Nigel Pereira, Orica, Australia, explains how a wireless initiation system can help the mining industry move towards a safer and more efficient future.

In early 2017, Orica launched WebGen™, a fully wireless initiating system for the first stage in fully automating the drill and blast process. It has now been fired in over 650 blasts in both surface and underground mines around the world.

The system allows for groups of in-hole primers to be wirelessly initiated by a firing command that communicates through hundreds of metres of rock, air and water. This eliminates the need for down-wires and surface connecting wires, enabling for new mining methods and blasting techniques that are safe and reliable. It also removes people from harm’s way, reduces operating costs and increases productivity benefits. This step-change in blasting
technology changes the industry’s traditional approach to blasting and mining.

It uses low-frequency magnetic signals to communicate with each wireless initiation system primer prior to a blast. Moreover, it is the only commercial explosives product with a Safety Integrity Level 3 rating, giving it the highest functional safety standard of any commercial explosives product in the world.

The system includes the i-kon™ III plugin detonator, a Pentex™ W booster and a DRX™, which is a digital receiver comprising a multi-directional antenna and a battery which serves as the in-hole power source.

Creating new ways of mining underground

The system has demonstrated the success of its fully wireless blasting technology in many underground mines and has allowed for the development of several innovative mining techniques that would have otherwise been deemed impossible to execute.

Case study: Musselwhite mine, Canada

At Musselwhite mine, an underground mine owned and operated by Newmont and located on the southern shore of Lake Opapimiskan, Canada, ore pillars that previously could not be recovered in underground operations were successfully extracted using a temporary rib pillar (TRP) method enabled by the wireless initiation system.

The main ore of the panel at Musselwhite was blasted and extracted while the enabled TRP held back the waste rock backfill. This delivered a 34% reduction of waste dilution, increased truck fill factors, improved ore recovery and increased mucking productivity by 20%.

Based on the success of the TRP method, numerous additional mining methods that are enabled by the system have been successfully developed and implemented at Musselwhite, resulting in similar positive outcomes.

Case study: CMOC Northparkes, Australia

CMOC Northparkes, a copper and gold underground mine located near Parkes, New South Wales, Australia, uses block caving methods in its operations. Due to the poor ground conditions at the site, pre-charging with a wired system was not a viable solution and would expose site personnel to remediation work.

The company’s technology delivered a 75% reduction in drill and blast crew exposure time at the brow and a 96% reduction of re-work and eliminated redrills at the mine.

This was made possible using WebGen enabled sub level caves (SLC) mining methods. The introduction of the wireless system delivered improvements in operator safety and mine productivity during pre-charging by eliminating the need to work near the brow.

The technology helped Northparkes experience a 25% firing to schedule improvements and 37% increased drawpoint availability, increasing safety and productivity at the mine.

Eliminating critical risks in surface mining

The system’s success in underground mining has led to an increased adoption of the technology in surface mining. To date, the company has completed successful surface blasts using its technology around the world. With its wireless capability, it presents an opportunity to overcome one of the industry’s most persistent limitations – a physical or wired connection to each primer in a blast.

Wired systems have a large physical presence and are susceptible to damage at every point along the connecting line. The potential for misfires due to downline damage has commonly led to the application of redundant initiation systems and can impede the loading of adjacent blast patterns due to flyrock damage. These contributing
factors increase blasting costs, reduce mine efficiency and limit blast productivity. Wired systems in priming, loading, stemming and tie-in activities require precautionary measures to protect wired connections, adding burden to manpower needs and timing.

Being fully wireless, the system’s application in surface mining dramatically simplifies bench operations with no tie-in process and reduces on-bench resources, inventory and misfires that occur due to line damage or cut-offs, slumping or operator error. Stemming costs are also reduced and back-up inventory is eliminated with wireless systems.

The absence of downlines also removes the interaction between heavy vehicles and initiating systems while reducing people’s exposure to on-bench hazards. The tie-in process is eliminated and spotters are not required to protect downlines, nor is there exposure to the dust and dangers of typical stemming operations.

With increased flexibility in mine planning and blasted inventory, mine operations enabled by the wireless initiation system can prime and load larger single blasts as well as eliminate firing window variability.

**Removing lightning risks and delays**

Due to the conductive characteristics of wires in surface mining, lightning storms pose one of the primary challenges in global surface mining. In the event of approaching lightning storms, a mining exclusion zone is placed around the loaded blast or in some cases, the blast is cut short and immediately fired.

As the system does not require downlines and surface wires, lightning production costs and the risk of unplanned initiation of loaded blastholes can be eliminated, while production constraints from exclusion zones are completely removed.

At a depth of 3 m below the collar of a blasthole, the units are protected from the hazards of lightning. In a lightning event, the temperature and pressure effects of lightning are rapidly attenuated by the earth. The absence of lead wires in this scenario prevents current transfer. Additionally, the magnetic field induced by lightning will not activate a unit to fire.

**Large wireless blast**

In November 2019, Orica introduced its technology to the BHP Billiton Mitsui Coal (BMC) Poitrel mine as part of a staged approach to assessing the viability of wireless blasting surface mine operations.

At a metallurgical coal mine located in northeast Australia, BMC Poitrel committed to four wireless blasts. The largest blast featured 1920 wireless primers in a Stratablast™ method, comprising of the top horizon as cast and lower horizon as coal protection in order to offer maximum coal recovery for BMC.

The blast demonstrated the performance and capabilities of the wireless initiation system in production capacity and served as a development process to introduce wireless blasting into the blast operations at the mine.

The BMC Poitrel Mine found that using the company’s technology helped reduce the worker’s exposure to dust in the pit, and eliminates the potential for misfires because they do not need to physically tie each hole into the blast pattern.

Eliminating the need to tie-in each hole also makes the process for loading explosives more efficient and less susceptible to wet weather delays, as the pit does not need to be shut down because of the potential risk of an accidental ignition during thunderstorms.

Focused primarily on efficiency benefits, the wireless evaluation blasts at BMC Poitrel delivered a noticeable reduction in exposure time to on bench hazards.

The mine spends a significant amount of time in tie-in and detonator logging activities. When schedule revisions turn up, production delays may occur and requires the blasting crew to leave behind one blast to prepare another. The wireless capabilities reduced such delays as it meant loaded blasts would be ready to fire at the completion of stemming, without delay for tie-in.

The mine realised time savings through the elimination of several activities that would not have been possible with a conventional electronic blasting system. Activities eliminated included downline protection and inspection, laying out prime safes and concurrent activities such as logging the detonators and delivering boosters and

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**Figure 4.** The world’s largest wireless blast at BMC Poitrel coal mine.

**Figure 5.** The Orica and Epiroc automation partnership aims to redefine underground drill and blast operations, enabled by WebGen wireless initiation system.
detonators to the hole as part of the assembly and encoding process. The efficiency analysis showed considerable improvement in tonnes and holes per staff hour.

Following the trials of the system at BMC Poitrel, the mine moved into a phased introduction of the technology, with additional blasts having been scheduled to commence at the end of April 2020.

**Enabling automation and digital integration**

WebGen 200, a newer generation of wireless initiation systems, harnesses digital technology to allow advanced reprogramming and digital inventory management, offering mine operations an integrated user interface with improved quality assurance. It is set to be released 4Q20.

Built with encoding capabilities and enhanced security, the reliability of each blast is further improved with the new generation technology detonators designed to endure even greater shock resistance. It is important in enabling the company realise its vision of transforming how drill and blast is used to unlock mining value across the value chain, utilising integrated digital and automated technologies to create safer and more productive operations for customers.

In November 2019, Orica and Epiroc announced a partnership to develop a semi-automated explosives delivery and charging system leveraging the unique capabilities of WebGen. A prototype of the system which will enable the mechanisation of wireless explosives charging at the development tunnel face is currently being developed for the underground mining segment.

Development charging still requires multiple people to be exposed directly to the tunnel face for considerable time periods. However, the first commercially available system (expected in 2021) means the end of manual activities at the development heading.

Additionally, a collaboration between the company and MacLean Engineering is applying the wireless initiation technology to develop a solution to safely bring down blocked drawpoints in block cave mines. Hang-up blasting is a major challenge for block and sub level cave mines where up to 30% of all drawpoints can be unavailable due to oversize material.

Trials were successfully completed in March 2020 with a fully mechanised drawpoint hang-up blasting solution. Demonstrating the capability of drilling and charging up to eight blastholes remotely using the wireless technology, improving safety dramatically with no need to tie-in detonators and with no boots on the ground.

**Conclusion**

As the entire industry moves rapidly towards an automated future, the introduction and adoption of a fully wireless initiating system will enable the mining industry to break new grounds in safety and introduce new ways of mining, new thinking and supporting the industry’s drive towards safer and more efficient mines of the future. **GAR**