

## WHITE PAPER

# Maximum efficiency, mitigate downtime: How predictive asset optimization is transforming operations

### Authored by:

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### Executive summary:

In today's fiercely competitive business landscape, downtime and unexpected equipment failures can be catastrophic. Every interruption in operations translates to wasted time, lost revenue, and missed opportunities. Taking a reactive approach to asset management and maintenance is no longer viable. Instead, businesses must adopt a proactive stance to stay ahead of the curve. Now, companies are turning to predictive asset optimization as a crucial strategy to mitigate downtime risks while optimizing production.

## What is predictive asset optimization?

Predictive asset optimization (PAO) combines artificial intelligence (AI) and machine learning to analyze historical asset data to predict future behavior. By analyzing data captured from sensors, machinery, and various sources, PAO takes a model-driven approach to understand current performance and identify patterns that signal potential issues long before failure

occurs. Using first-principles models, PAO accurately predicts process behavior and equipment failures—and determines the optimal timing for maintenance activities.

With PAO, companies can detect issues sooner, schedule maintenance and repairs at convenient times, minimize planned and unplanned downtime, mitigate asset failures, and improve overall customer satisfaction.

## The power of PAO: How it works



### Predictive Analytics:

By analyzing historical data and using advanced algorithms, PAO provides businesses with valuable insights to determine optimal timing for equipment upgrades, replacements, or repairs. Instead of taking a reactive approach, predictive analytics allow companies to plan downtime when it's convenient, keep that downtime as short as possible, and maximize overall productivity.



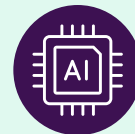
### First-principles simulation models:

PAO accurately predicts equipment and process behavior using first-principles simulation models. These models capture intricate details of physical processes, detect potential problems, and simulate various scenarios to determine the optimal time for maintenance activities. With PAO, companies can go beyond the traditional maintenance approach to optimize processes and extend asset lifespan—all while improving uptime, safety, and profitability.



### Visualization:

By providing clear visualization of data and insights and making complex data visually appealing and easy to understand, businesses can use PAO to quickly grasp the health and performance status of their assets. Users can easily identify anomalies, trends, and potential risks so they can allocate resources, optimize maintenance schedules, and drive continuous improvement.



### Artificial intelligence (AI):

Using AI algorithms, PAO analyzes vast amounts of data from multiple sources, including sensor readings, historical records, and operational parameters to identify hidden patterns, correlations, and anomalies that may go unnoticed by traditional analysis. Not only does this increase the accuracy of risk analysis and early issue detection, it also enables continuous improvement. By feeding back the insights gained from PAO into the design and optimization of future assets, organizations can continue to achieve greater levels of operational efficiency.

In today's fast-paced business environment, PAO gives companies a competitive advantage and paving the path for long-term success.

# Optimized assets equal optimal profits

## Maximize asset utilization with predictive optimization

The more efficiently and effectively a business utilizes its assets, the greater its potential for success. PAO offers a comprehensive view of asset performance and enables predictive optimization, allowing users to determine which assets are underutilized so they can fine-tune operations, maintenance, and repair strategies, as well as eliminate bottlenecks, to ensure assets are operating at peak potential. When assets are operating at optimal levels, productivity is higher and costs are lower, resulting in smoother workflows, faster turnaround times, and greater output.

## Leverage performance equations for component-level performance calculations

Integrating performance equations into predictive analytics gives users access to industry-standard equations and a full thermodynamics library that currently specializes in thermal power applications. Because performance equations integrate thermodynamic principles and measure beyond traditional sensor inputs and outputs, users can detect more nuanced deviations and anomalies earlier—and with greater clarity and context. This context makes maintenance planning easier, ultimately reducing costs and downtime.

With enhanced predictive capabilities in hand, users can improve asset management, proactively identify performance issues, maximize outcomes and uptime, and increase profitability.

## Optimize entire systems or subsystems

In the past, businesses focused on optimizing individual equipment without considering the larger impact on the overall system's performance. This fragmented approach often resulted in suboptimal efficiency, increased costs, and missed opportunities for improvement. PAO allows users to analyze individual asset performance and address concerns while understanding how each asset interacts within a larger system or subsystem.

By leveraging data from diverse sources such as sensors, historical records, and real-time monitoring, PAO can identify potential issues before they escalate into significant problems while optimizing the entire system or subsystem.

With asset and system-level insights, businesses can identify bottlenecks, streamline workflows, and ensure the assets and system are operating at peak potential.

### Optimizing an interconnected web of manufacturing assets

A manufacturing plant that relies on a series of interconnected machines to produce a complex product. Without PAO, each machine would be optimized independently, disregarding the impact of its performance on the overall production line. Using PAO can help workers optimize the entire production line, considering the individual performance of each machine and its contribution to the overall process. This systemic approach unlocks significant improvements in efficiency, quality, and cost savings.

## Reduce risk and increase profits

Every business understands the detrimental impact of equipment failures and unexpected downtime on productivity, efficiency, and profitability. The inherent risks associated with unpredictable failure rates present significant challenges. By using advanced analytics and machine learning (ML) algorithms to analyze real-time data from sensors and various sources, PAO helps users identify equipment issues before they escalate, mitigating potential safety issues and ensuring compliance with regulatory requirements.

PAO enables companies to achieve high equipment uptime and reduce maintenance costs, ensuring smooth operations and maximizing productivity, all while protecting businesses from significant finds and safeguarding employee well-being.

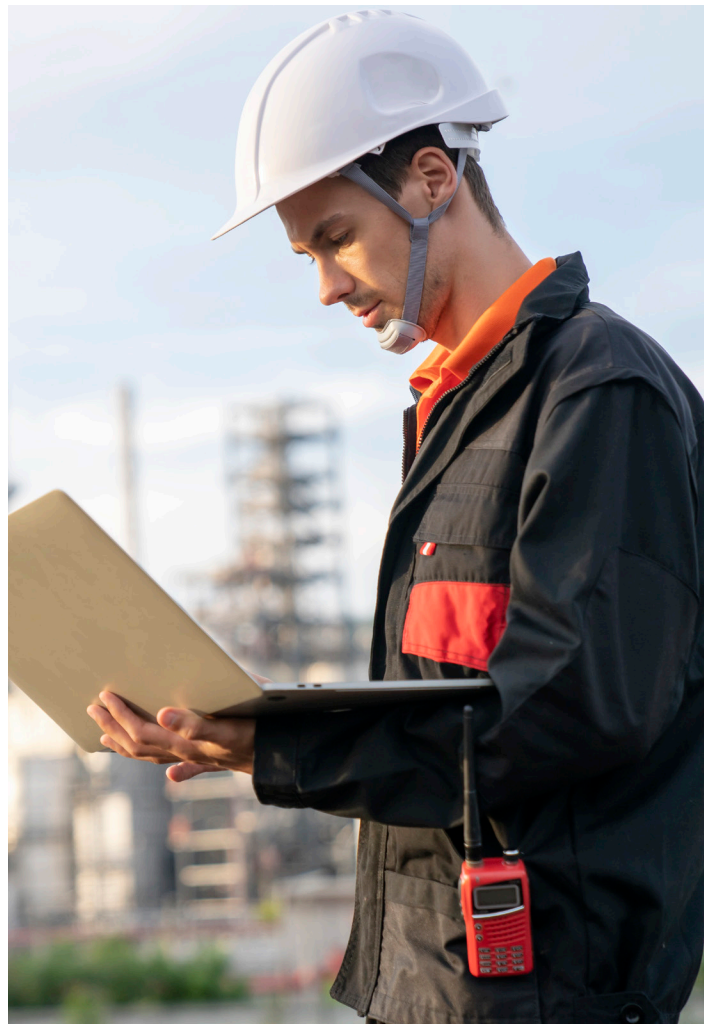


## Unlock maximum efficiency

Maximizing efficiency is paramount for any company, and PAO plays a crucial role in helping businesses achieve peak efficiency by providing valuable insights into the performance and health status of their equipment. By analyzing data from equipment sensors, maintenance logs, and other relevant data sources, users can detect underutilized assets or equipment that is being subjected to excessive workloads, leading to decreased efficiency and increased wear and tear. With access to real-time insights, users can pinpoint which equipment requires attention or replacement and track equipment usage and performance over time, revealing long-term trends and highlighting potential areas for improvement.

### What about extensive and intricate equipment fleets?

Managing thousands of pieces of equipment manually can be a daunting task, making it challenging to track performance and maintenance needs effectively. PAO automates this process, providing businesses with a comprehensive view of their equipment's health and performance in a streamlined manner.





## Suncor: Optimizing operations using PAO solutions

### Benchmarking gas turbine performance with predictive analytics

For Suncor, making informed operational decisions regarding maintenance and upgrades is critical to maintaining profitable operations. However, monitoring and isolating gas turbine performance degradation posed a significant challenge. Gas turbine operations are complex, with continuous changes in operating points that are influenced by external factors, making it difficult to accurately pinpoint performance degradation. To tackle this challenge, Suncor implemented predictive asset optimization.

By implementing first-principles-based KPIs, such as power output, heat rate, and compressor efficiency, Suncor successfully isolated degradation in various sections, including air inlet, compressor, combustion, and turbine. While that was a critical first step, Suncor was unable to configure the models to measure degradation while accounting for day-to-day operating point variations. In response, Suncor implemented a high dynamic range model using rated performance.

This PAO-enabled strategy used OEM performance curves, curve fits, surrogate-rated performance data sets, and model training to predict turbine performance. This approach provided valuable insights into degradation that traditional anomaly detection methods could not accurately detect.

By differentiating changes in performance from operating point variations, Suncor can now make informed decisions on its maintenance strategies, optimize gas turbine performance, and maximize operational efficiency.

### Improving sustainability by accurately predicting emissions

Suncor's commitment to sustainability extends beyond optimizing gas turbine performance. Aiming to drive further environmental change, Suncor used PAO-enabled tools to predict greenhouse gas emissions. While the company already used predictive analytics for its emissions, Suncor went one step further by integrating predictive analytics into a hybrid digital twin. The hybrid digital twin enabled Suncor to predict greenhouse gas emissions with remarkable precision, better understand factors that influence emissions, and make data-driven decisions to minimize environmental impact.

By increasing its emissions prediction accuracy, Suncor not only ensured its processes were aligned with its sustainability goals, but also extracted valuable insights to optimize processes. By better understanding its emissions and underlying influences, Suncor was able to implement targeted measures to reduce emissions, lower costs, and enhance overall operational efficiency.

[Watch the presentation](#)

## Predictive asset optimization with AVEVA

AVEVA™ Predictive Asset Optimization combines AI with process optimization software to improve predictive maintenance and help detect equipment behavior anomalies and predict failure weeks or months before they occur. AVEVA's portfolio of AI-driven PAO models is designed to optimize equipment, processes, and plants by generating deep insights into asset health.

With these insights, production and maintenance managers can better plan and prioritize maintenance activities to minimize production disruptions and avoid unplanned downtime because of equipment failure.

### AVEVA's comprehensive portfolio of predictive asset optimization tools includes:

- AVEVA™ Process Optimization provides rigorous first-principles simulation models
- AVEVA™ Process Simulation provides precise first-principles steady-state simulation models
- AVEVA™ Predictive Analytics provides AI-powered insights to maximize asset reliability and prevent unplanned downtime
- AVEVA™ Insight provides simple, seamless visualizations even for novice users

## Conclusion

PAO-enabled operations strategies are already changing how many companies run—and its importance will only continue to grow. Using data-driven insights to make informed decisions, users can stay one step ahead of potential equipment failures and prevent costly disruptions. By optimizing equipment usage, businesses can streamline operations, reduce inefficiencies, and maximize productivity, which will directly impact bottom-line results. When businesses invest in PAO, they are investing in a sustainable, optimized future that paves the path for growth, risk reduction, and increased profitability—all of which enable long-term success.

### About the author

Joseph McMullen, Senior Marketing Manager at AVEVA. Joe leverages his chemical engineering degree and his experience to understand customer problems to position potential solutions. Joe is passionate about technology, the digital transformation of industry, IIoT, SaaS, marketing, and solving customer problems. Joe has a Bachelor's degree in Chemical Engineering and an MBA from Villanova University. Joe has worked for AVEVA since 2001 with positions in technical support, product management, and various marketing leadership roles.