Enterprise APM Software
Your Assets Speak Volumes. Are You Listening?

Companies have invested in assets, processes, and systems on a massive scale to meet their business objectives and manage risk around safety, financial and environmental events. Hundreds of thousands of these assets produce a relentless stream of data every day – all with its own specific purpose – that can either keep you informed to help make smarter decisions or leave you vulnerable to blind spots and risk.

Organizations need the ability to know what all that data means in order to determine which information is key to the health of your assets, and which of those assets are critical to the health of your business.

The next key step is an intelligent asset strategy to help you answer essential questions that spreadsheets, ERP systems and historians can’t:

- How critical is the asset?
- How could this asset fail, and how could this failure risk be mitigated?
- What would the consequences of failure be, and how would it affect the business?

By combining real-time data with human experience, operating parameters, analytics and connectivity, an intelligent asset strategy continuously improves over time. It’s an automated loop of learning that can detect emerging threats for prevention and proper governance. Enterprise APM can provide improvement through intelligent asset strategies by:

- **Identifying critical manufacturing assets** by assessing risk to environmental, safety and production targets
- **Measuring performance** of assets through advanced analytical and simulation techniques utilizing your existing data
- **Providing the framework** to apply best practices across the enterprise
- **Ensuring continuous improvement**

As the global leader in APM for more than 20 years, Meridium has leveraged our experience in working with thousands of asset-intensive industries in more than 1,600 sites around the globe as the proving ground for Meridium Enterprise APM.

Software Solutions

**Asset Answers**

*Enabling diagnostics, analytics and benchmarking*

As the only cloud-based asset performance diagnostic solution, Asset Answers provides comparative analytics on your data, delivers instant visibility into operational information and data quality, and supplies organizations with insights to drive safer, more informed, and more profitable decisions.

Bad Actor Detection

Asset Answers allows users to quickly detect and evaluate “bad actors” using out-of-the-box industry standard KPIs focused on cost, reliability and availability.

Data Quality Management

It can be challenging to tell the difference between quality data and “bad data,” but Asset Answers comprehensively reviews and scrubs data so organizations can identify target areas for improvement, even down at the equipment level. Automated data quality reports can be scheduled on a
maintenance to avoid these occurrences. The Meridium APM Failure Elimination solution provides integrated and intuitive tools with a comprehensive approach to managing reliable production, determining the causes of failure, and mitigating or preventing the causes of failure.

**Production Loss Analysis**

Today’s industry leaders employ innovative, analytical, and proactive programs designed to eliminate production losses and enable plants to operate predictably and efficiently. Meridium’s Production Loss Analysis (PLA) capability manages production goals, collects actual production values, tracks production events and impact, and reconciles production targets. With robust analysis and reporting capabilities, PLA makes it easy to visualize production losses and their effects. PLA provides the essential tool for using production data to measure, analyze, improve and communicate performance across the enterprise.

**Generation Availability Analysis**

Meridium’s Generation Availability Analysis (GAA) application integrates information from maintenance, operational, planning and financial disciplines to support generation reliability analysis and drive continuous improvement strategies. GAA collects and standardizes monthly unit performance and event data that is used for Generation Availability Data System (GADS) reporting in North America (U.S. and Canada) and to the North American Electric
Reliability Council (NERC) for most generators. The real value of GAA is achieved through the integration of this compliance reporting process with other business reporting and analysis needs of the company. Fuel cost, replacement power cost and other financial information can be used to determine the true cost of failures instead of just the potential costs as required by NERC.

**Root Cause Analysis**

Equipment failures and production losses occur for a variety of reasons, including poor equipment reliability, inadequate processes or human error. The causes for these events must be established and preventive measures put in place. Meridium Root Cause Analysis (PROACT® for Meridium) is designed to audit and analyze undesirable events so that causes can be documented and strategies established to prevent reoccurrences. The PROACT® methodology guides users through the steps of documenting the failure event, capturing the failure modes, determining root causes, implementing recommendations and tracking the results. Tracking asset performance following the implementation of recommendations allows the user to easily establish the return-on-investment (ROI) of implementing the corrective measures. Use of templates simplifies the development of a comprehensive knowledge base to be created and used repeatedly across an enterprise, ensuring the right corrective strategies are employed with minimal delay.

**Reliability Analytics**

Organizations that understand the reliability and wear patterns of critical assets have a competitive advantage when creating cost-effective programs for mitigating risks. Meridium Reliability Analytics is a key enabler in investigating and improving the reliability and performance of these important assets. Production Analysis (Weibull) allows the user to quantify production losses and determine appropriate measures to protect profits. Monte Carlo simulation modeling techniques permit the user to determine the performance, cost and reliability under various scenarios.

**APM Analytics**

The latest solution offering, providing customers unique insights into their assets. Combining Meridium’s experience, machine learning algorithms and sensor data to proactively solve customer problems.

**Cognitive Analytics**

This capability features machine learning algorithms, trained and constantly updated against Meridium’s industry benchmarking solution – Asset Answers – to identify failure patterns that can be missed through traditional analytical routines. By taking complex processes and business challenges, and applying these advanced algorithms and innovative long text data mining and analysis, Cognitive Analytics can aggregate all of the data being collected and provide a full view of asset health and performance.

**APM Strategy**

_Improve the plan_

At the heart of the Meridium Enterprise APM landscape is the ability to effectively develop, implement, maintain and optimize intelligent asset strategies over the life of an asset. These strategies are comprised of the individual and collective actions performed to maintain, operate, monitor and inspect assets at an optimal cost with maximum risk reduction. These strategies should be based on the output of rigorous engineering methodologies and analysis, manufacturer’s recommendations, organizational best
practices, and human experience depending on the type and risk profile of the asset. Effectively managing the asset can provide tremendous value by enabling organizations to achieve the optimal balance of cost, risk and performance.

**Reliability Centered Maintenance and Failure Modes and Effects Analysis**

Reliability Centered Maintenance (RCM) and Failure Modes and Effects Analysis (FMEA) methodologies evaluate the function of the asset, the failure modes and the consequence of asset failure allowing for the definition of comprehensive maintenance, operational, and inventory strategies that balance costs and risks with overall production goals. Meridium RCM/FMEA capabilities constantly evaluate the asset’s performance using data collected through standard processes within EAM and condition/process monitoring systems. When assumptions or parameters are deviated from, users can be notified if the maintenance or operational strategy needs to change. Meridium RCM/FMEA follows the SAE JA1011 specification for RCM implementation and also provides a streamlined FMEA approach for less critical items.

**Asset Strategy Management and Library**

Meridium’s Asset Strategy Management (ASM) capability provides a better way to manage asset strategies using a risk-based approach. ASM provides a common methodology to define actions and their mitigated risks, with the ability to evaluate existing plans with basic qualitative risk analysis. Managers can validate existing plans or consider strategy options to update plans to be more effective in managing risk through:

- Central management of actions to maintain, operate, monitor and inspect assets based on cost and risk
- Importing existing plans or leveraging strategies developed from other Meridium capabilities including: RCM/FMEA, Risk-Based Inspection (RBI), Safety Instrumented Systems (SIS) and Hazards Analysis
- Managing and improving strategies over time by adding intelligence based on real cost, risk or health data

- The Asset Strategy Library, which includes predefined strategies for over 650 equipment types enabling organizations to easily accelerate the development of intelligent asset strategies

**Asset Strategy Optimization**

Meridium’s Asset Strategy Optimization (ASO) capability extends the qualitative risk/cost analytical capabilities of ASM through advanced, quantitative strategy modeling and simulation for assets and systems, resulting in optimized availability and reliability. ASO optimization routines can help analysts determine the best approach to performing maintenance, inspection or redesign activities. Using ASO, analysts can simulate failure models and asset strategies for multiple scenarios in order to identify the optimum APM policies.
Lifecycle Cost Analysis
Developing and implementing intelligent asset strategies is a vital component of identifying and mitigating the risks associated with equipment failures. Lifecycle Cost Analysis (LCA) enables strategy maintenance costs to be viewed from the perspective of the total cost of ownership of the assets. By contributing to decisions regarding when to repair versus when to replace, intelligent asset strategies can be optimized over the long term, thereby reducing costs for entire sites or fleets over defined accounting periods.

APM Health
Monitor and act
By connecting asset operating and condition data from multiple sources such as controls, monitoring systems and mobile inspections and giving this information context within an intelligent asset strategy, Meridium APM Health reveals an asset’s overall fitness for service, highlighting elevated risk and delivering early warning of potential failures. A workflow automation capability drives rapid situational adjustments based on deep knowledge of asset conditions, minimizing operational disruption, loss of revenue and unplanned maintenance costs.

Asset Health Manager
Meridium’s Asset Health Manager (AHM) capability combines health indicators in the context of known risk factors, inspections and work histories, and complex condition assessments and predictive analyses. Alert acknowledgment and recommendation management allows users immediately to turn information into action, driving rapid, fact-based management decisions to help reduce operational disruption, maximize revenue, and minimize unplanned maintenance costs.

Rounds
Meridium’s Rounds capability provides powerful design features for operator, maintenance, lubrication and other types of inspection routes with:
- Complex routings with conditional logic and flexible scheduling options, ensuring time is not wasted taking readings when not required
• Extensive templating capability to minimize effort in creating and maintaining routes
• Clean and clear data collection interface designed specifically for mobile devices while connected or offline (Data is transferred automatically to the Meridium Enterprise APM database when a connection is available.)
• Immediate notifications for mobile users that a reading indicates deteriorated asset conditions (Users can create recommendations for action, including photos showing current asset condition. Clear and rapid communication of maintenance requirements maximizes avoidance of unplanned downtime and minimizes maintenance expense.)
• Full integration with other APM Health solutions
• Health indicators are created automatically as routes are developed, reducing workload on administrators
• Policies can be triggered as new readings are entered, enabling automated rapid response to changing asset condition

M2M Analytics
Machine-to-machine (M2M) analytics use the power of predictive intelligence to improve plant performance by delivering accurate, real-time data to aid decision making. M2M analytics integrate seamlessly with Meridium’s Asset Health Manager to integrate data from thousands of assets into a single view, so organizations can see a wealth of information on process and equipment health and performance alongside process variables. The notification of potential problems lets users predict, detect and correct conditions that can lead to equipment failure or process upset before they result in unplanned downtime.

Meridium’s Emerson® AMS Analytics capabilities provide out-of-the box analytics and reports that support integration with AMS Device Manager, Machinery Health Manager, Performance Advisor and Performance Monitor.

Meridium’s GE Analytics capabilities provide out-of-the box analytics that support integration with GE’s Bently Nevada® System 1 and GE® SmartSignal.

APM Mechanical Integrity
Keep it contained
Fixed equipment failures represent the majority of failures in many asset-intensive industries, causing not only lost production, but also significant business risk. Integrating mechanical integrity data drives better decisions as to when to inspect certain equipment and what type of inspections to perform. This will not only optimize the costs at a given risk level, but will optimize the scope for major plant shutdowns.

Risk Based Inspection
Risk Based Inspection (RBI) is a methodology that assesses the probability of failure against consequence to optimize inspection activities based upon overall risk. Meridium’s RBI capability provides a complete RBI work process, for
the documentation of corrosion circuits and potential damage mechanisms, the calculation of overall risk with a quantitative and semi-quantitative evaluation, and implementation and execution of the inspection strategy. Meridium provides calculators in RBI, API 581 and Pipeline Management to define risk on fixed assets, linear assets and pressure relief devices. These risk calculators are based on industry standards such as API RP 580, 581, ASME B31.8s and API 1160. Meridium RBI has key work processes and software to not only calculate risk but also to drive the overall RBI program and ensure that intelligent asset strategies are evaluated and updated as equipment conditions change.

**Inspection Management**
The visual surveillance and inspection of assets is a critical element to assessing the condition of those assets. Equally importantly, visual inspection programs also are mandated by regulatory agencies that can levy significant fines for non-compliance. Meridium’s Inspection Management capability provides functionality to manage large-scale inspection programs, providing a means of documenting the frequencies and as-found conditions as well as tracking recommendations resulting from an inspection.

**Thickness Monitoring**
A widely-accepted approach to determining the condition of stationary equipment (piping, vessels, exchangers, tanks, boilers, etc.) is monitoring the wall thickness of the metal. Meridium’s Thickness Monitoring capability provides industry-standard API calculations and measurement management capabilities for stationary equipment condition. Specific calculations include minimum wall thickness, current and historical corrosion rate, next inspection date and retirement date.

**Mobile Inspections**
The surveillance of equipment condition is critical for the detection and prevention of equipment failures and ensuing unplanned downtime. Mobile inspections enable operators and inspectors to capture real-time data electronically, in the field, and allow those who come in contact with equipment on a daily basis to have a direct and immediate impact of the reliability of that equipment.

**APM Safety**
*Keep it safe*
Organizations need to be constantly vigilant about the risk of hazardous incidents in their facilities. Lack of previous incidents is no guarantee against future incidents, so it is essential to monitor process safety performance and respond to warning signals. Hazards analysis became a legal requirement for many global manufacturing industries in the mid-1990s, when standards such as OSHA 1910.119 Process Safety Management were enacted. Organizational safety culture is also increasingly important with changes in the industry, such as mergers, acquisitions, restructuring, outsourcing and downsizing. These changes are driven by tough competition, deregulation, and internationalism.
and require a deeper understanding of links between organizational factors and major hazard risk. These changes can result in loss of in-house expertise and corporate memory, inconsistent standards, dependence on outsourced functions, reduced employee motivation, changes in risk tolerance and a change in process safety management philosophy. Meridium APM Safety provides operational visibility and improved business decisions via intelligent asset strategies that promote a process-safety-minded culture, aimed at reducing hazards and risks associated with industrial processes.

**Hazards Analysis**
As a part of a corporate risk management program and for governmental compliance requirements, hazards analyses are conducted for new and existing manufacturing facilities on a regular basis in order to uncover potentially dangerous situations. Meridium’s Hazards Analysis capability is based on international hazards analysis standards such as IEC 61882 Hazards and Operability Studies Application Guide and is part of the APM Safety solution. It focuses on identifying risks, assessing risk level and managing the reduction of those risks and addresses the need to analyze, maintain, manage and follow through on safety-related recommendations as well as address compliance requirements. Two standard methods for conducting the analyses are available: Hazards and Operability Analysis (HAZOP) and What-if analysis. A standard data loader allows the user to import hazards analyses conducted in applications provided by third parties.

This capability is integrated with Asset Strategy Management and SIS Management to accommodate the “risk definition” phases of the safety lifecycle.

**SIS Management**
The Meridium SIS Management capability addresses the need to manage the reliability and performance of critical process instrumentation and safety instrumented systems (SIS) as well as address compliance requirements. It is based on international industry standards ISA 84/IEC 61511 and IEC 61508. Meridium SIS Management offers safety integrity level (SIL) assessments, safety requirements specification (SRS) project integration, SIL validations and proof testing. With these functions, a closed-loop process for SIS life cycle management is achieved. Meridium also has integrated exida’s Safety Equipment Reliability Handbook database for application of detailed failure rates of thousands of standard instruments. SIS Management also provides comprehensive revision tracking of all SIL elements with the ability to compare changes to versions.

**Mobile Proof Testing**
This capability allows users to carry out proof testing using a tablet device, thereby improving efficiency and reducing transcription errors.

**Calibration Management**
Meridium’s Calibration Management capability optimizes instrument calibration strategies across the entire enterprise to manage traceable and efficient calibration
and provide a standard format for capturing and protecting data. Calibration Management helps fulfill guidelines in international standards such as ISO 9001 (Quality Management System), ISO 14001 (Environmental Management System), IEC 61508, IEC 61511 and ANSI/ISA S84.00.01 (Safety), CFR 21 Part 11 (Food & Drug Administration). The primary functions of this capability address the need for loop and tag management, calibration management and optimization, and reliability analysis of instrumentation. A key aspect of managing instrumentation condition is monitoring calibration results, and Meridium offers a comprehensive, integrated system for large-scale programs. Calibration Management also documents calibration findings, percent of error and pass/fail results. The user also gets advice on calibration interval optimization. To automate field data collection, Meridium provides seamless integration with instrument calibration devices manufactured by Fluke.

Platform Solutions

APM Foundation
Building blocks to assess risk and improve performance
Meridium’s APM Foundation solution is a prerequisite to all other solutions. It provides the infrastructure and framework to support intelligent asset strategies through consistent core analysis and administrative tools for decision support.

A set of core capabilities acts as the foundation for standard work processes, providing a consistent user experience and includes the following tools:

Asset Criticality Analysis
Meridium’s Asset Criticality Analysis assesses and manages the criticality of systems and associated assets. A risk assessment, using a standard risk matrix, defines the criticality for each system and related assets with respect to safety, environment, operations and financial risk consequence categories. This provides a prioritization based on a risk ranking so that your human and capital resources can be effectively utilized on the most important assets and systems.

APM Metrics
Meridium provides a robust framework to apply balanced scorecard principles to APM. Strategies, objectives and key performance indicators (KPIs) can be defined to support the measurement of APM indices such as availability, reliability, lost production, regulatory compliance and asset/strategy cost management. Meridium APM Metrics allows KPIs to be displayed in a dashboard or scorecard layout and provide automatic alerting when thresholds are exceeded so corrective action can be taken. Meridium APM Metrics provides additional benefits including:

- Out of the box KPIs (leading and lagging indicators) which are based on the 4th edition of SMRP Best Practices
- Business Intelligence capability – Out-of-the-box work history OLAP cube (drill-down analysis, slicing and dicing) to reduce downtime and increase productivity. The work history cube content helps in-depth asset analysis and boost the adoption of advanced data analysis for effective asset reliability and maintenance management.

APM Designer
This capability enables calculation of complex asset health indicators, operating window excursion monitoring, and automated analysis including diagnostic and prognostic algorithms implemented in R script. The drag-and-drop user interface simplifies the creation of logic that can be applied across multiple instances and covers a wide variety of applications.

APM Maps
Visualization of physical assets provides a unique contextual reference that enables the user to make associations which are often lost or difficult to find within software applications. Asset visualization associates the physical asset with a geospatial reference and overlaying groups of assets which have geospatial references on a map. Additional map overlays such as weather, topography, and traffic provide the user with an unparalleled view and contextual information related to the physical asset.
**Language Options**

Support for multiple languages within a single database application, allows users in different regions to collaborate and reduces the IT footprint of the solution. Things such as end user help, field captions and tool tips are all localized. Meridium currently supports the following nine languages; English, Italian, Spanish, German, French, Russian, Chinese, Portuguese and Dutch.

**APM Connect**

*Seamless integration between platforms and applications*

Bringing an unprecedented level of connectivity and integration to today’s plant performance landscape through standardized data loaders, adapters and connectors as well as specialized integration services, Meridium APM Connect drives the collection, sharing and consolidation of critical asset information in the most effective manner to drive IT productivity cost and maintenance efficiencies.

- EAM Adapters to extract data from and interact with customer EAMs (SAP®, IBM Maximo®, Oracle®)
- Machine-to-Machine (M2M) Connectors to retrieve real-time historian information from various sources including OPC, Emerson AMS, and GE Bently Nevada System 1
- In addition to the standard product integrations listed above, APM Connect provides extract, transform, load (ELT) and enterprise service bus (ESB) capabilities that support robust custom integrations developed and supported by the Integration Center of Excellence (ICE).

These enterprise APM solutions enable our customers to see a clearer picture of their assets’ performance and overall operations. By integrating disparate systems, applying analytics and machine learning, and implementing intelligent asset strategies, your organization can create a continuous loop of improvement for improved safety, increased availability, and cost optimization. Are you ready to take your APM program to the next level? Let us help.
To learn more about next generation of Meridium Enterprise APM, visit

www.meridium.com/nextgenapm

Meridium is the global leader in asset performance management software and services for asset-intensive industries. Meridium lowers the risk of harm to people, our planet and profits by predicting and preventing physical asset failures. With Meridium’s unique enterprise analytics, our clients minimize production downtime while improving safety.

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