

PREDICTIVE MAINTENANCE FOR IMPROVED PERFORMANCE IN OIL AND GAS

WHITE PAPER

September 2018

Kim Custeau, Director of Information
and Asset Management, AVEVA

Executive Summary

This white paper will discuss the evolution of maintenance strategies, including the use of advanced pattern recognition and machine learning technology to enable the shift to more proactive and optimised strategies. Moving to a Predictive Maintenance strategy helps asset intensive organisations increase asset performance, reliability and availability to ultimately maximise economic return.

AVEVATM



INTRODUCTION

In the midst of tough economic times, oil and gas businesses are facing an urgent need to operate at the highest levels of efficiency while increasing productivity and controlling costs. They want to limit downtime and minimise risks to safety and the environment. While there are a number of challenges facing the industry, including digital disruptions and financial uncertainty, applications enabled by the Industrial Internet of Things (IIoT) can provide significant performance and reliability improvements.

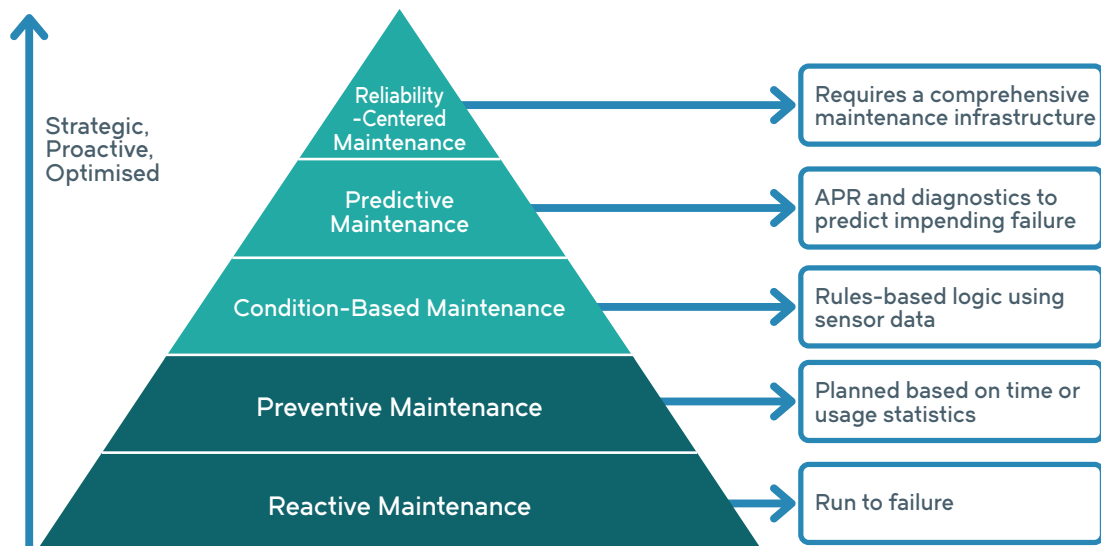
From an asset performance management (APM) perspective, organisations are leveraging industrial data and advanced analytics to keep equipment running safely and reliably for as long as possible. This is made possible through data collection and analysis for predictive maintenance execution, consequently empowering personnel to act before equipment failure occurs.

Smarter Maintenance

Oil and gas operations require a diverse set of complex assets. In many cases these operations are in remote and hard-to-access locations, where monitoring equipment health and performance presents a substantial challenge. Whether the asset is an offshore pumping station, compressor, drilling rig, transportation equipment, pipeline booster station, or any other critical piece of equipment throughout the upstream, midstream and downstream processes, real-time health and performance insights can be used to influence decisions and actions that drive efficiencies and improve competitive advantage. This asset health data is already being created and can be used in maintenance and asset management programs to mitigate risks and ensure that critical equipment is operating as expected.

Enterprise APM solutions integrate all the various elements of a comprehensive maintenance program, making valuable information accessible and delivering context for smarter decisions. It requires a broad portfolio to collect data on assets, analyse it, determine the next course of action and use that action to further refine and optimise processes. This continuous improvement program is outlined with the Maintenance Maturity Pyramid.

The higher you move up the Maintenance Maturity Pyramid, the more proactive the strategy becomes and the more advanced warning of equipment problems is required. This enables maintenance teams to better plan resources, order materials, and minimise unplanned events.





A smart, comprehensive maintenance program includes several approaches that are appropriate for various types of equipment with the goal of obtaining the greatest return on each asset. The most basic approach, reactive maintenance, involves letting an asset run until failure. It is only suitable for non-critical assets that have little to no immediate impact on safety and have minimal repair or replacement costs so that they do not warrant an investment in advanced technology.

On the other hand, Preventive Maintenance (PM) approaches are implemented in hopes that an asset will not reach the point of failure. The preventive maintenance strategy prescribes maintenance work to be conducted on a fixed time schedule or based on operational statistics and manufacturer/ industry recommendations of good practice. Preventive maintenance can be managed in the Enterprise Asset Management (EAM) or Computerised Maintenance Management System (CMMS).

A more proactive approach, Condition-Based Maintenance (CBM) focuses on the physical condition of equipment and how it is operating. CBM 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.

For more complex and critical assets, a predictive strategy is appropriate. Predictive Maintenance (PdM) relies on the continuous monitoring of asset performance through sensor data and prediction engines to provide advanced warning of equipment problems and failures. PdM typically uses Advanced Pattern Recognition (APR) and requires a predictive analytics solution for real-time insights of equipment health.

Risk-Based Maintenance (RBM) is a comprehensive prognostic strategy that allows plant operations and maintenance personnel to make decisions using PdM, CBM and PM outcomes. As a result, the planning for maintenance and the operation of equipment is more reliable and safe.



Predictive Analytics

Using a predictive asset analytics solution in support of a PdM strategy can lead to the identification of issues that may not have been found otherwise. According to research by ARC Advisory Group, only 18 percent of asset failures had a pattern that increased with use or age (Rio, 2015). This means that preventive maintenance alone is not enough to avoid the other 82 percent of asset failures, and a more advanced approach is required. Predictive analytics software uses historical operational signatures for each asset and compares it to real-time operating data to detect subtle changes in equipment behavior. The software is able to identify changes in system behavior well before traditional operational alarms, creating more time for analysis and corrective action.

WHAT COSTS COULD YOU AVOID THROUGH EARLY WARNING NOTIFICATION?

\$4,000,000+ avoided through early identification of power generation turbine blade damage

\$500,000+ avoided due to early identification of a plant motor coupling approaching failure

\$250,000 avoided due to early warning of a bearing seal differential pressure problem

\$243,000+ avoided by early identification of improper control valve positioning

\$370,000 avoided due to early warning of pump feedwater heater and bypass valve problems

\$250,000 savings per year through identification of pump inefficiencies for thermal performance improvements

\$50,000+ avoided through performance optimisation

Monitoring & Diagnostics Services

Organisations that are not equipped to handle the monitoring process internally due to resource limitations or other constraints can take advantage of monitoring and diagnostics services offered by AVEVA Software. AVEVA's Monitoring & Diagnostics Services Center (MDSC), located in Chicago, offers comprehensive monitoring and diagnostics services for all asset types, regardless of equipment manufacturer. Companies can outsource the monitoring and diagnostic services completely or leverage the center for supplementary assistance every step of the way from model training, to diagnostics, to best practices and recommendations. Our team of experts can be utilised for 24x7 monitoring to provide early warning notification of equipment problems.

Health and Performance Optimisation

Predictive asset analytics software solutions improve performance by providing early warning notification of equipment issues and potential failures. AVEVA's solution is built on an algorithm called OPTiCS that uses Advanced Pattern Recognition and machine learning technology. The software learns an asset's unique operating profile during all loading, ambient and operational conditions through the advanced modeling process. The result of the modeling process is a unique asset signature that is compared to real-time operating data to determine and alert upon detection of subtle deviations from expected equipment behavior. Avantis PRiSM is an intuitive system designed so that the user can easily configure it to monitor different types of equipment with no programming or highly detailed equipment knowledge.

Predictive analytics enables personnel to address subtle variations in equipment behavior before they become problems that significantly impact operations. Unscheduled downtime can be reduced because personnel receive early warning notifications of developing issues. Avantis PRiSM can identify problems days, weeks or months before they occur, creating time for personnel to be proactive. Maintenance costs can be reduced due to better planning; parts can be ordered and shipped without rush and equipment can continue running. Additionally, some suggested maintenance windows can be lengthened as determined by equipment condition. Other benefits include increased asset utilisation and the ability to identify underperforming assets.

Not only do companies improve their profitability by extending equipment life, lengthening maintenance windows, and increasing asset availability, other benefits are realised when considering the costs that "could have been," including replacement equipment, lost productivity, additional man hours, etc., when a major failure is avoided. Another increasingly important benefit is the capability for knowledge capture and transfer. Avantis PRiSM ensures that maintenance decisions and processes are repeatable even when organisations are faced with transitioning workforces, and the loss of experienced workers with critical institutional knowledge of the operations and maintenance of the organisation's facilities.



@avevagroup



linkedin.com/company/aveva

Conclusion

Smarter Operations, Now and in the Future:

As the IIoT continues to enable smarter equipment that creates increasing amounts of data, oil and gas companies are faced with both challenges and opportunities to leverage that data to mitigate risk and improve productivity. With predictive analytics insights, personnel know and understand the actual and expected performance for an asset's current ambient, loading and operating conditions. They know where inefficiencies are and their impact on financial performance and can use this information to understand the impact of performance deficiencies on current and future operations. This information also helps users assess the risk and potential consequences associated with each monitored asset and can be used to better prioritise capital and operational expenditures.

References:

Rio, Ralph (January 2015). "Proactive Asset Management with IIoT and Analytics," ARC Advisory Group Retrieved from: www.arcweb.com/blog/proactive-asset-management-iiot-analytics

Learn more about our oil and gas industry solutions at: sw.aveva.com/oil-and-gas

About the Author

Kim Custeau, Director of Information and Asset Management, AVEVA. Kim has 30+ years of experience in industrial asset management software and services. She is currently responsible for the strategic direction, commercialisation and development of AVEVA Software's information and asset management software portfolio globally, delivering solutions that help customers maximise asset reliability and performance. She graduated with a degree in Business from Mohawk College in Hamilton, Ontario.

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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