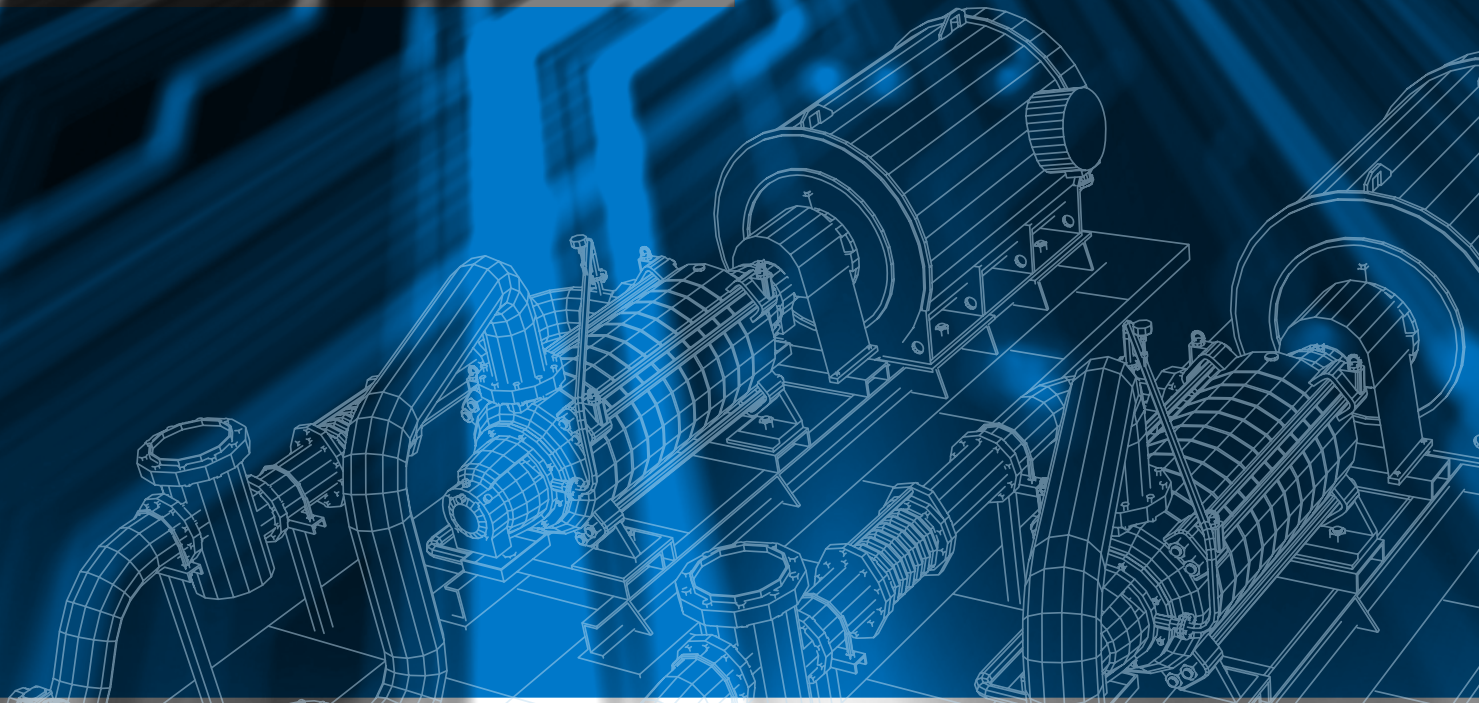


 | Brochure

Aspen Mtell[®]

Updated to include Aspen Maestro[™] for Mtell



Predictive Maintenance to Increase Safety, Improve Asset Performance and Reduce Emissions

Using predictive maintenance technology, **Aspen Mtell** delivers the earliest, most accurate warning of equipment failures. It also uses machine learning to recognize precise patterns in operating data that indicate degradation and impending failure—well before it happens. Aspen Mtell is proven across many industries, including energy, chemicals, mining, pharmaceuticals, pulp & paper, power and others.

Key Features of Aspen Mtell

Aspen Mtell recognizes leading indicators of potential asset failure and alerts plant staff weeks (or even months) prior to breakdown. Advance warning gives staff time to plan maintenance and reschedule production to minimize unplanned downtime and financial impact.

With Aspen Mtell you can accurately predict precisely when a known failure will occur, how the failure will occur and what to do about it. Aspen Mtell is derived from prescriptive advice such as the exact Failure Code directly linked from the EAM system.

Two additional features: Aspen Mtell does not require detailed models of the assets and the solution can be configured by your team, without a cadre of data scientists.

A Wider Window of Warning

Unplanned downtime prevention and mitigation requires organizational alignment. The early warning provided by Aspen Mtell's predictive maintenance technology gives users time to alert and align stakeholders to the issue. With a wider window of warning, it's possible to plan any needed maintenance in a way that considers Operations, Maintenance, Technical and Planning/Scheduling Departments and HS&E. The additional time and information enable effective collaboration for better remediation and timing decisions.

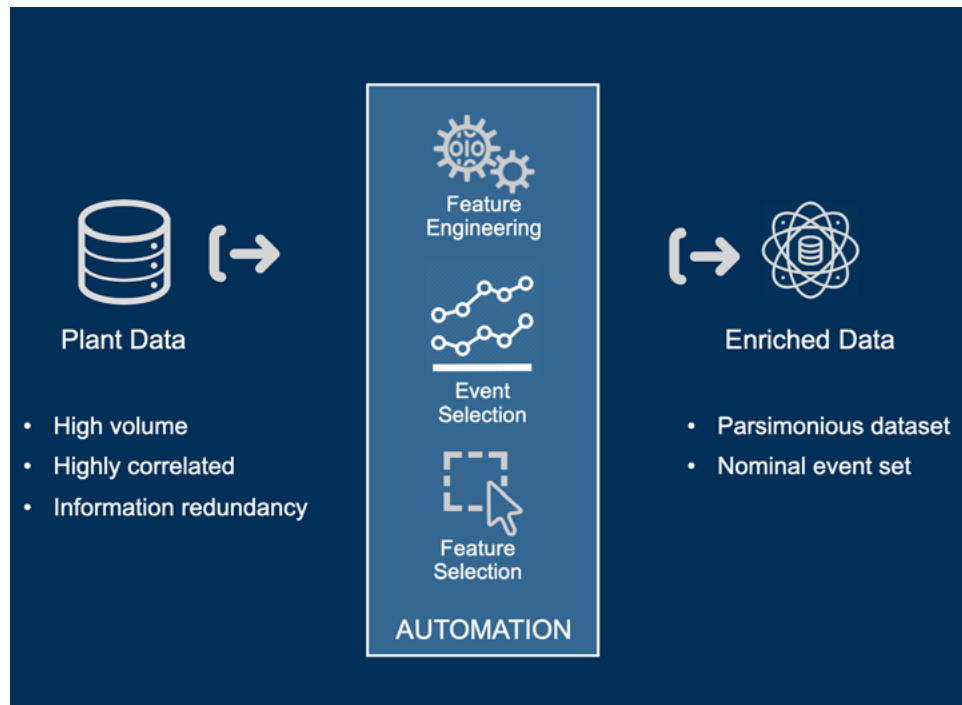


Challenge: Scalability and Limited Foresight of Most Solutions

In its infancy, predictive maintenance suppliers focused on proving their technology's ability to accurately predict asset failures. Now, in the next stage of technology maturity, prediction accuracy has become table stakes. The conversation today is focused on scalability.

With some approaches taking weeks to months to develop the predictive models for a single asset, scalability becomes critical. Assuming that prediction accuracy and lead times are base requirements, the financial success of predictive maintenance becomes a matter of how to roll out across hundreds or thousands of assets and potentially dozens of plants.

Aspen Mtell is unique in its scalability, as it can be deployed cost-effectively on primary and secondary assets. By focusing beyond the most important assets, small problems can be identified and mitigated before they become large problems—and near misses can be avoided. With Aspen Mtell's broader coverage across the base of assets comes better protection against the events that drive most plant accidents and emissions exceedances—shutdowns and startups.



Solution: Aspen Maestro for Mtell

Aspen Maestro is a breakthrough collection of features within Aspen Mtell, which can assist users in building prediction Agents. Aspen Maestro tackles the three biggest barriers in successful model building: data selection, data cleaning and creating context by incorporating domain expertise.

Aspen Maestro's AI streamlines data preparation by automatically identifying:

- Most important sensors
- Minimal number of inputs to find a good Agent
- Data regions for testing and training
- Tuning of hyperparameters
- Sampling frequency needed for analysis

Build Better Agents Faster

Data analysis can get bogged down in identifying, selecting and preparing data. Typically, these tasks can consume 50% or more of the time spent doing analysis. Aspen Maestro for Mtell streamlines and automates much of that data preparation. Through automated workflows, time and effort is minimized while reducing the skills and experience required by the end users. Aspen Maestro also tackles the selection of the hyperparameters that control the machine learning algorithm.

Aspen Mtell uses analysis to determine the most important sensors and identify a minimal set of inputs that result in a good Agent. In training Agents, the historical data must be segmented and Aspen Maestro automates that workflow.

Automate Feature Selection

Aspen Maestro also automates feature selection. In data modeling it often helps to use the data to enforce or identify key engineering principles and relationships. For example, if the difference in pressure between two points in the process is a key concept, you can create a pseudo variable for ΔP and use that in lieu of the two individual pressure readings. Aspen Maestro automatically identifies significant features.

Leverage Domain Expertise

Aspen Maestro allows users to incorporate domain knowledge. If there are key engineering equations pertinent to the analysis, they can be incorporated into the Agent. This is also a key capability that enables you to leverage your know-how and, importantly, leverage the know-how of other experts.

Identify True Patterns Based on Historical Data

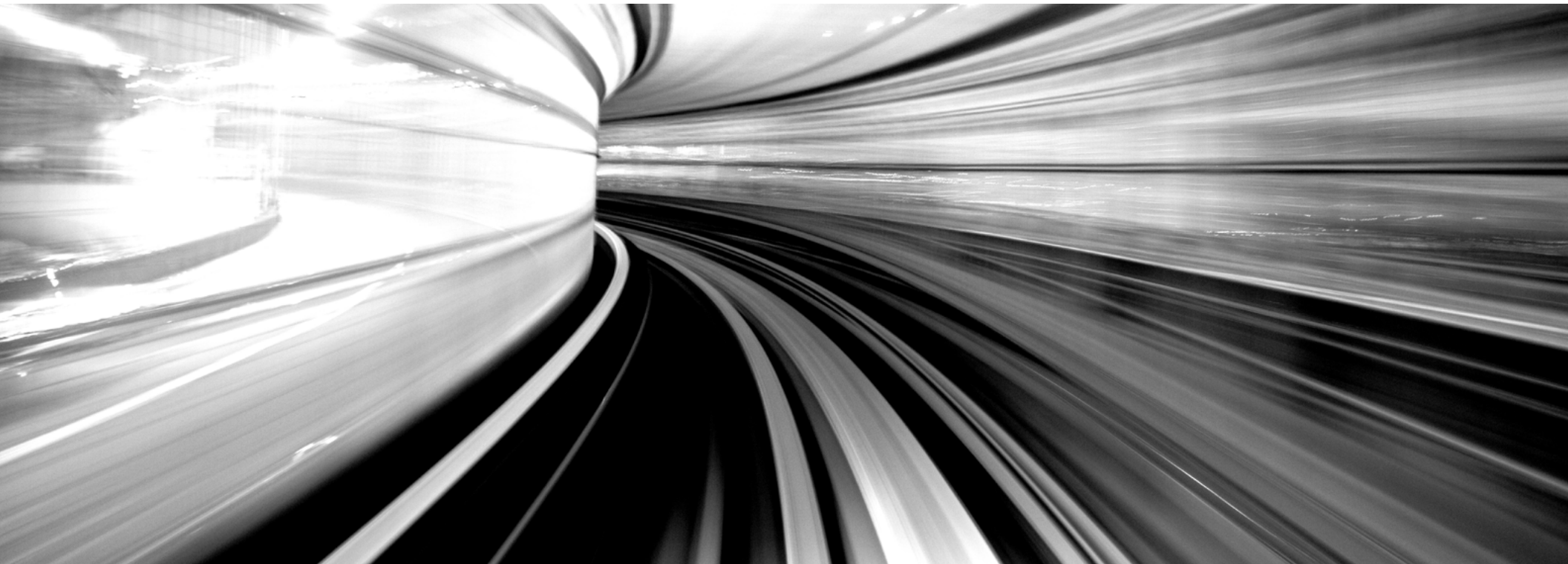
Most condition monitoring products only detect anomalies by trying to identify when actual behavior differs from what's expected. The most common approach is to use mathematical/statistical models based on engineering, thermodynamic and heat/mass balance equations. Such models typically contain inaccuracies; they also fail to factor in process changes. This approach has major weaknesses in scalability from building the initial models to maintain them over time.

In addition, many of these products tend to rely on simulations rather than true patterns based on historical data. As sensors capture information about operating conditions, these products don't analyze that data to change the patterns they seek and only speculate on time-to-failure because they lack Aspen Mtell's inherent precision.

The modeling limitations of many systems can result in frequent false positives, failure to detect many issues, lack of detail and clarity, and only late-stage warnings. With short lead times, alerts are often received only after damage has already occurred. Often such systems incorporate rules engines in an attempt to reduce errors. However, this technique does not adjust or adapt the accuracy of the core models.

Implement Easily, See Results Faster

In addition, other systems invariably require expert skills and knowledge of industrial equipment, creating models and building rules to constrain outputs. Aspen Mtell is far simpler to implement and offers more impressive and earlier payback.





Autonomous Agents Accurately Predict Failures

Agents in Aspen Mtell are designed to do more than just anomaly detection. Failure Agents detect the actual behavioral patterns that begin early in root cause conditions that lead to very specific failures, e.g., a bearing failure. Such patterns are not unique to a single piece of equipment and Agents can learn on one and share with many in a pool of similar assets.

Aspen Mtell's Autonomous Agents are software elements that automatically execute intense technical and analytical work in real-time, announcing issues with long lead times when they are detected. They work continuously 24/7, constantly learning and adapting—and retain absorbed knowledge forever.

However, when Anomaly Agents detect a previously unseen failure condition, a more detailed scrutiny determines the degradation pattern that created the anomaly and builds a specific Failure Agent that is able to detect the condition much earlier and with far greater accuracy. Another stark difference to alternative approaches is that the Aspen Mtell system runs near autonomously with only a little human guidance, doing the work of experts, much more regularly and far faster.

How It Works

Because it is both equipment- and process-agnostic, Aspen Mtell can integrate and interoperate with almost all equipment and systems found in manufacturing including programmable logic controllers, distributed control systems, instrument systems, plant historians, management information systems, EAM systems, business systems and more.

The Aspen Mtell application collects equipment metadata from the EAM system to build the appropriate equipment hierarchy for monitoring, including mapping the sensor tag names to the correct equipment. Once set up, the system analyzes equipment work orders from the EAM system



to correlate patterns of failure that occurred in the past, before Aspen Mtell was installed. Software Agents use the work order information to develop signatures of normal and failure modes, which are deployed immediately to monitor for the recurrence of those patterns, protecting against similar failures and detecting new anomalies that are readily categorized as either new normal conditions or new failure signatures. Unlike other systems, Aspen Mtell uses low-touch machine learning and adapts to new operating modes, enabling it to easily recognize new failure conditions.

Aspen Mtell's Failure Agents initiate alerts to users, sending failure work orders with the exact failure code into the EAM system using machine-to-machine (M2M/Industrial IoT) technology. In this prescriptive maintenance process, the Agent prescribes appropriate maintenance activity based on the machine's behavior. The operations and maintenance departments have an extended warning of the potential for failure and can work together with the other affected departments to make better decisions to remediate the failure in the most cost-effective way or adjust production. An Aspen Mtell notification allows small problems to be fixed before they become big ones.

The Aspen Mtell Difference

Safer

Predict asset breakdowns weeks, or even months, before damage occurs

Greener

Avoid excessive emissions during shutdowns and startups

Longer

With fewer equipment failures, assets last longer and are easier to maintain

Faster

Faster rollouts with Aspen Maestro technology for enterprise scalability



About Aspen Technology

Aspen Technology (AspenTech) is a leading software supplier for optimizing asset performance. Our products thrive in complex, industrial environments where it is critical to optimize the asset design, operation and maintenance lifecycle. AspenTech uniquely combines decades of process modeling expertise with machine learning. Our purpose-built software platform automates knowledge work and builds sustainable competitive advantage by delivering high returns over the entire asset lifecycle. As a result, companies in capital-intensive industries can maximize uptime and push the limits of performance, running their assets safer, greener, longer and faster.

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