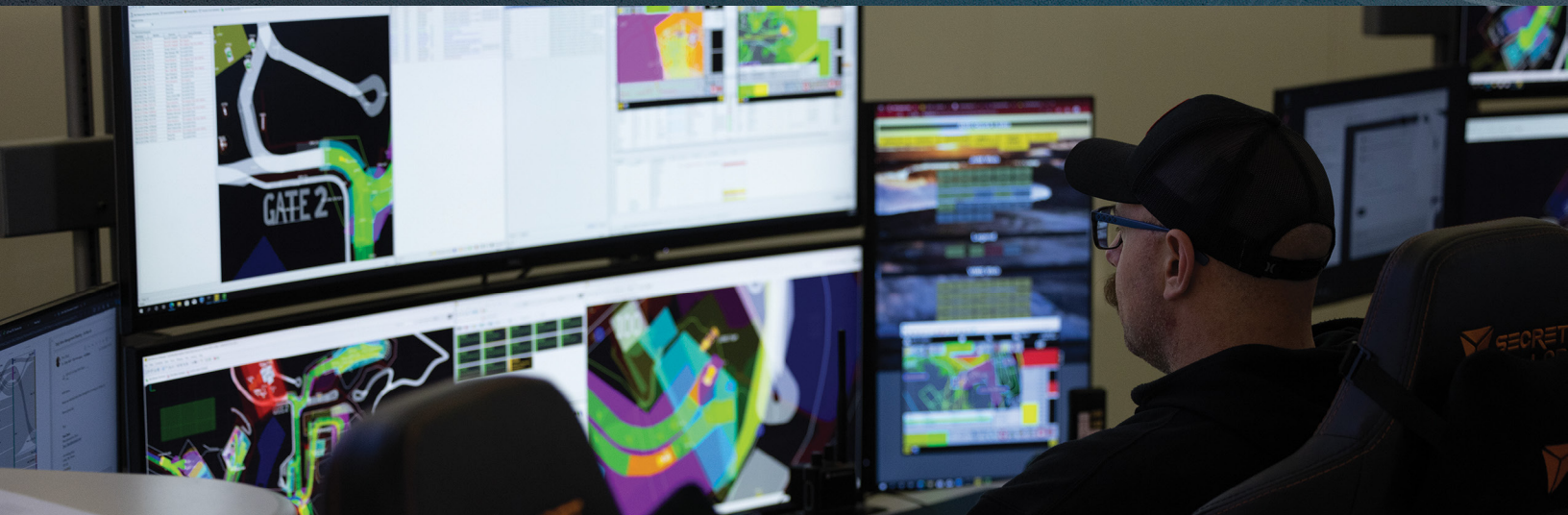




GET THE RIGHT LEVEL OF AUTONOMY FOR YOUR OPERATION



How much more productive would you be if your operators could control multiple machines at once, or if your machines operated around the clock — on their own? How much safer would your operators be if they were working in a Remote Operations Center?

What if you could achieve a more optimized mining operation — one that is safer, more sustainable and productive, and that delivers high outputs and lowers cost per ton?

It's possible with Cat® MineStar™ Command.

Command removes operators from harm's way and uses sophisticated algorithms to perform tasks autonomously. Whether it's accurately drilling holes, efficiently hauling material, gaining better utilization out of your dozers, or helping to keep people safe, MineStar delivers a solution.

Command leverages existing MineStar technologies as building blocks to measure and manage operational parameters and utilizes this information to make informed decisions on how to autonomously assign machines for improved productivity.

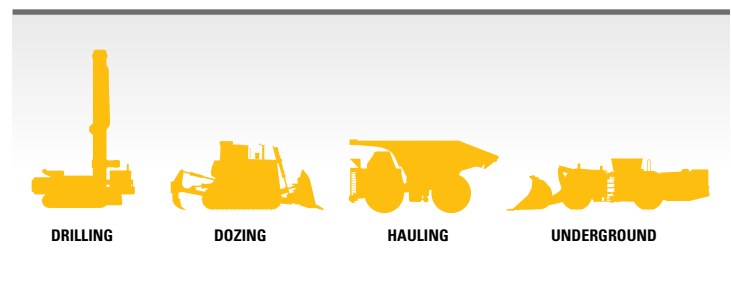
Autonomy focuses on optimization: Increasing productivity, utilization, availability, accuracy and consistency — all while improving safety. It also addresses labor shortages by attracting new employees who are interested in technology, broadening career pathways for current employees, and improving employee retention. In some cases, Command enables mines to utilize operation centers in the city to run autonomous mines, further attracting talent.

Cat MineStar Command

We understand that mining optimization is a journey that requires efficiency and precision across all aspects of the mining value chain. That's why Caterpillar continues to grow our portfolio of autonomous solutions.

Today, MineStar Command make it possible for you to automate a single mining process, remotely control a single machine, run multiple types of machines in semi-autonomous mode, automate multiple types of equipment across a mixed fleet, or implement a completely autonomous fleet of haul trucks that operate around the clock with no human intervention.

We're committed to delivering technology solutions that can make a difference for mines of multiple sizes, with different applications, challenges and opportunities. Together, we'll find the level of autonomy that's right for your operation — beginning with a site evaluation, through development and financing of the solution, deployment, change enablement and training. No matter where you are on your journey to autonomy, we'll meet you there and take you as far as you want to go.





Individual technology offerings can be used alone or combined in multiple ways to enable productivity, efficiency and safety gains.

Operator Assist

The foundational level of autonomy, these in-cab technologies help improve operator performance by automating machine functions.

Remote Control

Line-of-sight solutions for dozers leverage an over-the-shoulder control that provides access to all machine functions from a safe distance. Non-line-of-sight solutions use remote operator stations that perfectly replicate the machine's cab and controls to give dozer, drill, and underground loader operators remote control of multiple machines.

Semi-Autonomy

Command semi-autonomous capabilities can enable one operator to automate multiple machines, while scaling up to full autonomy.

Autonomy

Command autonomy solutions deliver complete automation for surface and underground operations—fully autonomous surface haulage, autonomous pattern drilling and automated underground load, haul and dump operation.

Command for Drilling

Cost-effective, high-precision autonomous drilling gets your whole mining value chain off on the right foot. Command for drilling helps you achieve increases in productivity, utilization and accuracy through drill automation — which will ultimately reduce your cost per ton.

Command for drilling offers a range of capabilities — from an operator assist offering that provides non-line-of-sight remote control, to a solution that enables one operator to manage multiple autonomous drills across a mine from a single remote operator station. A building block approach allows you to configure and automate the drilling system to meet your needs today, with the ability to easily expand in the future.

- Improves operator productivity and effectiveness, and increases safety by removing operators from dust, noise and vibration.
- Delivers consistent and accurate drilling that pays off in better blasting outcomes, more productive loading and hauling, and more efficient final processing.
- Delivers higher, more consistent drilling rates across varying geologies for all operators, resulting in an increase in overall fleet productivity.
- Helps to ensure that every hole is accurately placed to plan, drilled to the correct depth and angle, and able to stand up until blasting.
- Reduces machine wear and tear by enabling optimized drill operation under OEM recommendations.
- Converts non-productive drilling hours into productive drilling hours.

Cat machines can come out of the factory Command-ready, speeding the time from order to value at your site. Command integrates seamlessly into Cat machines — the ideal scenario for a turnkey solution that delivers the best outcome for your mine.

Dedicated MineStar implementation teams work hand-in-hand with local Cat dealers to install, deploy and integrate products into customer environments, and then ensure a smooth transition to their own teams. We offer a comprehensive suite of training opportunities that allows users to build skills through web-based, instructor-led, virtual reality and on-the-job courses. We also support and facilitate change enablement initiatives.

We understand the physical challenges inherent in mining operations, and our technology solutions are built to withstand them. Individual components are heavily validated, and systems are integrated to ensure reliability in the conditions where mining machines operate. All Command solutions are supported by the Cat dealer network.





Command for Dozing

Command for dozing offers multiple levels of remote control, including semi-autonomous operation, which allows a single operator to manage up to four machines from a remote location—boosting productivity and safety.

- Gives operators full control of the dozer while protecting them from on-site dangers and long-term exposure to dust, noise and vibration.
- Is scalable and flexible with three modes of operation: an over-the-shoulder, portable console; a remote operator station, where the operator can work in a comfortable, seated position with familiar controls; and semi-autonomous operation, which allows a single operator to manage multiple machines.
- Is deeply integrated with Cat machine systems to enable smooth, precise control for maximum efficiency and productivity.
- Delivers consistent dozing, improves equipment utilization and increases shift-long operator efficiency.
- Improves productivity and efficiency by making it possible for one operator to control multiple dozers.
- Allows application of geo-fencing and Avoidance Zone capabilities from Cat MineStar Equipment Tracking.
- Enables diversity in operators through an expanded available workforce. Remote operations can be undertaken by individuals who wouldn't otherwise be able to work in-cab.

Command for Hauling

Trucks equipped with Command for hauling operate autonomously, working safely around other equipment, light vehicles and personnel — all without an operator on board. By making it possible for trucks to operate autonomously, Command for hauling delivers gains in efficiency, safety and productivity.

- Enhances safety by relocating operators from hazardous or remote sites to control rooms and by reducing the number of people required to be working in the pit.
- Improves efficiency by enabling consistency in operations and providing near-continuous operation through the reduction of operational delays.
- Reduces machine damage and downtime due to misuse and overloading.
- Allows the instant alteration or redesign of mine maps to meet changing operational needs.
- Enables advanced assignment and tracking from a central location.

- Alerts maintenance personnel to machine faults, enabling repairs before failure and reducing downtime.
- Integrates with existing systems and processes and can be used on any brand of equipment.
- Provides a team of dedicated on-site Caterpillar operations support experts with years of experience in implementing, supporting and maximizing the benefits of autonomous haulage.

Command for Underground

Command for underground enables remote operation of load-haul-dump machines — from simple line-of-sight to Autopilot with Goal-to-Goal Automation — with an interface that is highly intuitive and user friendly to increase automation efficiency.

- Allows mines to relocate operators to a safe, comfortable location underground or on the surface, reducing exposure to hazards.
- Increases machine utilization by reducing the non-productive time at shift change, blast windows, and other conditions that require operators to be removed from underground.
- Leverages the Area Isolation Management System to allow staffed, remote and autonomous operations to work in close proximity.
- Improves machine navigation, reducing machine damage caused by contact with ribs.
- Boosts efficiency by allowing one operator to control multiple machines through adoption of advanced machine automation features.



For more information, go to cat.com/minestar or contact your local dealer.