

CAT® MINESTAR™

COMMAND FOR DOZING

DOZER REMOTE CONTROL
& AUTOMATION



CAT MINESTAR COMMAND FOR DOZING

SAFE, CONSISTENT & EFFICIENT DOZING THROUGH REMOTE CONTROL & AUTOMATION





More consistent dozing. More material moved. Greater operational efficiency. Reduced waste. Lower costs. Higher machine utilization. Safer operations.

These are just a few of the outcomes you can expect when implementing remote and autonomous dozing into your mining operation. However, not all autonomous dozing systems are the same. To get these benefits—and many more—the ideal solution is Cat® MineStar™ Command for dozing.

Caterpillar combines a proven technology solution, decades of implementation experience, deep system integration with Cat machines and the global support of the Cat dealer network to deliver an autonomous dozing solution that can take your operation to the next level of efficiency, consistency, safety, efficiency and availability—delivering maximized outputs and reduced costs.

DELAY TIME TURNED INTO PRODUCTION TIME

- » Higher machine utilization
- » More productive hours
- » Reduced idle time and lower costs
- » More material moved per hour per liter

OPERATORS REMOVED FROM THE PHYSICAL DEMANDS OF DOZING

MORE CONSISTENT DOZING

- » Efficient execution of plan
- » Less rework
- » Full blade every time

ONE OPERATOR. MULTIPLE DOZERS.

ADDRESSES LABOR CHALLENGES

- » Empowers operators at various skill levels to succeed
- » Enables operators to upskill into more technical roles

HOW DOES IT WORK?

A SCALABLE AND FLEXIBLE DOZING SOLUTION



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

The system is scalable and flexible, with three modes of operation.

- + An over-the shoulder, portable console works well for line-of-sight, short-duration activities.
- + A remote operator station enables the operator to work in a comfortable, seated position with familiar controls, increasing safety and machine utilization while removing the operator for an entire shift.
- + Semi-autonomous operation allows a single operator to manage multiple machines for maximum efficiency, increasing production, optimizing machine-to-operator ratios and increasing material movement.

REMOTE CONTROL (RC) OPERATOR CONSOLE



1 DOZER

REMOTE OPERATOR STATION



1 DOZER



SEMI-AUTONOMOUS
UP TO FIVE DOZERS

Command for dozing utilizes a radio network and onboard electronic systems to allow the machine to be operated via remote control. The system enables a seamless transition with staffed and remote operations.

- + Direct integration with machine electronics saves installation time, speeds machine response time, provides access to all operational features and delivers notifications of critical machine health parameters.
- + By utilizing the machine's existing onboard systems and electronic harnessing, reliability is greatly increased over non-integrated systems.
- + Commands from the operator console and station are sent directly to the machine electronic control module via remote control and a dedicated radio, reducing latency.

REMOTE OPERATION: TWO OPTIONS THAT ENABLE EFFECTIVE DOZER CONTROL

Both the operator console and remote operator station enable effective dozer control and are ergonomically designed to minimize operator fatigue while controlling the machine at a safe distance from potentially hazardous working conditions.



REMOTE CONTROL (RC) OPERATOR CONSOLE

The remote operator console is a lightweight, over-the-shoulder unit with similar machine functions as the cab. It offers fingertip controls and functional icons common with the machine to provide a familiar environment to reduce operator onboarding. A single operator can quickly and easily switch remote control between multiple RC-equipped dozers.

Full functionality of the dozer is available through the operator console. Basic machine functions such as start-up/shutdown, blade control, gear selection, steering and ripper control are easily accessed through the ergonomic layout of the console controls, all of which are protected from impact by the aluminum roll bar.

Advanced options such as Auto Blade Assist, AutoRip and Autocarry (if machine-equipped) are also accessible from the console. Critical machine and system status information is delivered to the operator through the intuitive layout of the console. LED indicator lights and display show the operator the gear selection, temperatures, operational mode, faults, system status and low battery warning.



REMOTE OPERATOR STATION

The operator station is a replication of the seat and controls from inside the cab. A vision system enables both line-of-sight operation as well as non-line-of-sight operation.

With a comfortable seat and familiar controls, the operator station enables ergonomic control. It builds on the features and functionality of the operator console with an added level of comfort for working longer durations.

The station can be utilized within any type of enclosure, permanent or fixed. One operator station can be assigned to multiple Command-equipped machines and can control an individual machine by performing a simple switch function on the station display. This saves costs by allowing one station to be purchased and utilized for multiple machines or moved to different working locations as the needs of the mine change.



ENSURING THE OPERATOR REMAINS IN CONTROL

The integration of machine electronics enables the activation of several enhanced features to ensure that the operator is always in control of the machine.

ENHANCED SAFETY FEATURES

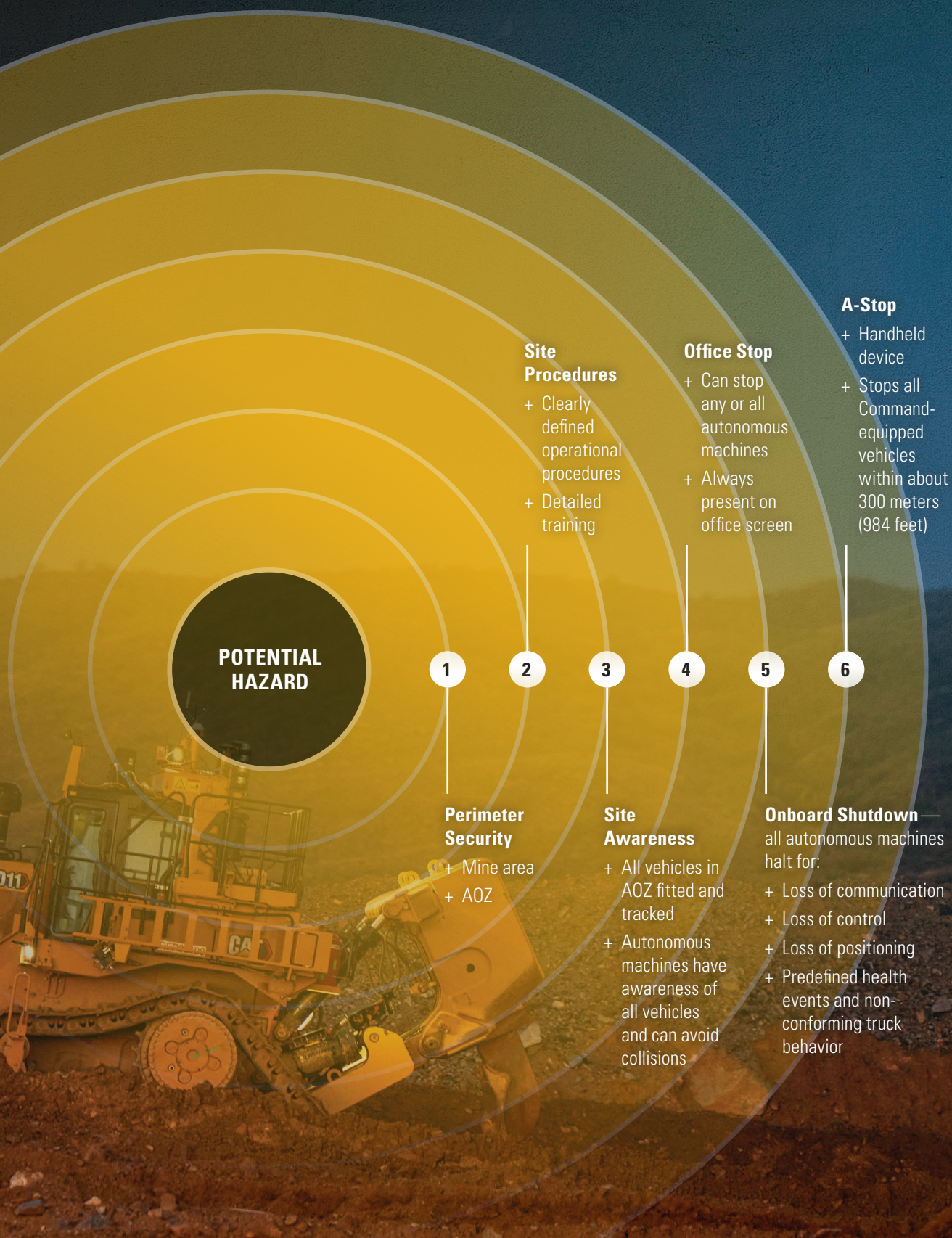
- + A machine shutdown will be activated when a loss of communication between the remote console and/or station is detected, or if the operator console is tipped too far, which may indicate that the operator has fallen. There is also a shutdown from the ROS or by an A-stop control feature if the operator has left the seat.
- + An optional avoidance zone feature (MineStar Terrain required) provides visual and audible warning if the operator approaches an identified area. Breaching an avoidance zone will result in the stopping of machine movement. Any stopping of the machine results in the application of the parking brake and the implementation of a lockout.

HOW DOES COMMAND MANAGE SAFETY?

MULTIPLE LAYERS OF PROTECTION—VALIDATED IN THE FIELD

Command contributes to a safer mining operation by removing operators from hazardous sites and reducing the number of people required on site. With multiple layers of safety, Command for dozing safely interacts with other autonomous machines, staffed vehicles and personnel working in the autonomous operating zone (AOZ).





WHY SHOULD WE CONSIDER IT?

WHAT MAKES COMMAND FOR DOZING RIGHT FOR MY OPERATION?

REDUCES TRAVEL TIME
FOR MOVING OPERATORS
TO MACHINES



REDUCES DOWNTIME
ASSOCIATED WITH
SHIFT CHANGES



ALLOWS PRODUCTION TO
CONTINUE IMMEDIATELY
FOLLOWING BLASTING
OPERATIONS





Running a large dozer on a mine site is a demanding and sometimes dangerous job — from dozing on unstable surfaces to handling hazardous materials to working in applications like stockpile feeding and leach pad and highwall maintenance.

Command for dozing offers several solutions to get operators out of the cab and out of harm's way. In addition, deep integration with Cat machine systems enables smooth, precise control for maximum efficiency and productivity.

- + Gives operators full control of the dozer while protecting them from on-site dangers and environmental hazards and eliminating prolonged exposure to noise, dust and vibration.
- + Enables continued operation when conditions become unsafe for operators to be on the machine.
- + Improves equipment utilization and shift-long operator efficiency.
- + Reduces labor challenges by attracting new employees, broadening the skills of current employees, allowing operators to extend their careers and improving retention.
- + 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.
- + Is scalable and flexible.
- + Is deeply integrated with Cat machine systems to enable smooth, precise control for greater efficiency and productivity.
- + Encourages use of onboard machine assist controls.
- + Consistently maximizes blade load and optimal angle.
- + Reduces non-productive time:
 - Reduces travel time for moving operators to machines.
 - Reduces downtime associated with shift changes.
 - Allows production to continue immediately following blasting operations.
- + Increases likelihood of working steeper slopes to improve efficiencies.

RISKS MITIGATED

With technology comes connectivity—and with connectivity comes risks. Our customers can be confident that we have the right controls in place to protect them against these risks. We take a proactive approach to protecting data and have embedded security within our MineStar offerings. We balance potential risks with the need to provide full features and functionality and follow a defined security strategy across the Caterpillar organization and to each of our connected offerings.

WHY CATERPILLAR?

PROVEN SOLUTIONS BACKED BY EXPERTISE & SUPPORT



MINESTAR: A PROVEN SOLUTION

- + Robust testing and validation process
- + Designed for challenging environments
- + Validated across multiple applications



WORLD-CLASS SUPPORT FROM CATERPILLAR AND CAT DEALERS

Support options include online and remote support delivered by Caterpillar, on-the-ground support from Cat dealers, and consultation services provided by both Caterpillar and Cat dealer experts.

- + Realize the full potential of your investment
- + Achieve critical availability of your MineStar technologies
- + Sustain operational gains through continuous improvement





IMPLEMENTATION EXPERTISE

We're uniquely qualified to integrate our products into your environment and provide guidance for long-term success.

Installation and Deployment

We work with local Cat dealers to install, deploy and integrate MineStar hardware and software into your environment, and then ensure a smooth transition to your own team.

Training

Our comprehensive suite of training opportunities allows users to build skills through web-based, instructor-led, virtual reality and on-the-job courses.

Change Enablement

Caterpillar experts support initiatives to help your personnel prepare for the transition to technology.

Processes and Procedures

We work with site leaders to develop the operational processes and procedures that are essential to success.



MINESTAR: AN INTEGRATED AND SCALABLE ECOSYSTEM

MineStar allows you to follow a phased approach to your technology journey, leveraging any of the building blocks that are the foundational elements making up your site operating system. Additional building blocks for safety and surface management use key common system components, allowing for the interchange of planning, blending, survey and production data within the one system.

- + Integrates data across the operation
- + Enables operational execution by managing and optimizing all assets



MINESTAR REPORTING

This centralized data warehouse consolidates data from multiple MineStar products. Flexible, customizable reporting allows you to extract the information you want, whether you leverage Caterpillar's own purpose-built mining analytics platform or export to a third-party platform.

TRACK, MONITOR, AUTOMATE AND MANAGE YOUR ASSETS WITH CAT MINESTAR SOLUTIONS

Cat MineStar Solutions is one of the mining industry's most comprehensive and thoroughly integrated suites of technology offerings for surface and underground operations.

MineStar can track, monitor, measure, manage and optimize all types of assets—from material and people to production machines and light vehicles on site. Whether you deploy a single technology or a multi-purpose solution, you can expect a safer, more productive and more efficient operation.

MineStar capabilities include:



TERRAIN, which increases efficiency and reduces variability of drilling, dragline, grading and loading operations through the use of high-precision guidance technology.

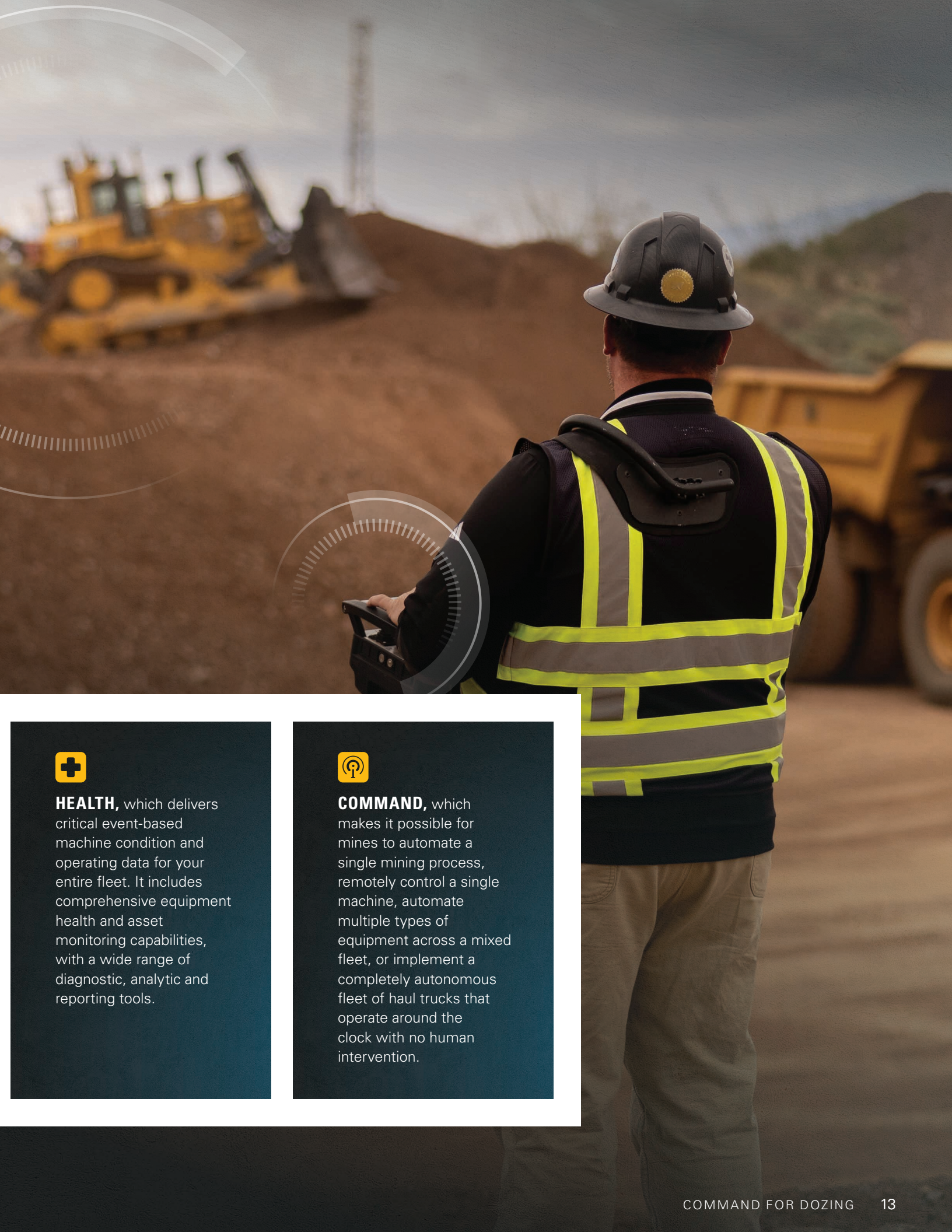


FLEET, which is an integrated fleet monitoring and management system that helps you measure, manage and optimize the use of assets at your site. It automatically records and tracks data up and down your value chain, providing insights that help you identify what's working and fix what's not.



DETECT, which helps increase operator awareness, enhancing safety at your operation. It includes a range of capabilities designed to assist the operator, including collision awareness and fatigue risk management for mobile equipment.





HEALTH, which delivers critical event-based machine condition and operating data for your entire fleet. It includes comprehensive equipment health and asset monitoring capabilities, with a wide range of diagnostic, analytic and reporting tools.



COMMAND, which makes it possible for mines to automate a single mining process, remotely control a single machine, 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.

SAFE, CONSISTENT & EFFICIENT DOZING

— THROUGH —

REMOTE CONTROL & AUTOMATION

Running a large dozer on a mine site is a demanding and sometimes dangerous job. Cat MineStar Command for dozing offers several solutions to get operators out of the cab and out of harm's way while boosting efficiency and productivity at the same time.



Benefits are as compared to operations without a similar technology. Actual results may vary based on application, infrastructure, network connectivity, equipment maintenance and operating procedures, among other factors.

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