

Modular Mining implements haul cycle automation at African iron ore mine

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Automation continues to play a critical role in the mining industry and, as the need for optimising production costs increases, the need to reduce human intervention at specific points of operation remain key growth-driving factors for the global mining industry.¹ While each mine has its own unique requirements, and can be at various levels of 'autonomy-ready,' one thing remains the same: improving efficiencies through automation of equipment and processes will be critical steppingstones to full autonomy.

A large opencast iron ore mine in South Africa has been a long-time customer of Modular Mining, utilising the DISPATCH[®] fleet management system (FMS) to help them optimise and automate dispatching and crew rotation, and monitor and reduce equipment abuse.

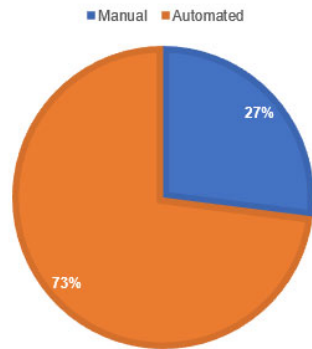
By further leveraging the DISPATCH optimisation algorithms and original equipment manufacturers (OEM) interfaces to automate the haul cycle tracking, as opposed to relying on manual input from the operator, the mine can significantly improve data accuracy and overall equipment effectiveness. A recent example of the value this provides is described in the following case study.

Modular Mining's Performance Assurance (PA) programme is a next-level support initiative designed to ensure that each customer receives maximum sustained value over the life of their Modular Mining technologies. With each PA engagement, a dedicated team of experts collaborates with a cross section of mine personnel to develop tailored, flexible, and proactive solutions to address each operation's specific challenges. Participating mines have seen numerous benefits, including enhanced truck productivity, shorter queue times, reduced equipment maintenance costs, and more.

As the mine sought to optimise its existing fleet's performance and maximise the rate of material moved they reached out to Modular Mining's PA team for help. Members of the PA team collaborated with mine personnel across multiple levels to develop a tailored and proactive solution to address their needs.

Working with mine leadership, the PA team conducted a thorough evaluation of continuous haul cycle data from the DISPATCH FMS and report inspections. From the results, the PA team identified that the haulage fleet operators were, on average, manually entering haul cycle arrivals at loading units 27% of the time (Figure 1).

MANUAL VS AUTOMATED ARRIVAL BEFORE PA (FEB 2020)



MANUAL VS AUTOMATED ARRIVAL AFTER PA (SEP 2020)

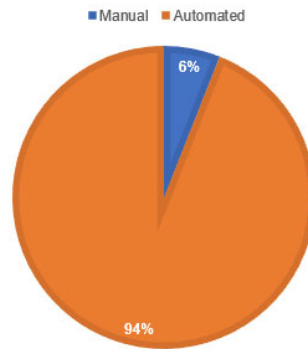


Figure 1. Comparison of manual vs automated arrivals at end-point locations before and after PA engagement.

Factors such as network connectivity, hardware maintenance, changes in roads and paths, placement of mobile access points, and system configuration, can all impact the operator's need to manually input arrivals. However, as with any manual process, data accuracy can be comprised, therefore, fewer manual interactions is the goal. Reducing the occurrence of manual processes also presents an opportunity for the mine to improve their operations. As in this case, the accuracy of captured cycle times was negatively affected, and the number of haul cycle exceptions that had to be managed by the control room, increased. The overall effect of this was limiting the mine's ability to further optimise their haul cycle.

Once the PA team and mine personnel uncovered the opportunity to improve and automate haul cycle arrivals, the team focused on enhancing the DISPATCH FMS' haul cycle automation (HCA) functionality to address the mine's challenges. The main objective of HCA is to automate the initiation of the haul cycle actions captured in the DISPATCH FMS, including:

- The assignment to the loading unit whilst at the dumping location.
- The arrival at endpoint locations (loading units, benches, dumps, crushers and stockpiles).
- The start of loading at the loading unit.
- The end of loading at the loading unit and assignment to dump location.

The HCA functionality combines location, time, and equipment information to create a comprehensive picture of the haulage cycle. Each destination, such as loading units, benches, dumps, crushers, and stockpiles, is assigned a virtual GPS beacon consisting of a reference location and a radius. When the truck detects that it is within range of the beacon and the truck's velocity is below a specific threshold, the truck automatically sends the ARRIVE action to the DISPATCH System's central server via the truck's on-board hardware.

The central server then records the ARRIVE equipment and location and automatically advances the equipment to the next stage in the haulage cycle. The system can be configured to leverage onboard equipment sensors for cycle state automation.

The HCA functionality is the driving force in haulage optimisation with the primary objective to reduce the need for the operator to interact with the in-cab mobile field computer. The benefits of this include:

- Improved the accuracy of captured cycle times.
- Improved optimisation levels.
- Fewer exceptions that need to be handled by dispatchers in the central control room.

The PA team worked with the mine to enhance the current HCA functionality to meet their specific challenges. In July 2020, the PA team implemented the enhanced HCA functionality, and within 3 months, it had reduced manual cycle usage which, in turn, increased the data quality and accuracy used in fleet optimisation.

As a result, the occurrence of zero spots reduced from 3.7% to 1.9%, for an improvement of 1.6%. In the DISPATCH System, a zero spot is typically recorded when a truck or shovel operator fails to press an action button on the mobile device at the correct time, as required to

correctly capture a haulage cycle event. This ultimately led to a 6 ktpd increase in production (Figure 2). The PA team anticipates the improvement could equate to approximately 2 million additional ktpy.

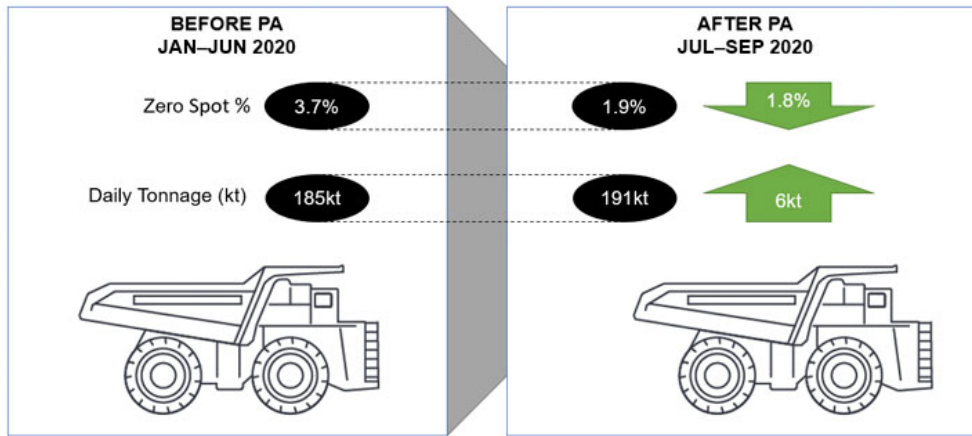


Figure 2. Comparison of daily zero spot percentages and daily kt before and after PA engagement.

By leveraging the PA team’s expertise, the mine successfully improved its overall equipment effectiveness and data quality, and reduced the workload of personnel in the control room. This enabled the mine to take a significant step towards meeting their strategic goals defined at their corporate level.

References

1. Automated Mining Equipment Market – Growth, Trends, COVID-19, Impacts and Forecast (2021-2026).

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