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An AI-based material assistant can help forecast shop-visit workscopes months in advance. (Credit: Lufthansa Technik)

Agents of Change

Agentic AI Offers a Remedy to the Inherently Reactive Architecture of Traditional MRO Practices

Administrative burden in aircraft maintenance remains stubbornly manual. As such traditional MRO is not held back by one single bottleneck, but by the fragmentation of the entire technical operations value chain.

Saravanan Rajarajan, AVP and Head of Aviation Consulting at Ramco Systems paints a picture of a data silo trap.

"Service Bulletins and Airworthiness Directives arrive as unstructured PDFs that compliance engineers must manually extract, cross-reference against fleet data, and convert into Engineering Orders. Technical logbooks and defect data are scattered across manual records or managed in different systems; when an AME encounters a recurring defect, historical record searches are manual and time-consuming. Workscoping for heavy checks requires iterative coordination across engineering, supply-chain, and planning teams. Parts kitting involves multi-factor sourcing decisions (Effectivity, Interchangeability, Certifications, TAT) made under time pressure, often leading to increased exposure to both TAT extensions and cost overruns. Compliance audit trails are fragmented, especially due to hybrid manual and system processing, making regulatory traceability weak," he explains.

Commenting upon this administrative bloat and lack of prediction, Abraham Saada, Founder and Technical Lead at ADO Aerospace says that the industry is fragmented across legacy ERPs (like SAP and Oracle) and static listing sites. "These systems rely on disconnected communication modules and point-to-point emails, meaning getting from a raw document to an actionable maintenance plan is heavily delayed.

Rajarajan adds that these hurdles cluster around a core constraint: every hour of administrative work performed by a licensed AME is an hour not spent on hands-on maintenance. Indeed, as Craig Gottlieb, Managing Director of Aerospace and Defence at Accenture notes, across the industry, planners and engineers spend 40-60% of their time coordinating resources rather than optimising outcomes and making decisions.

Asset lock-up

Another challenge is manual procurement. According to Saada, the entire supply chain relies on

manual RFQs and phone calls. "Furthermore, multiple contracting documents are generated manually on each step, like purchase orders, invoices, and air waybills; which drastically bottlenecks speed and limits the ability to rapidly resolve constraints," he says.

This trickles down into supply chain visibility. Anupam Singhal, President – Manufacturing at TCS says that an aerospace manufacturer may have strong visibility of Tier-1 and Tier-2 suppliers, while dependencies further down the chain can remain less clear. A Tier-4 or Tier-5 supplier producing a small component can still affect the availability of an engine or aircraft, particularly where parts availability is affected by logistics, labour, financial or geopolitical disruption.

"Aviation is also rightly rigorous in its compliance requirements. Every inspection, repair and replacement must be documented and traceable. Maintaining complete and accurate records across multiple systems and stakeholders creates a significant administrative burden, but it remains essential for airworthiness, auditability, regulatory compliance, and passenger trust."

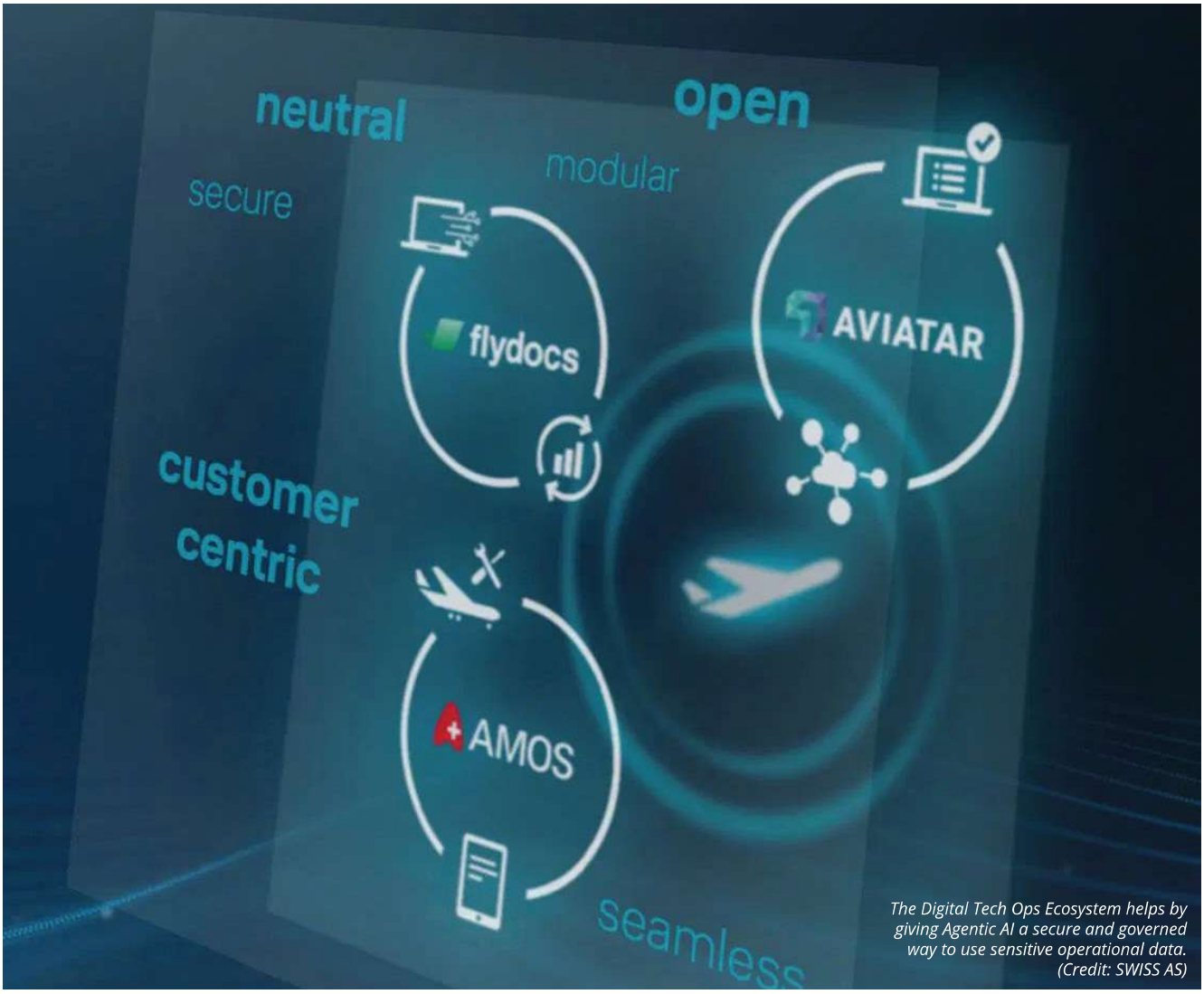
Traditional MRO processes are generally better equipped for maintenance events that are known and planned, but as Saada states, conventional MRO software is strictly reactive —designed for scheduled maintenance. "It operates like a static data storage repository rather than an interactive digital twin, he says.

"When a non-routine event occurs, the ERP system stops, and the manual scramble begins. Traditional platforms lack the dynamic capability to be context-aware; the ERP cannot dynamically reason across global supply chains, it forces humans into a manual fire-fighting exercise across emails and phone calls," he asserts.

According to Gottlieb, unplanned maintenance can cost 30–50% more because of emergency logistics and equipment sourcing. The financial impact becomes even more important within fixed-fee and outcome-based agreements, where providers carry greater responsibility for cost and performance.

Frank Martens, CCO of the Lufthansa Technik Digital Tech Ops Ecosystem remarks that unplanned and non-routine events show why isolated systems are no longer sufficient.

"A defect is rarely just a defect entry," he says. "It can trigger troubleshooting, engineering assessment, material checks, operational decisions, work-order



The Digital Tech Ops Ecosystem helps by giving Agentic AI a secure and governed way to use sensitive operational data. (Credit: SWISS AS)



Agentic AI is not designed to replace sales and procurement managers but is built to replace the admin fraction that keeps them bogged down in manual tasks. (Credit: ADO Aerospace)

creation, execution, sign-off, records updates and follow-up analysis. If those steps are handled in disconnected environments, response time suffers and the organisation loses transparency. The Ecosystem view is different: aircraft health signals, historical maintenance information, operational constraints and documentation are connected so that teams can move more quickly from detection to decision and from decision to compliant execution. This is especially important when the objective is not only to fix one event, but also to learn from it and reduce recurrence."

The common thread is that none of these problems is insurmountable individually, but together they create a context of manual, error-prone, labour-intensive workflows that scale poorly. This is precisely where Agentic AI begins to address the constraint.

Interactive digital twins

Gottlieb claims Agentic AI is particularly well-suited to MRO because it's built to gather and connect dispersed data quickly and at scale. "Individual AI agents perform specific roles—such as monitoring parts availability, workforce readiness or maintenance requirements—while sharing a common view of aircraft condition, documentation, decisions and deadlines. An orchestrator agent can coordinate those agents and bring the right information together as conditions change. In the near term, the biggest value is faster, better insight," he says. "For example, an AI-based material assistant can help forecast shop-visit work scopes months in advance, helping reduce turnaround times and improve material flow. Agentic AI can build on this by continuously connecting operational signals and helping planners respond faster, while humans remain in the lead."

Dr. Yasar Goedecke, Head of Analytics & AI at Lufthansa Technik agrees that Agentic AI goes beyond generative AI, acting as an intelligent assistant that not only retrieves information but also coordinates tasks across systems and workflows.

He provides the example of an engineer reporting corrosion during a C-check.

"An AI agent could automatically identify the affected aircraft configuration, search historical maintenance records, review relevant repair procedures, check parts availability and assess the potential impact on the maintenance schedule. It could then present engineers with recommendations and prepare supporting documentation for



review. The agent acts as a digital coordinator, helping engineers navigate complex maintenance scenarios while ensuring the human experts remain in control of decisions and approvals.

"By reducing the effort required to gather and process information, Agentic AI can accelerate decision-making, improve productivity, increase consistency and ultimately help reduce aircraft downtime. At Lufthansa Technik, we have already explored and developed AI-driven solutions in collaboration with partners including Microsoft, giving us valuable insights into how these technologies can support maintenance operations."

A further illustration is given by Rajarajan, who describes how Agentic AI synthesises information from fragmented data sources and surfaces actionable recommendations within defined guardrails and human approval gates.

"At the document layer, an SB/AD agent extracts structured compliance requirements from PDFs using large-language models trained on aviation technical language, evaluates fleet applicability by cross-referencing against aircraft master data, and generates Engineering Order drafts with task sequencing and resource requirements." He claims processing time drops from 8–12 hours to 30–60 minutes. "At the decision-support layer, a discrepancy-resolution agent performs semantic search over historical maintenance records, surfaces top-ranked resolutions with success-rate scoring, and enables mechanics to resolve faults in minutes rather than hours. At the supply-chain layer, a kitting agent evaluates all feasible sourcing options against a multi-gate framework (EIPC certification, SB/AD compliance, TAT vs. need date, contract rules), autonomously recommends or executes sourcing within pre-approved parameters, and reduces material costs by 8–20%."

However, the proviso here is that these are outcomes from controlled deployments; results vary based on data quality, integration depth, and organisational adoption. "The throughput gains are real, but they depend on foundational data governance and change management," states Rajarajan S.

TCS has applied this approach with an aerospace engine manufacturer. As Singhal recounts, rather than requiring an engineer to work through multiple manuals and large volumes of repair data, the AI-enabled system uses in-service engine data and technical knowledge to present two or three possible repair options, including the advantages and considerations associated with each. "We refer to this as 'Intelligence Choice Architecture'. Here, the engineer remains responsible for the final decision, supported by more relevant information delivered more quickly.

"In one such use case, this approach has the potential to reduce repair turnaround time by around 50%—for example, bringing a six-month process closer to three months. The same approach can also support supply chain resilience. An Agentic AI knowledge graph can map relationships across Tier-1 to Tier-5 suppliers, components, locations and risk signals, helping an aerospace manufacturer identify potential component risks and evaluate alternative options before they become an aircraft-on-ground event," he imparts.

It's about execution, not just answers for Saada. "Agentic AI moves beyond chatbots; it acts as execution software that plans and carries out multi-step work across various systems. Combining these workflows in the various systems is actually something like creating a smart contract or a digital twin of the procurement and supply chain process of the company."

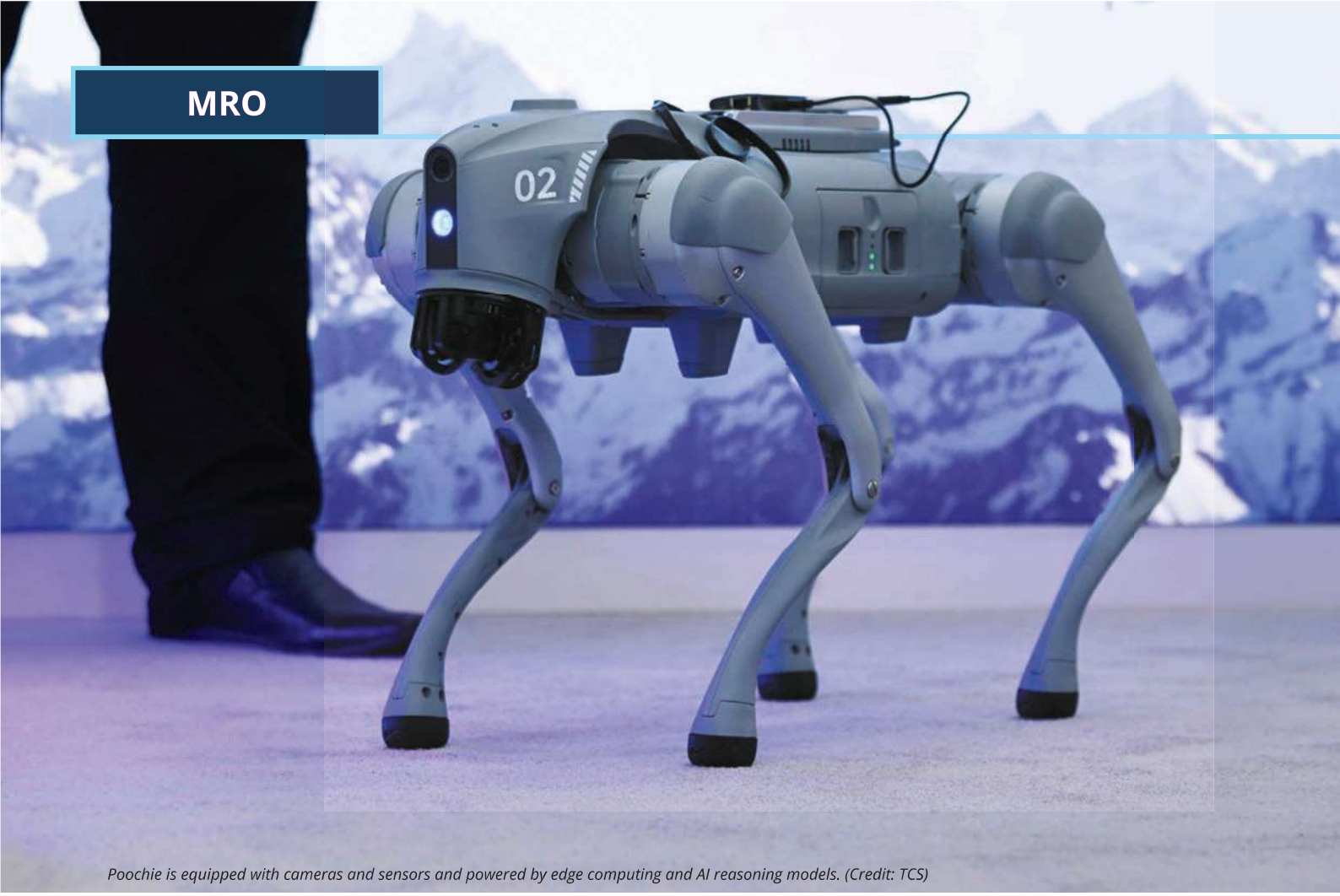
Under the ADO approach, the company deploys context-aware agents that act as an interactive layer. "If a part is needed, the agent instantly queries our "Network of Partners," communicates directly with OEMs or suppliers' inventory gateways, and negotiates the transaction," he says.

The improvement is that a procurement cycle that normally takes days is compressed into hours, drastically reducing AOG time, recovering lost wrench time, and streamlining the aftermarket supply contracts.

Despite these advantages, Agentic AI is cloaked in misconceptions.

Humans in the loop

The most pervasive misconception, says Rajarajan, is that Agentic AI operates autonomously without human oversight. In reality, aviation is a regulated environment where airworthiness decisions cannot be delegated to autonomous systems. No current regulatory framework permits an AI system to make or certify airworthiness decisions without human validation. Every credible deployment preserves human sign-off at the safety-critical decision point:



Poochie is equipped with cameras and sensors and powered by edge computing and AI reasoning models. (Credit: TCS)

an agent recommends, a licensed engineer approves."

Singhal agrees – "We see it as a human-plus-AI operating model. AI can process large volumes of information and identify patterns more quickly, while engineers continue to provide the operational understanding and experience required in a safety-critical environment."

Martens stresses that autonomous aircraft maintenance in aviation is neither realistic nor desirable. "AI should support highly skilled and certified professionals, not replace accountability," he remarks.

For Saada, humans stay in command, and every step runs under human direction or approval. "At ADO Aerospace, we are building sales and procurement agents that learn from the user's behaviour and experience over time, utilising human-centric design to safely provide higher autonomy in the future. The agent will work from the best procurement managers and even elevate their capabilities at the same time.

"Agents carry the heavy administrative lifting of checking global parts availability in multiple data lakes, negotiating with suppliers, and issuing purchase orders. However, the final sign-off, especially for safety, compliance, and airworthiness, always remains with a certified human expert. The agent simply provides the proofs and does the heavy lifting for the human to approve faster," Saada states.

Another misconception is that hallucination (confident but false outputs) makes aviation deployment impossible. Mitigation exists through retrieval-augmented generation (RAG), which grounds outputs in approved source material and requires page-level citations, reducing hallucination substantially.

Agentic AI is not simply a more advanced chatbot. As Saada upholds, the biggest misconception is that Agentic AI is just a generative text wrapper for reading technical manuals. "It isn't just about answering questions and telling you what to do next; it's about securely carrying out the work for you and acting as the execution muscle for the manual tasks."

Dr. Goedecke adds that while conversational capabilities are part of the technology, Agentic AI can also coordinate processes, retrieve information from multiple systems and support complex workflows.

However, Agentic AI cannot simply be layered onto existing MRO processes and technology for maximum benefit. As Gottlieb points out, its value depends on the quality and accessibility of underlying data and, importantly, on rethinking how work gets done. "MROs need to connect data across planning, engineering, workforce and supply chain—and redesign workflows so that AI-generated insights can translate into operational decisions. Agentic AI should therefore be treated as an operational and data transformation, not simply a technology deployment," he says.

An important misconception is that Agentic AI is solved, mature technology ready for enterprise deployment at scale. The reality is still nascent. "Regulatory frameworks are being written, standards are evolving, and integration challenges persist. Organisations deploying Agentic systems today should expect iteration and continuous learning," says Rajarajan.


Frank Martens, CCO of the Lufthansa Technik Digital Tech Ops Ecosystem


Craig Gottlieb, Managing Director, Aerospace and Defence at Accenture


Anupam Singhal, President - Manufacturing, TCS

Then there is also the misconception that AI can compensate for fragmented processes. If systems remain disconnected, AI will only accelerate isolated recommendations. AI-generated outputs are not always correct, as Dr Goedecke observes. "Like any technology, AI systems can make mistakes and therefore require governance, validation and human oversight," he says.

So, where are we with the adoption of Agentic AI in the MRO environment?

An adoption gap?

Agentic AI in MRO is still emerging, but adoption is accelerating. According to research from Accenture, 61% of aerospace companies are already deploying digital tools across supplier tiers, and 42% identify AI and automation on operational data as their top lever for increasing output without adding capacity. "These are important foundations, but Agentic AI requires another step: connecting data, workflows and decision-making around specific operational outcomes. The MROs getting this right are treating it as a cross-enterprise operational transformation," remarks Gottlieb.

There is a consensus around best practice beginning with targeted use cases where the business value and governance model are clear, such as troubleshooting support, repetitive defect analysis, work package readiness checks, material decision support, audit preparation or lease-transition readiness, before expanding to more advanced Agentic workflows.

To achieve that, the industry must avoid 'rip and replace', advises Saaba. "The best practice is deploying context-aware agents that sit as a layer on top of legacy systems. Instead of forcing OEMs to dump their proprietary data into a shared lake, companies should use strict data sharing protocols where agents securely query local servers without exposing the underlying backend data. We are currently conducting R&D workshops with OEM partners using this exact interactive layer to modernise their ERPs," he says.

If this is the now, then what of the future?

TCS sees Agentic AI working alongside Physical AI. "For example, at Farnborough Airshow, we demonstrated AI-enabled quadruped systems that combine cameras, sensors, edge intelligence, and reasoning models to perform inspection tasks," Singhal says. "These systems can capture images from the required angles, analyse the findings, and provide maintenance teams with a summary of detected anomalies and possible corrective actions. These kinds of systems are valuable for repetitive, difficult-to-access or hazardous inspections, with any certified aviation application progressing through operational validation and regulatory acceptance."

Over the next five years, Ramco expects wider adoption of specialised Agentic agents, regulatory validation of Agentic workflows, and the emergence of multi-agent orchestration as the dominant architecture.

As Rajarajan explains multi-agent orchestration will become standard architecture: multiple agents (SB/AD, discrepancy, kitting, compliance, predictive, scheduling) communicating and coordinating, activating in parallel for complex scenarios. Robotics and Agentic AI will integrate; Agentic inspection robots will identify defects and feed findings into maintenance agents that recommend repairs. "The result is Agentic systems delivering step-change in efficiency and labour productivity—exactly what the industry needs to serve growing fleet demand with shrinking technician availability."

"Over the next 5-10 years, we are likely to see AI become a digital operations layer across the entire MRO ecosystem," believes Dr. Goedecke.

He says the future of Agentic AI in MRO lies in increasingly connected maintenance ecosystems where specialised AI agents support planning, engineering, logistics and


Dr. Yasar Goedecke, Head of Analytics & AI at Lufthansa Technik


Saravanan Rajarajan, AVP and Head of Aviation Consulting, Ramco Systems


Abraham Saada, Founder and CEO, ADO Aerospace

compliance activities in real time. Combined with technologies such as predictive maintenance and digital twins, these capabilities could help move the industry from reactive maintenance towards more proactive and efficient operations

However, the goal is not autonomous maintenance. "Instead, Agentic AI will serve as a powerful digital assistant that enables human experts to make faster, better-informed decisions and keep aircraft available for service more efficiently.

Martens agrees, adding that these agents will help teams detect issues earlier, assess operational impact, check readiness, coordinate follow-up actions, document outcomes and learn from the result. "The strongest value will come from closed-loop processes where prediction, planning, execution, records and asset insight are no longer separate steps, but part of one connected operating model," he asserts. "In practice, this could involve AVIATAR watching the condition of your entire multi-fleet and detecting and interpreting an issue, AMOS and AMOSmobile supporting planning and execution and supporting parts decisions, and flydocs preserving the long-term asset view. For airlines, lessors and MROs, this means fewer disruptions, faster decisions, better compliance readiness, stronger asset value protection and more effective use of scarce technical expertise."

Saada contends we are moving towards the 'Autonomous Supply Mesh': a decentralised "network of networks," where the data lakes from listing websites, OEMs, and supplier inventories can communicate securely with each other through AI agents which intelligently regulate data sharing.

Predictive Liquidation is also on the horizon, whereby agents will continuously audit global inventory, autonomously identifying aging stock and negotiating its sale to active operators before it loses market value.

Saada also sees B2B procurement evolving into high-speed machine transactions within a multi-agent ecosystem. "In this environment, a buyer's agent and a supplier's agent securely negotiate and execute workflows instantly. The true breakthrough, however, is how this architecture seamlessly incorporates and compensates third-party data lakes or networks. If an external data owner—whether an OEM, a supplier, or an existing listing site—provides the critical inventory context that allows a smart supply contract to successfully reach the Purchase Order (PO) stage, the protocol instantly rewards them with a fractional micro-transaction fee. Similar to the instant micro-settlements seen in decentralised finance (DeFi) and cryptocurrency networks, this ensures immediate compensation for contributing to the fulfilment of the contract. We are not aiming to replace existing platforms; we are turning them into monetised nodes within a dynamic mesh."

He reveals that the company is soon to launch its 'most advanced' model, the MRO Edge agent, in Q4. Designed to independently authenticate part availability, initiate multi-party negotiations, and present finalised freight forwarding options, MRO Edge "completes half the procurement workload before a human ever needs to step in."

Encouragingly, according to Accenture 42% of aerospace executives identify AI and automation on operational data as their top action for increasing output without adding capacity.

"Agentic AI can take this further," says Gottlieb, "by continuously connecting signals across demand, supply, workforce, maintenance and customer commitments, giving planners faster and better insight as conditions change. The business outcome is greater responsiveness, more productive use of existing capacity and more consistent delivery against customer commitments."

By Alex Preston