


# PLANNING FOR THE UNEXPECTED

AI could help MRO providers anticipate emerging defects and make better use of existing capacity. **Mario Pierobon** reports

Maintenance data remains extremely fragmented. An external MRO company may perform essentially the same maintenance on the same aircraft type for different airlines, but each operator has its own approved maintenance programme (AMP) derived from the OEM maintenance planning document (MPD). References, descriptions and structures differ, so learning from one customer does not automatically transfer to another. Historically, systems have understood labels rather than the underlying maintenance intent.

According to Scott Wells, managing director at MRO-PRO, artificial intelligence (AI) and semantic analysis offer us the opportunity to overcome this barrier. "If an operator's specific maintenance activity can be understood based on intent and traced back to its common origin in the MPD, we can suddenly begin learning across different operators rather than within individual customer silos," he says.

This opens the door to federated maintenance intelligence. "A single MRO company could learn from dozens of inspections; collectively, the industry can learn from thousands," Wells says. "We can begin to build much more robust probabilistic models of defects, labour consumption, parts and equipment requirements without having to share customer identities, pricing, or commercially sensitive information. The principle is simple: share knowledge, not ownership of the underlying data."

## AI-driven scheduling engines

From the perspective of an external MRO provider, the real opportunity lies beyond simply using AI to optimise a schedule, affirms Wells. "An algorithm can only optimise what it knows. The next step is to provide the scheduling engine with a much deeper understanding of what is likely to happen during the maintenance intervention.

"A basic maintenance input may contain hundreds of planned tasks, but it can also generate a significant volume of emerging defects," he explains.

Wells adds: "Very often, it is precisely these defects, along with the spare parts, tools, services and additional labour required to fix them, that disrupt the schedule and ultimately cause downtime."



Historically, MRO companies have been very good at planning known work and then reacting to everything else, according to Wells. "AI offers the industry the opportunity to change this approach. By analysing the results of previous maintenance activities and aligning them with the underlying maintenance objective, providers can begin to determine that, when a particular maintenance activity is performed, there is a certain probability of a given defect occurring, and that this defect has a corresponding probability of requiring specific spare parts, tools, or services.

"This is the direction we are taking with MRO-PRO's Mile Maintenance Intelligence & Learning Engine, learning from execution results and using this information to plan subsequent inspections.

"This fundamentally changes scheduling. Instead of balancing technicians, hangar capacity, spare parts and equipment sequentially around a fixed work package, MRO companies can begin scheduling them simultaneously based on the likely workload."

Real-time execution data thus closes the loop, points out Wells. "By knowing actual man hours, task completion rates, emerging workload and material demand as the inspection progresses, scheduling can continuously respond to the reality of the maintenance event rather than pre-initiation assumptions," he says.

"The greatest practical opportunity for AI is shifting maintenance planning from reactive to probabilistic, knowing more about what is likely to go wrong before the aircraft enters the hangar and planning accordingly."

## Dynamic scheduling

There is a clear physical limit to what software can accomplish, as AI cannot create another hangar or another qualified technician, and the shortage of qualified maintenance personnel is a very real constraint for the industry, according to Wells. "However, it is necessary to distinguish between physical capacity and usable capacity," he says.

"For example, if a supplier has available technicians but they are unable to complete a task because they discovered a defect late and the required part will not arrive until tomorrow, they technically have work capacity, but they are not using it productively."

The same is true when tools are not set up, work is sequenced inefficiently, or

JEWERS
WORLD CLASS AIRCRAFT HANGAR DOORS
Trusted by leading airlines to power aviation's most advanced facilities.

BUILT ON BRITISH ENGINEERING.
PROVEN WORLDWIDE.
jewersdoors.co.uk | UK: +44 (0)1767 317090 | UAE: +971 (0)4 430 9002 | sales@jewersdoors.co.uk
For more Information



an emerging requirement is discovered too late to be addressed without disrupting control, affirms Wells. "This is where predictive planning and dynamic programming can create additional usable capacity.

"If historical data tells us, for example, that there is a significant probability that a particular task will generate a specific defect and require a specific component, we can make an informed decision about provisioning that component before the task begins. We have not created another technician or another hangar post, but we may have eliminated hours or days of avoidable wait time from inspection."

On a large scale, shorter, more predictable downtime increases the amount of maintenance that can be performed through the existing MRO network, affirms Wells. "Therefore, I would not define dynamic scheduling as simply identifying bottlenecks," he says. "If implemented correctly, it should identify them in advance, help us avoid some altogether, and continuously redirect available resources as the maintenance event changes. The industry's inherent capacity constraints remain, but we can significantly improve the utilisation of the capacity we already have."

## AI and regulatory frameworks

Wells believes AI should support maintenance decision-making, but it should not replace the responsibility of properly authorised personnel. "Licensing and authorisation requirements, skills, certification validity, working time and fatigue controls, inspection requirements and approval responsibilities should be considered mandatory constraints within a planning system," he says. "These are not variables that an optimisation engine should be allowed to exploit to the detriment of productivity."

From a counterpoint, however, improved predictive capability can strengthen safety margins by reducing operational and commercial pressure on personnel, according to Wells. "Anyone who has worked in aircraft maintenance knows that the most critical moment for an inspection is often near the end, when an aircraft approaches its scheduled delivery date and an unexpected defect or material requirement arises," he says. "We should not pretend that the commercial pressure to deliver an aircraft does not influence the context in which human decisions are made."

If predictive intelligence before introduction into service reveals that there is, for example, a 63% chance of needing a certain component, and it is decided to procure it, then when a failure occurs, the engineer does not face a logistical problem in addition to the engineering one, affirms Wells. "The component is available, and maintenance can be performed correctly without unnecessary scheduling pressures," he concludes. ●



▲ **Scott Wells**, managing director, MRO-PRO

**"THE GREATEST PRACTICAL OPPORTUNITY FOR AI IS SHIFTING MAINTENANCE PLANNING FROM REACTIVE TO PROBABILISTIC, KNOWING MORE ABOUT WHAT IS LIKELY TO GO WRONG BEFORE THE AIRCRAFT ENTERS THE HANGAR AND PLANNING ACCORDINGLY"**

***Scott Wells, managing director, MRO-PRO***