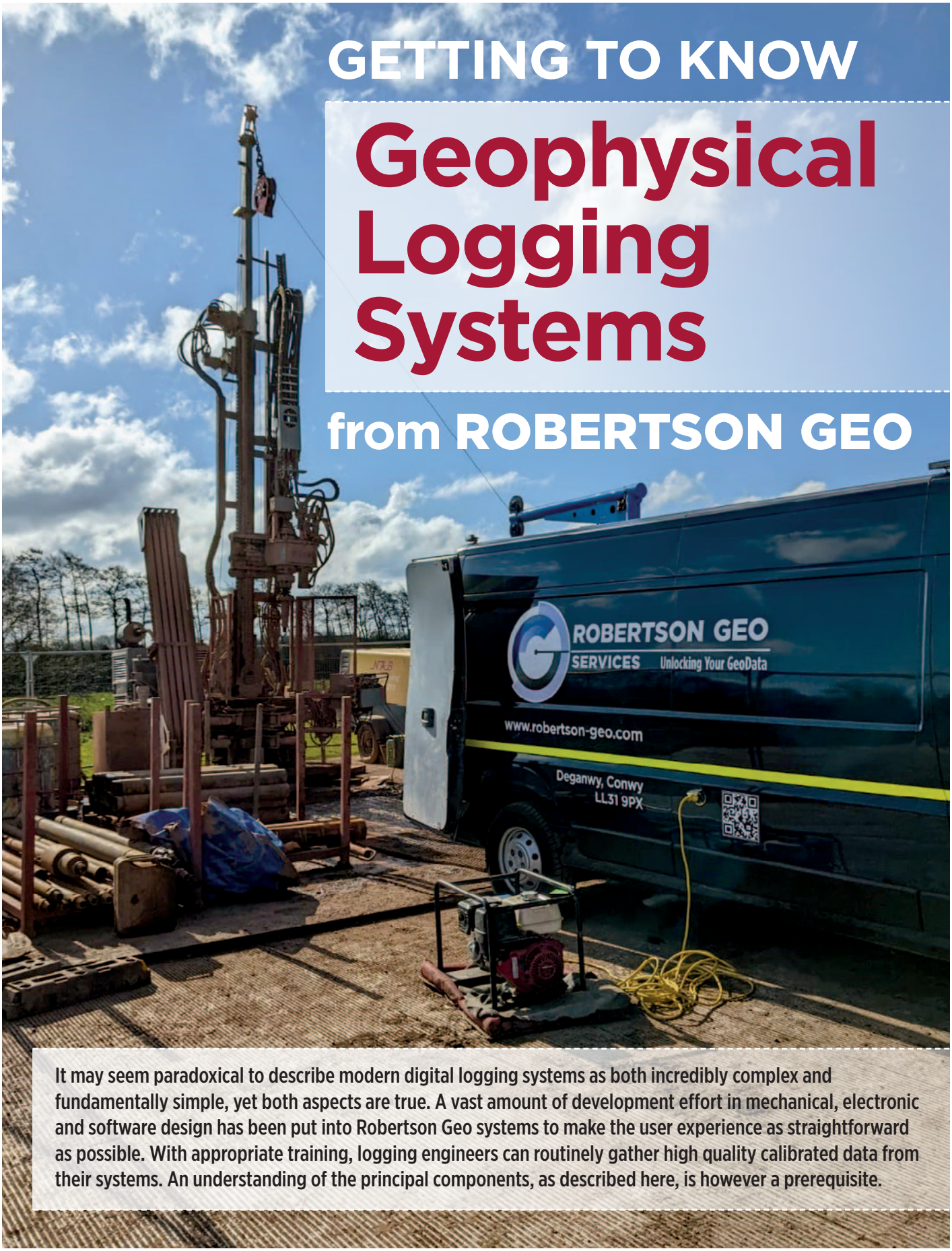
GETTING TO KNOW
Geophysical Logging Systems
from ROBERTSON GEO



It may seem paradoxical to describe modern digital logging systems as both incredibly complex and fundamentally simple, yet both aspects are true. A vast amount of development effort in mechanical, electronic and software design has been put into Robertson Geo systems to make the user experience as straightforward as possible. With appropriate training, logging engineers can routinely gather high quality calibrated data from their systems. An understanding of the principal components, as described here, is however a prerequisite.

Above: Logging engineers need to be resourceful – here using a tree to support the winch during portable operations.

Getting to know Geophysical Logging Systems from Robertson Geo

The Main Components

A Robertson Geo geophysical logging system is made up of several items of electrical and mechanical equipment which work together to make specialized measurements within a borehole at known depths. Despite there being a considerable range of measurements, there are several key principles which hold true throughout.

The logging system operates under computer control via a USB connection. The computer is fed with data measurements from a borehole probe and data from surface instruments associated with a logging winch. This allows the system to make a graph or table of measurements against borehole depth or time, as required. The computer allows control of many functions of the system both automatically and under operator control.

In general, a logging system will consist of an electrical power source, a computer and software, a geophysical logger (Micrologger2), a logging winch, a tripod (or sheave wheel), borehole probes, connecting cables, probe accessories and maintenance items. Robertson Geo logging systems are relatively compact but will require a vehicle to transport the equipment to site, in most cases this will be a customised dedicated logging vehicle.

Electrical Power Source

The most common option for providing electrical power to Robertson Geo logging systems is a properly voltage-regulated AC mains generator.

This should have sufficient spare capacity to run all the equipment on the job, especially relevant for heavy probes or deep boreholes where the winch is pulling hard. If a reliable single-phase domestic mains power supply (220V or 110V) is available on-site this may be used instead.

A true-sinewave type DC to AC mains inverter, together with batteries, may also be used in place of the generator. A 12V power supply unit will be required for 12V winches and the Micrologger2 when using AC mains only.

For logging systems based on small winches (Mini Winch or 500m Winch) the entire system may be run using 12V power only. This will require one or more car or leisure type batteries connected in parallel to directly power the winch and surface system. Battery based options are useful for sites where liquid fuel generators are not allowed or where concerns about pollution may exist.

Computer and Software

Laptop style computers are favoured by logging engineers as they are self-contained and can run on their own internal batteries, often for several hours. They are extremely resilient to

power dropouts, switching seamlessly from AC power to battery power without re-booting. Laptops provide versatility as they can be used both for portable operations and in vehicle-based setups. It is good practice to dedicate a computer to logging operations to prevent unforeseen clashes with other software and to avoid connecting to the internet before or during logging. Operating system updates need to be approached with caution as they can cause problems. Following an operating system update, the whole system should be thoroughly tested before commencing field operations.

Robertson Geo provides a minimum recommended specification for logging computers as shown in the table below.

Recommended Logging Computer Minimum Specification	
Processor:	Intel Core i7-7700
Memory:	16GB RAM
Disk Drive:	500GB SSD
Graphics:	Intel HD Graphics 630 GPU
Operating System:	Windows 10 64-bit

Older computers with lower specifications may be sufficient for many probe/software combinations but will need to be fully tested first. The latest laptops may have only a single USB port and if additional devices such as a mouse need also to be connected, a USB hub can be used. In this case the system again needs to be fully tested to ensure that there are no clashes between devices and the system operates correctly. It also recommended that operators using laptops for logging ensure that they have sufficient access rights assigned to them to allow for full control in field situations where contact with centralised IT departments may be limited. Installing logging software is usually a trouble-free operation but using auto-install for USB drivers is best avoided. The instructions in the relevant software manual should be followed very carefully with respect to driver installation.

Through the logging software it is possible to configure and control power and communications with the borehole probes, monitor real-time depth and data from the probes and optionally configure winch cable tension. Configuration of most aspects of the system are made within the software and, once familiar with this, it is worth making a written record of all settings for future reference together with copies of all specialist files in case one needs to start again.

There are many facets to geophysical logging with Robertson Geo software packages and specific training is recommended for all but the most expert users. Post-processing of data, using GeoCAD® is also a vital part of the logging service and this may be undertaken in the field but is more commonly done elsewhere. Log processing is another expert field where training will benefit.

Micrologger2

The Micrologger2 is the principal surface acquisition device used by almost all Robertson Geo systems. Since its introduction in 2001 this small robust unit has been at the heart of most systems, now field-proven for ease of use and reliability. The unit provides power and communications through the logging winch to the borehole probes under software control from the logging computer via a USB connection. The power required is 12V, either from a battery or more commonly from an AC source through a supplied transformer.

The logger has an on/off switch which also indicates power is present and will flash when the borehole probe power is activated. There are various connectors on the unit for power, USB and data through a special 4m long data lead connected to the logging winch. A green 'Link' light on the Micrologger2 will flash frequently during software startup and thereafter periodically after connection has been established. When the unit is powered, it is also usual to hear sound from the internal cooling fan.

The Micrologger2 also registers depth changes which come from the depth encoder mounted on a wheel, either direct on the logging winch or, on a tripod positioned over the borehole. Tension is also monitored from a strain gauge, where fitted. These signals are passed through the special data lead from the winch, along with power and data to and from the borehole probe.

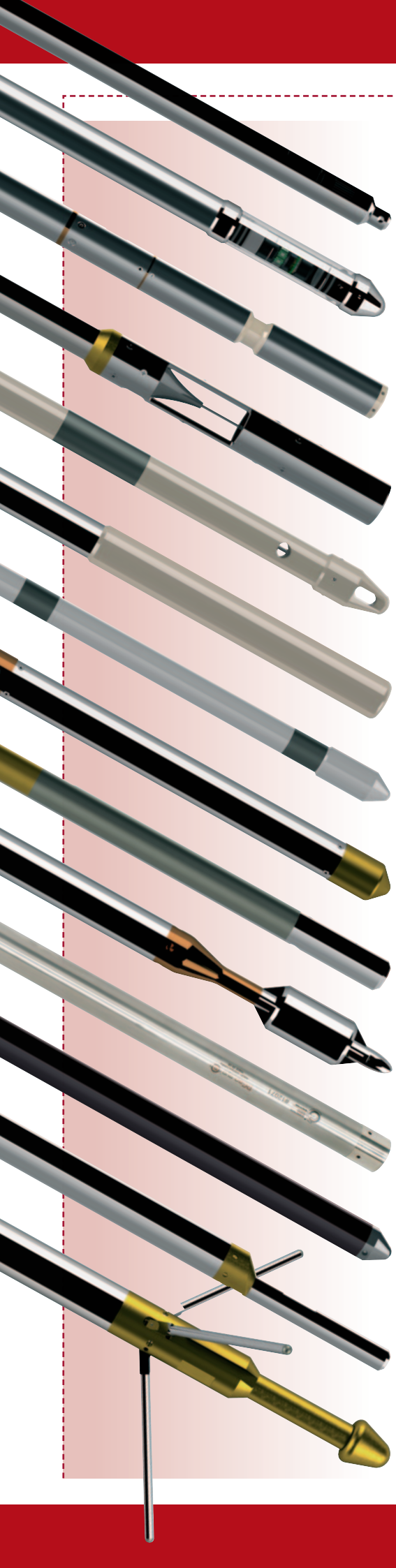
Logging Winch

All Robertson Geo winches feature an electrically driven rotating drum of special 'armoured' wire cable, which contains electrical wires embedded within to pass power and data to a borehole probe. This cable and associated connection are designed to operate at considerable depth and fluid pressure. A robust connector known as a cablehead is fitted on the free end of the logging cable to provide connection to the borehole probe.

This connector also provides mechanical support between the probe and logging cable. The ability to renew the cablehead by stripping down and re-joining to a newly exposed piece of logging cable is an essential skill to learn for geophysical logging. This should be undertaken periodically as a regular maintenance task, with frequency dependent upon winch usage and operating conditions. Damage to the cablehead can also occur at any time in the field requiring the operator to replace the cablehead, often under less-than-ideal conditions.

The winch will feature a movement control panel to regulate speed of cable travel and direction, along with an emergency stop and an overcurrent circuit breaker. There will also be connection points for power supply, Micrologger2 data cable and a depth connection for a remote depth encoder on a tripod. Most winches will also feature a connection point and switch for an earth stake to be used for electrical logging.

The logging cable will travel over a calibrated wheel which will turn in unison with cable movements to register depth. A further smaller wheel is present on 2000m winches to exert pressure onto a load cell to register cable tension. To pass the rotating cable connections through to the stationary frame of the winch a device known as a slip ring is used. This has a set of sealed rotating contacts at the axle of the cable drum to provide power and data connectivity for the borehole probe.



Tripod/Sheave Wheel

For vertical boreholes, a wheel mounted on a tripod or alternatively one or two sheave wheels are used to allow passage of the cable into the borehole as the cable usually pays out horizontally from the winch. The Robertson Geo tripod consists of a free-spinning wheel fixed to a strong metal plate, into which can be attached three sectional support legs to suspend the wheel over the borehole.

The depth encoder may be mounted on this tripod so that movements of the wheel can be sensed by the Micrologger2 via the depth cable. In some cases where heavy or long probes are used it will be preferable to use a sheave wheel setup requiring a top connection from either a drilling rig or a crane.

Borehole Probes

Robertson Geo logging probes are designed to operate reliably under the extreme conditions of fluid pressure and temperature found at depth. In addition, they must be transported to and from site safely and be handled carefully to avoid shocks which can damage some of the delicate components.

The variety of probes measure many physical properties of formations and may feature orifices, windows, or moving parts. Some probes are heavy whereby handling may require the use of a team or lifting equipment. Probes receive power from the Micrologger2 through the winch logging cable to operate. All communications to and from the probe are digital, allowing the probes to receive commands and transmit the measurement data back to the surface in real time.

Many probes will require the use of some accessories such as special carrying cases, connector covers, centralisers (to keep probes in the middle of the borehole), de-centralisers (to press the probe into contact with the borehole wall), calibrators or testers, and sometimes a weighted sinker bar to overcome buoyancy issues in thicker fluids. A few probes use radioactive sources to stimulate the formation for measurement and special considerations for handling these safely are required. Most probes will require some form of calibration beyond that provided at the factory and jigs are available to do this in the field or at base.

Conclusion

When the basic principles of geophysical logging are understood, Robertson Geo logging systems can be regarded as relatively straightforward to operate and maintain. Operators need to have a safety-first attitude as they are often handling the equipment in challenging environments, with the winch needing constant vigilance when operating. A good understanding of the relevant software used to collect and process the data is also required.

Robertson Geo offers a variety of training packages which can be customised to meet client needs. These can be conducted at the Robertson Geo base in Deganwy or remotely at a client site.

In addition, training videos are available to customers here at our **dedicated Youtube channel**.

Heritage Shaft Inspection at East Pool Mine

Cornwall, UK

Robertson Geo Services were contracted by Cornish Metals to perform a sonar and video camera survey at East Pool Mine in Cornwall, an impressive industrial heritage site. The aim of the survey was to investigate the integrity of the shaft looking for any signs of possible collapse.

The shaft to be surveyed, known as Taylor's Shaft, was constructed between 1921 and 1925 to provide water pumping for the East Pool Mine following an underground rockfall which caused flooding. Once the shaft was completed, a 90-inch pump known as Harvey's Engine was installed and remained operational until 1954.

The pumping engine, manufactured in 1892 is one of the largest surviving Cornish beam engines in the world. Preserved in its towering engine house it serves as a reminder of Cornwall's days as a world-famous centre of industrial engineering and innovation. The mine started out in the early 18th century producing copper ore, later producing tin, arsenic and wolframite before closing in 1945, eventually becoming part of the local World Heritage Site.

The Sonar Survey

The Sonar Caliper probe, developed and manufactured by Robertson Geo, is designed to provide a scaled and orientated cross-section of large bores, shafts, caverns and trench walls; combining accurate diameter measurements with a fully orientated 360° view of its surroundings.

The Sonar Caliper operates by emitting a pulse of sound that is reflected by a solid object; timing the delay between emission and the arrival of the reflected sound wave back at the probe to allow a calculation of distance to be made. The probe makes 400 individual radius measurements in a 360° arc around the probe and then orientates them to magnetic north.

The calibrated measurements were taken statically in the shaft at specific intervals and presented as cross sections. The cross-sectional data was then used to produce a 3D wireframe representation of the shaft.

The Video Camera Survey

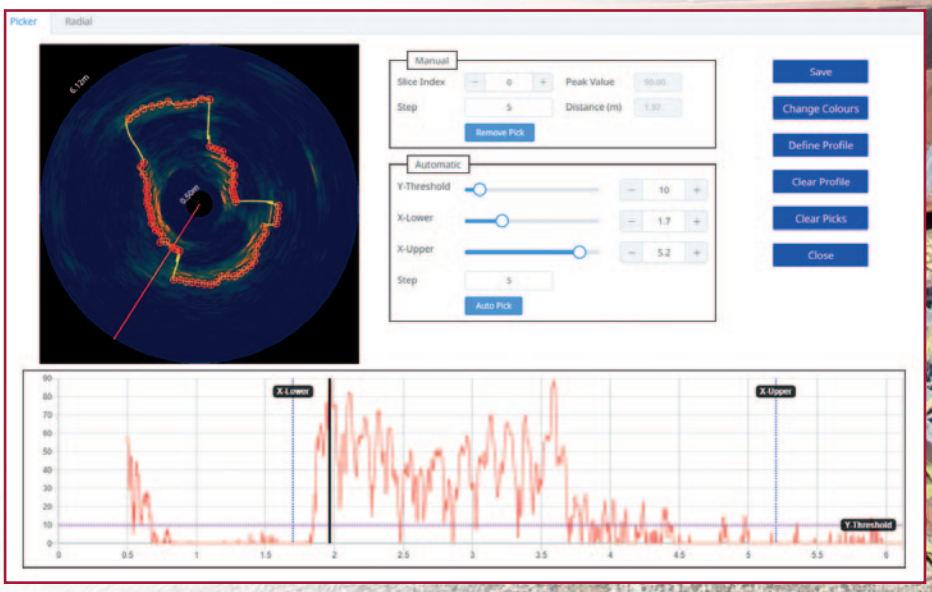
When inspecting shafts, a video camera survey is usually a prime requirement. The video camera, with side and bottom view capability, can produce clear images both in air and underwater of the condition of the shaft walls and floor. The video obtained is recorded for subsequent detailed inspection. The recordings made form a permanent and legally binding record of the structural condition of the shaft.

The video camera in operation illuminating the shaft, as seen from above.

Below: Sonar Logging in progress at Taylor's Shaft.

Weighing only 16kg, the Sonar Caliper is easily handled by a single engineer.

Example of the sonar data during acquisition.



Robertson Geo enters another exciting chapter on its US journey. From our humble beginnings in Houston, Texas, in 1998, RGUSA has continually adapted its US business model to meet market needs. In 2016, we moved to Fresno, California, to help serve our growing West Coast clients. However, the location proved difficult to support our expanding sales in the US and Americas, and it was time to move.

RGUSA now based in PHOENIX, ARIZONA

Why Phoenix?

Phoenix offers superior access to our markets in North and South America via a main international/domestic airport and a second domestic one (Fresno was 3.5 hours from the nearest international airport). Arizona also offers us a pool of talent which we couldn't attract in central California.

As Robertson Geo plans to launch its Marine Geotechnics services in the US by Q2 2024, serving the OWF markets, we need an accessible base with abundant local talent to expand our team over time. Transporting engineers and equipment throughout the US and the Americas relies on having easy access to airports, and the new office is just 15 minutes from the international/domestic airport.

Our highly experienced Robertson Geo Services team now handle all our global training and commissioning needs, and this, coupled with our plan to expand our rental business in the US, requires improved facilities and more qualified engineers, and our new Phoenix office can offer this.

As we build our new team in the US, we need a good workplace for them to grow and prosper, as they are the key to our success. Phoenix offers our staff more opportunities, a good working environment and an improved work/lifestyle balance.

Please contact our Americas Sales & Operations Manager, Stephen Stroud, for more information - email: sstroud@robertson-geo.com

Water Well Rigs and Loggers Thailand

In the early 1980s, PAT-Drill started life as a non-profit organisation committed to improving life conditions in deprived areas. Nowadays, PAT operations are focused on developing regions of the world, where local and international NGOs and aid agencies lead projects in collaboration with them.

Robertson Geo recently provided a water well logger to PAT-Drill as part of their drill rig supply to a significant Thai customer. Drilling and logging go side by side, saving considerable downtime (and money) if the driller can log the borehole themselves immediately after drilling, reducing the risk of the borehole collapsing too.

For this particular customer, PAT-Drill also provided a custom-built logging truck using their state-of-the-art manufacturing facilities and an innovative in-house team of designers. The practical and, moreover, highly cost-effective layout is ideal for the application. The logger included the Micrologger2, 500m winch and Electric Log with Natural Gamma and Temperature. Other tools can be added to the system at a later stage, on a plug-and-play basis, including Robertson Geo's downhole camera.

Robertson Geo looks forward to working more closely with PAT-Drill on future projects in Thailand, Asia and Africa, where we also plan to introduce more of our unique market-leading technology, such as the RGeo-eye® camera and GeoCAD® Visualizer Software.

Top-Tier Agents Meeting a great success

Robertson Geo recently hosted a 'Top-Tier Agents' meeting in Deganwy, North Wales, with key representatives from Central Asia, South America, Africa, the Middle East, Indian Sub-continent and Asia attending.

The event focused on 'selling on value', corporate compliance, new products and markets, a strategic review, our goals and aspirations for our three-year and 10-year plans, marketing and promotion, and various brainstorming sessions. We also reviewed customer feedback as part of our ongoing improvement program and ISO 9001-2015 audit, which is critical for our success.

As well as four days of hard work, we also had time to enjoy some sightseeing in our beautiful surroundings of Conwy and Llandudno and a visit to the odd pub or two!

Robertson Geo at 2nd Korean Offshore and Hydrogen Summit

Robertson Geo recently attended the 2nd Korean Offshore and Hydrogen Summit (KOWHS) with our local representative Taek Wang Electronics Corp.

The show was well-attended, and it was nice to see many familiar faces and meet new clients too. The summit brings together senior representatives from across the region, where they will touch upon key topics on the offshore wind market and green hydrogen's prospects in South Korea.

Robertson Geo has extensive international experience as a specialist provider of services and equipment to the renewable energy markets with a proven results-based record of reliability in securing the highest quality calibrated data from both on-shore and with systems suitable for heave compensated drill ships or jack-up rigs from the harshest of offshore locations. The Robertson Geo PS Logger® probe has become essential to OWF site geotechnical investigation.

Robertson Geo has had a busy year attending more events and exhibitions than ever before, promoting our range of products and services across multiple business sectors. Attending events and exhibitions, meeting existing and prospective clients face-to-face, remains vital to developing business relationships.

2024 also promises to be an exciting year for Robertson Geo, particularly as we expand our US business and continue to promote our Marine Geotechnics initiative. We look forward to seeing you at future events, which will be posted on our website at www.robertson-geo.com/upcoming-events

AL AIN, UAE : ICEG 2023

ABU DHABI, UAE : ADIPEC 2023

SEATTLE, US : DFI 2023

KAZAKHSTAN : MININGMETALS 2023

LIFE OF A LOGGING ENGINEER

Worldwide Travel

Working for Robertson Geo Services, no two days are the same, from working in the office and workshop in Deganwy, Wales, to logging jobs up and down the UK and Europe and more extensive trips further afield.

This trip began with flying to Kaohsiung, Taiwan, to meet a client and join a geotechnical drilling survey vessel in Taichung port. This client had purchased a Robertson Geo Marine Winch, PS Logger® and 3-Arm Caliper tool and required onsite training.

Joining them on their next offshore wind project for eight days while they drilled and logged three 100m boreholes allowed me to train them in probe theory, equipment setup, maintenance and to provide first-hand experience in borehole logging with the probes.

While in Taiwan, another client signed up, having purchased another similar setup and they needed training for their project in the Philippines but would be boarding a vessel currently in a Vietnamese seaport! With a start date not yet confirmed and an impending typhoon about to hit Taiwan within days, as soon as the ship returned to port, I rushed to the airport and jumped on the next flight out of Taipei, heading for sanctuary in Hong Kong to await further instructions.

Having run to Hong Kong to escape the typhoon, it had now changed direction and was heading straight towards Hong Kong and was upgraded to a 'super-typhoon', which meant another scramble for the next flight out and to Ho Chi Minh City, Vietnam. After spending five days in port training the crew on probe theory, maintenance and processing, I joined the vessel for a 5-day project on which we could run the PS Logger® and 3-Arm Caliper probe. A short section of a borehole was used to demonstrate best logging practices, ready for their upcoming geotechnical survey project in Manila Bay, Philippines.

Trips like these remind me how lucky I am to work for such a great company as Robertson Geo, with the places we get to travel to and the people we meet along the way.

James Boyett
Senior Logging Engineer

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SAFETY IS KEY ©

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