By Justin Johnsen

From Data to Action

Real-time asset information should benefit everyone in an organization

MODULAR MINING SYSTEMS INC.

Optimizing a mining process requires an initial understanding of all parties involved. It is important to know what is at stake from one process to the next and, just as important, to know the stakeholders. Whenever the implementation of a real-time maintenance management system is discussed, the most commonly identified groups are operations and maintenance departments.

However, limiting the stakeholders to these departments alone misses the bigger picture — ignoring several groups within mining organizations and the industry at large that benefit from the information gathered. Implementing a real-time maintenance system directly impacts several groups whose active involvement in the implementation process allows faster recognition of the inherent benefits.

Who holds a stake?

It is well established that maintenance managers rely heavily on information to develop long-term strategies. To ensure current equipment can meet future demands, managers require information on fleet reliability, cost and operating characteristics. Superintendents and supervisors implement maintenance plans based on priority, manpower and cost of repairs. Planners and schedulers work to predict preventive maintenance schedules, component replacement intervals and warrantee work based on the information provided them. Maintenance engineering groups desire the necessary data to understand and research opportunities for continuous improvement. Finally, mechanics desire to work efficiently, without constantly changing priorities.

Operations departments gain from maintenance planning, scheduling, diagnostics and predictive process optimizations. Operational managers and superintendents examine specific details of the mine plan, seeking ways equipment configurations can meet or surpass material movement goals. Field supervisors and fleet dispatchers require maintenance schedules for equipment rotation and daily plans to maximize their production goals. Lastly, operators depend on maintenance to provide equipment that operates safely and reliably.

Supporting departments play a huge role in the day-to-day and long-term plans of successful organizations. Tire shops, lube and fuel services, and reliability-centred maintenance (RCM) technicians all rely on operations and maintenance to work cohesively for operational and mechanical excellence. Tire life, rotations and budgeting are determined by reviewing available information. Inconsistent or non-existent data regarding tire life can cause large discrepancies in the operational budget. Lube and fueling operations provide the lifeblood of the equipment. Without information on fluid levels, production is compromised. RCM technicians ensure oil, vibration, ultrasound and thermal imaging, providing information back to the organization facilitating value-added decisions on machinery health. Without predictable schedules from maintenance, repairing or replacing onboard technology, or performing RCM tasks, adds to unscheduled downtime.

In modern mines, there are onsite groups ensuring the regulatory agencies expectations are exceeded. These reporting parties help maintenance and operations provide environmentally sound processes and employee safety. Safety departments audit and report on the organization's ability to provide the safest equipment and working conditions for the employees. Environmental services must be able to view and report on carbon emissions and the success of the fluids management.

OEMs continuously strive to produce better components and outperform their competition. There are also opportunities for contract maintenance, which requires cost control and KPI tracking to maintain customer satisfaction. Providing real-time data to the experts leads to long-term maintenance success and, at times, information to help OEMs produce better products.

A real-time maintenance system with remote monitoring and data capturing abilities assists all of these stakeholders in achieving capacity assurance. The keys to its effectiveness — to a significant ROI — are the proper implementation and organizational participation. Once groups recognize they hold a stake, they must play their part and work together. Overall, maintenance management software is a steppingstone towards the integration of proactive maintenance into daily routines and continuous improvement.

What are the benefits?

Moving forward with an insertion of technology and data into the maintenance realm has numerous benefits, which allow an organization to move beyond the reactive practices of post-failure download diagnostic or having operators report abnormal conditions occurring onboard. The new proactive process is relatively easy to implement, providing immediate returns to the entire organization.

Furthermore, the remote data collection aspect of a maintenance system allows for an organization to institute reliability engineering or RCM practices in addition to the real-time maintenance. RCM implements engineering analysis of the operating characteristics of components and ensures resistance to failure, typically measured by mean time between failures (MTBF). Also, RCM implements the engineering analysis into a predictive model to identify the probability a failure is likely to occur. The focus on acting early will result in less repair time and lower repair costs, which translates to predictive maintenance.

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Real-Time Benefits

In a fleet management system, all equipment has operational data captured regardless of type or model. Having all of these data gathered and displayed in one single software package optimizes the troubleshooting, actions and reporting, eliminating the need for separate software packages for each OEM. Real-time maintenance systems show active alarm conditions for all equipment regardless of manufacturer, immediate diagnostics for an active fault code through snapshots and the association of the troubleshooting or repair guides for alarms.

Viewing real-time raw sensor data (Figure 1) can indicate the root cause of faults as well as parts necessary to fix, perform preventive maintenance (PM) inspections, or provide the details necessary to identify a larger issue — whose immediate correction could avoid a catastrophic failure. The application also reduces the time to dispatch a mechanic to an equipment unit or simply eliminates unnecessary trips. However, to limit the benefits to a single group or department will hinder acceptance; delaying deployment and ROI. Identifying and maximizing the benefits for each stakeholder will amplify the acceptance and shorten the timetable for successful implementation.

Remote Data Collection Features

Historical information and data collection for analysis can move an organization from reacting to alarm conditions in order to prevent an impending failure to a more proactive approach involving statistical analysis, component-level root-cause analysis

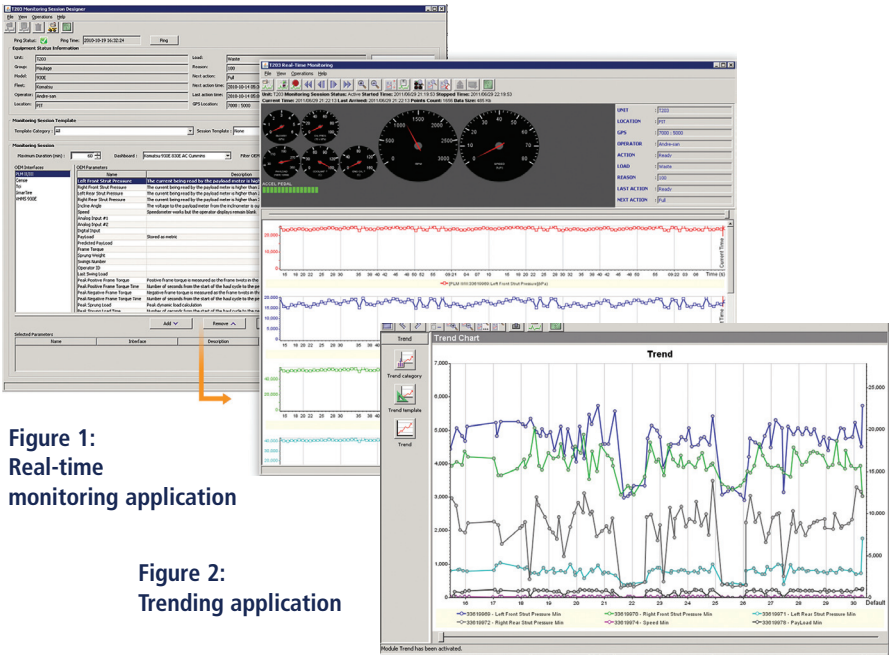

Figure 1:
Real-time monitoring application

Figure 2:
Trending application

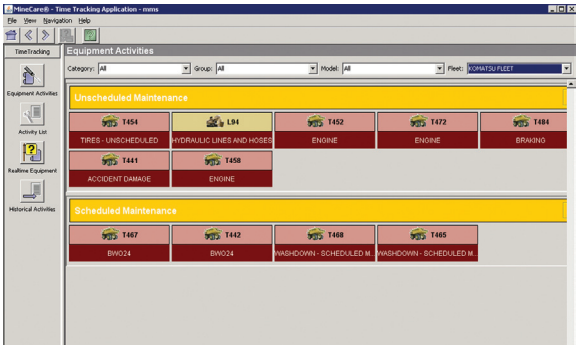

Figure 3:
Time-tracking application

and failure mode effects analysis. This is what is expected through historical analysis and research. The benefits typically are listed only to assist those directly assigned to ensure reliability. To ensure successful implementation, a stakeholder must again be aware of the entire organization and recognize all potential benefits of remote data collection.

Abnormal conditions can lead to larger failures or reduce the overall ability of equipment to perform at the desired level. Behind these alarms are the individual sensors with raw values triggering notifications. The context surrounding these signals provides the details necessary to prevent continual accumulation of abnormal conditions (Figure 2). While sensor information is critical, detailed logs for unscheduled downtime events are also necessary to better understand opportunities for improvement. Time tracking allows detailed information that can be related back to the abnormal or alarm conditions being captured in the system (Figure 3).

Temperatures, pressures, speed and operating conditions, among other factors, are critical to understanding the history behind the capacity of a particular component, and whether it is achieving the desired productivity and/or life cycle. When looking to implement technology to improve performance or reduce costs, looking beyond just maintenance benefits will ensure success.

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Real-time maintenance systems are designed to allow users to take raw data and convert that into information — then take action. This concept is used frequently, and it should be a focus for an organization considering maintenance management technologies. All this should come back to benefits. A system's ability to turn data into information and information into action should benefit as many groups inside the organization as possible. Implementation without organizational buy-in is possible, but with microscopic tracking of return on investments, it is not probable. Once groups recognize they are stakeholders in the implementation, that there are qualitative and quantitative benefits to all parties, organizational buy-in and acceptance is achievable. The entire organization participating and benefiting from the decision to implement technology into their maintenance program will ultimately provide a sustainable and repeatable predictive/preventive maintenance ratio. When the ratio is sustainable and repeatable, the entire organization is successful.

Benefits to Multiple Stakeholders

Maintenance (Local & OEM)
- Component-level tracking for warrantee or reliability concerns
- Relationship between operational status information and equipment health notifications
- Critical analysis, diagnostics, and action process established in a single system
- Remote preventive maintenance vehicle health inspections

Operations
- Procedural improvements via analysis of current practices
- Road condition monitoring with GPS tracking
- Operator KPI inputs

Safety/Environmental
- Inspections on ensuring safe maintenance practice
- Emissions tracking through fuel burn rate and fluid levels for spillage monitoring
- Accident investigation: onboard data provides context to help identify root cause
- Equipment safety system operation
- Onboard fluid leakage identification

Support Services
- Response time and service impact to production tracking
- Onboard fluid levels for more efficient fuel and lube assignments
- Procedural improvements for tire rotations, tire temperature and pressure monitoring

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