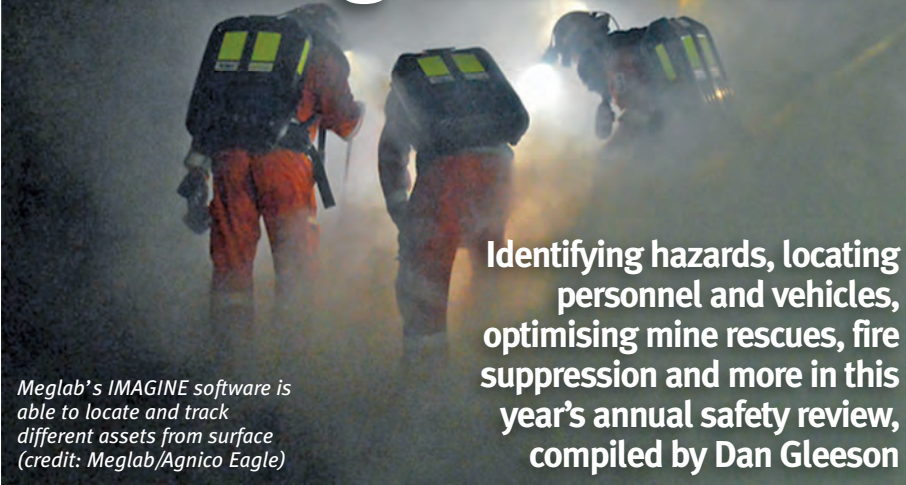


# Tracking the trends



Meglab's IMAGINE software is able to locate and track different assets from surface (credit: Meglab/Agnico Eagle)

**Identifying hazards, locating personnel and vehicles, optimising mine rescues, fire suppression and more in this year's annual safety review, compiled by Dan Gleeson**

In the COVID-19 era, safety on mine sites is front and centre of the minds of mine managers and executive teams.

Prevention, diagnosis and self-isolation are the three main areas mining companies are pursuing in order to keep employees and communities safe, and operations running.

As Josh Savit, Product Manager-OAS at Hexagon Mining, says, "the global pandemic has changed the landscape of the mining industry, increasing the stress in an already stressful environment".

This has seen many mines mandate that their employees wear face masks. This includes vehicle operators.

While masks reduce the risk of COVID-19 transmission, they also present a new challenge for safety, especially for fatigue and distraction detection, according to Savit.

In 2019, Hexagon launched HxGN MineProtect Operator Alertness System Light Vehicle (OAS-LV) to address the need for a fatigue and distraction solution for pick-ups, buses, and other vehicles outside of those classified 'off-highway'. This system is based on the same proven technology used in OAS-HV, which protects operators of haul trucks at mine sites.

Both feature the most advanced fatigue and distraction algorithm, according to Savit, an algorithm that is now equipped to deal with the problems some fatigue management and distraction detection systems are experiencing with COVID-19-appropriate face masks.

The advancement of this algorithm stemmed from a client request made during the development of OAS. This client requested the solution identify fatigue and alertness events while the operator wears a dust mask, or other face covering.

Solving this request was far from easy, according to Savit.

"Most face trackers rely on limited data points, requiring the full face to be visible," he said in a

blog post. "A face mask, therefore, renders face trackers inoperable. The ability to focus is stuck in a continuous loop, trying to establish the needed points. Events generated are false positives because the system can only lock on to a greatly reduced number of data points."

The OAS 6.1 algorithm, however, uses dynamic tracking, constantly readjusting and mapping the face with every movement, removing the data point requirement, according to Savit.

"This is possible due to the OAS machine-learning library," he said. "With more than 400,000 images to reference, the algorithm can create millions of unique models. By modelling beyond a standard dust mask to include everything from turtlenecks to respirators, the library grows. This allows Hexagon's face tracker to adapt and focus on key facial components; eyes and forehead, for example."

Savit expanded on the system's abilities for IM: "The machine-learning algorithm can visualise the face as if the mask is not there. It also uses an increased number of data points from the upper face to create a dynamic image."

Enhancements to the algorithm, combined with the continual growth of the machine-learning capabilities, mean operators can wear face masks while still being monitored for signs of fatigue and distraction, Savit says.

"Subsequently, overall performance of the system has improved," he said.

This feature is a differentiator, according to Savit, allowing the operators and operations to trust the alert and know the OAS system is accurately capturing the face.

He concluded: "In my opinion, it's a given that mask wearing will continue to proliferate in the mining sector. Hexagon's commitment to safety

means we are not satisfied with the status quo and we are always working to improve the OAS."

## The next level

In the face of COVID-19 mine shutdowns in South Africa, Booyco Electronics has been advancing testing of its proximity detection systems (PDS) to comply with the Level 9 safety standards that will soon enter the law books.

The importance of this testing arises from recent changes in Chapter 8 of the Mine Health and Safety Act, which require mines to take "reasonably practicable measures" to prevent collisions between trackless mobile machines (TMMs) – as well as between pedestrians and TMMs.

Past measures implemented by mines have included systems that warn pedestrians of their proximity to TMMs (Level 7) and systems that deliver an advisory instruction to TMM operators (Level 8).

"The Level 9 standard raises the bar significantly, requiring electronic PDS systems to take mechanical control of the TMM and automatically bring it to a stop when a dangerous situation is detected," Booyco Electronics CEO, Anton Lourens, said. "This elevates what is traditionally called a PDS into what is really a collision avoidance – or collision management – system."

Booyco Electronics says it was the first to begin Level 9 testing in South Africa, which is conducted by the University of Pretoria's Vehicle Dynamics Group. The tests are aligned with the international standard ISO21815. Regulations regarding Level 9 compliance are expected to be finalised by the end of 2020.

Lourens says the company's strong relationship with TMM OEMs has allowed it to make good progress in testing Booyco's equipment on their machines in terms of Level 9 standards. "This ensures that our technology can assist to safely and effectively bring a vehicle to a standstill when required," he said.

He highlighted that the parameters of Level 9 control have evolved over the past year or two.



Enhancements to the OAS 6.1 algorithm, combined with the continual growth of the machine-learning capabilities, mean operators can wear face masks while still being monitored for signs of fatigue and distraction, Hexagon says

Beyond just stopping a vehicle, the Booyco Electronics PDS can also instruct the vehicle to reduce its speed to a specific level under given conditions.

Booyco has already equipped several South African platinum mines with its latest Level-9-ready PDS system, with its latest contract involving the equipping of 35 underground vehicles with Booyco CXS PDS systems.

**Collision avoidance**

Avoiding machine collisions at stockyards and ports is essential to protect employees, prevent unnecessary repairs, and reduce machine downtime and, therefore, productivity losses.

**indurad** addresses these challenges by implementing radar-based solutions to automate balanced machines, with every advanced radar-based automation project involving the application of a reliable collision avoidance system (CAS).

indurad sensors scan machine environments for possible collision threats and assist operators by removing blind spots. Radar sensors establish an ‘electronic fence’, protecting uniquely defined virtual collision zones around the machine. If objects are detected within the collision zones, the indurad solution will send a message to the machine’s PLC to slow down or stop the machine. Predictive detection and machine regulation without abrupt operational interruption offer great

advantages over conventional lanyard and trip switches, the latter of which do not allow for direct machine control and are usually insufficient in ensuring a manual machine stops before a collision occurs.

Additionally, the machine is equipped with an indurad GNSS system for more advanced object detection and positioning. This system enables a more accurate and reliable position calculation compared with conventional machine encoders, according to indurad. GNSS positioning is considered a basic requirement and essential for all indurad’s machine-based calculations, and is especially important when implementing machine to machine collision avoidance applications in ports or stockyards, where multiple machines operate in close proximity.

**Shiploader CAS scenarios**

Typical shiploader collision scenarios include:

- Spout to hatch collisions;



*Shiploader boom with indurad iSDR-H 2D sensors on the left- and right-hand sides of the boom*

- Boom collisions with the ship and other shiploaders during luffing and slewing; and
- Chassis collisions with objects or mobile equipment on the rails.

To address these collision scenarios, 1D and 2D radar sensors are mounted on the sides of the boom, under the boom, around the spout, and on the machine’s chassis.

**Stockyard CAS scenarios**

indurad prevents collisions between stockyard



**Don't get left behind**

As well as improving operator safety, HxGN MineProtect CAS provides the technological building blocks to an autonomous operation.



**Everyone gets home safely**

Hexagon firmly believes that the most important assets coming out of a mine are the people who make mining possible. Committing to a comprehensive safety portfolio might be the smartest investment a mine can make.

CAS and OAS Analytics are the latest advance in helping customers pursue zero harm. And one more way to ensure that everyone gets home safely.

**Serious about safety**



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