



# TAKE TECHNOLOGY UNDERGROUND

CAT® MINESTAR™ SOLUTIONS  
FOR UNDERGROUND



R3000H

CAT



Cat® MineStar™ is the mining industry's most comprehensive and thoroughly integrated suite of technology offerings. MineStar has been delivering results for many years and is proven on mine sites around the world—the majority of them surface operations. As more miners pivot from open pit to underground mines, Caterpillar has expanded our technology portfolio to ensure we're able to support them just as we've done on the surface for decades.

It's no secret that underground mining presents special challenges when it comes to safe, efficient operation. That's why we tailor our MineStar Solutions to the unique needs of your environment.

No matter the size, type or complexity of your underground operation, Cat MineStar can help you deal with the challenges you face every day: Controlling costs. Extending equipment life. Working more productively. And keeping people safe.

## CAT MINESTAR SOLUTIONS FOR INTEGRATED UNDERGROUND OPERATIONS



FLEET



DETECT



HEALTH



COMMAND

Proven safety, productivity and automation solutions from a company that knows the underground mining industry, applications, and equipment—and what it takes to deliver not just a product, but a solution; not just a service, but an outcome.

Cat MineStar Solutions have the ability to track, monitor, automate and manage all types of assets—from people to production machines to light vehicles on site. Offerings can be deployed individually or integrated to create a comprehensive technology system that is scalable and configurable to the needs of your operation. And they work with any brand of equipment, sharing data across existing machines, systems and technologies.

We'll work alongside you to develop a customized technology roadmap, helping you with the change management that is key to the successful adoption of technology. Whether you integrate a single technology or a multi-purpose solution, you can expect a safer, more productive and more efficient operation.



CAT

PARK SCREENS BEFORE

Map View





## MINESTAR FLEET

# ENHANCE SAFETY AND STAY IN TOUCH WITH ESSENTIAL UNDERGROUND INFORMATION — IN REAL TIME

Fleet provides real-time visibility to cycle time, payload and other key operational parameters. It automatically records and tracks data up and down the value chain, providing insights that help you identify what's working and fix what's not. Thanks to our proprietary high-precision underground positioning technology, mines can accurately track personnel and assets to sub-meter accuracy. This also gives you access to critical cycle information, so you can better understand machine usage and overall efficiency of operations. Real-time two-way task management provides essential data that positively impacts productivity and helps you optimize the entire mining operation.



### CAPABILITY PACKAGES

#### OPERATION MANAGEMENT — SHORT-TERM SHIFT PLANNING AND SHORT INTERVAL CONTROL

Gives site leaders and controllers total control over tasks with dynamic in-shift rescheduling that can be communicated directly to operators via in-cab display.

#### SITE PERFORMANCE & REPORTING — CYCLE/TONS WITH DATA PRO

Collects data on material grade, location, delays, and proficiency of operators, helping miners enhance data management and streamline operations.

#### SITE PERFORMANCE & REPORTING — ASSIGNMENT OPTIMIZATION

Helps miners better understand machine usage and overall efficiency of operations. Users can actively prevent bottlenecks and experience gains in productivity.

- » Provides flexibility to change assignments and shift KPIs in real time
- » Allows site managers to review operations and manage areas of critical importance and eliminate paper management of shift plans and tasks
- » Boosts utilization of all assets through delay management

- » Optimizes the site for efficiency gains and performance benchmarking by providing continual data capture
- » Ensures conformance to cave management
- » Enables on-demand vent and dust suppression
- » Lowers energy costs
- » Integrates deeper into mine infrastructure and Command for underground operations
- » Provides Auto Assignment through Command integration

#### DATA COMMUNICATIONS

Connects people and machines throughout the underground environment through a purpose-built mine tracking and communications solution.

- » Delivers communications and tracking in one solution through a single hardware platform
- » Lowers costs, reduces maintenance and is easy to deploy and manage with no specialists required
- » Provides ability to leverage the existing Wi-Fi network
- » Uses active Wi-Fi, which enables sub-meter positioning

## MINESTAR DETECT .....

# PREVENT UNINTENDED INTERACTIONS BETWEEN PERSONNEL AND ASSETS TO IMPROVE SITE SAFETY

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Detect addresses risks to people and assets by letting you “see” in the dark. Using a high-precision peer-to-peer proximity detection system coupled with a revolutionary communications and tracking network, Detect can prevent incidents and track people and machines—wherever they are underground—in real time.

Detect provides situational awareness to operators, alerting them to hazards before they become a threat with no reliance on mine infrastructure. Detect allows operators to visualize all machines and personnel within a configurable radius. It also alerts operators and personnel when machines or objects come into close proximity to aid in collision avoidance.



### SITE TRACKING & VISUALIZATION — HIGH-PRECISION ASSET AND PERSONNEL TRACKING

Provides site controllers a view of all miners and the locations of light and heavy vehicles via a Wi-Fi device.

- » Enables simple visualization of underground personnel in real time, providing controllers a zonal view as well as a high-precision perspective of proximity detection
- » Provides operators continuous awareness of their surroundings to sub-meter accuracy, along with the location and status of all personnel and assets

### ASSET DETECTION — HIGH-PRECISION PROXIMITY DETECTION

Uses high-precision proximity detection to keep machine operators and on-foot personnel aware of each other and their positioning in real time.

- » Delivers audio, visual and vibration alerts to personnel when proximity limits are breached

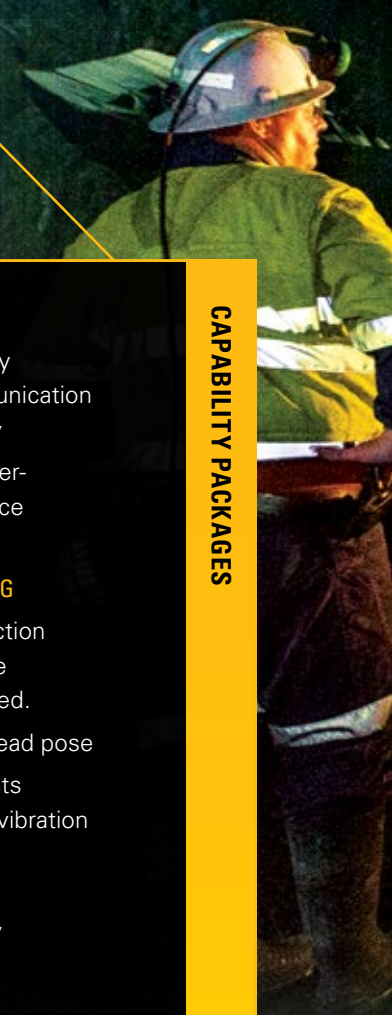
- » Uses high-bandwidth and low latency technology with peer-to-peer communication independent of network connectivity
- » Features intuitive installation with user-friendly configuration and maintenance

### DRIVER SAFETY SYSTEM (DSS) — FATIGUE AND DISTRACTION MONITORING

Uses a non-intrusive, in-cab fatigue detection technology to instantly alert operators the moment fatigue or distraction are identified.

- » Monitors eye-closure duration and head pose
- » Immediately alerts operators of events through configurable in-vehicle seat vibration and/or audio alarm
- » Includes option to send events to a 24-hour monitoring center to classify and confirm events

CAPABILITY PACKAGES







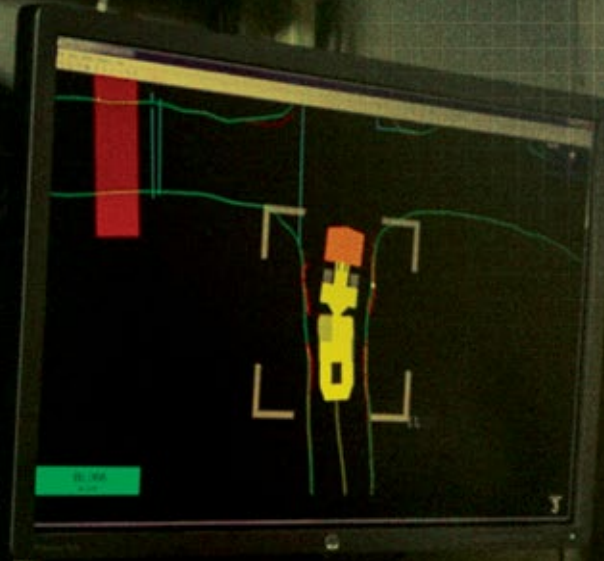
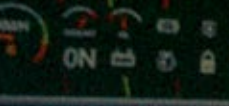


COPILOT

BL066

Status: Machine Disabled  
2012 Machine Fault: 0x1000 00000000 0000

ON





## MINESTAR COMMAND

### IMPROVE SAFETY AND UTILIZATION WITH SEMI-AUTONOMOUS OPERATION

Command for underground enables remote operation of load-haul-dump machines, providing immediate productivity and efficiency gains. The system improves safety by removing operators from hazardous environments. It also delivers machine utilization increases over line-of-sight mucking operations by reducing the downtime required for shift changes, blast times, and any other conditions that can remove operators from the face. Automation also improves accuracy of tunnel navigation, boosting productivity and reducing machine damage caused by contact with drive walls.

Options range from simple line-of-sight to full autonomy. This building block approach allows miners to capture value at their most economic entry point while allowing scalability as technology maturity grows.



#### CAPABILITY PACKAGE

##### MACHINE CONTROL AND GUIDANCE

Allows mines to relocate operators to a safe, comfortable location underground or on the surface for remote operation of load-haul-dump machines.

- » Reduces operator fatigue and improves the working environment by removing operators from the exposure of noise, dust, seismic activity and other hazards
- » Makes it possible to access deeper ore bodies that were previously not extractable
- » Optimizes shift changes by enabling hot-seat operator exchanges
- » Enables control of multiple machines from a single Remote Operator Station
- » Increase safety through the establishment of speed zones and exclusion areas

## MINESTAR HEALTH

# MAKE INFORMED DECISIONS AND OPTIMIZE YOUR MAINTENANCE STRATEGY

Machine health data is critical to helping you make the right maintenance decisions—decisions that allow you to improve the reliability of your mining equipment, reduce unplanned downtime and prevent failures that can lead to lost productivity and costly machine repairs.

MineStar Health products and services enable you to collect and transmit equipment data, monitor critical machine parameters, obtain real-time alerts, analyze operational trends and patterns, predict failures and receive repair recommendations—assisting you with proactive maintenance services and predictive equipment analysis.



### CONNECTIVITY ENABLERS

Enable you to collect and transmit machine electronic data.

- » Product Link Elite (PLE)
- » Health Interface Module (HIM)
- » VIMS 3G
- » Telemetry

### APPLICATIONS

Provide visualization and reporting of machine electronic data.

- » VIMSpC: A laptop software used by service technicians to diagnose events, upload configuration files and perform quick health checks on an asset.
- » Health Office: A site-based data visualization and reporting tool that comes standard with a set of pre-defined reports and provides real-time functionality including event notification and channel polling. Third-party software packages are required for reporting management.

- » Health Equipment Insights: A cloud-hosted, internet-accessible data visualization and reporting tool with customizable, interactive data dashboards and intuitive drill-down functions.

### SERVICES

Enable Cat and Cat dealer condition monitoring services.

- » Equipment Care Advisor (ECA): A powerful web-based application that is an enabler to Caterpillar and dealer condition monitoring services. It utilizes advanced analytics, leverages global knowledge sharing, and offers recommendation management and value tracking.
- » VIMS Converter: Delivers VIMS data files in a non-proprietary format for ingestion into a data system of choice, such as OSI Pi. It enables the large scale, automated conversion of machine health and productivity information into an open and accessible format.

CAPABILITY PACKAGES



**CAT** Radial Seal Air Filter  
106-2673 CZ

Don't forget to use  
SAE OIL ANALYSIS

↑↑

**CATERPILLAR**  
Made in Czech Republic

One Filter

**CAT** Radial Seal Air Filter

Don't forget to use  
SAE OIL ANALYSIS

**CAT** Hydraulic Oil Filter

R2900G

XTR

## UNDERGROUND TECHNOLOGY SOLUTIONS FROM A MINING MANUFACTURER

Caterpillar isn't just a manufacturer that makes machines and technologies for mining; we are a mining company with a unique, hands-on knowledge of underground operations. Cat technologies for mining were designed specifically for that purpose.

MineStar Solutions come with a number of other significant benefits:

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### TRAINING

A comprehensive suite of web-based, instructor-led, and on-site and simulation training to help you rapidly deploy technologies and get up to speed quickly—so you can start reaping the benefits.

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### SUPPORT

In partnership with the global Cat dealer network, we help you achieve critical availability, optimize performance and realize the full value of your investment.

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### IMPLEMENTATION

We provide expertise and work hand-in-hand with Cat dealers to successfully install, deploy and integrate products into your environment, and then ensure a smooth transition to your own team.

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### CYBERSECURITY

We take a proactive approach to ensure your connected assets and the data they provide are protected against risks.

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### TESTING AND VALIDATION

Individual components are heavily validated, and systems are integrated and tested to ensure reliability and performance of hardware on machines underground at our test track at the Burnie proving grounds.

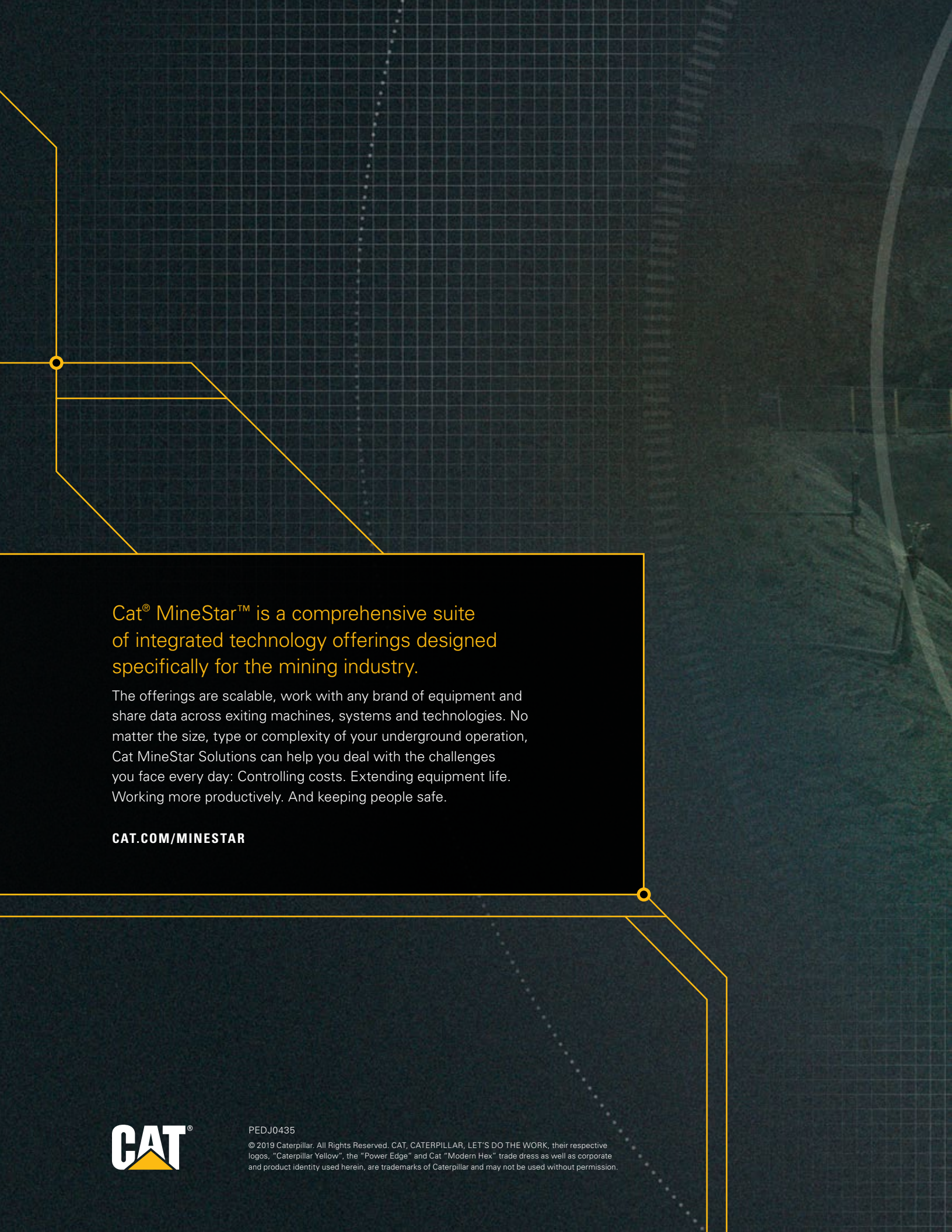
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### DURABILITY

We understand the physical challenges inherent with underground mining, and our technology solutions are built to withstand them.







Cat<sup>®</sup> MineStar<sup>™</sup> is a comprehensive suite of integrated technology offerings designed specifically for the mining industry.

The offerings are scalable, work with any brand of equipment and share data across existing machines, systems and technologies. No matter the size, type or complexity of your underground operation, Cat MineStar Solutions can help you deal with the challenges you face every day: Controlling costs. Extending equipment life. Working more productively. And keeping people safe.

[CAT.COM/MINESTAR](http://CAT.COM/MINESTAR)



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