Evolving Tools for Managing Surface Fleets

Recent developments in surface fleet management systems show a push towards real-time decision support and more connected open-pit operations

By Nia Kajastie, European Editor

Suppliers of mine fleet management systems (FMSs) have continued to refine their products to help optimize surface operations. Developments in this space have been driven by a need for faster decision-making and greater interoperability.

Among other things, updated systems come with new user interfaces and hardware options for improved performance. The vendors have also launched enhanced optimization models and cloud-ready architectures aimed at improving day-to-day control in open-pit environments.

These improvements have been introduced to allow for clearer visibility of production, reduce delays, enable quicker adjustments and offer more reliable automation support. Strengthened cyber security and more streamlined data-sharing capabilities are also important developments.

Alongside these technical upgrades, companies continue to prioritize practical implementation, through structured change management and training.

Key Launches and Developments

Over the past year, Komatsu has expanded the capabilities of its DISPATCH FMS through the introduction of the Modular Ecosystem. This is an interconnected suite of platforms designed to simplify workflows.

As part of this ecosystem, Komatsu has introduced three new DISPATCH applications — Roadways, Replenish and Adaptive Config — with a fourth, Look Ahead, being prepared for launch.

"These apps help mines keep their road networks current with minimal intervention, optimize fueling and charging strategies, automate system configurations and execute adaptable shift plans in real-time," said Aluizio Marcelino, senior product specialist for mining technology solutions at Komatsu. "DISPATCH apps enable customers to achieve higher productivity, reduce idle time and operate more predictably and efficiently."

Haultrax recently redesigned a key part of its FMS, creating FleetOps 2.0.

The FleetOps module uses GPS tracking and intelligent algorithms to compile real-time operational data to enable miners to measure, report and improve on key metrics for optimized productivity and improved performance.

The new version, designed with production supervisors in mind, comes with more intuitive and user-friendly visuals that are optimized for tablets and phones.

Lorenzo Scalabrini, operational lead for HX Digital at Haultrax, said: "With this launch, we're giving supervisors the tool they need to confidently meet production and safety goals, lead their teams to success every shift, and make their work easier and faster."

On the hardware side, Haultrax has launched HXTag. It is a compact, ultra-modern edge computing device designed to capture precise machine data through a Global Navigation Satellite System (GNSS), digital inputs, Controller Area Network (CAN) bus, and serial communication over WLAN, LAN and GSM networks.

HXTag is a plug-and-play unit designed for harsh mining environments that automatically collects and transmits operational data. It can be mounted externally and is rated to IP66K to withstand high-pressure water cannon blasts during machine washdowns. The unit is designed to link seamlessly with FleetOps to provide visibility into production performance.

Haultrax has also introduced FM-SaaS, a software-as-a-service model for its FMS solution. Miners can get access to a bundle of hardware, software, updates and support for one monthly fee per asset without a minimum term.

"Many mining operations face challenges adopting new technology due to high upfront costs and complex implementation requirements," said Gordon Crane, commercial director at Haultrax. "FMSaaS solves this by delivering the fleet management system as a simple monthly subscription."

For Hexagon's Mining division, the biggest milestone from the past year was the release of an improved version of Hexagon OP Pro.

It is designed to provide stronger fleet efficiency, smarter dispatching algorithms, accelerated analytics, broader equipment integration and increased system stability.

Haultrax fleet management system. (Photo: Haultrax)

"Enhancements such as improved understanding of shovel status, more proactive truck assignment and refined feed-rate calculations help mines improve utilization and reduce operational delays, even in edge-case scenarios," explained Jarym Kowalchuk, head of product for operations in Hexagon's mining division. "Key performance indicators now refresh in a few seconds, giving users immediate insight and supporting fast, data-driven decisions."

Hexagon also added to the system's equipment compatibility, with support for more truck, drill and plant systems. These include Volvo trucks, Epiroc drills and multi crusher bay systems.

Kowalchuk said that this makes "OP Pro easier to deploy in mixed fleets and more complex crusher interfaces."

He continued: "Architecture updates ensure performance reliability under high-load conditions or extremely large fleets ensuring consistent performance during peak operational periods."

Model Mining director Marcelo Romero said that 2025 had been an exciting year for the mining technology consultancy as well.

"We introduced the SimpleFMS Display for customers who wanted more operator feedback," he said. "While the black-box system works perfectly without a screen, the new mobile app adds powerful tools like real-time equipment status, production reports, heat maps, overspeed alerts and checklists – and it works with minimal wireless infrastructure.

"We also redesigned our web interface to make it intuitive and fast, so teams can stay aligned and reduce training time."

Additionally, Model Mining launched a new version of SimpleBLENDING, focused on ore control at the primary crusher. "It reduces process variance, improves recovery and makes hitting blend targets easier and more reliable for dispatchers," Romero added.

Outliers Mining Solutions, a consulting firm with FMS expertise, offers a software solution that leverages real-time FMS data to drive Short Interval Control and deliver actionable productivity insights.

"Over the past year, our key FMS developments have focused on moving beyond passive information delivery to real-time action enablement," said Brad Jewson, director for mining at Outliers Mining Solutions.

"The most significant launch has been our automated critical event notification system, which pre-emptively identifies emerging production losses as they happen, enabling supervisors and dispatchers to intervene in a short interval.

"We also introduced the ability to track the impact of these actions and gain insights into how to address them in the future, closing the loop between detection, response and measured value. These enhancements materially improve how truck-and-shovel fleets are managed in real time and elevate the effectiveness of Short Interval Control."

Role of Automation and AI

Automation, artificial intelligence (AI) and machine learning are now at the core of FMS evolution for many solution providers.

Marcelino said that these advanced technologies continue to shape Komatsu's approach to fleet management, "enabling faster decision-making and more precise optimization across the haulage cycle."

"Through advanced algorithms and the application of AI our FMS platform can now identify bottlenecks, forecast disruptions and automatically recommend or execute corrective actions," he continued.

"These technologies also support a broader vision of interoperability and autonomous readiness, allowing mines to progress along the automation spectrum, from assisted operations to more advanced autonomous functions, at the pace that best meets their needs."

The evolution of Hexagon's OP Pro is also "increasingly shaped by the industry's shift toward advanced real-time analytics, AI and scalable cloud technologies," Kowalchuk noted.

"This influence is visible today in our intelligent dispatching logic, which uses improved algorithms to refine shovel assignment priorities, optimize routing and reduce downtime in dynamic operating conditions."

Hexagon sees AI playing an even bigger role in the future.

"Our roadmap includes deeper optimization models capable of learning from historical and real-time operational data, enabling smarter predictions and more adaptive decision-making. These technologies will unlock richer production insights and support more natural, intuitive interactions, such as enabling users to access insights through natural language queries," Kowalchuk explained.

So, as automation and AI mature, OP Pro could deliver more proactive recommendations and exceptions-based workflows.

An improved version of Hexagon OP Pro was released in 2025. (Photo: Hexagon)

Model Mining's SimpleFMS uses smart algorithms to automate the production cycle, so operators can focus on driving while the system handles repetitive tasks.

"It automatically captures production data for any truck, make or model and logs delays like shift changes or breaks — cutting down on human error and eliminating manual dispatching," Romero noted. "I like to say the SimpleFMS black box knows what the truck is doing, just like a smartwatch knows if you're walking, running or sitting."

In 2025, Model Mining ran internal AI and machine learning projects. In 2026, the development of AI agents will begin for its SimpleFMS, SimpleBLENDING and SimpleSIC solutions.

Outliers Mining Solutions is also making use of advanced technologies for its FMS data-driven solutions.

"We are combining our operational expertise with client-specific learnings from our software solution, enabling us to automate Short Interval Control analyses, identify the highest-value actions and optimize decisions that drive productivity in real time," said Jewson.

Data Integration and Sharing

Improving integration and data sharing has become a priority for mining technology providers, including FMS suppliers. By breaking down data silos, operations can get closer to establishing a single, trusted source of operational information.

Komatsu's Modular Ecosystem has an open-architecture design that enables data from Komatsu products, third-party vendors and mixed-fleet equipment to coexist within a single platform.

"We are also helping to lead the development of interoperability standards through ISO working groups, ensuring

SimpleFMS mine traffic management window. (Photo: Model Mining)

that automated systems can communicate reliably and that customers benefit from a more connected and collaborative technology environment," Marcelino said.

Model Mining's SimpleFMS supports cloud-based architecture and interoperability, so mines have the capability to share data in real time across planning, maintenance and reporting systems. Users can access dashboards and reports from their phone, ensuring everyone sees the same information.

"We're also expanding our portfolio to enhance operational safety," Romero said.

Model Mining now offers advanced safety solutions, including an Anti-Collision System (Level 9) and a Fatigue Detection System through a trusted safety partner.

"Looking ahead to 2026, expect deeper integration between safety and FMS solutions, providing richer operational and safety context for a more productive and secure work environment," he added.

Haultrax aims to enhance data integration by providing API access that allows connection with external systems such as data warehouses, payload management systems, high-precision positioning systems and other operational tools. Additionally, it offers Power BI reporting solutions to ensure business users can access, visualize and interpret key operational insights.

Hexagon wants to expand interoperability on multiple fronts with OP Pro.

"Support for more makes and models helps mines operate mixed fleets without compatibility barriers," Kowalchuk pointed out. "This aligns with industry trends toward operational flexibility and the rise of electric and hybrid fleets."

OP Pro's ability to share real-time data with planning, plant and maintenance workflows is also meant to strengthen cross-functional coordination.

"For example, enhanced onboard monitoring tools give plant personnel clearer visibility into targets and fleet progress, enabling better synchronization with upstream activities," Kowalchuk continued. "Engineers can use real-time positioning and misrouting alerts to optimize production flows, while maintenance relies on accurate utilization data to plan interventions."

In the future, Hexagon will focus on deeper integration across its ecosystem, including planning tools, collision avoidance and fatigue management technologies.

"This will reduce hardware requirements, standardize data sharing and strengthen the foundation for a more connected life-of-mine environment," Kowalchuk said.

Outliers Mining Solutions' focus lies on integrating FMS, production data, planning systems and workflows, with the aim of making Short Interval Control fully data driven.

"By streamlining data sharing between platforms, we remove manual work, improve KPI accuracy, create opportunities to discover new learnings and insights, and ensure that real-time decisions in the field and the control room are aligned with the mine plan," Jewson said.

Cyber Security Concerns

As mines continue to become more digitalized and systems more interconnected, cyber security is front of mind for technology providers. This is made all the more urgent due to recent cyberattacks in the mining industry.

Cyber security is also a foundational element of Komatsu's technology strategy.

"Our FMS platforms are built on a secure architecture that incorporates modern authentication protocols, data encryption, rigorous access controls and continuous monitoring to detect anomalies before they impact operations," Marcelino explained.

"We work closely with customers' teams to ensure solutions align with site-specific cyber security policies. Our open-architecture approach maintains strict controls around data ownership, allowing customers to decide when and how their information is shared."

Model Mining said it works closely with leading technology partners and customers to implement best practices.

These include cloud infrastructure protection to prevent and respond to attacks; data encryption at rest and in transit; role-based access control to prevent unauthorized changes; and regular vulnerability assessments and hardware patching.

To enhance security across its FMS ecosystem, Haultrax leverages Microsoft Entra ID for robust authentication and enforces multi-factor authentication (MFA) for all users. Its servers are protected with CrowdStrike Falcon sensors, enabling real-time threat detection and response. In addition, its environment is monitored 24/7 by two dedicated security specialists.

Haultrax is working towards compliance with ISO 27001 cyber security requirements, with certification targeted for 2026. The standard provides verification that an organization is using an internationally recognized Information Security Management System (ISMS) to keep its information assets safe and secure.

Hexagon is also on track to get ISO 27001 certification in 2026.

Moreover, many of the upgrades in the newest version of Hexagon's OP Pro indirectly reinforce cyber security.

"The transition toward greater cloud scalability, broader integration and improved system stability is supported by secure-by-design principles within our development process," Kowalchuk said.

Change Management and Training

When introducing more advanced systems on a mine site, users will always need appropriate training and support to manage the transition. The technologies alone cannot improve the operation; it ultimately depends on how effectively they are applied by the people on site — or those supporting the operation remotely.

Marcelino believes that successful technology adoption requires strong change management.

"Our teams provide structured onboarding programs, scenario-based training and continuous support to ensure dispatchers, supervisors and operators can quickly build confidence in the system. With intuitive interfaces, remote assistance tools and data-driven insights, we help customers integrate new workflows seamlessly, sustain long-term performance and maximize the value of their technology investments," he said.

For Outliers Mining Solution, change management and capability building are some of the core outcomes of its professional services work.

"Our focus is to close skills gaps, build a true understanding of production driv-

ers and ensure teams can sustain performance long after our engagement ends. We integrate training, coaching and role-specific upskilling from the outset so that system adoption is strong, behaviors are embedded and the solution's value endures," Jewson explained.

The team behind Haultrax's FMS has a mining operational background, meaning it has direct experience of how sites work and the pressures that teams can face.

In addition to deploying software, Haultrax offers role-based training, in-pit coaching, process alignment and continuous improvement support.

"We look at how digital solutions and mining technology can be integrated into a business and implemented with the people at the frontline and apply it in a way that brings most value to them. I commonly say that we have the ability to communicate the same message in different languages, from C-suite level to middle management and operators — in the meeting room, pre-start meeting, or in an operator's cab," explained Haultrax managing director Shyamal Sharma.

One of the strengths of Hexagon's OP Pro is that it offers benefits across various roles within the mining organization, thus reducing the friction of change.

For operators, simplified dialogue boxes, faster status-change shortcuts and clearer plant monitoring can help reduce workload and errors. For engineers and controllers, more precise feed-rate calculations, real-time truck positioning and timely misrouting alerts support adherence to plans and help refine processes. Maintenance teams benefit from higher-frequency analytics refreshes and more accurate availability tracking, enabling proactive scheduling. Management, in turn, can gain heightened visibility through real-time analytics and intelligent dispatching.

"Our implementation approach builds on these features with structured onboarding, scenario-based training and continuous post-deployment optimization," Kowalchuk said.

Romero explained that Model Mining's FMS platform is first and foremost built for simplicity.

"Operators don't need to enter data manually — the system captures and streams production metrics automatically, so supervisors don't have to spend time training operators. This makes adoption smooth and reduces resistance to change," he said.

A Look Underground

Over the last 12 months, Micromine has focused on improving real-time visibility for underground operations through its underground FMS, Pitram.

It recently introduced comprehensive Shotcrete Tracking, enabling full traceability from the batch plant to the sprayed locations. The system records key quality and process data, including batch numbers, slump tests, additives and transfers between mixers and sprayers. It also supports complex scenarios, such as partial discharges across multiple locations or the disposal of unused material. All shotcrete-related events are processed during the shift and stored in the reporting database.

Erich Guevara, head of business unit for Micromine Pitram Americas, said: "One of the core improvements was Pitram Connect, our mobile-first experience designed to give supervisors and engineers immediate access to shift data without being tied to the control room.

"This includes new capabilities such as recording measures directly in the app, real-time task progress and instant updates from operators underground."

Micromine also released Real-Time Deviation Tracking, which highlights plan-versus-actual discrepancies as they occur, not at the end of the shift.

"Another major focus has been strengthening our material management capabilities, from stope to ROM. Mines are now leveraging richer load-haul-dump tracking, improved ore routing intelligence, and tighter reconciliation workflows to reduce losses and bottlenecks," Guevara said.

Micromine sees automation and AI reshaping expectations for what an FMS should deliver in the underground space.

Guevara explained that, in Pitram, it is applying these technologies in the following ways:

- Automation of routine data capture to reduce operator burden and improve reporting consistency.
- Pitram Vision, the world's first machine-vision-based capability for automated LHD cycle detection.
- Expanding its onboard integration framework, with the latest release supporting a broader range of equipment for direct data acquisition and fully automated data flows.
- Anomaly detection and deviation insights, helping teams identify trends and operational risks that would be difficult to see manually in large volumes of shift data.

As underground mines also push toward more connected, continuous operational workflows, more integration between systems has been a focus for Pitram as well.

"Over the past year, we've strengthened interoperability across planning, maintenance, ERP and analytics environments, as well as with OEM equipment integration," Guevara noted.

"We expanded an already established set of onboard integrations by adding Caterpillar VIMS, Komatsu Komtrax and Volvo articulated haulers, alongside existing support for Loadrite onboard scales and other OEM systems."

Critical data on machine health, payload, fuel burn, cycle counts and engine hours then flows into Pitram, and it is automatically converted into structured production events.

Activities such as cycle changes, dumping, refueling and servicing can be captured without manual entry. This helps reduce operator load and improve data quality, and mines can respond faster to emerging bottlenecks or equipment issues.

Micromine has also strengthened APIs for third-party tools, enabling better interoperability with OEM dashboards, fleet maintenance systems and corporate data lakes.

Micromine sees cyber security as non-negotiable for operational technology systems. It has thus invested in:

- Hardened authentication and role-based access controls across all Pitram interfaces, including Connect.
- Enhanced encrypted data transfer between all clients, including underground mobile units and servers.
- Regular third-party penetration testing and security audits to benchmark against global best practice.
- Separation of operational and corporate data layers.
- Alignment with Weir Group's enterprise-grade cyber security governance.