Connected underground

Innovative Wireless Technologies is combining connectivity, analytics and ventilation monitoring to help mines respond faster, cut downtime and optimise production in real-time.

Ensuring a mine site's performance depends on myriad factors, but a pillar of the process is operational intelligence: the seamless conveyance of information through uninterrupted channels delivered into a clear, accessible format.

Innovative Wireless Technologies (IWT) delivers exactly that through its wireless SENTINEL network of communication and remote monitoring devices paired with its analytics platform.

The network provides operators with real-time visibility to identify issues early, adapt quickly, and improve safety and productivity.

Combined with the SENTINEL Wireless Ventilation Monitor (WVM), the system enables distributed airflow observation in hard-to-reach areas, allowing earlier detection and faster responses. For underground operations, this level of visibility moves beyond convenience and becomes fundamental to performance and consistency across the mine.

Traditional communications systems have often struggle underground. Wi-Fi relies on predictable environments and clear lines of sight, while wired systems can be costly and slow to extend as mines evolve and headings advance.

"Mines are not clean, open, static environments," IWT director of marketing Jeremiah Colling said.

"They are harsh, irregular and constantly changing."

This reality underpins IWT's mesh-based approach, where each node becomes part of a broader communications layer, allowing data to move across multiple paths and reroute when conditions change. Instead of relying on a single connection point, the network becomes inherently more flexible and resilient.

This 'data-hopping' architecture allows information to move node-to-node until it reaches its destination, overcoming non-line-of-sight challenges that are common underground, resulting in a system that adapts with the operation.

That connectivity feeds into IWT's analytics capability, which is aimed at turning raw data into actionable insight. That kind of real-time optimisation depends on data that is continuous, trusted and immediate.

"If the data is delayed, incomplete or only available in fragments, then managers are not optimising operations in real-time," Colling said.

"They are reviewing history and reacting late. That is a completely different thing.

"Reliable transmission is what turns digital systems from a reporting tool into an operational tool. It allows mines to detect emerging issues sooner, coordinate people and assets with confidence, and make decisions while there is still time to influence the shift instead of just explaining what went wrong after the fact."

Rather than overwhelming users with raw figures, the analytics platform organises data into trends, alerts, exceptions and workflows that help to answer three questions:

- What is happening?
- Why it is happening?
- Where is attention needed?

In practical terms, production gains of 5–15 per cent are typically achieved not through one major change but by reducing repeated inefficiencies across a shift, such as delays, bottlenecks, idle time and poor coordination between crews and equipment.

"The point is not more data, but rather visibility into what is causing unplanned downtime," Colling said.

The same principle applies to maintenance, with IWT pointing to savings of up to 40 per cent when shifting from reactive to planned workflows. Real-time monitoring provides earlier indicators of abnormal patterns, allowing teams to act before failures occur and better align maintenance with production windows.

Artificial intelligence (AI) and machine learning support this by identifying subtle

The IWT analytics platform provides continuous awareness of underground operations.

Images: Innovative Wireless Technologies

patterns, from recurring downtime causes to emerging risks and inefficiencies that may otherwise go unnoticed.

"Our philosophy is simple: let the system do the watching, the sorting and the pattern recognition; let the people do the deciding," Colling said. "That is how you get scale without losing operational common sense."

That balance is especially important in mining, where conditions change quickly and experienced personnel bring context that no model can fully replicate.

Building on this shift towards real-time operational visibility, ventilation emerges as one of the most critical underground applications of continuous monitoring.

Using microelectromechanical systems (MEMS)-based pressure sensing, the SENTINEL WVM enables continuous, distributed monitoring across more locations, shifting airflow management from periodic checks to alive operational condition.

When integrated into the analytics platform, ventilation data becomes part of a broader system view, allowing operators to compare zones, identify trends and pinpoint issues more efficiently and with greater confidence.

This helps to reduce time spent diagnosing problems, and as compared to traditional methods, real-time monitoring can cut detection times from hours to minutes, giving operators a clearer starting point for response.

Wireless devices provide continuous visibility where traditional infrastructure is difficult to deploy.

That reduced uncertainty is especially critical in the mining industry, where downtime is often extended not only by the issue but by the time taken to understand it and determine the appropriate response.

For underground operators, shortening the gap between problem emergence, detection and response is one of the biggest advantages of a connected mine, particularly as operations continue to scale in complexity.

As mining operations grow more complex, IWT's integrated, real-time visibility across communications, analytics and ventilation is becoming essential to improving safety, efficiency and decision-making underground. AM