A TRUCK-LOAD OF POTENTIAL

Neil Ferreira (Modular Mining) and Gary Robertson (MineWare), USA,

look forward to the mining industry's future potential as mine systems become more integrated.

2020 will see the integration of mining systems, solutions, processes and technologies that advance the productivity of truck and shovel operations worldwide. As the industry embraces digitalisation, interoperability and integration, truck and shovel mining operators have raised the bar on payload and productivity targets.

Moving away from the traditional and conventional, load and haul operations are adopting new technologies that either optimise the productivity of the loading equipment through payload and material selection management or improve the material flow of the haulage unit through advanced fleet management systems (FMS).

There has been a marked increase across coal and metalliferous sectors globally in the adoption of these and other technologies to improve the accuracy and productivity of their operations. Even with the uncertainty of commodity prices, this trend is driving the growth for semi and full automation tools across the global market.

Truck and shovel operations offer the biggest opportunities to achieve better operational efficiencies, and these interoperable solutions can add significant value while reducing costs to an entire fleet. Payload management is one such aspect that can be dramatically improved with systems that are interoperable. Having more accurate payload data, and fast access to that data, can help miners to:

- Increase production tonnages.
- Improve loading efficiencies and data reliability.
- Increase repeatability and consistency.
- Achieve tighter payload distributions.

- Reduce truck bunching and number of trips to the dump point.
- Ensure accurate cost analysis and production reporting.

Additionally, access to accurate payload data can help mine operations validate contractors' reports of material movement and fuel utilisation to ensure that the mines are realising the true tonnages and expenditure being reported. Conversely, production contractors can use the data to quantify their reported results (with lower reconciliation adjustments throughout the month) and provide accurate billing invoice amounts.

Repercussions of inaccurate payloads

The repercussions of inaccurately recorded payloads – or payloads that result in truck overloading or underloading – can significantly impact a site's bottom line and negatively affect downstream and upstream objectives.

While overloading a truck might appear to increase a mine's productivity potential, it can damage the frame, steering, brakes, tires and other components. When this damage requires the truck's removal from the haulage cycle for repair, the practice of overloading, whether intentional or not, costs mine sites far more than it saves. Spillage is also more prevalent with overloaded trucks and, in addition to slowing circuit cycle times, can often result in tire damage and unsafe haul roads.

Underloading also poses several problems for truck and shovel mining operations, including the failure to realise production targets and additional, unnecessary trips between loading and dumping locations, which wastes time and fuel, and increases tire and component wear.

Some sites track their payload manually or use a standard 'truck' factor. This often results in production inaccuracies and discrepancies. While it seems logical that a miner would be able to calculate production tonnage by correlating specific truck capacities with the number of loads hauled by each throughout a shift, the numerous variables behind truck and shovel mining, including operator experience, bucket sizes, fragmentation quality and more, often equate to wider payload distributions and varied payload averages. Modular Mining recently worked with a coal mine in Africa that practiced this manual approach and found that the site's trucks were being underloaded by 13% on average.

However, truck payload underloading or overloading is not the only lever that needs to be managed to achieve vast productivity improvements. Mine sites that leverage a holistic technology solution are also capable of improving the whole loading and haulage operation.

Productivity technology integration

MineWare Product Strategy Manager Gary Robertson believes that miners can achieve significantly greater accuracy and productivity by integrating their real-time shovel payload monitoring system with their FMS. As subsidiaries of Komatsu, MineWare and Modular Mining have been working together to do just that. The partnership expands Modular Mining's already-integrated machine guidance and fleet management solution with MineWare's Argus Payload Monitoring System offering to maximise payload tracking and accuracy at opencast mine sites.

Neil Ferreira, Associate Director, Product Strategy at Modular Mining, explained that the focus is no longer just about getting the right amount of material into the truck. "Via the Komatsu family of integrated technologies, we are now able to move beyond the issues of 'the right amount' and 'the right material' to instead achieve 'the right amount of the right material, to the right truck, directed to the right place.'"

The integration of fleet management, real-time payload optimisation and machine guidance can provide sustainable efficiency improvements that mining companies are striving to achieve.

Mining companies generally seek to deploy holistic solutions that can reduce the duplication of hardware and software while helping the bottom line with every bucket dug. Material handling and haulage are large operational expenses for mine sites, and are also one of the most important processes throughout the entire mining value chain. For these reasons, the OEM and OTM integration of mining systems is a key enabler for sustainability and cost-effectiveness.

Mines have been seeking ways to maximise the data they receive from their existing technologies. The additional capabilities of doing so can improve the mine's efficiency well beyond the haulage and loading process. This can be achieved when accurate truck identity and capacity information is displayed on the

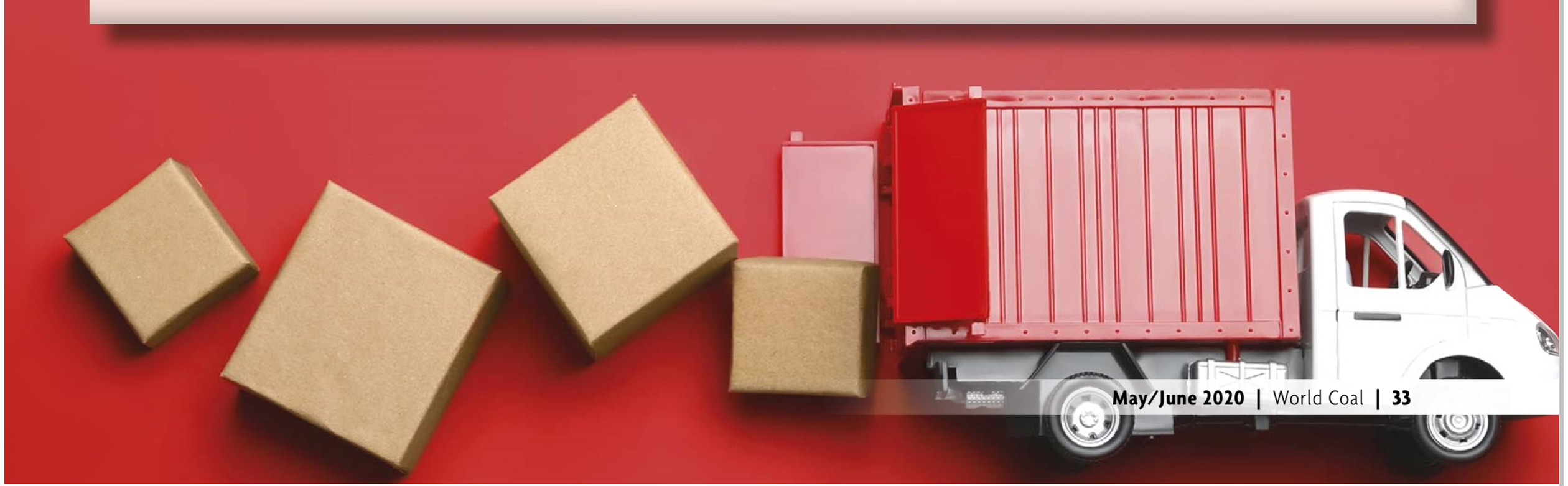

Figure 1. Integrating FMS, machine guidance, and payload monitoring data will help truck and shovel operations improve productivity.

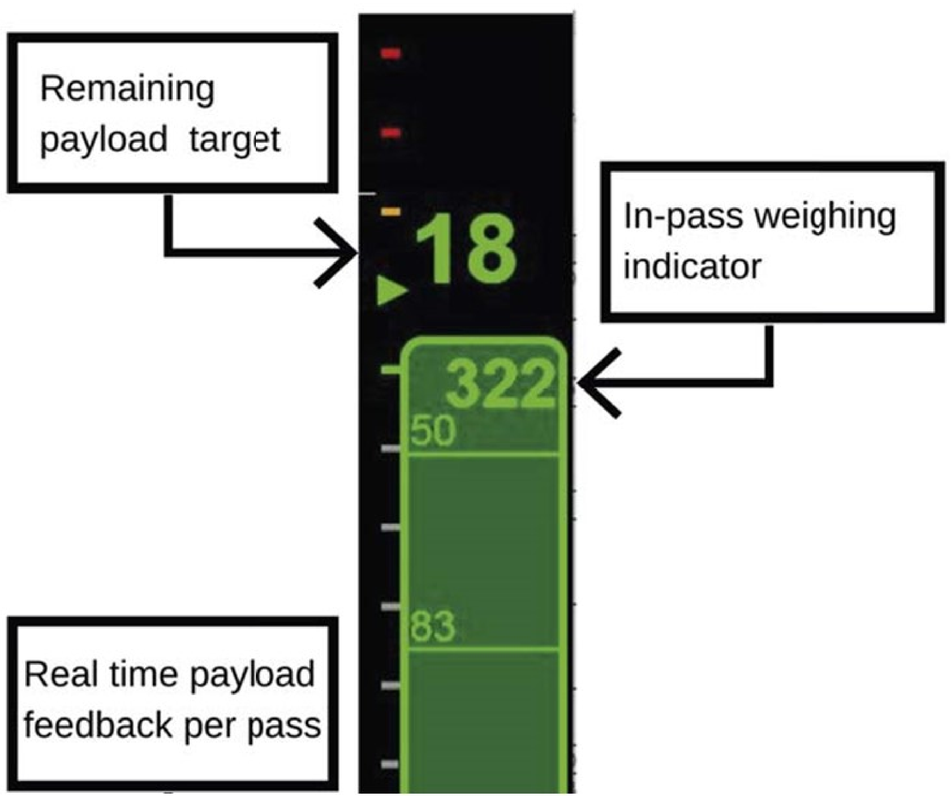

Figure 2. MineWare's Argus system provides clear feedback, in real time, on the remaining payload needed to reach optimal truck capacity.

shovel monitoring system screen and when the shovel-based, bucket by bucket payload information is displayed on the FMS system.

Sharing payload (and other cycle decomposition) data from a mine's shovel monitoring system with their fleet management system can reduce the costs of hardware, GPS and truck detection technologies such as RFID tags. In fact, a secondary goal of the MineWare/Modular Mining integration is the eventual reduction to a single display and leveraging a shared set of positional hardware and infrastructure.

Interoperability at work

There are several load and haul technologies available to the mining market today, each designed to optimise some aspect of the upstream mining process. While these technologies can provide operational improvements individually, they can drive significantly greater gains when integrated together; mines are better able to tighten their payload distribution and move the average load closer to the desired nominal payload capacity target.

Most truck-based payload technologies communicate payload values after the fact, meaning that instances of truck under or overloading aren't communicated through the FMS until after the truck has left the digger, thus there is a latency. By displaying the shovel-based payload information on the FMS screen, operators obtain the accurate real-time payload information they need and therefore they have the opportunity to ensure the truck's actual target payload is achieved every time.

Using a fleet management system to integrate a miner's machine guidance system with their shovel-based payload system also improves the accuracy and efficiency of the FMS optimisation, while facilitating more robust reporting.

Many FMS calculations today are based on static assumptions about location and material type; by leveraging data from the machine guidance system and bucket payload monitoring system, the FMS and the operator no longer rely on assumptions because the actual bucket location, the geology (from the site model), dynamic payload calculation (the truck tray is volume or tonnage constrained) and the amount being loaded into the trucks, are known factors.

Integration can vastly improve the quality and accuracy of a miner's reporting abilities, as well. In a nonconnected environment, a miner likely has payload tracking data in one place and format FMS tracking data in another place and format, and machine guidance data in yet another.

Trying to run a report or summary about daily progress requires pulling three reporting packages together – but since they are in different formats and likely utilise different timestamps, this is both difficult and unreliable. By integrating the disparate systems, miners will be able to transmit key bits of information back and forth to run better payload and fleet performance reports – with much more ease and accuracy.

"It is currently difficult, if not impossible, for mining organisations to connect data from a shovel payload system to load information in a fleet management system, regardless of the systems in use," said Ferreira. "The value of getting all of that data into a unified system for reporting, KPIs, and performance management is huge. This value not only translates into improved productivity but in turn, can have enormous improvements on bottom line profits."

Improving payload accuracy at opencast mines, especially through an integrated solution like Modular Mining and MineWare's, is a seemingly small action that can lead to significant productivity gains. As load and haul mining operations continue to seek innovative technologies to improve their productivity, they will look to digitisation, interoperability and integration more than ever before.

By improving both the accuracy of the payload data achieved across a site, and the site's access to that data, an integrated solution can help miners break down silos, improve their operational efficiency and catapult their profitability potential. WC