

Caterpillar has launched Fleet 5.0, which features a new Store and Forward capability that manages data handling during communications outages, whether it's due to an area of the mine lacking adequate network coverage or a wider network communications outage

Optimal platforms

There are many aspects to fleet management systems and as operations get more complex, they are increasingly about much more than simple truck fleet optimisation, reports Paul Moore

With optimistic industry forecasts making headlines, mines are looking to capitalise on the long-awaited economic upswing. But to recoup losses experienced over the previous decade mines while simultaneously making forward progress, mines must continue to control costs and do more with less. **Modular Mining Systems Inc (MMSI)** says its DISPATCH® Fleet Management System (FMS) can help mines accomplish these goals and more.

“At its core, the DISPATCH FMS is about haulage optimisation. As mining’s first-ever computer-based dispatching tool, the DISPATCH system revolutionised the way mines worked (and still work) in real-time. Employing a trio of proprietary algorithms and an array of complex mathematical calculations, the DISPATCH FMS automated and optimised truck/shovel assignments to create a faster and more efficient loading and haulage workflow. Nearly 40 years after its debut in 1979, the DISPATCH system has expanded beyond its original focus to help mines reduce costs, save time, and maximise equipment utilisation in other ways. While the ability to move more material in less time is the primary goal for most mining operations, that isn’t the only road to success. With the DISPATCH FMS, mines gain the tools

they need to not only optimise their haulage cycles, but to also address other issues that can hinder operational efficiency, productivity, and profitability.”

The following are just three of the ways Modular says the DISPATCH system goes beyond material movement to help mines solve some of the most common problems. The first relates to time-consuming shift changes. “Manually assigning operators to equipment units at shift start or needing to find equipment left at unscheduled locations at shift end, can quickly result in many unproductive hours per year. The DISPATCH FMS offers two solutions that can help mines streamline shift change: the Lineup Management and Parkup modules. The Lineup Management module analyses information from the DISPATCH system central database based on specified criteria and automatically assigns qualified personnel to equipment before a shift begins. Lineup assignments can then be quickly and easily communicated to equipment operators using, for example, a scrolling display on a monitor. The module can also be used to manually assign operators to equipment units or override automatic assignments. The Parkup module enables the dispatcher or supervisor to automate the assignment of equipment to a

specified parkup location at shift change, thus reducing the possibility of an operator leaving equipment in an undisclosed location. Assignments are optimised so that trucks are allocated to parkup locations near the assigned end-points when trucks are unable to complete an additional full or empty haul. With this module, the dispatcher or supervisor has an effective and timely decision-making tool for parkup assignments, making it possible to maximise production during the last hour of the shift in progress and the first hour of the subsequent one.”

A Modular customer in Colombia reports that they are now moving an additional 20 loads of material per shift thanks to the implementation of the Lineup Management and Parkup modules. Per the mine’s calculations, the additional loads equate to approximately 120,000 BCM of additional material moved per month, or nearly 1.4 MBCM over the course of a year.

Another aspect of DISPATCH is monitoring misused equipment. Most mines have established best practices which specify how the units in the fleet should be operated to help ensure driver safety and prolong equipment life. However, unexpected changes in haul road conditions or improper operator behaviour can result in the equipment being treated in a less than ideal manner. “The DISPATCH FMS’s FastFeedback and Speed Management modules can help mines head off costly incidents and prevent equipment abuse. The FastFeedback module provides the backbone for immediate, actionable feedback to operators. When used in conjunction with the Speed Management module, operators receive real-time speed notifications on their mobile devices. The FastFeedback module is also utilised to communicate tasks to auxiliary equipment. FastFeedback uses on-board sensors or GPS events to trigger real-time alarms with a configurable message directly to the operator, supervisor, and/or dispatcher. Alarms are logged in the central data-base, facilitating review of best practices and mine procedures.”

The Speed Management module uses GPS technology to accurately measure equipment velocity. When equipment units pass through monitored zones, the equipment’s current speed is compared with the configured speed limit values for the specific location. Speed violations can be reported in real time to the supervisor and dispatcher in the central office and, when paired with the FastFeedback module, operators receive real-time speed notifications on their in-cab mobile devices.

With these modules in place, operators can prepare for, or avoid, hazardous road conditions such as debris, spills, or closures, thus

Modular's DISPATCH system now goes well beyond material movement to help mines solve some of the most common problems, from time-consuming shift changes to monitoring misused equipment

minimising the risk of equipment or personal harm. In addition, operators can use the notifications provided to take immediate self-corrective action.

A Modular customer in Nevada reports that equipment operators have confirmed that the Speed Management module (along with other DISPATCH FMS modules) has helped increase operator situational awareness, resulting in a reduction in mobile equipment-to-equipment collisions.

Finally is the issue of miscalculated payloads. Under- or over-calculation of payload can prove detrimental to not only profitability and productivity, but also equipment health. "Underloading can lead to trucks running below capacity with unrealised production opportunities, additional trips between loading and dumping locations, resulting in wasted fuel and unproductive drive time, and increased tyre and component wear. Overloading poses a greater risk of damage to the truck's frame, suspension, brakes, and tyres; the potential of which is exacerbated by rough terrain or steep elevation changes."

The DISPATCH system's Payload module



captures real-time payload information from the onboard payload monitoring systems on DISPATCH FMS-equipped haul trucks. Under certain conditions and configurations, truck payload data is displayed on the in-cab mobile devices in shovels and trucks. A key benefit of this functionality is the real-time capture and communication of the tonnage values being loaded into a truck with each pass; crucial data

needed for tightly correlated target-to-realised production values, and to ensure accurate cost analysis and production reporting. By having real-time access to material weight as it accumulates, shovel operators are less likely to under- or overload the haulage units.

A Modular customer in Australia reports that following integration of payload functionality giving shovel operators access to real-time



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OEM-provided truck load weights, the mine experienced dramatic improvement in loading accuracy and consistency. Productivity was maximised by trucks being consistently loaded to their full capacity while overload exceptions were minimised, thus reducing the need for truck operators to tip and reload to comply with stated tolerances. The mine greatly reduced underloads and overloads with greater than 10% variance from the target weight.

Modular concludes: “Across the board, the real-time mine management capabilities of the DISPATCH system can help mines of all type and size become more efficient and productive; and realise a higher rate of return on their human, equipment, and technology, investments.”

Wenco launches Mine Performance Suite 6

Wenco International Mining Systems has recently announced the release of Wenco Mine Performance Suite 6. The culmination of several years of research and development, the sixth version of the Wenco Mine Performance Suite pushes the boundaries of mine software. It moves Wenco beyond traditional dispatch systems, incorporating user interface enhancements and across-the-suite integration for improved insights, safety and performance.

System 6 builds on Wenco’s 30-year history in mining systems with several step-changes to its suite of solutions. This version includes a complete reimagining of flagship Wencomine Fleet Management System that enable customers to gain even more performance from every shift. Expanded data exchange and interoperability across the Wenco suite – including machine guidance, collision avoidance, maintenance, and

business intelligence offerings – empower customers to leverage their data to extract even more value from their mines.

Revolutionary changes in the user interface – such as tight integration of the maps and dispatch interfaces and a complete redesign for the automated dispatch configuration – provide dispatchers a more efficient and intuitive way to monitor and interact with their mobile fleet. “We have received great feedback from our beta site users which indicated this was a major step forward towards improving efficiency and reducing pressure on dispatchers,” said Andrea Blazenko, Product Manager, Wencomine Fleet.

Taking Wenco’s pioneering innovations in dispatch automation a step further, the Wencomine Dynamic Dispatch algorithm now completely automates routine activities, such as shift changes, breaks, and fuelling. These advances further reduce the demand on dispatch and optimise truck activity for efficiency.

Wenco has focused extensive effort on offering mines more value and insight from data. System 6 helps dispatchers and managers gather more insights in real-time – and over the life of the mine – with improved dashboards, data cleansing, and business intelligence support. New Wenco dashboards deliver real-time insights, displaying payload compliance percentage, wait times, bucket-by-bucket loading, hourly progress to production target, and more. These dashboards make it easy to identify and assist underperforming production before the shift is complete.

Extensive upgrades to haul cycle analytics give users and managers the confidence of knowing precisely how dispatch automation is performing independent of other factors, encouraging

greater insight, confidence, and user adoption. Advanced data cleansing prepares data for storage, ensuring simplicity and clarity when building reports or connecting to business intelligence applications to extract broader insight.

Leveraging its interoperability enhancements, the Wenco Mine Performance Suite 6 introduces two highly anticipated solutions:

- Avoca BI — a powerful data warehousing and mine intelligence application

- ReadyLine — a predictive maintenance planning and condition monitoring solution

“Our customers are starting to look closer at how to unlock hidden value in data collected across their operations. There is also a tremendous opportunity with predictive maintenance solutions to significantly increase component life and prevent catastrophic failures for more predictable availability,” said David Noble, Vice President, Research and Development.

Caterpillar Fleet 5.0 has expanded capability

Cat® Fleet tracks data across the entire mine site and automatically handles scheduling and assignment tasks, including refuelling scheduling and shift changes. A capability set within Cat MineStar™, Fleet automatically provides reports and alerts in near real-time to pit managers for immediate response. Fleet works with all machines (regardless of manufacturer) and systems to measure, manage and maximise equipment operation and material movement.

Use of cloud-based computing technology and Wi-Fi connectivity offers an affordable and easy entry point for new Fleet users. Caterpillar introduced a major upgrade, Fleet 5.0, in late 2017. The new version offers a number of expanded capabilities including Blending to Destination and Store and Forward for data handling during communications outages.

While Cat MineStar has always had a blending element, the new Blending to Destination feature expands blending capabilities to include wheel loaders and load-haul-dump scenarios. The new capabilities are designed to help blending operations run as smoothly and efficiently as possible.

Blending to Destination involves controlling the rates, grades and percentages of material to the crusher, stockpile or dump. This is done while simultaneously making the most effective use of mobile equipment given operational constraints (by assignment). Blending to Destination assists in delivering material as specified to the processing plant, maintaining acceptable grade and material homogeneity in stockpiles, and ensuring dump material conforms to design and regulatory bounds.



The new Suite 6 from Wenco includes a complete reimagining of the flagship Wencomine Fleet Management System that includes expanded data exchange and interoperability across the Wenco suite – including machine guidance, collision avoidance, maintenance, and business intelligence offerings

The Store and Forward capability manages data handling during communications outages, whether it's due to an area of the mine lacking adequate network coverage or a wider network communications outage. A communications outage can prevent collecting data needed to optimise fleet performance, but with Fleet, machines can store the communications they would normally send over the network and forward them when a network connection is re-established. The system enables gathering data during a network outage, even one that lasts a full shift, and using that information to review and optimise operations.

“While the Store and Forward feature does not replace a well-maintained radio network, it helps ensure that minimum data requirements are met to enable the creation of cycle data in MineStar. Fleet 5.0 also includes a number of improvements that make normal work routines faster and easier. These capabilities all come together to help mining operations reduce cost per tonne, enhance productivity and boost overall site profitability.”

Hexagon and creating scalable IoT platforms

As FMS systems converge with autonomy and other areas, the levels of data analysis keep increasing. Carl Brackpool, **Hexagon Mining** Product Manager, Operations told *IM*: “Mining is

still reeling to understand how a prior costly spend to migrate data to expensive cloud architectures, over the last five years, has yet to provide actionable information that's better than real-world expertise at the mine manager level. Digitizing our industry, away from spreadsheets and decades-old, highly predictable, processes, is complicated. Adding a buzzword like 'IoT' is already colliding with skepticism. Hexagon believes that true integration starts with scaling what you already have, to prevent costly regrets later. Our IoT message is simple: you don't need a complete overhaul to be savvy and competitive. Customers already have an IoT platform and it's called 'process automation,' a complex system of end-point sensors and machines producing data across the legacy networks.”




Heavy equipment OEMs would historically instrument more components of the working mine fleet, than the maintenance and reliability engineers could reasonably manage in terms of data streams monitoring the truck, shovel, LHD, drill or dozer. In most cases, numbers of sensors were dormant, never to be polled by the serial systems management networks. “Some were connected but running in the background with only the most commonly used dashboards used at the dispatch or mine operating centres to track a handful of performance indicators from machines in the field. The lack of utilisation was a combination of poor communications from a

vehicle; the cost of raw data traversing onboard networks, only to fill local storage or private/public clouds; and no way to process all that data in a meaningful way.”

“If the rush to an IoT utopia of connected shovel teeth and cap lamps as store-and-forward mesh network nodes did anything, it's that it highlighted data congestion points wherever the transactions occur in asymmetrical communications networks. The result was a challenge that these edge devices needed a platform to broker messages from endpoint to analytics tools, then back with a set of better instructions, thus completing the loop for a self-learning process automation network within the onboard systems framework. Without this sharing of telemetry, then discreet sub-systems, such as tyre pressure monitoring, only contributed to a monitoring function that measured against policies (over and under pressures) and alarming when the threshold was out of band.”

Machine learning would make driverless mining machines aware of their position, their tasks, and avoid other machines operating in a carefully coordinated balance in the pit or from the working face to the belt line transfer, ore passes or crushers underground. Hexagon sees the real value as helping customers plan for more connected assets and workers. “We see gateways to affordable systems enhancements.

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Critical to customer success is all assets from a variety of vendors, talking to each other. We promote data engines to take full advantage of interoperability, from planning, to operations, to market. Mines should not let anyone sell them on a complete, expensive system with decades of implementation. Hexagon believes in a fully scalable IoT platform that begins with making a mine's existing investment smarter, scaling only as fast as its budget allows and driven by proving each phase pays for itself before embarking on the next milestone in an IoT roadmap that the mine defines."

VIST and the true digital mine

VIST Group FMS customers include Severstal, Evraz, SUEK, EuroChem, Metinvest, OCP, NLMK, Polymetal, Polyus and ArcelorMittal. But for the past five years a major focus has been investing in the future technologies in mining, such as autonomous dump trucks, autonomous drilling rigs and predictive analytics for different applications in mining.




Dmitry Klebanov, VIST Group Business Development Director believes the worlds of dispatch, autonomy and process analytics are rapidly converging. "The main difference of our modern approach of providing solutions to the mining industry is that we provide a true digital mine, not only a module with health monitoring or optimisation of the fleet. Some vendors are well known for offerings that highlight health monitoring and dispatch, others focus on industrial safety and still others predictive analytics and robotics...but there are gaps between all these functions, since vendors do not generally provide change management and are not process consultants. In the near future, consulting companies, such as McKinsey, Accenture and BCG will start implementing technologies, and will be able to compete with the usual vendors of IT technologies in mining, because they have the competence in organisational changes that are necessary for a modern digital mine."

The VIST Intelligent Mine offers unmanned mining operations with autonomous dump trucks and intelligent teleoperation with augmented reality for loaders, shovels dozers, graders and other on-site machines. For haul trucks and excavators it cites increase utilisation of up to 20-25%, and reduced maintenance cost of 10-15%, together with reduced payroll and reduced consumables. For drilling rigs VIST says it can increase utilisation up to 35%, as well as maintenance works by 10-15% per year.

The original VIST VG KARIER FMS has many specific modules that can help mines get the most out of their operations.

As an example it has an optimisation module

VIST Group digital solutions

 Stand alone and OEM	<ul style="list-style-type: none"> •Payload system for dump trucks •Tires pressure and temperature monitoring •Fuel monitoring •Collision avoidance •Fatigue monitoring •Diagnostic systems for mining vehicles
 Dispatch and safety	<ul style="list-style-type: none"> •VG Karier Mine Fleet Management System – optimization and automatic dispatching •VG Underground – Dispatch for UG mines •VG Drill High Precision Drills guidance •VG Scarex – Automation and High Precision for Excavators •VG Railway – Railway Automation and Dispatching •VG Safety – EHS system
 Robotics and predictive	<ul style="list-style-type: none"> •Intelligent mine® •Remote control and autonomous guidance -Autonomous and tele-operated system for mining -Predictive analytics

that estimates the required number of dump trucks required based on the actual performance of shovels, actual travelling speed of dump trucks and other factors derived from the statistics of the current and preceding shifts. Therefore, a dispatch control operator is prevented from sending "extra" dump trucks to the work area, whose operation cannot meaningfully increase the output of shovels.

This module also enables the dump trucks' open-cycle operation with automatic control. The driver gets from the system a notification showing to which shovel his dump truck should travel after discharge, or after a significant change of the situation in mining operations (failures, etc)

The optimisation module ensures the enhancement of performance by accurately estimating the required number of vehicles and directing those vehicles to the proper positions at the proper times. This functionality enables management and control actions that result in significant performance enhancement as compared to a manual system without intelligent computer-based algorithmic optimisation.

With the creation of optimisation groups, the dispatcher divides the available shovel fleet into groups, each working in an open cycle. A group may consist of a single shovel. In this case, the dump trucks assigned to it are not redistributed by the system in the process of operation. The dispatcher may manually relocate a dump truck between groups and within a group. In this case, the system sends the same notification to a driver as it does in case of automatic distribution. The driver is actually unaware of the fact of who or what is guiding his operation: software, a traffic control operator or a foreman using a workpad with software. However, every instruction is recorded in the data base and can be analysed at any time.

The VG KARIER system also provides "end-to-end" fuel logging including logging of fuel in gas

Summary of the platforms and functionalities that make up VIST Group's digital mine

stations, loading of fuel trucks, fuel feed form fuel trucks to vehicles, and control of fuel consumption by vehicles. Every stage of this process is subject to double and triple checks. For instance, in loading of fuel trucks the possibility of a discrepancy is checked in three measurements: change of the fuel level of an immobile storage tank, change of fuel level in a fuel truck vessel and fuel volume passed through fuel-handling facilities. This type of check is also applicable for transport vehicle refuelling.

The maintenance module lets miners keep a reliable history on technical maintenance in terms of its durability, periodicity, quality, etc as well as a history and control of substituted units and devices of dump trucks, which allows mines to judge the cost of maintenance and also by implication the different results from components from different manufacturers. As with other systems it creates a complete and reliable picture of technical maintenance and repairs: where, at what time and for how long the work was taking place as well as effecting the timely planning of technical maintenance and repairs and make conclusions about the mode of operation of a vehicle.

There is the option of adding scheduled technical maintenance and repairs and comparing their standards and worklists and the capability of keeping a history both for repairs and technical maintenance of a truck and all of its units and devices installed on the truck independently as well as keeping archives on installation\dismantling of units and components of a truck for which the spare capacity rate is generated. There is automatic personnel notification of the necessity of technical maintenance and automatic personnel notification about faults during operation. **IM**