CAT® MINESTAR™ EDGE

COMMUNICATION & MESSAGING GUIDE

For Caterpillar Internal and Dealer Use Only // April 2020

CAT®

GIVE YOUR OPERATION AN EDGE

More than 25 years ago, Cat® MineStar™ changed the way mining companies operate — targeting individual portions of the mining operation and delivering unprecedented gains in efficiency, safety and productivity.

What if you could use those proven technologies across the entire mining organization and have visibility to every aspect of your operation? What if you had near-real-time access to data that was up to 98% accurate? And what if you could make changes in-shift while already knowing the impact they would have further down the value chain?

With Cat MineStar Edge, you can.

Edge is a new technology platform that delivers more connected, integrated, scalable and intuitive products that extend further up and down the value chain. It creates an operational ecosystem that gives you visibility to every aspect of your operation, allowing you to efficiently execute your mine plan and deliver optimal quality to the plant and to the surface. Edge makes it possible to measure, manage, analyze and optimize your entire operation. And because it's delivered as a cloud-based, subscription-managed application, it lowers costs and delivers a better user experience.

"Our goal is to provide data leading to more informed decisions and lowering the overall cost-per-ton for the entire mining organization. In fact, several of our current Idaho mining clients have found that MineStar Edge paid for itself in as little as six months after implementation."

— TYLER SIMMONS
INDUSTRY SOLUTIONS MANAGER
WESTERN STATES CAT

INTRODUCTION

CAT® MINESTAR™ EDGE

MineStar Edge is a new platform that augments our current MineStar offerings and ensures we will be able to advance them for years to come. It better aligns with the way our customers work and dramatically improves their overall experience.

MineStar Edge creates an operational ecosystem for mining companies, aligning with the way many already manage their businesses. Rather than having data that exists in individual silos, Edge brings visibility to the entire mining operation and enables mines to see how activities early in the process impact those further down the value chain.
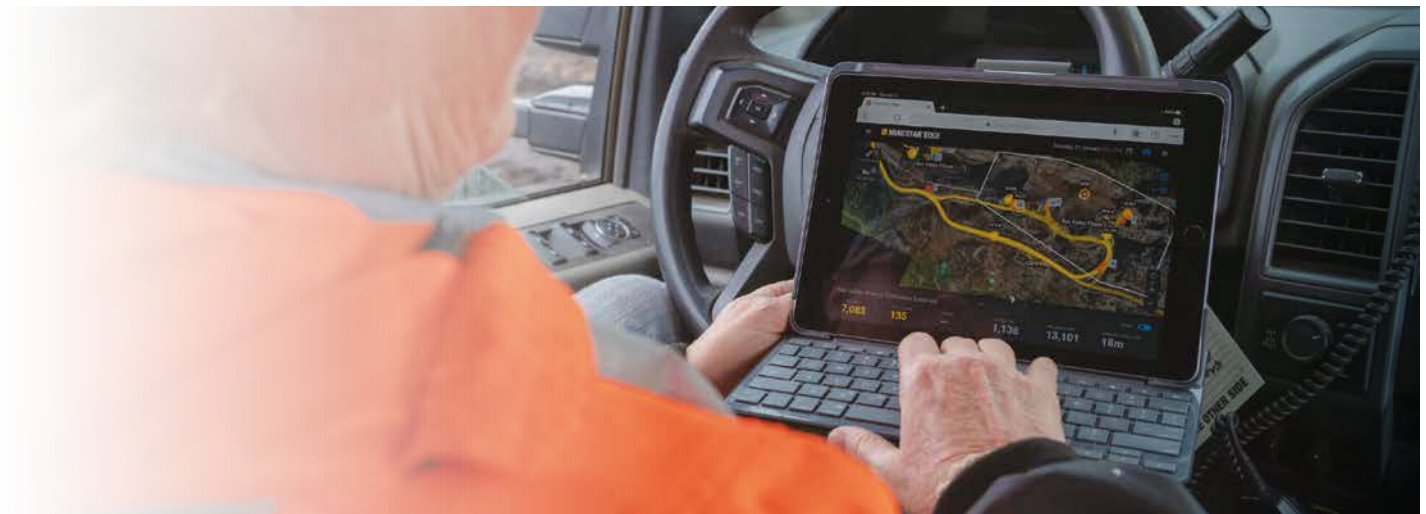
At its core, MineStar Edge delivers better solutions. Edge leverages the latest technology advancements—including data fusion, machine learning and Artificial Intelligence—so it will continue to get smarter as it collects data, identifies patterns and learns to make decisions with minimal human intervention.

Edge also significantly improves the customer experience. Because it is delivered as a cloud-based, subscription-managed application, it lowers network requirements as well as associated costs of deployment, service and training. It also speeds the time from order to use, and allows automatic upgrades, updates and fixes. In addition, sites have the option to have some applications hosted locally to ensure higher connectivity and less latency.

Customers select an offering by role, function or task—paying only for those functionalities they need. This new model will make buying and using technology more cost-effective and efficient and allow operations of every size and type to more easily take advantage of the benefits technology makes possible.

As we advance our technology offerings, Edge allows us to work with greater velocity. The platform enables our dedicated technology to more quickly develop and deliver new features and functionality for mining operations of all types and sizes.

As they strive toward optimization, today's miners recognize the need for an ecosystem partner that allows them to focus on managing their operation rather than their technology. Wherever they are in their optimization journey, Caterpillar and MineStar Edge make that possible.

MINESTAR EDGE OFFERINGS

» Equipment Tracking
» Production Recording

WHAT MAKES THE EDGE PLATFORM DIFFERENT OR BETTER?

» MineStar Edge makes use of Artificial Intelligence (data fusion and machine learning) to determine and communicate the accuracy of the information it is providing.
» Edge is purpose-built for the end user.
» The display is designed to empower operators without requiring their direct input.
» Edge allows sites to start small and scale up to a full operational ecosystem.

"The numbers showed that that in one year's time, we could eliminate one full truck out of our haul's cycle. That equated to $400,000 in savings a year. And that that's just one small thing. So that change alone paid back for this system within a little over a year's time. "

— PROJECT MANAGER
IDAHO PHOSPHATE MINE

EQUIPMENT TRACKING

Fleet Management Systems (FMS) have been around for more than three decades in a variety of forms. Today, MineStar Edge is disrupting the industry's approach to FMS with Edge Equipment Tracking.

Traditionally, sites have used pencil and paper to keep track of information on their assets. Even if they leverage Production Recording technology to get data on the load/haul cycle, they have lacked access to the same information for non-production machines like water trucks, dozers, graders, drills, light vehicles, etc.

Equipment Tracking provides information on these mobile assets, whether they are Cat or competitive machines. It tells supervisors what the fleet is doing, who is operating which machine, and how they are spending their time.

By replacing paper with accurate recording, supervisors can better understand utilization and make decisions about equipment investments and effectivity. Equipment Tracking provides insights that help mines better manage their assets, and as a result they deliver more value and mines enjoy a lower overall cost of ownership.

WHAT DOES IT DO?

Equipment Tracking provides a basic level of information on all assets consistently, including data on locations and movements, velocity, payload, cycle times and fuel level as well as SMU and time utilization. Supervisors can view scheduled and unscheduled downtime along with scheduled and unscheduled operational stoppages.

FEATURES

»   **Service Meter Readings.** This feature allows operations to gather SMU data continuously from all assets. Data is no longer gathered manually through operators recording on paper or calling over the radio — eliminating incorrect entries.

»   **Fueling.** This feature allows operations to visualize and export fueling records — from when the machine was fueled to what was put in the tank and how long fueling took. It automatically measures fuel events, quantities and percentages to allow operations to manage the efficiencies of their fueling processes and fuel consumptions. It reduces or eliminates errors because data is collected automatically and also lowers the cost of fuel — one of an operation's largest expenses.

» **Location Accuracy.** Equipment Tracking delivers high-accuracy data recording, reducing downstream errors when the position is referenced for automatic collection of information.

» **Replay.** Equipment Tracking has the ability to replay shifts in great detail, allowing users to set date, time and speed of the replay. Replay helps answer Production Recording questions and provides information for incident investigation and material tracking investigation.

» **Time Utilization Tracking.** Equipment Tracking records the time that equipment is available, down, operating or stopped due to a non-operating activity. Many of the components of the non-operating time are measured automatically and accurately with the machine learning and data fusion engine. This feature provides accurate KPIs for use in time utilization models and leads to increased productivity and production. Errors are reduced by eliminating the need for operator input.

» **Automatic Stoppage Measurement.** Edge will automatically measure time when the equipment is not being productive and will attempt to classify with a machine-learning approach. This reduces or eliminates missed or incorrect time measuring and gives operations information they can use to measure and manage their processes—specifically those that have production loss impacts.

» **Downtime.** Equipment Tracking helps sites measure and manage equipment downtime and classify it as scheduled or unscheduled. A key indication of the effectiveness of the site's maintenance and reliability programs, reducing downtime can lead to improved productivity.

» **Operator Tracking.** This function allows operations to better manage and measure equipment operators, including allocating them to machines and tracking performance. An optional display empowers operators with KPIs about their personal performance. Operator Tracking allows operations to understand the impact their key assets have on the outcome of the shift, and helps sites improve on these impacts—leading to a more consistent operation and reduced cost-per-ton.

» **Health Event Record.** Health Event Records can be visualized in the system, exported to CSV/Excel, or accessed through an API. This feature helps operations improve equipment availability, reliability and production by measuring, managing and ultimately reducing events. It also helps sites understand the root cause of events, whether that is the equipment, location (mine design or road maintenance) or operator practices

DIFFERENTIATION FROM HEALTH EQUIPMENT INSIGHTS

» The main difference between Equipment Tracking and Health Equipment Insights (HEI) is the focus. Equipment Tracking focuses on the operations side of the business, while HEI is focused primarily on the maintenance/physical availability side of the equation. However, Equipment Tracking can provide input to and support HEI.

» Like Equipment Tracking, HEI is a cloud-hosted, internet-accessible data visualization and reporting tool. It empowers users to efficiently navigate, view, manage and use machine data so they can make informed maintenance decisions that will help maximize the availability of equipment.

» While HEI tracks events and puts them into a histogram, Equipment Tracking provides a detailed reason as to the "why" behind the event. Did it occur because of the machine the operator or the location?

» Equipment Tracking offers some capabilities that go beyond what HEI provides:

– It tracks fueling delays/fueling downs while HEI provides fuel level only.

– It offers replay to see what was going on when the event occurred.

– It has SMU and can start to help with inspections.

PRODUCTION RECORDING

You can't manage what you haven't measured. And you can't effectively manage what you've measured inaccurately.

Every mining operation has opportunities hidden within every shift. But how do you find those opportunities if you're not accurately measuring what's happening during that shift? From payload to dig rates to operator breaks — every activity has an impact on productivity and an opportunity to be improved.

MineStar Edge Production Recording helps you find those opportunities by giving you visibility to your entire mining operation. When paired with Equipment Tracking, it delivers an accurate and automated near-real-time solution that measures and reports on every aspect of the load-haul-dump cycle without requiring any operator input. The result is a boost in productivity and a reduction in the overall operating costs of your managed assets (mine, material and machines).

For many sites, traditional comprehensive fleet management systems can be too complex and cost-prohibitive, requiring significant investments in time and money to set up and maintain. Production Recording, however, is an easy-to-use subscription-based solution that delivers the key functionality all sites require: accurate, real-time production data.

THE OPPORTUNITIES

» **Missed production targets.** Every mine has production goals such as total tonnes moved, dig rate, rate of material put through crusher, etc. All impact management's ability to measure progress toward production. Accurate information allows you to course-correct — in real time — to ensure your operation is on target.

» **Payload compliance (under- or over-loaded trucks).** Under-loading means not getting maximum value from the truck or the cycle and impacts cost-per-ton. Over-loading can impact component life, boost maintenance costs and increase unplanned downtime. Balancing this out equates to more effective machine utilization over the course of a shift.

» **Shift changes / long operator breaks.** The goal of an efficient mining operation is to effectively use all resources. Shift change and operator breaks, while necessary, must be managed to reduce the impact they have — keeping operators productive and reducing machine idle time.

» **Misplaced loads.** When material is dumped in the wrong location, mines take an immediate hit to their profitability. For example, if waste is dumped into the crusher or ore is dumped into the waste pile, the result is lost revenue. And if the blend is inaccurate, you'll receive less income from your finished product.

Sites using Production Recording have reported significant gains, including:				INCREASED PRODUCTION	IMPROVED START-UP, BREAKS AND SHIFT MANAGEMENT
IMPROVED BLEND	IMPROVED TRUCK PAYLOAD MAINTENANCE	IMPROVED PAYLOAD COMPLIANCE	IMPROVED OPERATOR PERFORMANCE MONITORING	IMPROVED INCIDENT INVESTIGATION	

WHAT DOES IT DO?

MineStar Edge Production Recording pairs with Equipment Tracking to deliver an accurate and automated near-real-time solution that measures and reports on every aspect of the load-haul-dump cycle. It provides accurate, reliable and actionable data with no operator input required.

Production Recording helps mines of all types and sizes improve the efficiency of their operations and increase their overall tons produced. The data it provides identifies opportunities, allows you to make changes within the shift, and delivers insights on how those changes will impact production if implemented.

The accuracy of the data gives personnel such as Pit Supervisors, Mine Managers and Install Technicians the confidence they need to make quick, real-time decisions related to operational execution. Data can be accessed on a mobile tablet device as well as through a web-based application. A production dashboard provides information on the operation, including defined materials, active load and dump areas, active load and haul equipment, and active crushers. The dashboard enables viewing of hourly production metrics as well as cumulative shift-to-date production metrics for the site, material, load and dump areas, equipment and the crusher.

Beyond the shift, Production Recording allows you to continually monitor and make operational decisions and implement training that will allow you take advantage of the opportunities you uncover.

Production Recording makes use of AI technologies (data fusion and machine learning) to determine and communicate the accuracy of the information it provides. In addition, most data is provided by the machines themselves rather than being entered by the operators, eliminating the risk of incorrect data entry due to human error. The result is better-informed recommendations that enable better decisions by mine personnel and better outcomes for your operation.

FEATURES

Summary of Production Progress in Shift. This feature monitors load and dump counts, tons, and BCM/BCY, and provides in-shift production updates through app, HTML, API or Reports/Dashboards. It provides in-shift production updates in near-real time and delivers data with accuracy as high as 98%. It allows operations to stay connected to progress in the shift and allows managers and supervisors to quickly see if the site or asset is on track and to take corrective action within the shift to ensure the desired outcome.

Production Targets. This feature provides the ability to enter a target or plan for total in-shift or an hour rate by loads, dumps, tons and BCM/BCY and track the progress against the plan in real time throughout the shift. It provides visual confidence that progress is on plan or allows an operation to make corrective actions if progress is not as intended.

Drill Down / Spin the World. By clicking on the entity in the home page map or by navigating to the entity in the production page, users can drill down to see the performance of entities such as individual machines, areas, routes, materials and operators. It allows managers to investigate and determine root cause to ensure the operation is progressing against plan.

Production Projections. The system calculates and visualizes the expected production at the end-of-shift for the site and individual entities including site, load and dump areas, routes, loading tools and trucks, and material. This feature provides the ability to see the expected production at the end of shift for site and all entities and gives supervisors and managers confidence that they will meet or exceed the plan. When the expected production is below plan, it allows supervisors to take corrective action within the shift to change the outcome.

Production Record. The system provides production records from loading tools, haul trucks and wheel loaders operating in load-haul-dump areas. It replaces paper and delivers highly accurate, automated production records in near-real-time, giving sites confidence to use the data to make business decisions. It automatically tracks material moved from location to location, along with the associated equipment and operators, without requiring input from controllers or operators.

Load & Haul Cycle Records. The system collects loading and hauling records for every aspect of the cycle. It enables sites to review production records from the point of view of the material transaction and movement from the load face to the dump, including the times, machines and operators involved. It delivers accurate transactional records that can be used as a source of truth for material movements.

PRODUCTION RECORDING | BY THE NUMBERS

When we talk about data accuracy, we're not kidding. The best systems available to date—when used to their full potential by humans—are only 80-90% accurate. With Production Recording on the MineStar Edge platform, we are now able to deliver data that is 98% accurate data.

This accuracy results in:

| **29%** REDUCTION IN UNDERLOADS | **17%** REDUCTION IN SHIFT CHANGE | ROI IN **3** MONTHS | **25%** INCREASE IN PRODUCTION | **IMPROVEMENTS IN ACCURACY** OF THE BLEND RECIPE |

DID YOU KNOW?

Traditional data systems can be inaccurate when they require operator input on certain tasks (e.g., when machines go on delay, shift change, etc.). It is estimated that human error causes significant inaccuracies in production data—in some cases up to 30 percent. Because Production Recording requires less manual input, operations teams can be more confident in decision-making.

"The biggest impact for us has been that we now have instantaneous feedback on how we're doing on a day-to day basis. We have goals for our equipment and superintendents that we expect them to meet on a daily basis. They now have a tool that they can use, whether they're in their office or out here on the field that tells them how they are doing right now. So we don't have to wait until the end of the shift to find out how many load counts we had, how much material we move. They can now get instantaneous feedback on how they're doing."

— PROJECT MANAGER
IDAHO PHOSPHATE MINE

FREQUENTLY ASKED QUESTIONS

What makes the cloud-based platform different or better?

» MineStar Edge makes use of Artificial Intelligence (data fusion and machine learning) to determine and communicate the accuracy of the information it is providing.

» Information is easily accessible, in near-real-time, so customers can make informed decisions during a shift to have an immediate impact on productivity.

» Because the platform is cloud-based, it is easier to deploy updates.

» Customers are not required to invest capital in servers and database solutions that are often required for mining technology solutions.

When will products be available on the new platform?

Equipment Tracking and Production Recording are available now. The vision is to augment all MineStar capabilities with the platform moving forward. This will take strategic planning and change management as we continue to support current customers and manage market opportunities. We'll also continue to coordinate our plans to align with new technology products being developed by other groups within Caterpillar, availability of development partners and customer pull.

How will MineStar Edge data be stored?

In areas where there is limited wireless coverage, store-and-forward technology holds data until machines are in a coverage area and can send data off-board. Once stored, reports and site / asset data are available indefinitely.

Will the offerings be secured?

Yes. Users log in using their CWS authentication and authorization. The product offers the ability to give users different levels of access (e.g., full access or read only).

How will the offerings be updated?

Caterpillar has the ability to remotely update software and configuration, with a defined process in place for Caterpillar Support to roll out onboard changes to existing sites. Updates to the office software are made via the Cloud. Customers are empowered to download and run apps on their tablets and mobile devices.

How will MineStar Edge offerings be sold and deployed?

For the foreseeable future, MineStar Edge functionalities will continue to be sold through the Cat dealer network.

Installation will be the responsibility of the dealer technician who will follow the step-by-step instructions on an app to install hardware, configure equipment, register and activate onboard hardware, and use a diagnostic tool to validate the installation. In the office, the mine will be able to configure site-level characteristics, define materials, input operational schedules and identify individual pieces of equipment. Consulting and training will also be offered for a fee.

CAT®