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Asset Performance Management 4.0 and Beyond with Risk-Based Maintenance

WHITE PAPER

JANUARY 2019

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Executive Summary

In any asset-intensive industry, businesses are pressured to continually improve asset performance and reliability; all while minimizing costs and ensuring regulatory compliance. In this environment, optimizing maintenance is critical. New technologies such as cloud, big data management, complex systems modeling and advanced analytics and concepts such as the Industrial Internet of Things (IIoT) and Industry 4.0 offer users the ability to strategically plan, forecast and optimize their maintenance. Leveraging these new technologies enables the evolution beyond traditional reactive maintenance and towards proactive maintenance. This is the future of maintenance, operations and asset management – Asset Performance Management (APM) 4.0

INTRODUCTION

APM 4.0 in Action

In an increasingly competitive market, organizations across multiple industries need to be able to take the bold steps necessary to optimize their maintenance strategies and operations. A rigorous, risk-based maintenance solution that can evaluate how cost, risk and performance should be balanced over time to deliver sustainable outcomes isn't a choice any more, but a necessity. Implementing Asset Performance Management (APM) 4.0 enables the transition to full risk-based maintenance for improved asset performance, increased asset reliability, reduced risk and ultimately maximum return on asset investments.

Innovative companies are reaping the significant benefits of implementing proactive maintenance strategies today. When a major dairy company implemented risk-based maintenance, the result was 30% spare parts cost reduction and a 3% increase in productivity in the first year. The investment paid for itself sevenfold on a yearly basis, and the APM implementation also initiated a systemic cultural shift as the existence of extensive data libraries enabled a companywide culture of risk awareness, asset responsibility, and problem ownership.

THE MAINTENANCE MATURITY PYRAMID AND APM 4.0

When discussing APM 4.0, it's important to first consider the five levels of maintenance, the value of each approach and where they fit into a comprehensive maintenance strategy. The maintenance maturity pyramid helps to visually represent the journey towards more proactive and optimized maintenance execution, all of which should be embedded in a solid asset management system based on ISO 55000. Enterprise-wide data management, risk management and mitigation form the foundation for a comprehensive APM strategy.

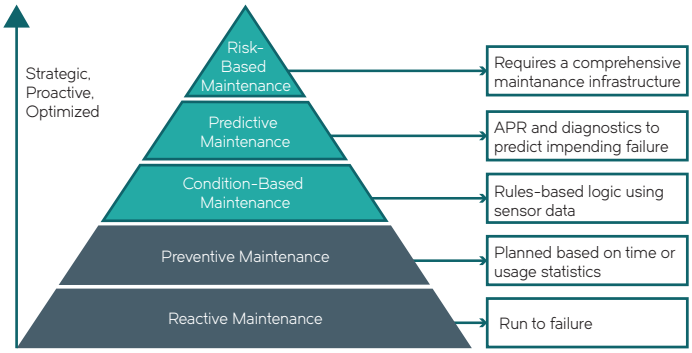

Figure 1

The Maintenance Maturity Pyramid illustrates the multiple levels of maintenance that fit into a comprehensive maintenance strategy.

At the bottom of the maintenance maturity pyramid is the most basic approach, **reactive maintenance**. Reactive maintenance involves letting an asset run until it fails, then repairing or replacing it. This is suitable for non-critical assets that have little to no immediate impact on safety or plant availability and have minimal repair or replacement costs. However, the drawbacks of reactive maintenance are clear, as it is completely unsuitable for high-cost or mission-critical assets.

The next level of maintenance maturity is **Preventive Maintenance**, which is regularly scheduled maintenance implemented in hopes that an asset will not reach the point of failure. The preventative maintenance strategy prescribes maintenance work to be conducted on a fixed time schedule or based on operational statistics and manufacturer/industry best practice recommendations. However, if preventive maintenance is not optimally implemented, it can either be applied too frequently, leading to large maintenance costs, or

infrequently, causing potential issues. Preventive maintenance can be managed in the Enterprise Asset Management (EAM) or Computerized Maintenance Management System (CMMS)

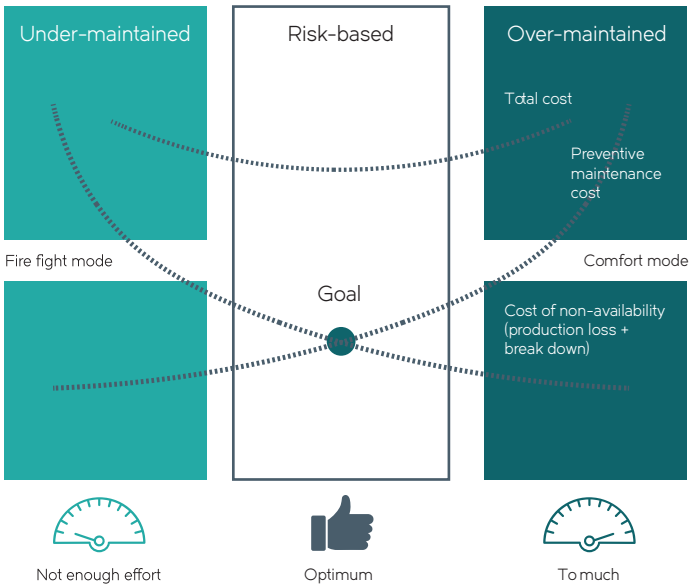

Figure 2

Hitting the sweet spot with optimized maintenance based on acceptable risk.

Some equipment failure patterns are not related to aging or usage and appear to happen randomly, hence **Condition-Based Maintenance** (CBM) is sometimes recommended. CBM focuses on the physical condition of equipment and how it is operating and is ideal when measurable parameters are good indicators of impending problems. The condition is typically defined using rule-based logic, where the rule does not change depending on loading, ambient or operational conditions. If the condition is met, work orders can be automatically generated to help mitigate risk and proactively resolve potential problems.

For more complex and critical assets, a predictive strategy is appropriate. Using **Predictive Maintenance** (PdM), organizations can move from asking "Why did that happen?" to "What will happen?" Predictive maintenance solutions learn an asset's unique operating profile during all loading, ambient and operational process conditions. Existing sensor data is compared to real-time operating data using advanced analytical modeling techniques to determine and alert upon subtle deviations from expected behavior. Once an issue is identified, root cause analysis and fault diagnostics help the user to determine the significance of the problem and the resulting course of action. These early warning notifications enable users to address issues before they become problems that significantly impact operations.

At the very top of the maintenance maturity pyramid, the implementation of risk-based maintenance involves a comprehensive maintenance strategy that leverages existing data, advanced analytics and simulations and forecasts to understand the true issues driving asset performance and reliability. By implementing risk-based maintenance, organizations can move beyond preventing failure, and towards optimizing future performance – from "What will happen?" to "What should we do?" This moves the asset from a cost center to a major driver of profitability for the business.

Risk-Based Maintenance

Implementing Risk-based maintenance delivers numerous benefits for organizations. First, getting the most out of your existing production assets is a key success factor in achieving business objectives. Risk-based solutions allow companies to prioritize asset management by focusing on the assets that need attention. Advanced asset criticality analysis ensures the most important assets receive priority and more rigorous analysis for optimal maintenance. When asset failures occur, root cause analysis enables users to quickly diagnose the cause and act to eliminate reoccurring incidents. Inventory management quantifies the effect of spare parts to optimize asset management levels.

The second key benefit of risk-based maintenance is strategic. By practicing a future-focused, risk-based asset management strategy, users can perform detailed analysis and simulations to visualize the effects of deploying different asset management strategies, and ultimately, achieve short-term efficiencies and long-term sustainability. In-depth risk analysis provides detailed insight into the real factors driving asset reliability and performance, facilitating long-term planning. Extensive simulation capabilities allow users to see the impact of differing asset management approaches, enabling an aligned strategic approach to operations and asset management.

"How do we allocate resources efficiently and fairly between competing short- and long-term (commercial, social, environmental) interests?" is one of the largest pain points of asset-intensive industries. Therefore, it is important to consider the role and impact of accurate financial forecasts, as unexpected shifts in CAPEX and OPEX budgets can derail even the most well-laid asset management plans. Advanced risk-based maintenance tools allow users from different business units to design, simulate, measure and optimize CAPEX and OPEX assessment plans, ensuring that asset management plans accurately reflect the likely financial future. Risk-based maintenance technologies can provide quick time to value – a solution with an extensive library of readily available reliability data can speed up deployment time by up to 90%.

Providing Closed-Loop Optimization

A comprehensive APM solution enables an APM 4.0 approach by ensuring that maintenance strategies are deployed in the most efficient and effective manner possible. APM solutions manage the collection of data from any number of sources, incorporate advanced analytics technology that combine rules-based logic and machine learning, and can trigger actions in the work order system to manage asset lifecycle and maintenance processes. These solutions help maintenance teams, systems engineers, controllers and many others take advantage of the massive amounts of data available today and use it to answer questions and make real-time decisions to maximize asset reliability and performance.

Using APM, engineers can identify and predict asset failures early, so personnel can spend less time sifting through raw data and more time resolving issues. Integration with advanced workflows facilitates the continuous improvement process, constantly driving improved operational excellence. An open-ended and hardware-agnostic solution enables easy integration with existing systems.

On the front end of an APM implementation, conducting an APM Assessment can be an invaluable tool in getting started. A good APM Assessment will evaluate all facets of a company's asset management strategy, including the business context, to determine potential areas of improvement. Experienced consultants will distill these findings into a thorough action plan, providing an ideal guide for companies looking to take the first step.

CONCLUSION

Asset intensive industries are under continuous pressure to improve the operations of their assets while maintaining regulatory compliance. Leveraging new technologies such as cloud, big data management, machine learning and analytics can drastically improve the enterprise's ability to strategically plan, forecast and optimize maintenance strategies to improve asset performance management.

About the Author

Kim Custeau, With over 30 years of experience in industrial asset management software and services, she is currently responsible for the strategic direction, commercialization and development of AVEVA's asset management software portfolio globally; delivering solutions that help customers maximize asset reliability and performance.

About AVEVA

AVEVA is a global leader in engineering and industrial software driving digital transformation across the entire asset and operational lifecycle of capital-intensive industries.

The company's engineering, planning and operations, asset performance, and monitoring and control solutions deliver proven results to over 16,000 customers across the globe. Its customers are supported by the largest industrial software ecosystem, including 4,200 partners and 5,700 certified developers. AVEVA is headquartered in Cambridge, UK, with over 4,400 employees at 80 locations in over 40 countries.

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