



Predix Asset Performance Management

A Digital Mine solution



How can you make your mining operation safer and more reliable while helping to ensure optimal performance at a lower sustainable cost?

As a mine site operator, you need to predict and prevent failures in a timely manner. But to do that, you need to better manage your data across the enterprise.

You've invested in assets, processes, and systems on a massive scale to meet your business objectives while managing risk around safety, financial, and environmental events. These hundreds—perhaps thousands— of assets produce enormous amounts of data that can either keep you informed to help you make smarter decisions—or leave you vulnerable to blind spots and risk within your mining facility.

You need the ability to:

- Collect, analyze, and visualize the data that is crucial to your mine site assets' health—all in one place
- Prioritize your work, within your mining operations, by determining which assets are most critical to the overall health of your operation
- Understand the true status of each asset
- Predict equipment and process issues with greater accuracy before they occur
- Assure mechanical integrity of your assets and regulatory compliance
- Learn from continuous, real-time analysis and visibility to understand the options for mitigating potential problems while balancing associated costs, risks, and benefits

In other words, for each of your mining assets, you need a process that contains all the best-practice steps necessary to ensure optimal asset and operational performance to maximize your desired outcomes.

Solutions are needed that:

- Reduce unplanned downtime
- Optimize operations
- Enable proactive processes

What if anomalies were predicted and maintenance was performed when only needed?

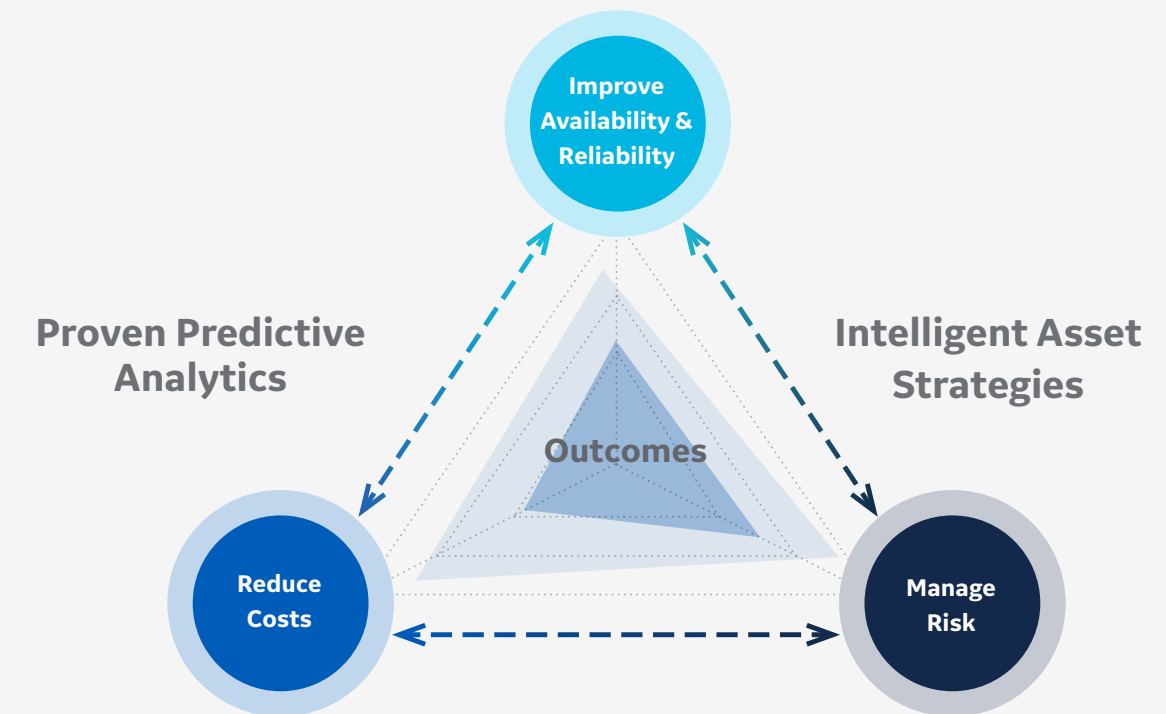
What if every plant performed like your best plant?

Predix Asset Performance Management

Predix Asset Performance Management (Predix APM) is a suite of software and service solutions designed to help optimize the performance of your assets. Predix APM increases asset reliability and availability while optimizing maintenance costs, mitigating operational risks, and reducing total cost of ownership (TCO).

The suite connects disparate data sources and uses advanced analytics to turn data into actionable insights while fostering collaboration and knowledge-management across the organization. Predix APM works across all equipment, all OEMs, and all industries, across the plant, and across the fleet.

Built on Predix Platform, Predix APM gives organizations the flexibility to develop new analytics and applications, making it versatile to meet changing needs.



Predix Asset Performance Management offering

Core capabilities

Connectivity • Data management • Condition monitoring • Configurable dashboards • Analytics catalog • Workflows • Performance benchmarking



Extraction

- Haul truck
- Hoist
- Dragline
- Compressor
- Fan
- Blowers

Mineral processing

- Mill
- Crusher
- Compressor
- Conveyor
- Fans
- Blowers

Smelting and refining

- Leaching
- Furnace
- Compressor
- Pumps
- Fans
- Blowers

Other assets

- Air heater
- Generator
- Scrubber
- Heats exchanger
- Gear box
- Boiler



Getting started on your digital journey

The starting point for your Industrial Internet journey is getting connected to build digital twins—software representations of your physical machines and processes within your mining facility. Sensors transmit data from your industrial assets securely to your chosen storage topology: on-premises, in the cloud, or hybrid. You can then leverage our digital industrial applications like Predix APM, Predix Operations Performance Management (Predix OPM), and Safe Technologies from GE Mining for your assets and operations. You can also create custom analytic applications by assembling prebuilt Predix Platform software services and building new Predix services from scratch.

Predix Platform: The platform for the Industrial Internet

Predix Platform combines the scalability of cloud computing, big data management, and advanced analytics to power new generations of industrial mining facilities. Born from GE's own experiences as a global industrial leader, Predix Platform is a purpose-built, hardened cloud platform that provides the connectivity, security, and performance needed to drive advanced industrial applications for your mining site. Using Predix-powered applications, you can quickly gain insights about the availability and performance of your industrial assets, reduce downtime, and optimize agility and scale.



Get connected

Predix APM gives you a single, secure way to gather data from a wide variety of assets and systems, creating a comprehensive and validated data repository. Predix APM applications provide you a unified, complete, and accurate view of your operations—at the asset, plant, and enterprise levels—anytime and anywhere.



Get insights

Once your equipment is connected, Predix APM goes to work monitoring your assets and alerting you about behavioral anomalies. Predix APM predicts equipment problems before they happen so you can focus resources where they are needed. And when issues do arise, Predix APM provides comprehensive case and knowledge management to ensure that your best practices are captured and available for future use.



Get optimized

The ultimate goal of Predix APM is to identify maintenance strategies that balance reliability, availability, risk, and cost. Predix APM allows you to replace scheduled maintenance with just-in-time, predictive maintenance. Predix APM takes optimization to an entirely new level, providing you the quantitative foundation to implement a comprehensive, financially optimized intelligent asset strategy.

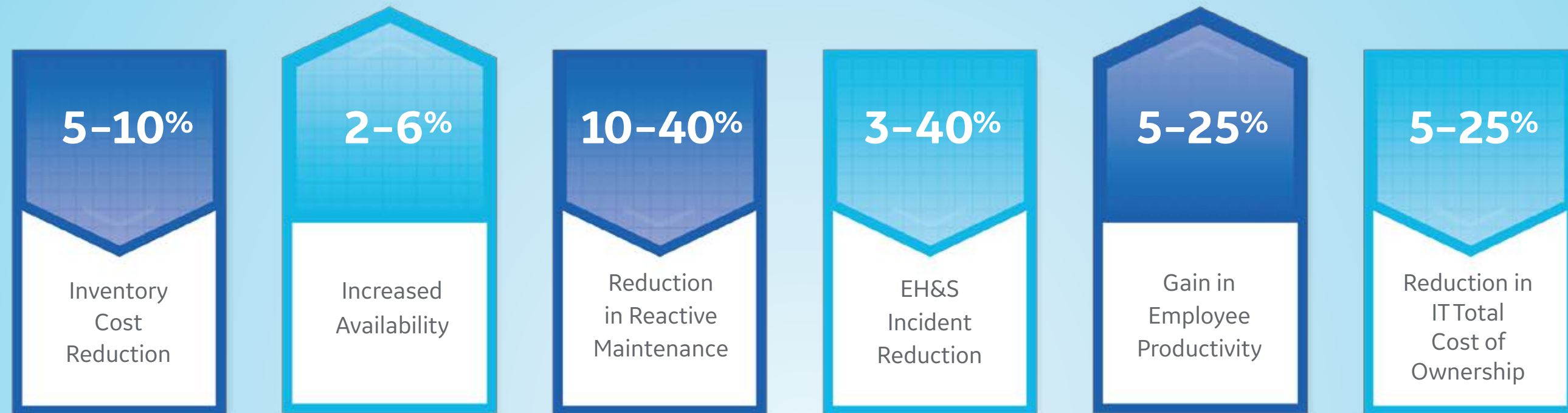


Benefits of Predix Asset Performance Management

- Reduces unplanned downtime and increases availability and reliability by helping to ensure that critical assets and systems are monitored and protected from emerging threats
- Reduces costly emergency repairs by detecting problems early, turning unplanned downtime into planned downtime
- Reduces often unnecessary routine preventive maintenance and helps you move to more efficient and proactive condition-based and risk-based maintenance
- Reduces inventory costs by determining spare parts requirements based on failure rates, logistical constraints, and downtime and consequence costs
- Protects the health and safety of employees and the environment by reducing asset-related incidents
- Improves workforce productivity by prioritizing maintenance based on criticality and cost
- Helps maintain and institutionalize technical expertise (tribal and organizational knowledge)
- Delivers continuous improvement
- Lowers total cost of ownership through a software-as-a-service (SaaS) model that provides flexibility and access to business insights where it matters—with edge, cloud, and hybrid configurations
- Provides the ability to operationalize your own in-house analytics by using Predix APM capabilities
- Provides a standard way to connect machines, data, and people to deliver faster time-to-market; a well-designed, consistent interface for a superior user experience; dynamic scalability to meet growth needs; and extensibility to grow functionality as business needs evolve



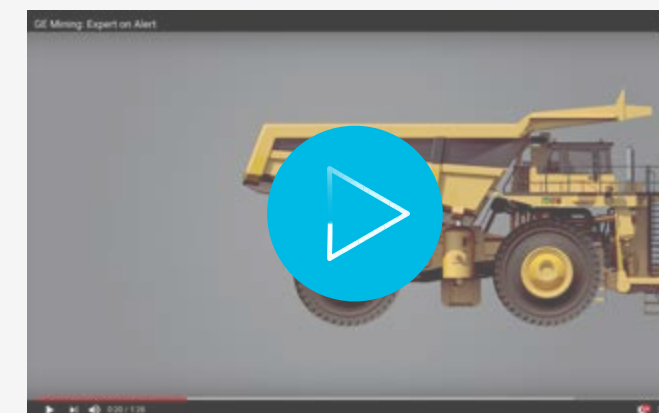
Actual customer value from Predix Asset Performance Management



Within our suite of Predix APM capabilities, Expert on Alert is an innovative digital solution from GE that delivers real-time information about truck performance to make better decisions, improve operational efficiency, maximize truck availability, and minimize maintenance dollars and efforts.

[Check out our Digital Mine video](#)

[WATCH NOW](#)



GE's Digital Industrial Managed Service Center (IMS)



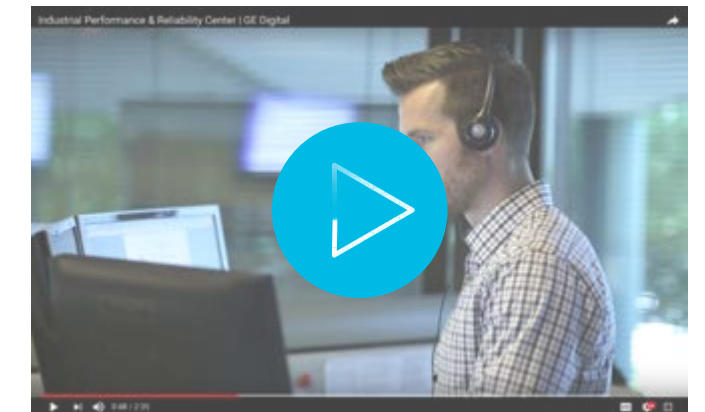
GE Digital's IMS is located in Chicago, IL.

The Managed Services team is staffed with unique industry expertise. This allows us to help your team use the GE Digital's solutions to ensure your business outcomes. We can use the digital solutions on a short-term, transition basis, while we help coach and transform your processes or on a long-term basis with many flexible levels of support.

Decrease cost to serve, increase analyst productivity, simplify IT, and accelerate innovation in service delivery.

Check out our
IMS video

WATCH NOW



IAPRC statistics at a glance

6500+ GE and non GE assets, **2100** mining assets

250k+ Tags monitored in real time, **75k** mining tags

50+ Customer call per week

60+ Actionable notifications per week

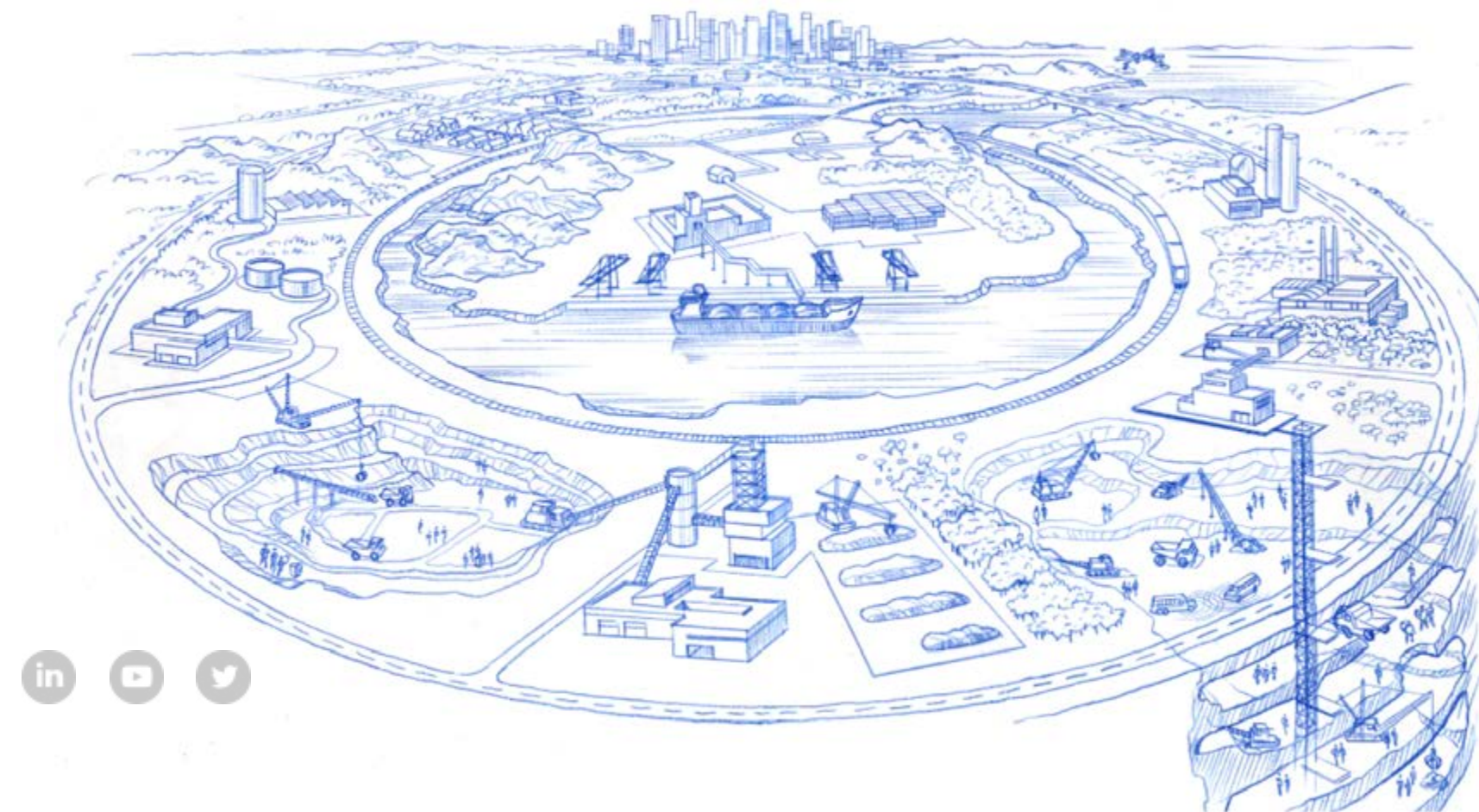
10+ Years of operation

350+ Years of reliability expertise on staff

7 Global locations to be close to customers

170+ Languages supported for calls and reports

10,000+ GE and non-GE assets transitioned to independent customer monitoring



Lifetime production and
mechanical losses avoided

\$837 MM

2015 production and
mechanical losses avoided

\$132 MM

Average customer
return on investment

3.7 MONTHS

Range of production and mechanical
losses avoided per actionable notification

\$2K - \$60 MM

Examples of Digital Mine catches

Compression Problem

Bank Cylinder Exhaust Temperature decreased by ~180 °C reaching maximum temp of only ~430 °C at full engine speed.

Cause

Injector clogging or malfunction on Bank injector operation.

Drive End Bearing

Driving End Bearing Temperature had been increasing as high as ~168 °F upon motor start up. Bearing Temp not showing the same increases and is reaching a maximum of ~113 °F.

Cause

Verify bearing lubrication.

Coolant Loss

Coolant Pressure had decreased from ~230 kPa down to ~180 kPa and appeared to be declining further.

Cause

Potential coolant leak or water pump issue.



Predix APM includes APM Health, APM Reliability, APM Integrity, and APM Strategy



APM Reliability

- Digital twin blueprints
- Root cause analysis
- Reliability analysis



APM Integrity

- Risk based inspection
- Inspection management
- Thickness monitoring
- Hazards analysis
- Management of change



APM Strategy

- Criticality analysis
- Reliability centered maintenance
- Failure mode and effects analysis
- Strategy manager
- Lifecycle cost analysis



APM Health

- Health manager
- Rounds
- Calibration management



78%

APM Health

APM Health, a Predix APM solution, manages data across a variety of assets and systems, creating a comprehensive and validated data repository and unified view related to expected performance at the asset, plant, and enterprise levels.

By solving the challenge of data disparity and latency associated with the management of industrial assets, APM Health provides a real-time view of asset health and condition status, delivers early warning of potential failures, and highlights elevated risk areas. Beyond gaining a real-time view of asset health, status, and issues—anytime, anywhere (edge, cloud, hybrid), APM Health enables industrial organizations to accelerate time-to-value, automate data integration, and activate data analytics.

APM Health includes:

- Health manager
- Rounds
- Calibration management

APM Reliability

With APM Reliability, a Predix APM solution, asset-intensive organizations can leverage advanced predictive diagnostics to analyze data and detect and diagnose asset issues before they occur.

This allows companies to schedule downtime and control costs on their own terms. APM Reliability is designed to work across all assets (fixed, rotating, and non-rotating), all

equipment types and manufacturers (GE and non-GE), and all industries—across the plant and across the enterprise.

APM Reliability includes:

- Digital twin blueprints
- Root cause analysis
- Reliability analysis

APM Integrity

APM Integrity, a Predix APM solution, equips organizations to enable a closed loop mechanical integrity program across the enterprise. This comprehensive inspection solution helps operators reduce risk, lower inspection costs, and ensure regulatory compliance relative to their fixed assets. Leveraging an integrated set of tools, APM Integrity enables users to calculate risk and the remaining useful life of assets to generate, implement, and execute optimized inspection strategies while streamlining auditability and compliance governance.

With APM Integrity, asset-intensive organizations can lower environmental, health, and safety (EH&S) incident probability, increase availability, reduce reactive maintenance, and improve productivity.

APM Integrity:

- Risk-based inspection
- Inspection management
- Thickness monitoring
- Hazard analysis
- Management of change

APM Strategy

APM Strategy, a Predix APM solution, provides a common methodology to develop and manage asset strategies by using a risk-based approach to conduct analysis of individual assets, a group of assets, or an asset system. By balancing risk, production goals, and resource investment, APM Strategy allows asset-intensive organizations to focus costs on the most critical assets—reducing maintenance and inventory costs, increasing availability and reliability, and moving away from reactive maintenance practices to a proactive approach.

APM Strategy includes:

- Criticality analysis
- Reliability-centered maintenance
- Failure mode and effects analysis
- Strategy manager
- Lifecycle cost analysis



Get started today

GE's Digital Mine leverages decades of experience, cutting-edge data science and analytics technology, and the scale of \$1 trillion in managed assets to offer a full suite of Predix APM solutions, powered by Predix Platform, the platform for the Industrial Internet. Predix APM balances traditionally competing priorities—reducing costs, improving availability and reliability, and managing risk—to provide intelligent asset strategies that help maximize asset performance and productivity.

Are you ready to make your operation safer and more reliable while helping to ensure optimal performance at a lower sustainable cost?





About our collaboration

The Wabtec and GE Digital collaboration brings together decades of mining vertical expertise with best-in-class OPM and APM software development practices, which is precisely the kind of collaboration needed for this incredibly dynamic space.

Wabtec is a re-seller for GE Digital Solutions. Please contract your Wabtec Seller if interested in learning more about our Digital Mine Solutions.

About GE

GE Digital is reimagining how industrials build, operate and maintain their assets, unlocking machine data to turn valuable insights into powerful business outcomes. GE Digital's Predix portfolio – including the leading Asset Performance Management, Automation and MES applications – helps customers manage the entire asset lifecycle. Underpinned by Predix, the leading application development platform for the IIoT, GE Digital enables industrial businesses to operate faster, smarter and more efficiently.

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About Wabtec

Wabtec Corporation is a leading global provider of equipment, systems, digital solutions and value-added services for freight and transit rail. Drawing on nearly four centuries of collective experience across Wabtec, GE Transportation and Faiveley Transport, the company has unmatched digital expertise, technological innovation, and world-class manufacturing and services, enabling the digital-rail-and-transit ecosystems. Wabtec is focused on performance that drives progress, creating transportation solutions that move and improve the world. The freight portfolio features a comprehensive line of locomotives, software applications and a broad selection of mission-critical controls systems, including Positive Train Control (PTC). The transit portfolio provides highly-engineered systems and services to virtually every major rail transit system around the world, supplying an integrated series of components for buses and all train-related market segments that deliver safety, efficiency and passenger comfort. Along with its industry-leading portfolio of products and solutions for the rail and transit industries, Wabtec is a leader in mining, marine and industrial solutions. Wabtec has approximately 27,000 employees in facilities throughout the world.

Visit the company's new website at:

www.WabtecCorp.com

