NEWMONT EXPANDS USE OF COMMAND

COLLABORATION WILL HELP MINE REALIZE FULL VALUE

SITUATION

Leeville mine,* Newmont Nevada's largest underground mine, produces about 450,000 ounces of gold each year. An early adopter of technology and automation, Newmont had long ago installed a line-of-sight remote system for Load Haul Dump (LHD) loaders and in 2012 began a journey to semi-autonomy with the introduction of Cat® MineStar™ Command for underground, running on Cat LHDs. This semi-autonomous system was operated from Remote Operator Stations (ROS) housed in mobile underground trailers.

Operators embraced the system and enjoyed the more comfortable operating environment of the ROS. The site saw productivity increases thanks to the co-pilot and autopilot functionality as well as the ability to tram in second gear.

But Leeville was unable to realize the full benefit of its investment in the system. A mixture of issues with system reliability, machine size, ground conditions and an unreliable WiFi network eroded the operation's confidence with the system—and ultimately led to underutilization of Command. Meanwhile, internal management changes and other major projects made rectifying the situation a low priority.

* Leeville mine is now a part of Nevada Gold Mines, a joint venture between Barrick Gold Corp. and Newmont Corporation. The massive mining operation comprises 8 mines along with their associated infrastructure and processing facilities. Nevada Gold Mines is operated by Barrick.

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OPPORTUNITY

In 2016, Newmont initiated a head-to-head trial of LHD automation systems, comparing Cat Command to a competitive system that runs on Cat machines. After a three-month pilot, Newmont determined that Command was its system of choice, primarily due to its multiple machine control capabilities and the ability to function on the mine's existing third-party digital network.

Newmont agreed to install Command on Leeville's existing R1600G LHDs and move operations from the underground operator stations to a centralized control room on the surface. In late 2017, Cat dealer Cashman Equipment began installation of the system. At the same time, Caterpillar saw an opportunity to ensure that the obstacles in the way of the system's success would be addressed and removed.

2012
Semi-autonomous Cat Command for underground system introduced; underground ROS operation
System underutilized

2016
Head-to-head trial of LHD Automation systems
Command selected

2017
System installed and operations moved to surface
Collaboration initiative begins

2019
100% of stope tons produced by Command
Line-of-sight system eliminated

COLLABORATION

An initiative to ensure the success of the autonomous program resulted in a collaboration agreement that united Newmont, Cashman and Caterpillar. In exchange for giving Caterpillar access to the mine for visits and promotional activities, Leeville would get the support it needed to realize the full value of Command:

- Early access to new software and hardware releases
- Regular visits from a Caterpillar application specialist
- Dedicated support from Cashman

In addition, Newmont made a commitment to the autonomous system, creating a focused technology support group in Nevada led by region management and supported by Newmont subject matter experts (SMEs). The company also formed a global group tasked with looking at technology and opportunities for improvement and expansion across other Newmont underground operations.

INVESTIGATION

A team of technology experts from Newmont, Caterpillar and Cashman visited Leeville, evaluating the Command system as well as the site's people and processes. The investigation included an initial assessment and discussion with stakeholders to identify issues; benchmarking to understand the need for training and process change; a study of the processes to identify gaps and overlaps and understand requirements; and assessing the capabilities of the system and looking at how it is integrated into the overall mine operation.

Regular meetings, coupled with a visit from Caterpillar product support personnel, highlighted the highest priority issues and a small team was formed to analyze, plan and develop fixes.

The first order of business was resolving issues that were preventing the efficient use of the Command system, such as WiFi network conditions, system reliability, and a knowledge gap for operators and service personnel. Once these issues were addressed, attention turned to expanding knowledge across the mine—from operations and engineering to maintenance and communications. Several discussions with these stakeholders reviewed the organizational structure, identified roles and responsibilities, and highlighted gaps in procedures, documentation, tooling and resources. In some cases, the team found a support structure that was lacking or non-existent.

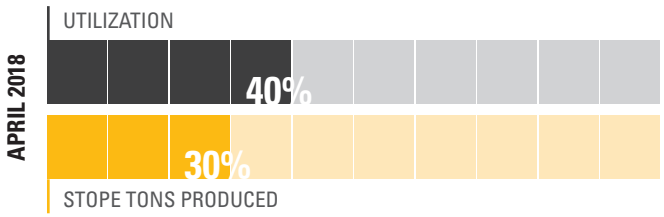
Operator feedback was another key focus of the investigation. Leaders recognized the need for operators to feel confident that they were being heard—from sharing improvement ideas for the ROS to requesting additional training on the system.

While initial improvements addressed priority issues and enabled higher utilization of the Command LHDs, Caterpillar recognized that there were more gains to be realized. The arrival of a dedicated Caterpillar Command SME helped Newmont understand the system in much greater depth, focusing the conversations on the growth of the system rather than the issues associated at the operational level. In May 2018, Leeville undertook a series of change management practices, incorporating people, processes and scheduling.

RESULTS

With a strong partnership in place, Newmont set a goal to produce 100% of the stope tons from Leeville using the Command system.

A baseline for comparison was set in April 2018, when utilization was at 40% and stope tons produced were at 30%. Just four months later, by the end of August 2018, use of the line-of-sight system had been eliminated, Command utilization had risen to 80%, and stope tons produced by Command reached 100%.



With 100% Command utilization, Leeville is now realizing the full benefit of its investment in the semi-autonomous system. Command has helped the mine:

- Boost productivity by a sustained 20%+
- Reduce damage to machines thanks to the system's accurate tunnel navigation
- Improve operator safety by locating them well out of harm's way
- Increase operator satisfaction and engagement, and reduce turnover thanks to the comfortable environment, which reduces fatigue

NEXT STEPS

The next step for Newmont and Caterpillar goes well beyond Leeville mine. The companies are working together on autonomous designs that will allow multiple sites to be controlled from a central control room. They're also exploring opportunities to further streamline the flow of ore from the stope to primary processing.

In addition, Newmont hopes to replicate the Command success at Leeville by creating a best practices playbook that captures the process flow, requirements and documentation. This playbook will help Newmont onboard new operations with minimal disruption, downtime and cost. The result will be a reduction in the productivity dip typically seen when changes are made within any organization.

Cat MineStar™ Command for underground combines onboard computers, cameras, LADARs and off-board software to autonomously steer load-haul-dump (LHD) machines during hauling. That allows operators to load and dump material from safe, comfortable control stations—located well out of harm's way on the surface or underground. It also improves accuracy of tunnel navigation, boosting productivity and reducing machine damage caused by contact with drive walls.

Command is an integral part of MineStar Solutions for underground, the mining industry's most comprehensive and thoroughly integrated suite of technology offerings. Additional capabilities include:

- Fleet, which provides real-time visibility to cycle time, payload and other key operational parameters.
- Detect, which addresses risk to people and assets by making it possible to track them wherever they are underground — in real time.
- Health, a suite of products and services that enable the collection and analysis of machine health data.