

Remote Borehole Sensors

Challenge

The challenge for our project partner Newcrest Mining is the measurement of temperature and pressure beneath an open pit where the rock temperature is extremely high and where saturated steam may be present.

This project involves the research and development of a system that can wirelessly measure underground temperature and pressure in geothermal regions.

Traditional wired sensors and data loggers can be used to carry out site measurements, but suffer two key drawbacks:

- Underground cables can break.
- Above-ground data loggers at the hole collar are susceptible to damage during bench blasts and vehicle activity.

Wireless underground sensor systems offer the obvious advantages of:

- Eliminating underground sensor cables – so no breakage issues
- Surface receiver equipment can be located at damage-safe locations, away from the hole collar.

Mining3's key technical challenges for this project are:

- Designing an underground sensor/transmitter that can work at 150 degC at high pressures.
- Transmitting data wirelessly through the solid and fractured rock over 100m to 200m.
- Ensuring system receivers are sensitive enough to process low-level underground sensor signals, but robust against site magnetic noise sources.

This wireless sensing system is the first of its type in the world.

Its underground data transmission capabilities can be extended to additional mining applications, where the gathering of data from long ranges, in rocky environments is crucial.



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Research

TMining3 has pioneered the use of extremely low-frequency magnetic signals in the mining environment, to carry out underground ranging measurements and data transmissions. This prior research is built upon in this project with the introduction of solid-state, extremely low-frequency transmitter technology (no moving parts). The transmission research is accompanied by corresponding signal reception work - processing low-level magnetic signal data in the presence of high-level environmental noise. The additional research effort is targeted toward developing a design architecture that operates at extremely high geothermal temperatures.

Benefit

- Wireless underground sensors negate the need for underground sensor cables – eliminating cable breakage issues.
- Surface receiver equipment can be located at damage-safe locations, away from the hole collar (as there are no sensor wires)
- Solar-powered wireless surface receiver equipment is easy to relocate on site, as there are no sensor cables or power supply cables to re-route or protect from vehicles.
- Improved system maintenance, as there are no sensors or power cables that are exposed to surface damage hazards.
- The wireless nature of the system allows integration with the mine's LAN system and the option to remotely access measurement data, without the need for physical site access.

Status

Phase 2 of this research project is focused on the development and testing of prototype units, for trialing at Newcrest's Lihir Gold Mine. The surface elements of this system are currently being shipped to Lihir. The underground pressure and temperature sensors will follow for onsite testing planned in Feb 2023.

Partners

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About Mining3

Mining3 is the world's leading research organisation, directed by its global mining industry members to develop and deliver transformational technology to improve productivity, sustainability and safety.

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