

## A Revolution in Base Maintenance Intelligence for MROs

### Introduction

The aircraft maintenance industry is at a point where the volume of data and the maturity of analytical technologies have changed fundamentally. Advances in artificial intelligence, semantic analysis, and large-scale data processing now make it feasible to understand maintenance activity at a level of depth and consistency that was not achievable previously. This creates an opportunity not only to improve existing processes, but also to rethink how maintenance intelligence itself is created and applied.

This white paper details a new approach to maintenance intelligence. One that moves beyond static task execution and historical reporting, towards intent-based learning and predictive foresight. It examines why traditional systems have struggled to support learning in third-party maintenance and how emerging technologies can overcome limitations that were previously considered structural and unavoidable.

For MRO leaders, the implications are significant. Organisations that can learn faster, forecast more accurately, and apply insight consistently across customers and aircraft gain a lasting operational and commercial advantage. For the MRO sector collectively, shared learning has the potential to raise standards, reduce uncertainty, and change expectations of what is achievable in base maintenance planning and execution. This white paper outlines the foundations of this evolution, and what it means for the future of third-party maintenance.

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## Executive summary

Third-party Maintenance Repair Organisations (MROs) operate in an environment where learning is structurally constrained. Whilst aircraft maintenance is governed by OEM Master Planning Documents (MPDs), execution occurs through Approved Maintenance Programs (AMPs) that vary widely in structure, terminology, and task definition. This fragmentation prevents aircraft data from being reliably aligned across customers, forcing MROs to reset planning assumptions and rely heavily on manual experience whenever they change operator.

Traditional maintenance systems reinforce this limitation. Built around AMP-level task execution, they rely on exact references, keyword matching, and manual mapping. Even advanced reporting remains siloed and customer-specific, making cumulative learning across third-party maintenance effectively impossible. As a result, predictive planning, accurate defect forecasting, and scalable operational insight have remained out of reach.

MRO-PRO addresses this problem by introducing a fundamentally different approach to maintenance intelligence. Instead of treating tasks, defects, parts, and tools as isolated records, MRO-PRO's platform understands what they represent functionally. Whilst humans intuitively grasp intent, doing so consistently and at scale across thousands of tasks and historical checks has never been achievable.

At the core of this approach is **MILE™ — the Maintenance Intelligence & Learning Engine**. MILE is a proprietary engine developed by MRO-PRO to understand maintenance intent and align all activity back to a single MPD-driven foundation. By seeing through operator-specific AMPs to the MPD beneath, MILE establishes a consistent source of truth for planning, execution, and analysis.

This MPD-level alignment enables a step change in capability. Tasks, defects, parts, tooling, and services can be traced back to their true origin, allowing defects and material demand to be forecast probabilistically, rather than assumed. Forecast accuracy improves continuously as execution data feeds back into the system and learning compounds over time.

This intelligence accelerates work pack planning, supports fully digital, paperless execution, and gives managers live insight into milestones, man-hour burn rates, and emergent workload. The same capability extends into sales, enabling accurate forecasting of labour, defects, and material during tendering, replacing spreadsheet-driven estimation with data-backed confidence.

MILE can operate at industry scale, dramatically accelerating learning and reducing the risk of entering new aircraft types or maintenance domains. Together, these capabilities define a new operating model for third-party maintenance, that's based on shared intelligence, continuous learning, and predictive foresight. MRO-PRO does not simply digitise existing workflows. It redefines how maintenance intelligence is created, learned, and applied.

## The core industry problem: Fragmented maintenance intelligence in MROs

Third-party maintenance repair organisations (MROs) operate under fundamentally different conditions to in-house airline maintenance teams. Rather than supporting a single operator with a single Approved Maintenance Program (AMP), third-party MROs service multiple airlines across the same aircraft types. Although every aircraft is governed by an OEM Master Planning Document (MPD), MROs do not execute the MPD directly. Each operator or CAMO derives its own AMP from the MPD, introducing variation in task references, descriptions, structure, and grouping.

As a result, the same physical maintenance activity appears differently across customers. Execution data generated for one operator cannot be reliably aligned with data from another, even when the aircraft type and maintenance scope are identical. Planning intelligence, statistical analysis, and operational learning become trapped inside individual AMPs. When an MRO changes operator, accumulated knowledge is largely lost, forcing planners to reset estimates and rely once again on manual experience and judgement.

Traditional maintenance systems are built around this AMP-level reality. They depend on exact task references, keyword matching, manual mappings, and spreadsheet-driven analysis. These approaches may function within a single operator's environment but fail in a multi-operator context. Even advanced reporting tools remain fragmented, producing narrow, customer-specific insight that cannot be reused or scaled. This is not a tooling gap or a configuration issue; it is a foundational limitation. Without a reliable way to align data beyond the AMP, cumulative learning across third-party maintenance has historically been impossible.

## The breakthrough insight: Maintenance intelligence must be built on intent not labels

The key insight behind MRO-PRO is that meaningful maintenance intelligence cannot be built on labels alone. Task references, descriptions, defect narratives, part numbers, and tooling identifiers are all examples of artefacts that vary between engineers, operators, and MROs, even when they refer to the same underlying maintenance activity.

For example, one engineer may record a defect as "MLG seal worn," another as "main landing gear leg seal U/S," and another as "left leg O-ring worn." Although these descriptions refer to the same underlying issue, traditional systems treat them as unrelated events. The same problem exists across AMP tasks, parts, tooling, services, and equipment, where small variations in wording, acronyms, part numbers, or naming conventions prevent reliable aggregation and meaningful analysis.

What matters is intent, which means what the task, defect, part, or tool represents in functional maintenance terms. By understanding intent, differences in wording, acronyms, and operator-specific conventions become irrelevant. Tasks can be aligned back to their MPD origin. Defects can be grouped by true underlying issue rather than free-text description. Parts and tools can be understood by what they are used for, not simply how they are labelled.

This is not a new concept to experienced planners or engineers. Humans intuitively understand intent. Given enough time, a skilled individual can review task cards, defect histories, and material usage and mentally connect related items across different descriptions and operators. However, this process is manual, subjective, and unscalable. Performing

this level of analysis across thousands of tasks, defects, parts, and historical checks would take weeks or months of effort and would need to be repeated for every new work pack and customer.

MRO-PRO's breakthrough is the ability to perform this intent-based understanding at scale. By using AI to analyse maintenance language, industry acronyms, and historical execution patterns, the system can identify intent and align data consistently in seconds rather than months. This makes it possible to move beyond simple historical reuse and into probability-driven forecasting, where the likelihood of defects, parts, and tooling requirements can be predicted reliably, based on true maintenance intent rather than fragmented labels.

## Introducing MILE™ — Maintenance Intelligence & Learning Engine

To solve this problem, MRO-PRO has developed MILE™ — the Maintenance Intelligence & Learning Engine. MILE is a proprietary engine purpose-built to understand maintenance intent across tasks, defects, parts, tools, and services, and to align that intent back to a common MPD-driven foundation.

MILE converts maintenance data into semantic intelligence. It analyses task references, descriptions, aircraft context, defect narratives, industry acronyms, and historical outcomes to determine what each item represents functionally, not just how it is written. The engine has been trained on OEM MPDs, aviation-specific language, and industry terminology, allowing it to interpret varied expressions of the same maintenance activity with a level of accuracy that traditional systems cannot achieve.

From the outset, MILE delivers a high degree of accuracy by presenting probable matches and relationships based on learned patterns and intent recognition. Crucially, this is not a static process. Human planners and engineers remain in the loop, reviewing results, making refinements, and confirming or correcting matches where necessary. These human decisions are not lost but rather captured and fed back into MILE's learning process.

Over time, this creates a compounding intelligence effect. Each confirmation, adjustment, and correction improve the engine's understanding, meaning that future work packs benefit from the learning of past ones. Tasks that once required manual interpretation are recognised immediately. Defect relationships become clearer. Parts and tooling associations become more precise. The system continuously refines itself, reducing the need for human intervention as confidence and accuracy increase.

MILE is owned, designed, and continuously evolved by MRO-PRO. It is not a generic AI service or an analytical add-on, but the core intelligence layer upon which the entire platform is built. As MILE learns, the effort required to plan a complex base maintenance check reduces dramatically. What once took weeks or months of manual analysis can, after a period of learning, be achieved in minutes, with a level of granularity, consistency, and predictive confidence that has not previously been possible in third-party maintenance.

## Why MILE changes everything: A single MPD platform for Predictive Maintenance

The most fundamental capability of MILE is its ability to see through operator-specific AMPs and align maintenance activity back to the MPD. This single capability changes everything. By establishing a consistent MPD-level foundation, MILE removes the fragmentation that has historically prevented meaningful learning across operators, customers, and organisations.

Once AMP variability is eliminated, every downstream element of maintenance can be traced back to a common origin. Tasks align to MPD requirements. Defects can be associated with the MPD-driven activity that caused them. Parts, tooling, services, and equipment can be linked to the maintenance intent they support. Rather than existing as disconnected records, all execution data converges around a single, consistent reference point.

This convergence enables a fundamentally different form of learning. Because MILE operates at the MPD level, it can aggregate execution data across multiple checks, operators, and participating MROs. A defect is no longer “something that happened before” within a single organisation; it becomes an outcome that can be analysed probabilistically against a specific MPD task across the industry. The same applies to parts and tooling, where MILE can determine not just what has been used historically, but the true likelihood of a given item being required for a given maintenance activity.

As more data flows through the system, MILE’s predictive accuracy increases. Federated learning across anonymised industry data allows probability models to be built on a scale that has not previously been possible, particularly for less common tasks and defects. This creates a continuously improving feedback loop, where every completed check strengthens the intelligence available for the next one.

This architecture cannot be retrofitted into legacy maintenance systems. Platforms designed around simple task execution models cannot be transformed to operate at MPD-level intent without rebuilding. MRO-PRO has been designed around MILE from the outset, with planning, execution, and analysis all driven by the same intelligence engine.

This is why MILE changes everything. By establishing a single MPD-driven source of truth and continuously learning from execution data across organisations, MRO-PRO moves maintenance from static planning and historical reporting into a new era of predictive, probability-driven maintenance intelligence that improves with every use.

### Learning-driven work pack planning at speed

With MILE in place, the work pack planning process changes fundamentally for planners. Instead of starting from a blank slate for each new customer or check, planners import tasks into MRO-PRO and immediately benefit from intelligence accumulated through previous planning activity and execution outcomes.

MILE recognises tasks based on intent and automatically matches them to previously learned MPD-aligned tasks. Along with this match comes the associated planning intelligence, including historical man-hours, known defect relationships, typical parts and tooling usage, and any refinements made by planners during previous checks. What was once manually inferred or remembered by individuals is now applied consistently and automatically.

This removes the need for planners to repeatedly decide where tasks sit, how they should be categorised, or what they are likely to require. There is no reliance on assumptions such as “this card usually belongs here” or “this task always needs that part.” Once a task has been planned and confirmed, that learning is retained. By the third or fourth similar check, the system is effectively pre-configured, allowing work packs to flow with minimal manual intervention.

The result is a planning process that is faster, more consistent, and far less dependent on individual experience. Work packs that previously took days or weeks to assemble can be prepared in a fraction of the time, with greater accuracy

and completeness. Planners move from manually constructing plans to reviewing and refining intelligently prepared work packs, focusing their effort where it adds the most value, rather than repeating the same setup work for every check.

### Digital execution with built-in operational intelligence

MRO-PRO extends MILE's intelligence from planning into live execution on the hangar floor through a fully digital, paperless maintenance environment. Engineers perform all task execution, inspections, defect recording, and CRS sign-off electronically, working directly on tablets at the point of maintenance. This ensures that execution data is captured accurately, consistently, and in real time.

Because all tasks, defects, parts, tools, services, and equipment are pre-classified, zoned, and structured through MILE, execution data is inherently consistent across the entire work pack. Tasks are completed within a known context, by zone, priority, inspection status, and maintenance intent. This consistency is critical. It transforms raw execution activity into high-quality operational data, that can be analysed and compared across time, checks, and organisations.

On top of this digital foundation, MRO-PRO provides a layer of execution intelligence that gives managers unprecedented visibility into the live state of the maintenance event. Milestones can be tracked dynamically, with progress measured not only by task closure but by time elapsed, revisions applied, and delivery rate against plan. Manhour consumption is visible in real time, including burn rates, closure rates, and emerging workload as new defects are raised.

One of the most powerful outcomes of this approach is visibility into emergent man-hours. By comparing MILE-driven forecasts against live execution data, managers can see how much unplanned work is appearing, when it is appearing, and how it is impacting the required daily throughput to maintain TAT. This insight allows early intervention, whether through manpower adjustment, milestone revision, or commercial discussion, rather than reacting after the impact has occurred.

The result is a step change in how base maintenance is managed. Execution is no longer opaque or retrospective. Managers are equipped with live, structured insight that reflects the true position of each project. Decisions are informed by data rather than intuition, enabling better control of progress, risk, and outcome throughout the maintenance event.

### Commercial and sales enablement through MILE

The same intelligence that transforms maintenance planning also fundamentally improves the sales and bidding process. Because MILE aligns tasks to their MPD origin and understands the downstream impact of those tasks, it provides a level of cost and effort visibility that has traditionally been unavailable during tendering and quotation.

When a prospective customer provides a task list or bid tally, MRO-PRO can analyse it in seconds. Tasks are recognised by intent, aligned to MPD requirements, and enriched with historical execution data. More importantly, MILE can forecast the probability of defects arising from those tasks and identify the likely parts, tooling, services, and equipment required to address them. Labour, material, and support costs can therefore be estimated not only for the planned scope, but for the work that is statistically likely to follow.

This replaces a historically manual, spreadsheet-driven process that relied on limited data, isolated experience, and conservative assumptions. Instead of pricing blind or buffering excessively for risk, MROs gain a data-backed view of probable workload and cost before committing to a contract. The result is more accurate bids, better capacity planning, and reduced exposure to under-quoted work.

By using the same intelligence for both planning and sales, MRO-PRO ensures consistency between what is sold and what is delivered. Forecasts used during tendering flow directly into work pack planning and execution, reducing commercial surprises and improving trust between the MRO and its customers.

### **Federated learning and scalable acceleration**

MILE becomes even more powerful when combined with federated learning across the MRO-PRO ecosystem. Participating organisations can choose to opt in to anonymised data sharing, allowing MILE to learn from a much broader dataset than any single MRO could generate alone.

Because learning occurs at the MPD and maintenance-intent level, data can be shared without exposing commercially sensitive information. Pricing, customer identity, and contractual terms are not shared. What is contributed is execution intelligence: task outcomes, defect relationships, labour consumption, and material usage aligned to MPD intent. This ensures confidentiality while maximising collective learning.

The impact of federated learning is a dramatic acceleration in accuracy and confidence. Probability models for defects, parts, and tooling improve far more quickly as data volumes grow across multiple organisations. Forecasts that might take years to stabilise within a single MRO can mature in a fraction of the time when informed by industry-wide execution patterns.

Federated learning also removes one of the biggest barriers to growth for third-party MROs: entering new aircraft types or maintenance domains. Traditionally, moving into a new platform meant starting from scratch, with limited data and high commercial risk. With MILE and federated learning, MROs can begin with a baseline of collective industry knowledge, enabling more confident bidding, planning, and execution from the outset.

Participation is optional. MROs may choose to operate in isolation, but they will learn more slowly and with less statistical confidence. Those who opt in benefit from faster learning, stronger forecasts, and a continuously improving intelligence layer. Over time, the advantages of participation compound, creating a clear incentive to contribute to and benefit from shared, non-commercial maintenance intelligence.

### **A new operating model for third-party maintenance**

MRO-PRO represents more than an incremental improvement in maintenance software. It introduces a fundamentally new operating model for third-party MROs, built on shared intelligence, continuous learning, and intent-based understanding rather than static task execution.

By anchoring all planning, execution, and analysis to MPD-level intent, MRO-PRO removes the structural barriers that have prevented third-party MROs from learning effectively across customers, aircraft, and time. What was once

fragmented, manual, and experience-dependent becomes systematic, scalable, and continuously improving. The result is not just better outcomes on individual checks, but a permanent uplift in organisational capability.

For MROs using the platform, this creates a step change in how work is prepared, delivered, and managed. Planning becomes faster and more reliable. Execution becomes more transparent and controllable. Commercial decisions become better informed and less risky. Over time, organisations that adopt this model operate with a level of foresight, consistency, and confidence that fundamentally differentiates them from those relying on traditional approaches.

At an industry level, the implications are even broader. Federated learning allows maintenance intelligence to improve at a pace that no single organisation could achieve alone. As more data flows through MILE, probability models strengthen, forecasts sharpen, and blind spots shrink. The industry stands to benefit from better insight, more predictable outcomes, and a shared understanding of maintenance reality that has never previously existed.

This is a genuine inflection point. The combination of modern AI techniques, domain-specific intelligence, and real-time digital execution makes possible what could not be achieved before. MRO-PRO is pushing the boundaries of what maintenance systems can do, not by digitising existing workflows, but by rethinking how maintenance intelligence itself is created, learned, and applied.

For third-party MROs, adopting this model is not simply a technology upgrade. It is a shift in how maintenance is understood, planned, and delivered.