IBM Cognitive Equipment Advisor

Cognitive analytics for improved asset performance and reduced repair time.

Watson IoT.

IBM

Executive Summary

The increasing number of critical connected assets, volumes of operational data generated, greater asset complexity, and increasing scarcity of "tribal knowledge" in many industries as a result of changes in the workforce requires asset-intensive organizations to become far more efficient and effective in identifying and resolving problems that impact health of critical assets, in the plant or located remotely.

IBM Predictive Maintenance and Quality enables asset-intensive organizations to monitor asset health, predict impending asset degradation or failure, and identify the likely reasons for declining performance. With this insight operations and maintenance personnel can move from a reactive to a proactive maintenance strategy with goals of improved asset reliability, availability, and performance.

IBM Cognitive Equipment Advisor augments the asset health monitoring capabilities and machine learning techniques of IBM Predictive Maintenance and Quality with cognitive capabilities applied to unstructured data associated with repairs, maintenance, procedures, and techniques to offer enhanced insights and recommend optimum repair methods and procedures.

The complementary capabilities of these two key components can help asset intensive organizations improve asset performance, reduce repair time, reduce overall maintenance costs, and implement more effective operations and maintenance strategies for critical assets.

Connected, Intelligent Assets Require New Strategies

The advent of the IOT and increasingly intelligent, connected equipment provide an opportunity for asset intensive industries to implement strategies that can help improve asset performance and optimize maintenance practices. Operational data – historical and real-time – generated by assets can be captured and analyzed to provide detailed, accurate predictive insight into asset performance. Predictive analytics, using machine learning can identify impending asset degradation or failure well ahead of the actual event enabling organizations to proactively prevent or remedy the problem.

The increasing complexity of assets, equipment, and machinery requires asset-intensive organizations to develop new skills and strategies for effective maintenance and repair. With the burgeoning IoT and newer instrumented assets incorporating software to enhance their functionality, maintenance organizations require additional skills and deeper expertise to effectively maintain these assets. Maintenance personnel often have limited information regarding effective ways to diagnose and resolve issues associated with these increasingly complex assets.

In many industries the retiring workforce exacerbates the problem of retaining skilled, knowledgeable workers who intimately understand asset operations and repairs as a result of years of on-the-job experience. The retiring workforce leaves many organizations with a significant knowledge gap.

However, organizations that have substantial body of asset documentation, maintenance records, and other sources of unstructured information associated with asset maintenance, procedures and processes can now apply cognitive technologies to these sources to identify appropriate maintenance procedures for the specific problems identified by predictive analytics.

The combination of predictive maintenance and cognitive capabilities exploits the potential of both asset operational data and repositories of detailed maintenance data, applying reasoning and learning to help the enterprise to become smarter and more efficient regarding asset operations and maintenance. Asset-intensive organizations now have the capability to analyze operational data and derive an asset health assessment to predict future asset performance. Upon prediction of specific asset failure, IoT Equipment Advisor's cognitive functions can provide detailed, accurate repair recommendations to help reduce repair time and increase first time fix rates.

Cognitive Equipment Advisor Identifies Impending Asset Failure with PMQ

IBM Predictive Maintenance and Quality applies machine learning and dynamically discovered rules to analyze multiple operational data sources to predict equipment malfunction and asset failure to help avoid costly downtime, reduce maintenance costs, and improve process throughput. Driven by predictive analytics, it detects even minor anomalies and failure patterns to identify assets and operational processes that are at the greatest risk of failure or degradation.

Once the specific problem has been identified, cognitive capabilities can then be employed to recommend appropriate procedures to remedy the problem and quickly return the asset to proper operating conditions.
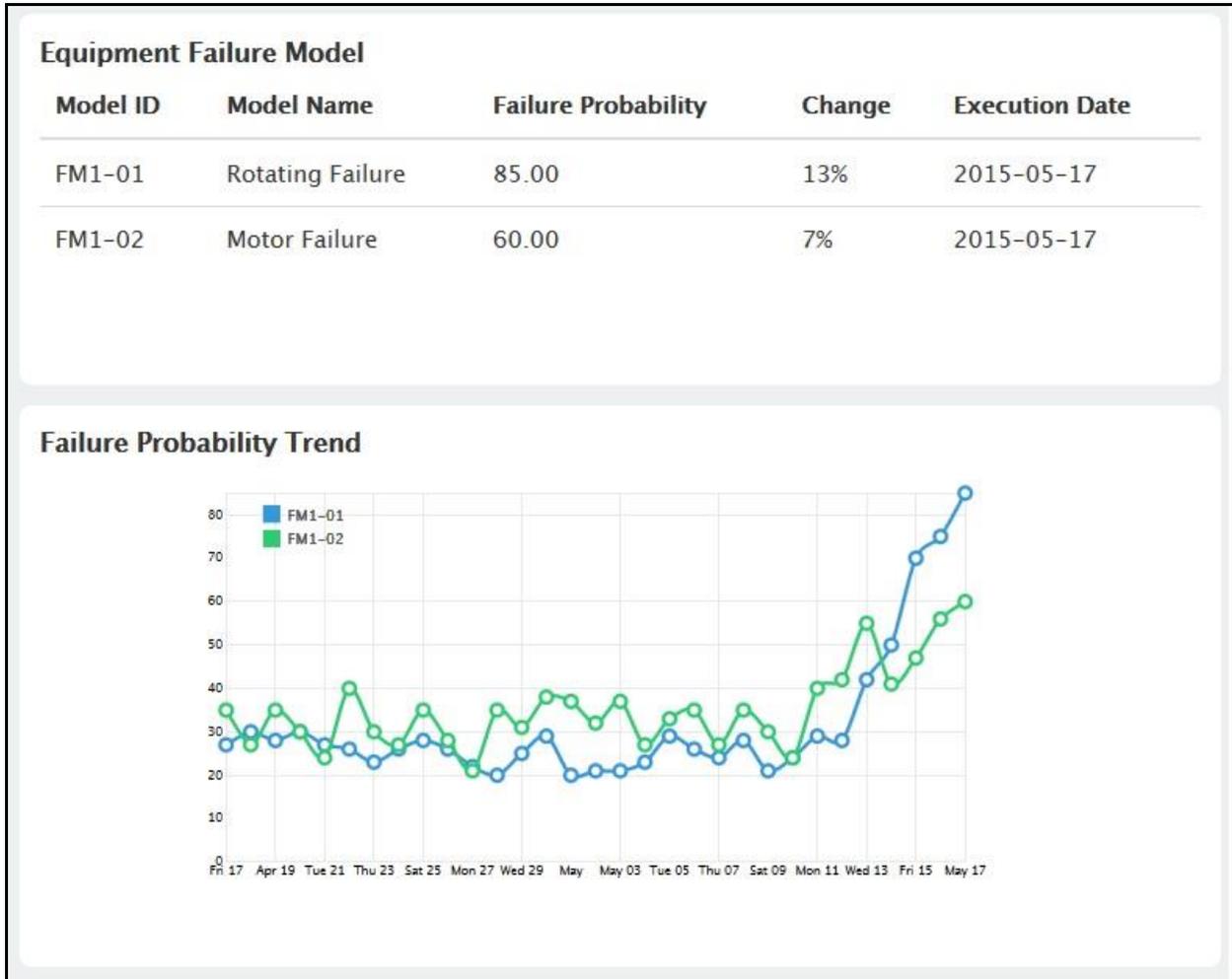
Equipment Failure Model

Model ID	Model Name	Failure Probability	Change	Execution Date
FM1-01	Rotating Failure	85.00	13%	2015-05-17
FM1-02	Motor Failure	60.00	7%	2015-05-17

Failure Probability Trend

Figure 1: Predictive analytics identify impending asset failure and failure probability.

Cognitive Recommends Optimum Repair Approaches

IBM Cognitive Equipment Advisor augments IBM Predictive Maintenance asset health monitoring capabilities with cognitive methodologies and machine learning techniques that analyze structured and unstructured data from maintenance logs, work order history, equipment manuals, technical documentation, industry blogs, and other relevant unstructured data associated with repairs, procedures, and maintenance techniques.

IBM Cognitive Equipment Advisor then aggregates the data, applies cognitive, and then visualizes the patterns it has uncovered to offer enhanced insights and recommend optimum repair methods and procedures. It delivers data, analytics and cognitive insights relevant to the user's role, context and current maintenance activities, dramatically reducing the amount of time spent looking for information and increasing the ability to effectively execute repairs. IBM Cognitive Equipment Advisor can assist with diagnostics via an interactive dialog to make repair recommendations with the highest probability of success including parts and tooling.
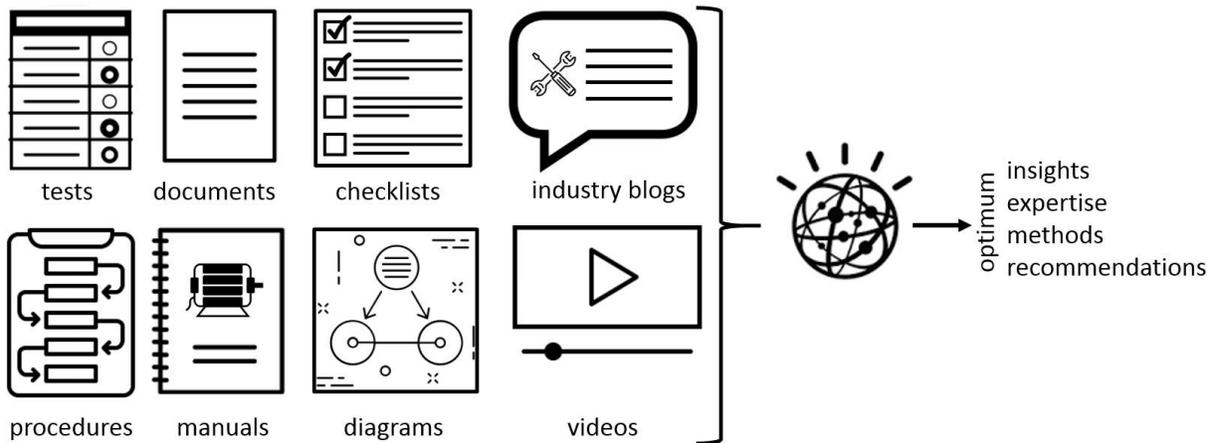
Figure 2: Aggregate and apply cognitive analytics to identify the most relevant and optimum ways to effect maintenance and repairs.

Analyze, Identify, and Apply Expertise

IBM Cognitive Equipment Advisor applies cognitive methods to a wide range of unstructured data to identify entities and concepts such as equipment details (model, version, configuration, controller), equipment status/conditions, service technician notes, tests and test results, hypothesized failure, prescribed repair procedures, repair resolution, operational procedures, tooling, expertise, and evidence, and utilize this insight to provide probability-ranked guidance regarding diagnostic and resolution options or next best action recommendations to help preempt or resolve correlated failures.

IBM Cognitive Equipment Advisor can isolate impending problems just as they begin to form, group comparable issues across similar assets, and help synthesize asset and repair history data in one place. By harvesting best practices and technical expertise maintenance personnel become more effective and efficient in preventing or remedying asset failure and degradation.

Maintenance Information as an Asset

A major airline employs cognitive to improve maintenance practices. Cognitive analysis is applied unstructured information and numerous formats of aircraft operational data generated by flight, cabin, and ground crews, maintenance personnel, and ACARS messages. Careful analysis of historical fault resolution data and analysis of maintenance costs, in addition to specific maintenance recommendations provide dispatch support, maintenance processes, and enhance preventive maintenance practices.

Recommend Appropriate Procedures

Cognitive and machine capabilities of IBM Cognitive Equipment Advisor applied to the wealth of existing asset operational and maintenance information can help diagnose issues faster and provide insight into relevant potential solutions more quickly to help minimize repair time and reduce risk of improper repairs by providing multiple probability-based options to ensure the appropriate procedure or repair is recommended.
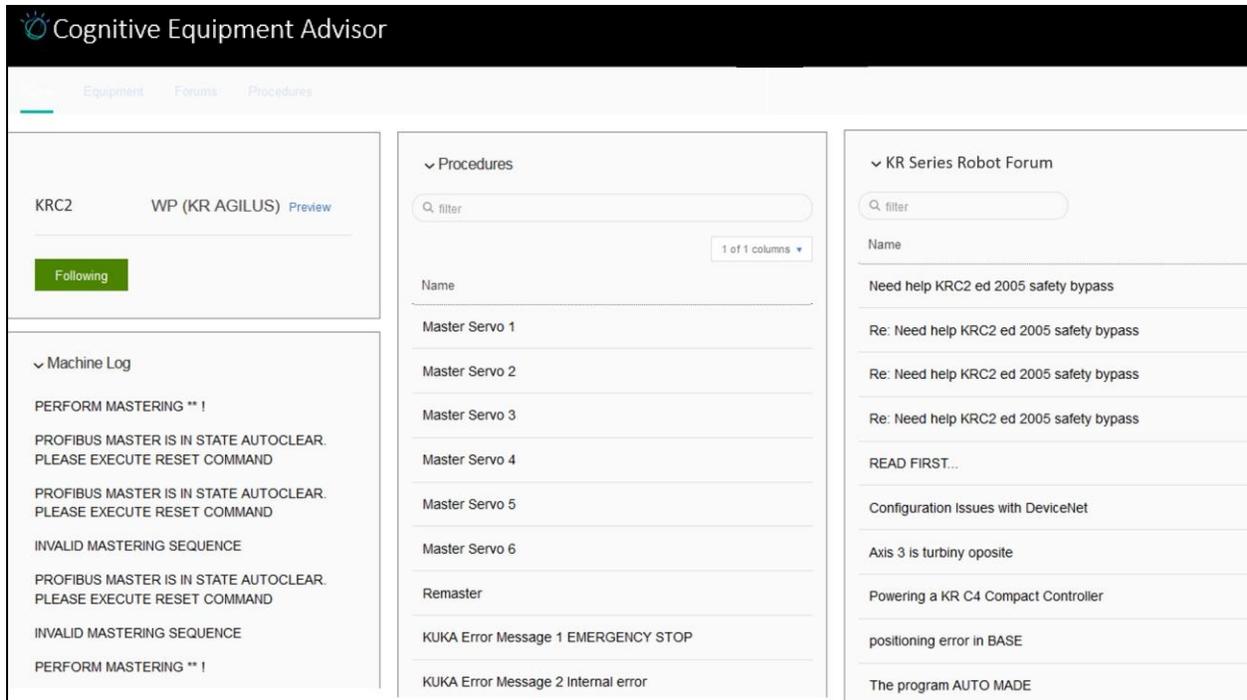
Figure 3: Easily access relevant maintenance, procedures, and technical information for specific assets and identified problems.

For example, recommendations could include: most effective repair procedures, optimum maintenance cycles, and proactive step-by-step guidance regarding field repairs, lowest possible cost, and/or minimum disruption. It can also assist with more detailed diagnostics via an interactive natural language dialog to make repair recommendations with the highest probability of success including parts and tooling.
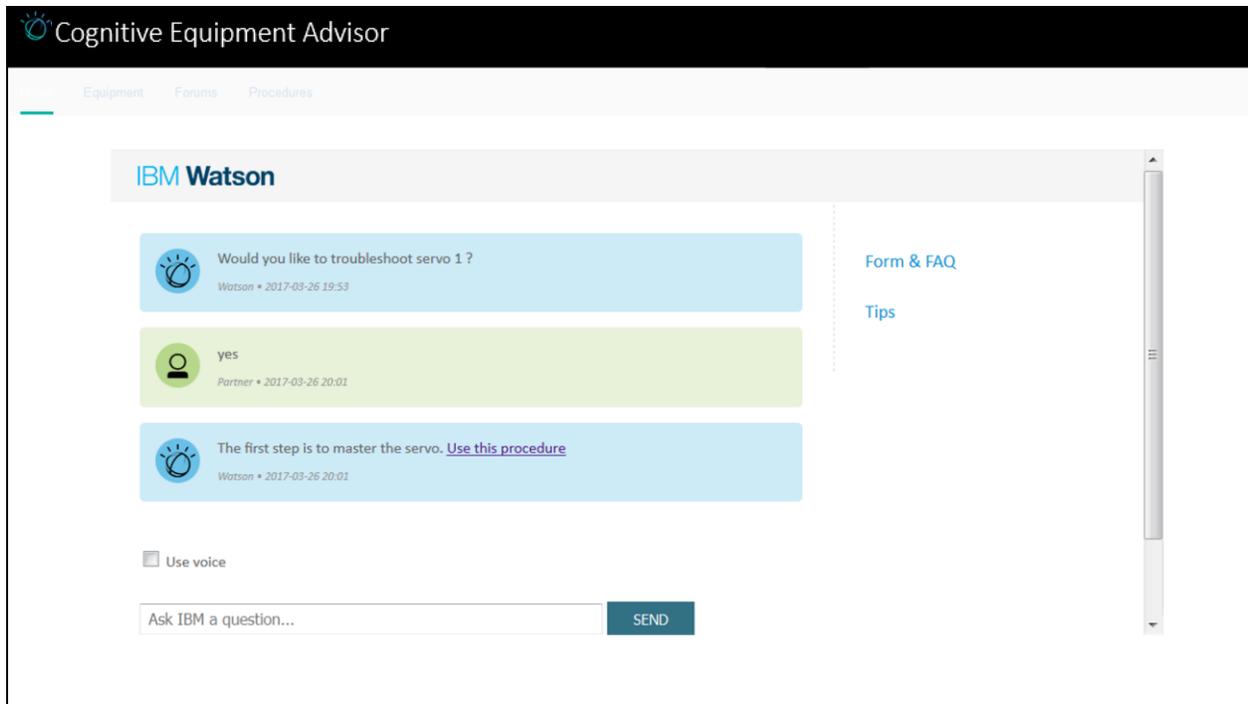
Figure 4: Via an interactive dialog Cognitive Equipment Advisor can make repair recommendation based upon the problem identified by IBM Predictive Maintenance and Quality.
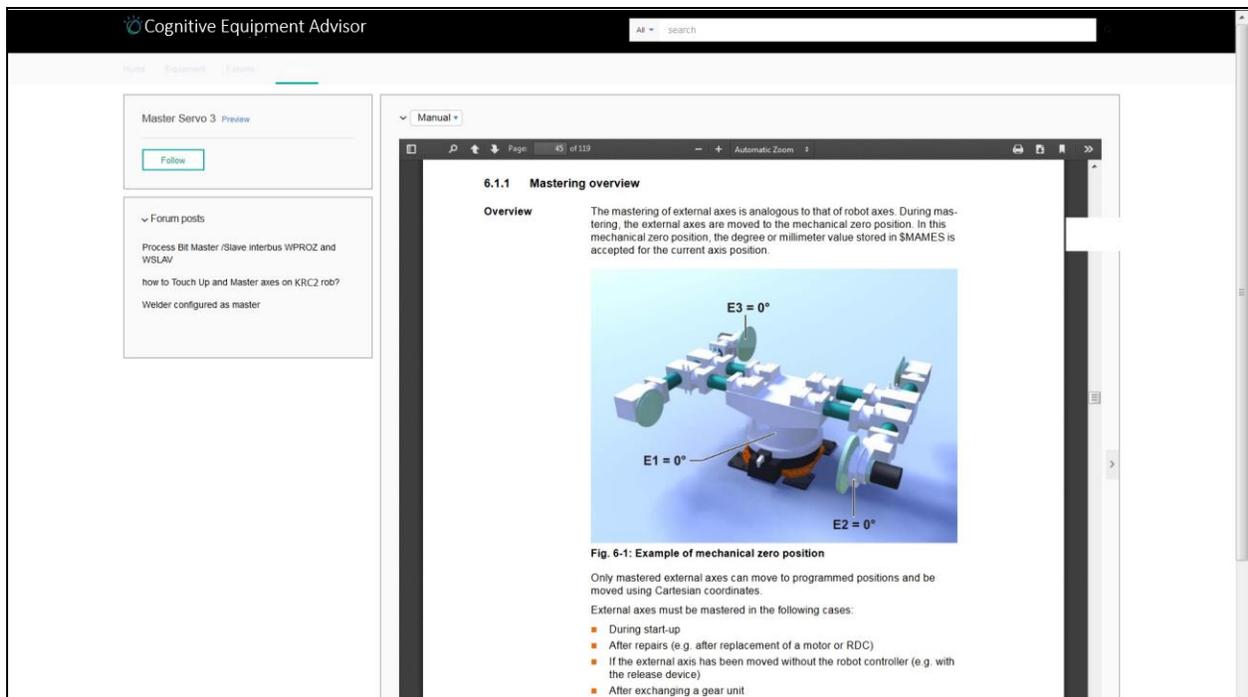

Figure 5: Cognitive Equipment Advisor then enables access to relevant resources to help maintenance personnel resolve the problem as effectively and efficiently as possible.

Cognitive assistant for field technicians

A heavy equipment manufacturer reduces maintenance costs via cognitive capabilities that combine structured and unstructured data and images to help resolve work orders more quickly on site. The solution allows field technicians to diagnose issues faster and provides insight into relevant potential solutions. Through use of cognitive capabilities the manufacturer has improved first-time fix rates and reduced repair escalations by 25%.

Synergy of Predictive and Cognitive

The combined benefits of predictive maintenance and cognitive capabilities are realized through the capture and analysis of historic and real-time operational and performance data generated by assets as well as analysis of relevant information associated with maintenance activities conducted on specific assets or classes of assets. The overall process for realizing these benefits can be thought of as: connect, predict, repair and optimize.
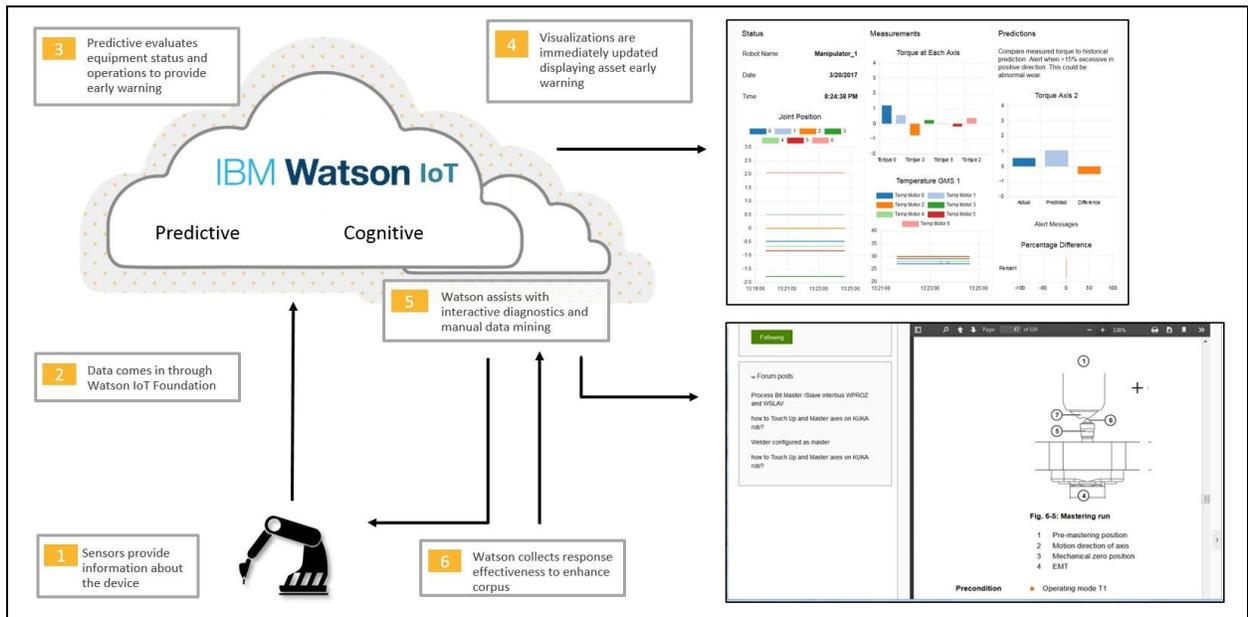

Figure 5: Connect (1 & 2), Predict (3 & 4), repair (5) and optimize (6) to improve asset performance and accelerate repair time.

Connect and gather operational data

Gather data from instrumented and connected critical assets wherever they are located – on-premise or remote. The solution provides connectivity and data collection – both real time and historic data – from myriad devices, sensors and equipment without requiring changes to your infrastructure or systems.

Predict asset degradation or failure

Apply predictive analytics to operational data gathered from critical assets. Discover non-obvious patterns and correlations to provide early warning of asset degradation or failure. Analytics can also indicate time to failure, probable cause, and expected remaining life for components. Preempting issues before they arise

with early warnings and accurate predictions can help reduce asset downtime and maintenance costs.

Repair efficiently and effectively

Apply cognitive capabilities to relevant maintenance information to identify the best methods and procedures relevant to specific maintenance needs. Analyze maintenance logs, equipment manuals, forums, and technical documentation to harvest best practices and expertise not currently captured. Based upon the predicted failure assist with diagnostics via an interactive dialog that can offer repair recommendations, including appropriate parts and tooling, and provide step-by-step repair guidance to

facilitate highest probability of success in preventing failure or returning the asset to operational conditions.

Optimize for continual operational improvement

Continued application of predictive and cognitive capabilities, using reasoning and learning systems to constantly evaluate operating performance. Look for alternate settings or operations to improve asset availability and reduce maintenance costs. Reduce time to repair by improving first-time fix rates. Continuously optimize the use of systems, equipment and people. Cognitive can also be employed to help improve maintenance schedules, parts inventory management, spares locations, as well as recommend supply replenishment based upon predict need.

Embrace Analytics and Cognitive to Improve Operations and Maintenance

Technology trends are enabling asset-intensive organizations to become far more efficient and effective in their ability to operate and maintain critical assets. Intelligent, connected assets generate volumes of detailed operational data that can be captured and analyzed using machine learning to predict impending asset failure or degradation and identify the source of the problem. Cognitive capabilities can be applied to unstructured information associated with asset operations and maintenance to uncover expertise, guidance, and recommended procedures to help improve operational efficiency and execute maintenance and repairs efficiently and correctly.

The benefits of applying these new technologies to the changing business needs of asset-intensive organizations are many. Gain a more detailed and accurate understanding of asset performance. Reduce mean time to repair while simultaneously improving asset availability. Aggregate and analyze historical and collective operational and maintenance expertise to retain the tribal knowledge and experience. Provide a single source of expertise easily accessed by maintenance personnel to facilitate quick resolution of impending asset degradation or failure. Improve first-time fix rates. Lower maintenance costs via early warning of impending failure, diagnosis, and guidance regarding appropriate repair procedures.

The complementary capabilities of IBM Predictive Maintenance and IBM Cognitive Equipment Advisor can help asset intensive organizations improve

asset performance, accelerate time to repair, reduce maintenance costs, and implement more effective and efficient operations and maintenance strategies for critical assets.

Learn more

IBM Cognitive Equipment Advisor is one of the IBM Watson IoT™ for Manufacturing and Industrial Products offerings designed to drive cost savings and operational efficiency for critical assets. To learn more about IBM Cognitive Equipment Advisor and the IBM Watson IoT portfolio, contact your IBM representative or IBM Business Partner, or visit:
ibm.com/internet-of-things