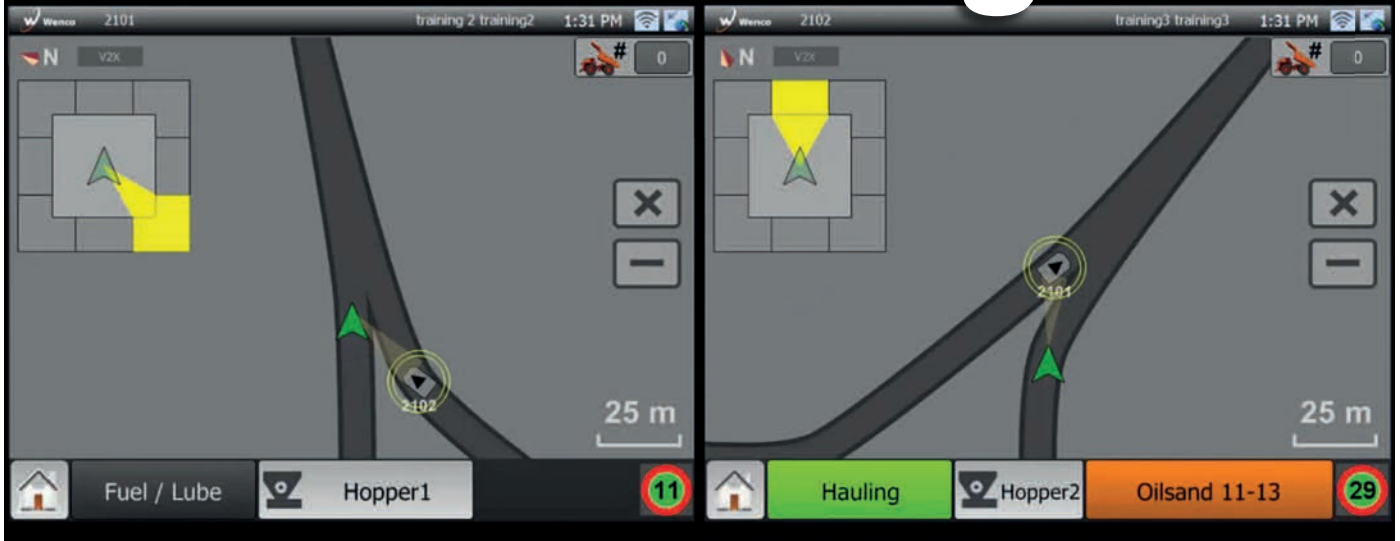


# Real time mining



## Paul Moore looks at some developments in fleet management systems, from integration with collision avoidance to some customer case studies

Safety stands as a dominant concern of the mining industry. Research from groups such as the Earth Moving Equipment Safety Round Table (EMESRT) has helped to establish best practices for operating heavy equipment in a safe and secure manner. In a white paper by **Wenco Mining Systems** Director of Business Development, Jason Clarke and Technical Content Writer, Devon Wells, the authors point out that EMESRT recommendations have directly contributed to equipment and software designs aimed at eliminating fatalities, injuries, and occupational illnesses associated with surface mining equipment; and that many current-generation collision avoidance systems incorporate logic based on EMESRT risk scenarios in order to sort real safety hazards from otherwise benign proximity detection events. But they also argue that there is still a persistent issue inherent to any rule-based proximity detection logic: false positives due to missing contextual awareness.

“Integrating collision avoidance systems with fleet management data adds this necessary context. Equipment status, destination, route network, bench elevation, and other parameters collected by a real-time fleet management system have the potential to affect the severity of hazards found through a collision avoidance system.” Their paper discusses the impacts to mining safety that come about as a result of incorporating contextual fleet management data into collision avoidance logic scenarios.

“Many factors contribute to the high incidence of false positives with GPS-based collision avoidance technology. Some systems

may not recognise the travel trajectory of individual units. Therefore, they send alerts even though operators always remain safe, as when units pass each other along a haul route. Other systems may not consider operating scenarios in which units typically work in close quarters, such as spotting or loading. Still others may not include elevation in their hazard logic, so equipment operating on two different benches may still trigger alerts. In each of these scenarios, the collision avoidance system lacks the appropriate context necessary to determine the true hazard risk.”

One way the authors argue to add useful context to these collision avoidance systems comes from technology most mining operations already have available — fleet management systems (FMSs). FMSs gather and store large volumes of operational data associated with a mining operation, including equipment status, shovel locations, dump locations, road networks, bench elevation, and other parameters. By connecting this operational data with GPS and peer-to-peer real-time position data, collision avoidance systems can understand the context in which equipment is operating. They can determine whether or not proximity is ordinary or problematic based on current equipment activity. In this way, they can quickly ascertain the actual safety risk associated with a geographic position and alert operators only in instances of legitimate concern.

“This increased hazard alert accuracy has the potential to reverse the rejection of collision avoidance systems by equipment operators. In

*Hitachi Construction Machinery and Wenco International Mining Systems recently developed the Fleet Awareness V2X safe driving support system for mining dump trucks*

doing so, OEMs can appropriately respond to the Design Philosophies of EMESRT and move significantly closer to the ultimate goal — an entirely safe mining environment.” FMSs contain vast data around mine design and equipment behaviour that directly relates to collision risk. Their GNSS-supported maps detail sites’ available road networks, including elevation readings that add a third dimension to onboard proximity detection. In this way, FMSs can provide data that aids in projecting a more accurate risk of hazardous proximity than peer-to-peer collision avoidance systems can alone. As well, FMSs function through the use of status codes that explain the current activities of working equipment. This information adds colour to collision detection data, which can inform system logic used in assessing collision risk and deploying hazard alerts. By incorporating this contextual data into their algorithms, collision avoidance systems gain a richer understanding of real conditions on site and their associated levels of risk to equipment and operator safety.

“The ability to access a comprehensive model of every road in a mine can greatly enhance the safety of a collision avoidance system. At a typical surface mine, all equipment travels along routes originally defined by mine planners, then updated with actual GNSS points occupied by units as they work. FMSs store this topographical data in their operational databases, which they use for a range of fleet assignment and optimisation purposes. Although equipment only travels along these predefined routes, an isolated collision avoidance system has no knowledge of this road

network. As a result, these systems default to calculating equipment travel behaviour based solely on data they can access: direction of travel, equipment speed, and previous GNSS points. Therefore, projections from these systems assume equipment will continue to travel in a consistent direction, at a constant speed, irrespective of the actual route available. Objects that fall within these projected paths initiate alerts, whether or not equipment will ever enter these objects' proximity. In many cases, intersections, bends in the road, or other detours will lead equipment away from these objects, rendering these alerts erroneous. Integrating FMS road network data allows the system to factor in these changes to vehicle trajectory as it calculates risk of collision. In this way, the integrated system can foresee future vehicle position with greater accuracy and remove any alerts associated with off-route projections of proximity."

Elevation data from FMSs adds further nuance to collision detection. As with the cases of faulty path projections, isolated collision avoidance systems also send erroneous alerts when they detect equipment operating in close proximity at different elevations. Surface mines often adopt a helical design, with many tiered benches crossing the same GNSS coordinates at distinct heights above sea level. In this way, several equipment units may occupy similar

two-dimensional positions while operating safely on separate benches. "Low-precision GNSS-based collision avoidance systems are unable to detect this three-dimensional data, so they cannot consider it in their alert calculations. Instead, they exclusively rely on two-dimensional geographic position to determine hazard risk. As a result, they often send alert notifications to operators working on distinct benches who face no risk of collision. FMSs contain this three-dimensional data missing from accurate hazard assessment calculations. Their GNSS-supported models detail the elevation of all benches on site. Linking this bench elevation data to the collision avoidance system allows the system to expunge any alerts stemming from equipment operating at distinct elevations. In this way, integration removes yet another layer of inaccurate alarms from the system, further enhancing its utility for mining."

Informing the collision avoidance system of FMS equipment status also has the potential to enhance the accuracy of its alerts. FMS status codes indicate the current activity of mine equipment, which directly relates to its current and future behaviour and its operating parameters. In this way, status can provide valuable information to collision avoidance systems for distinguishing standard operating procedures from legitimate safety hazards. For example, an isolated collision avoidance system

may generate an alert any time a hauling unit enters the proximity of a loading unit — even during routine tasks requiring close proximity, such as spotting or loading. A system based solely on proximity has limited ability to sort between a safe, normal proximity transgression and a potential collision. System logic may remove alerts generated from equipment moving at low speeds, but equipment moving at low speeds is not necessarily operating in a manner free from risk of collision. However, adding FMS status codes into hazard calculations offers a collision avoidance system the ability to dismiss alerts generated through ordinary, safe equipment operation. Proximity warnings generated while a hauling unit remains in spotting or loading status can stay hidden from operators. Yet, the system can remain aware of other equipment operating nearby in case those units present their own hazards. In addition to close proximity warnings, FMS status codes also provide information concerning other operating conditions that affect collision risk calculations, such as vehicles hauling material versus travelling empty. Equipment hauling a payload contains additional weight that lengthens its stopping time and distance. Understanding the hauling or empty status of an equipment unit, the collision avoidance system can recalculate the buffer distance required for safe equipment operation.

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It can alert operators of collisions with more granularity than possible through using speed and direction data alone. Ultimately, integrating FMS-derived status codes presents an opportunity for collision avoidance systems to exercise more discretion in sending hazard alerts to equipment as they follow normal courses of operation.

The authors conclude: “Even the most advanced technological solutions for collision avoidance come with substantial drawbacks that hinder their utility for surface mining. Complex systems and high costs render many options unviable, while GNSS-based peer-to-peer technology continues to deploy excessive false alarms that force its rejection by machine operators. The contextual data gathered by an FMS, though, presents a real boon to these peer-to-peer collision avoidance systems. Unlike stereoscopic video or lidar, this data comes at no additional cost to sites that already use an FMS. Yet, it can greatly aid collision avoidance systems in sorting real hazards from false alarms through its ability to provide information about site parameters and equipment behaviour. FMS data adds a GNSS-supported map of the mine’s road network, which can facilitate more accurate predictions of equipment travel paths. It provides access to bench elevation data, so collision avoidance systems can nullify alerts produced by equipment operating on separate benches. It gives colour to equipment activities through status codes, allowing the system to mute alerts from equipment working under ordinary conditions. In total, this additional data gives collision avoidance systems the context they need to judge hazards from safe operation and cease sending nuisance alerts to operators.”

FMS data does not present the only option for enhancing the safety of collision avoidance systems to EMESRT-approved levels. Technology vendors are continually working to develop new sensors and logic that can correct for many of the issues in current generation GNSS-based peer-to-peer collision avoidance systems. These future options will undoubtedly reduce many of the current complications and raise mine safety to new heights. “But, FMS data is already available to connect to collision avoidance systems to address many of the current concerns. In integrating FMS and safety systems, mines stand to significantly decrease the false positives arriving from their current collision avoidance systems and, thereby, make their systems more practicable for surface mining. This integration nudges the current generation of collision avoidance closer to the ideal vision for safety set out in the EMESRT Design Philosophies and offers a workable solution to enhance safety for everyone throughout the mining environment.”



## Caterpillar's Fleet in focus

The Cat® Fleet system is described as super portable, easy to use and light on bandwidth. Machines store data and forward it at wireless hot spots, eliminating the need for sitewide broadband coverage. Because it requires only a basic WiFi connection, it is especially good for mines that need to start small and add capabilities as their needs evolve.

In terms of what sets Cat Fleet apart from competitor FMS solutions; Greg Wood at Caterpillar Global Mining told *IM*: “We hear feedback from customers and reporting solution providers that MineStar Fleet has both more extensive and better data than the competitor solutions. This makes it easier for customers to analyse their operation and make productivity improvements. We have also had successes delivering increased productivity at mining operations that have migrated to MineStar Fleet from competitor systems.”

The system is also evolving with new functionality. “For mining operations that are looking to consistently deliver their production plan, the new production management functionality makes it easier for customers to enter their production plan and monitor the compliance to plan during the shift. New blending functionality in MineStar Fleet 5.0 will enable mining operations to reduce their percentage rehandle or increase their recovery by managing their blend more effectively.”

It is also a common misconception that MineStar Fleet is used predominantly by operations operating mostly Caterpillar machines, as around one third of machines instrumented with MineStar Fleet were not manufactured by Caterpillar.

As FMS systems have been around for some time, *IM* asked Wood what has changed in terms of what they can do and what mining customers want them to do: “From a fleet management system perspective, the major change from a network perspective took place a decade ago

*Caterpillar has had successes delivering increased productivity at mining operations that have migrated to MineStar Fleet from competitor systems*

with the transition from UHF to WiFi networks and since then they have become more forgiving from a network perspective and the latest version of MineStar Fleet includes improvements in this area. We are starting to see mining operations transition from WiFi to LTE networks.”

It is also important to point out how competitive the FMS market is, as these systems are not necessarily installed for life of mine and it is common for sites to change or update their technology. Wood adds: “It comes down to the bottom line. Technologies, management and even processes change over time and operations are still striving to increase production, lower cost or optimise the quality of the product they produce. Investing in new technologies can add great value with a good return on investment. Caterpillar continues to focus its FMS and other technologies on measuring and optimisation value which goes directly to the bottom line. We have had many sites achieve big gains after switching from a competitor system to MineStar.”

Finally on the role MineStar Fleet plays in making automation a reality, some Fleet customers have successfully migrated to the Command for Hauling product. “And whilst migrating the server application to Command for Hauling is fairly straightforward, a higher specification network and additional sensors and systems on the trucks are required. The change management associated with the people and processes is another key consideration.”

## Hitachi and Wenco unveil V2X

This white paper highlighting the integration of collision avoidance with FMS technology was followed in September 2016, by an announcement from **Hitachi Construction Machinery** and Wenco International Mining

Systems on the development of the Fleet Awareness V2X safe driving support system for mining dump trucks. The system incorporates V2X (vehicle-to-vehicle and vehicle-to-infrastructure communication) technology owned by Hitachi Ltd.

“At present, customers engaged in mining operations around the world are striving to improve safety along with the efficiency of the entire mining supply chain, from exploratory mining to excavation, production, processing, transport and shipment. To achieve these aims, there is increasing demand for machinery and software manufacturers to incorporate ICT technology into mining machinery and management systems, and to provide solutions that integrate these technologies.”

The Hitachi Construction Machinery Group has developed the Fleet Awareness V2X safe driving support system under these circumstances, it says in an effort to continue improving safety at mining operations and promote productivity. The system incorporates GPS technology and is built on the existing PitNav system, which uses an operator’s seat monitor to show the real-time positional data of machinery at mining sites along with travel routes.

By conducting wireless communications between vehicles without relying on IT infrastructure, the system enables operators to quickly understand the location of other mining

machinery, such as the numerous dump trucks and hydraulic excavators operating at mining sites. The real-time positional data of each vehicle is displayed on a map in the driver’s seat monitor. The system also makes use of the vehicle information on the fleet management system, so that when a vehicle comes in proximity to other mining machinery such as another dump truck, an appropriate warning is displayed in the monitor with accompanying sound. By providing these warnings to the operator while driving, the system contributes to the reduction of collisions in situations with poor visibility, such as at intersections in hilly terrain, or at night when there is some distance to the next vehicle on the road ahead.

The Hitachi Construction Machinery Group embraces the “One Hitachi” concept of using the construction machinery technology that it has accumulated over many years in combination with the Hitachi Group’s strengths in ICT & control and IoT technology, while also promoting open innovation. Moving forward, Hitachi Construction Machinery says it will continue to serve as a familiar and trusted partner by providing ‘reliable solutions’ that resolve customer issues through collaborative creation.

### Modular aims to reduce TCO long term

There is an increasing shift to consider ways of increasing productivity and reducing the long-

term cost of ownership (TCO) through the value derived from technology. **Modular Mining Systems** has been providing solutions to increase productivity and reduce costs for more than three decades. The leading DISPATCH® Fleet Management system is proven to help mines maximise production and minimise costs, with reported productivity gains of 13%. The MineCare® Maintenance Management solution and ProVision® Machine Guidance solutions help mines identify and prevent equipment health issues; and improve shovel, dozer, loader, and drill operators’ ability to adhere to plan, respectively. “Customers using the MineCare solution have achieved maintenance-related savings of \$1 million per year and 20% reduction in downtime. The ProVision solution has demonstrated increases in bench accuracy of up to 87% and a 20% reduction in explosives costs.

To expand the capabilities of the DISPATCH system, Modular has introduced the Idle Monitor module and the Active Tire Management system. The Idle Monitor module helped one customer identify occurrences where engines were left running while the equipment was immobile. By implementing a procedural change in response to the Idle Monitor’s findings, the mine realised nearly \$1 million in fuel cost savings in less than a year. The Active Tire Management system interfaces with manufacturers’ onboard tyre monitoring utilities to acquire tyre data in real

Minimized false alarms

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360° detection

No IT infrastructure required

Vehicle-to-vehicle communication

Warning: This Collision Awareness System (System) is designed to reduce the risk of certain accidents by providing visual and audio warnings to the driver of a potential collision. The System has limitations and cannot notify of all impending accidents. This System is not a replacement for proper safe and attentive driving. Please drive carefully at all times and do not rely on technology to prevent a collision. The System is only activated in certain circumstances and may not engage in all driving situations, weather or road conditions. Accordingly, never wait for a collision warning. The driver is always responsible for proper operation of the vehicle and for maintaining the correct distance and speed - even when the Collision Awareness System is used. Failure to comply with these instructions could result in serious injury or death.



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MineAlert CAS in-cab display

time. Using the acquired data, the Active Tire Management system works to mitigate premature tyre failure, while the DISPATCH optimisation algorithm includes tyre control actions as part of its real-time decision making logic. Over a four-week trial period, the Active Tire Management system achieved an average of 48% fewer events per shift than were observed before system activation.

Modular's latest innovations, the MineAlert™ Collision Awareness system (CAS) and Guided Spotting system, it says can help mines increase efficiency while simultaneously helping to improve operator safety. These products, debuted at MINEexpo 2016, have the potential to improve overall productivity and profitability and have a positive influence on the mines' cost-per-tonne ratio.

Modular told *IM*: "The CAS, an early warning system that alerts the equipment operator of potential collisions with other CAS-equipped vehicles, is designed to improve operator awareness and reduce vehicle-to-vehicle collisions. Predictive algorithms analyse the location, speed, and trajectory of all vehicles in the monitored vicinity and generate warnings and alarms only when hazardous or potentially hazardous conditions exist. Unlike other collision awareness systems on the market, Modular focuses on minimising false or nuisance alarms to provide operators with critical decision-making safety information only when it matters."

The Guided Spotting system builds upon the success of Modular's machine guidance technology, first introduced for excavators nearly 20 years ago. A dedicated display unit provides visual directional indicators to help operators more quickly navigate the truck bed into optimal loading position, leading to a reduction in shovel hang times. In addition, the system facilitates

double-sided loading; a practice many mines have eliminated or diminished in reaction to concerns about truck-shovel collisions. "The dynamic navigational queuing gives operators increased confidence when loading on the offside, at night, or during periods of reduced visibility. Additionally, the system helps to prevent loading-zone overshoots and other potentially dangerous spotting-related incidents. In field trials conducted in 2016, the Guided Spotting system's performance improvement potential was confirmed in the range of 4-34%, depending on the mine and operational scenario."

Finally, in keeping with one of its key strategies, the company restructured its business organisation and processes to provide customers with a new proactive support model, termed the Performance Assurance Program. The initiative reflects a strategic decision and global resource support commitment to assist customers in realising maximum applied value over the life of their Modular investment. A dedicated Performance Assurance team works with mine personnel across multiple levels to develop tailored, flexible, and proactive solutions, establish mutually defined goals and milestones, and create and track quantifiable key performance indicators. Since the program's introduction in March 2015, Modular says participating mines have seen numerous benefits, including improvements in network coverage, reductions in queue times, and increases in cycle times and tonnes per kilometre hour (TKPH).

"We have been perfecting the Performance Assurance program with our customers for nearly two years and have achieved great results, thus far," said Jorge Mascena, VP Customer Value at Modular. "The Performance Assurance program is a clear demonstration of Modular's commitment to the mission of increasing the safety and efficiency of our customers' operations," he added.

### FMS and network quality

Today's leading FMS solutions automatically assign trucks to shovels based on a number of preconfigured options, by site. This is done to optimise equipment movement and reduce time spent waiting in queues. A mine can make a significant impact on its bottom line if it can keep its truck fleets moving, and its loading tools busy, as opposed to trucks waiting to be loaded or shovels waiting for a truck. Todd Rigby, Director of Sales at **Rajant Corporation** told *IM*: "Wireless communications play a key role in the operational effectiveness of these systems. When mines invite us in to discuss their networks, I have found 100% of the time that they are dissatisfied with the return on investment they are achieving from their Fleet Management Systems. There is a direct correlation

between the quality of the network, and the ROI a mine is achieving from its FMS. Rajant customers all have one thing in common: they are achieving at or above expected ROI on their FMS systems."

There are a number of different pieces of information that pass between the dispatch office and a haul truck. The FMS sends instructions on where to pick up a load, and where to dump a load. Rigby comments: "In a hard rock mine, this is important, because a truck driver cannot visually tell if the material being loaded in his truck is ore or waste rock. So unless he receives a timely instruction, he doesn't know if he is supposed to take the material to a stockpile, a leach field, a crusher, or a dump. Having reliable communications is key to making this solution a valuable tool. Alternatively, if a truck fails to report it has picked up a load, the FMS system cannot accurately calculate the day's production. Lost loads are a common complaint of mine operators suffering with unreliable networks. Different FMS systems have different features. But one thing they have in common is their dependence on reliable communications. Rajant's kinetic mesh wireless network has a proven track record in mines all over the world. Rajant's solution provides all of the above requirements, delivering mission critical communications."

In terms of how can you spot a reliable mine network, Rajant suggests the following attributes:

- Intelligent nodes, capable of maintaining multiple redundant connections
- Continuous connectivity
- Distributed Routing Intelligence
- Autonomous Adaptability, providing load balancing; routing around local interference; routing around localised network congestion; routing around unexpected service interruption
- Self-healing
- No single point of failure

### GE and the Digital Mine

There are several scenarios in surface mining operations that can present collision hazards. **GE** states: "Vehicle operators in mines have to accomplish difficult tasks, while increases in mine productivity have led to a proportional increase in equipment size and the number of mobile equipment units in many mines. Hazards in the pit can include large boulders, high walls, berms, other trucks, shovels, excavators and support equipment, as well as the workers and other people on the worksite. As a mine site operator, fleet management systems for open pit mines allow your mine to maximise production and efficiency, while increasing safety and control. Using state-of-the-art field hardware and communications software, along with best-practice business processes, the Digital Mine provides industry-proven fleet optimisation for enabling safer mine sites."

The company argues that the global mining industry is at a turning point. “The quality and availability of the ore grades is declining, so miners must dig deeper and process more rock to deliver the same amount of ore. Simultaneously, market prices continue to fluctuate, putting increasing pressure on driving operational productivity at the top line. Mining operations are trying to balance running a profitable plant, controlling their CAPEX and OPEX spend while at the same time maximising the \$/tonne that comes from the plant. GPS-based equipment positioning, equipment health monitoring, maintenance tracking, blending, and production reporting allows for all this to happen. With over 12 years of recognition for its optimisation algorithm, and over 5,000 installations worldwide, Digital Mine Safe Technologies is considered a go to source for helping mine sites operate safer and reliably.”

The GE CAS provides 360° situational awareness of objects in proximity to vehicles during stationary, slow-speed and high-speed operations in order to reduce the risk of vehicle-to-vehicle, vehicle-to-infrastructure, vehicle-to-personnel and vehicle-to-environment interactions. The system provides real-time predictive proximity alerts with high integrity and low levels of nuisance alarms, along with powerful web-based reporting as a management tool to achieve ‘zero-harm’ objectives. All



*GE Digital Mine solutions help miners to promote safer mining practices, while increasing asset performance and optimising operations*

vehicles using the system are fitted with a GPS receiver, vehicle to-vehicle radio link and vehicle display unit. The system automatically detects obstacles within critical zones around a vehicle and notifies the driver with progressive audible or voice alerts and radar-style graphic alerts on the vehicle display unit.

Mine personnel are also fitted with a personnel protection tag that alarms when the person enters the programmed high-risk zone of a heavy vehicle. “Both the heavy-vehicle operator and personnel on the ground receive audible and visual alerts. The personnel protection system uses the same low frequency magnetic

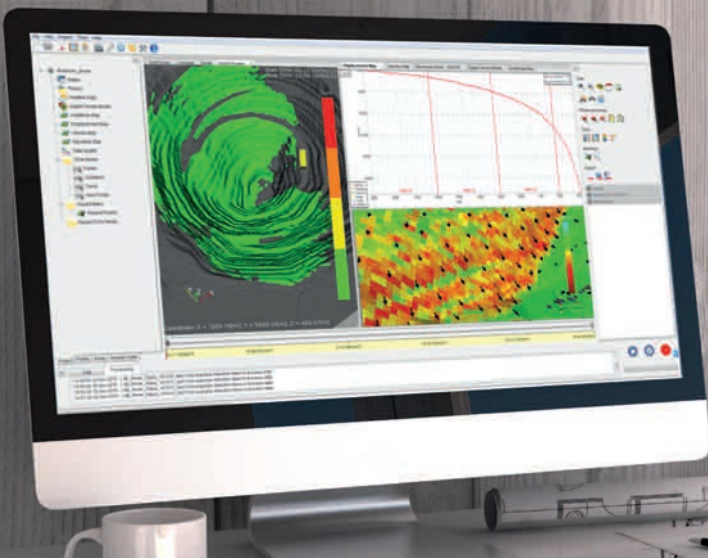
technology that GE uses for the underground CAS, which sees through metal and strata and is not dependent on line-of sight for operation, providing accurate, stable and reliable proximity detection without any blind spots.” The personnel protection tag includes GPS tracking, man-down and duress alarms. The unit comes with hard-hat and belt mount options, using a belt-mounted base unit with remote alarm unit for helmet mounting.







“Today, Digital Mine solutions help miners to promote safer mining practices, while increasing asset performance and optimising operations. How much could be saved with connected



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machines? A 1% improvement in operational costs across the entire mine value chain adds up to nearly \$5.4 billion in savings, just amongst the top 40 miners.”

South32 and GE have just announced the signing of a three-year strategic partnership to assist in the development of South32’s technology roadmap and activation of the company’s digital transformation. The partnership, GE’s first with an Australian mining company in the digital space, it says is a step towards playing a much bigger role in the global mining sector. “For South32, GE is the ideal partner, having recently undertaken their own digital transformation. This partnership marks the beginning of an exciting journey. South32, with its diverse mining portfolio spanning ten operations and five countries, sees a real opportunity for technology and innovation to drive safety and productivity improvements.”

Through this partnership South32 will utilise GE’s Predix™ platform, which is designed specifically for industry and connects industrial equipment, data analysis and instant insights. The system will enable South32 to make fast, informed decisions, and provides the opportunity to optimise entire operations, rather than individualised assets and equipment. “Bringing the world of operational technology

and information technology together to monitor equipment and systems remotely and predict future behaviour is a game changer,” Graham Kerr, Chief Executive Officer, South32 said. “It has the potential to identify and solve a problem before it affects operations.”

“By partnering with GE, we have an opportunity to transform the way we work,” added Ricus Grimbeek, Chief Technology Officer, South32. “If we get this right, the result won’t just be an incremental improvement but a new level of efficiency and performance.”

For GE, bringing digital transformation to the mining industry is an exciting prospect. “The future of mining is digital. With data and analytics, we can achieve greater levels of productivity, operational efficiencies, and improve safety,” GE Chief Executive Officer and Chairman, Jeff Immelt said. “We look forward to working with South32 to help them optimise their operations and accelerate the digital transformation of the mining industry at large.”

“Mines collect terabytes of data today, but do not have the platform or solutions to provide real-time insights to deliver operational productivity,” GE Mining CEO Scott Phillips said. “Together, GE Mining and South32 have the opportunity to help solve these challenges in the mining sector. This is a very exciting time to be in mining.”

## Hexagon FMS at Peña Colorada

Following the mine plan in operations was a big challenge at the Peña Colorada iron ore mine in Mexico prior to the implementation of a **Hexagon Mining** fleet management system (FMS). The ability to monitor in real time the location of the trucks, shovels, dozers, etc, was a significant technological innovation to make sure that the plan stayed on track. Nowadays, the mine planning engineer and operator can communicate and adjust to make changes as needed, thus reducing deviations from the plan. With the adoption of a fleet management system, multiple reports can be created to report key performance indicators (KPIs) and measure performance. It is said that “the observer effect” is particularly true for mine operators. Once the monitoring systems were implemented, people’s behaviours drastically changed, just by the fact that they knew they were being observed and monitored. “Prior to the implementation of the FMS at Peña Colorada there was little accountability on the operator side. Multiple delays, extended breaks, and missing equipment were not unusual. All of these factors add up and take their toll on productivity and profitability. However, since the implementation of Hexagon Mining FMS, the delays on shift change, fuel and meals have been reduced significantly and missing equipment is a thing of the past. Moreover, the FMS optimises

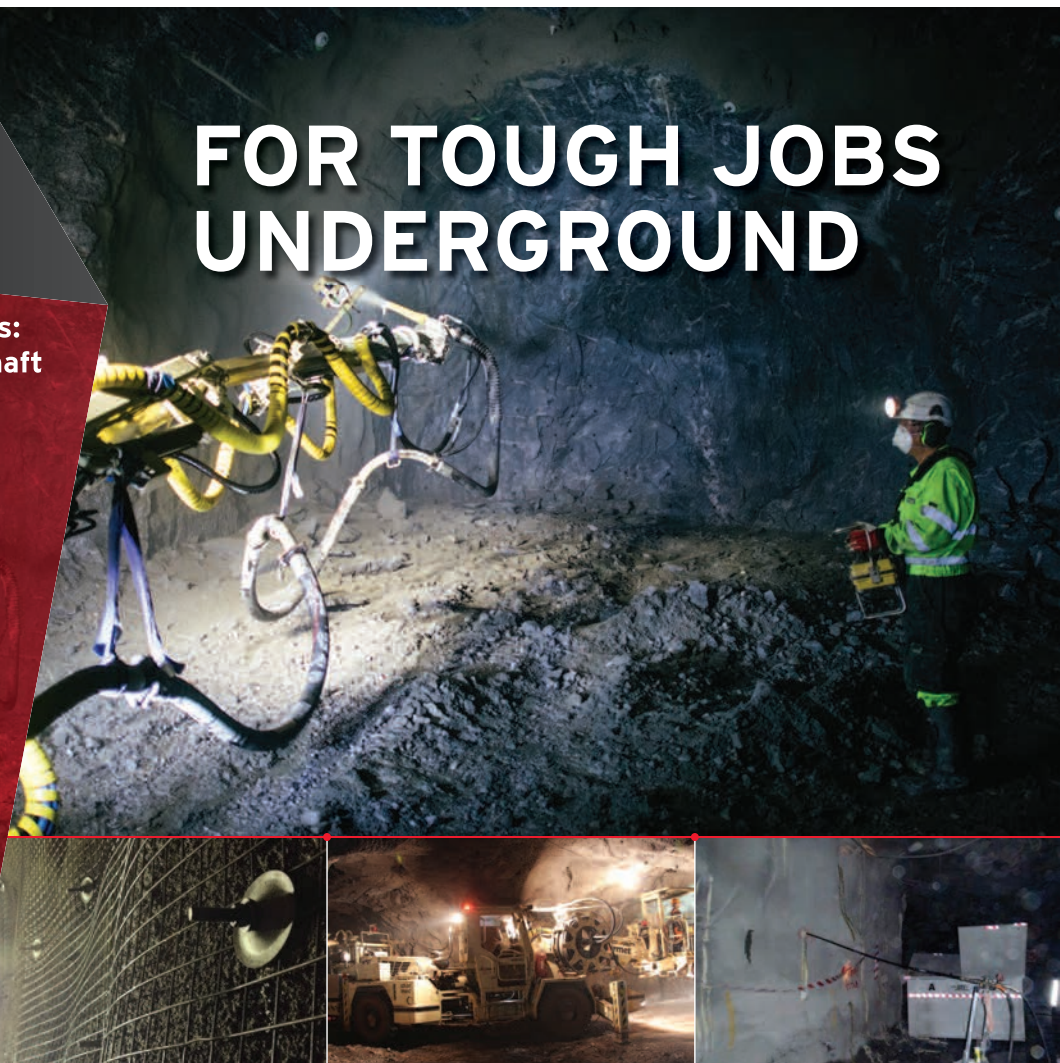
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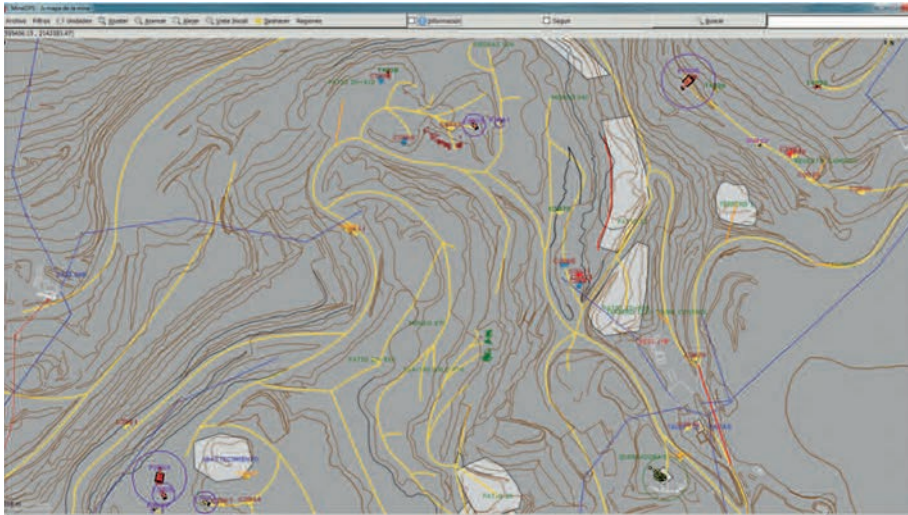
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*Real time mine monitoring through the adoption of a fleet management system, means multiple reports can be created to report key performance indicators (KPIs) and measure performance*

the load, haul, and dump cycles, minimising wait times and ensuring that the material is routed to the best economic destination.” In total there are five excavators and 26 haul trucks plus the dozers, drills, and other equipment monitored at Peña Colorada.

As for the drills, the planners used to have to go to the field to physically inspect the progress and note how many holes have been drilled, how many remain, etc. Now they can see the blast pattern in real time and see how many holes have been drilled, how many remain; they can look at the KPIs of the drill and get metrics on penetration rate, metres drilled, hole profiles, etc. Additionally, the drills are equipped with high-precision GPS and this has been very valuable as they have noted an increase in productivity. Peña Colorada is in a hurricane zone and thunderstorms pose a safety risk. An alert system changes from orange to red if a storm is approaching. In red alert, the topographers could not be in the field staking the collars to be drilled. The alerts could last six hours or more and in many cases the drills would fall behind and production would suffer. Now, the collar coordinates are passed from the planner to the operator digitally with high-precision GPS systems, eliminating the need for the topographers to be staking out the collar locations in the field. The blast manager can see a screen showing the blast pattern in real time, and planners can check the progress of the drill. The FMS displays in red the holes already done, in blue the remaining holes, and the KPIs for the drill. Operators and planners can communicate and any deviations can be adjusted as needed in real time.

The high-precision guidance system allows for accurate blasthole location, monitoring of production data, improved fragmentation, ore recovery, etc, and the hardware can be easily installed in the operator’s cabin. “Lastly, it should

be noted that production reports used to take many hours to complete and required staff dedicated for that purpose. Additionally, the information was communicated verbally and recorded by hand, which resulted in many inaccuracies and errors, compromising the validity of the reports. After the implementation of the FMS, production reports are produced with one click and the information is reliable and in real time.”

### **VG Karier now with host of new functions**

The FMS market leader in Russia and the former CIS, **VIST Group**, with its VG Karier system describes the key reasons for implementation as follows: “Implementation of the VG Karier

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- Easy to install with little ongoing maintenance, requiring only **one tensioner adjustment EVER!**
- Offers the **lowest blade-to-belt pressure** of any cleaner on the market.
- **You can put it anywhere!** Installed at an angle, it requires very little space for installation.
- Suitable for both **mechanical and vulcanized splices** because of its durable tungsten carbide tips, which are available in multiple grades of carbide to match your application.

#### **The Bottom Line:**

*The CleanScape® Cleaner is an innovative, durable metal-tipped belt cleaner that provides maximum cleaning efficiency without compromising your belt.*

#### **Ask about trying it Risk-Free ASAP!**

*Try this cleaner risk-free and you will insist we replace the rest of your cleaners as well. If you don't think it's the best cleaner you've ever used, we will give you your money back. Period.*



call **800.544.2947** or **309.852.2384**  
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## New functions of VG Karier FMS

New functions	Benefits
Optimisation with different criterias, quality management	Productivity, turnover or cost reduction
Module of coal quality control	Efficiency of charge preparation
Analysis of excavator performance (cycle analysis)	Efficiency of excavation
Motivation of drivers and shovel operators based on complex KPIs	Increase the effectiveness of staff
High precision shovel guidance, integration with geological planning module	Efficiency of transportation, optimization
Tyre management and predictive analytics for mining	Reduced tyre costs
Mechanics module. SW for technicians and maintenance engineers	Increase the availability for units and aggregates
Road quality control	Increase in tyres availability, increase in average speed, performance
VG Drill- high precision drills guidance	Increasing the efficiency of the drills, reducing costs for roller cutters, explosives, re-drills
Railroad dispatch, station control and management	Increasing the efficiency of railways, transportation
Collision avoidance system, integrated to VG Karier	Increase in average manoeuvring speed
The system of positioning and control of personnel in the mining area	Control function, increase of reliability of data
Integration with Reutech radars for slope stability control	Increasing the safety of mining operations
Autonomous dump trucks, tele operated dozers, excavators, autonomous drills	Productivity (reduction of technological downtimes, personnel)
New functions of environment, health and safety management system by VG	Control function, process support
Monitoring of teeth and granulometric composition in the shovels bucket	Control function, process support

automated mine fleet management system is aimed at higher efficiency of the mine transport fleet due to optimisation of the truck allocation, downtime/delays reduction, reducing the time of shift changes, and payload optimisation control.” It can also mean improved mineral quality management due to mineral quality optimisation and application of high-precision navigation systems.

It also means getting accurate and reliable information on the number of trips and tonnages of the transported mined material. The result can be longer running time of dump-truck assemblies due to automatic control of loading, and speed limit compliance control. Another benefit is the elimination of any opportunity for unauthorised fuel discharge and lower fuel and lubricant consumption per tonne of transported mined material due to minimisation of downtime during working shifts, and sound planning based on fuel consumption facts about every dump truck. Improved safety-in-operation is achieved due to automatic control of dump-truck speed and permissible loading limits. Automation of maintenance and repair planning processes is also possible.

Beyond the basic FMS system, the attached table shows a number of new functions of VG Karier, that the company has added to its base modules and has already started to provide to the mining market.

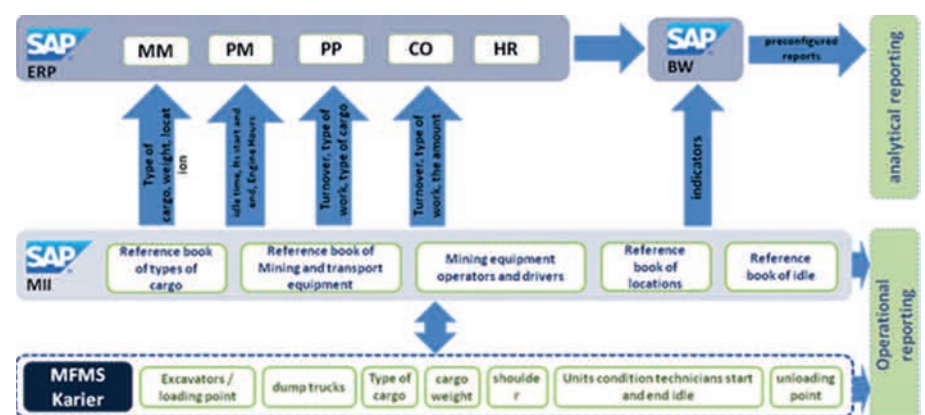
### VIST and ABB collaboration in India

Perhaps not that well known in the global market, ABB and VIST Group have more than 25 years of experience in development and

deployment of mine Fleet Management Systems. The ABB India team with the support of VIST Group specialists provides high quality support and maintenance of the VG Karier system including all possible options. In summary, ABB supplies the Wireless Tropos Network along with power and backup, with VIST Group supplying the FMS hardware and software, backed up by ABB India support and maintenance.

At TATA Steel’s West Bokaro coal mine in India, ABB installed a high performance Tropos broadband wireless communication network, on which the VG Karier FMS is running. VG Karier software is engineered using the Oracle database. It is used as the main part of real time management and optimisation and is also used in reporting. This feature is typical for modern fleet dispatch systems, as compared to old systems, where the database is only used for the reporting system. The FMS at the mine covers 69 trucks and 17 loading tools along with 11 fuel and water trucks.

The ABB Tropos open standards-based radio network architecture enabled TATA Steel to build one network that aggregates communications for present applications, including broad band-low latency connection for GPS location of equipment, real time monitoring of critical health parameters, providing immediate reports, and seamless integration with system and future applications like VoIP telephony, Wi-Fi connectivity and infrastructure security including video surveillance. Tropos mobile mesh routers interoperate seamlessly with Tropos fixed routers to deliver a robust, high-performance wireless connectivity solution for mobile workers and equipment. At vehicular speeds, the mobile routers support voice, video and data connectivity and extend the Tropos fixed network to provide access for handhelds and other endpoint devices. The Tropos Mobile MESH router uses a standard, unlicensed 2.4 GHz radio to connect with clients and other Tropos mesh routers. It is packaged in a rugged, weatherproof enclosure that is specially suited to extreme applications. *IM*



VIST Group also has a long term relationship with SAP and has various successful experiences of integration. An example of an implemented interface with SAP is shown here