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MRO 360°

TOO MUCH OR NOT ENOUGH

Inventory Optimisation

Plan Smart - Save Big

Engine LLP Management

Full Control Required

Tool Calibration and Tool Control

Maintenance Mythbusters

Newer Aircraft Require Less MTX

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Dear Industry Colleagues,

Have you wondered if inventory strategies have changed that much since supply chain problems entered the equation, and whether demand forecasting successfully helps to mitigate certain supply challenges? Hopefully the wide variety of responses obtained from various respected industry professionals will help to answer those questions for you in our first feature article *Inventory Optimisation – Change is Not Optional*.

Our second feature article, *Effective Engine LLP Management – So Much More Than Timing?*, focuses on the different challenges faced with life limited parts (LLPs) because unlike other engine parts, LLPs cannot be "repaired," "refurbished," or "overhauled" to extend their life once they reach their certified limit.

We continue our popular Mythbusters series of articles, this month focusing on whether *Newer Aircraft Require Less Maintenance*. Is it that maintenance requirements for new aircraft have dropped, or is it more a case that the nature of maintenance has simply changed?

Lastly, we decided to take a closer look a tool calibration and tool control in aircraft maintenance relating to precision, accountability, and the invisible backbone of safety. It is remarkable just how much so many aspects of this single point of focus has changed over recent years.

As always, I hope you enjoy this issue.

Torsten Tamm
Publisher

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Cover image: *Shutterstock*

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Inventory Optimisation

GKN Aerospace launches additive manufacturing programme

GKN Aerospace has launched TITAN-AM in partnership with the U.S. Air Force Research Laboratory
© *GKN Aerospace*

GKN Aerospace has launched TITAN-AM (Titanium Industrialisation and Technology Advancement for Near-net Additive Manufacturing), an US$8.4 million programme in partnership with the U.S. Air Force Research Laboratory (AFRL). The initiative is aimed at advancing and industrialising Laser Metal Deposition with Wire (LMD-w) technology to support next-generation aerostructures. The TITAN-AM programme will focus on five key areas critical to enabling LMD-w for aerospace structural applications. These include the industrialisation of LMD-w processes for large-scale titanium aerostructure components, the development of robust titanium material datasets to ensure structural performance and reliability, and the advancement of simulation capabilities to optimise both design and manufacturing outcomes. In addition, the programme will develop non-destructive inspection techniques tailored to additive manufacturing processes and demonstrate the technology on selected aerospace structural components. The programme will be carried out at GKN Aerospace's Global Technology Centre in Fort Worth, Texas, which serves as a hub for advanced manufacturing innovation and collaboration with U.S. defence and aerospace partners.

UK CAA approval unlocks new growth for FL Technics Wheels and Brakes

FL Technics Wheels & Brakes has received UK CAA Part-145 approval © *FL Technics*

FL Technics Wheels and Brakes, a component maintenance provider and part of the FL Technics Group, has secured approval from the UK Civil Aviation Authority (CAA), enabling it to service UK-registered aircraft and expand its capabilities within the component MRO segment. The approval (UK.145.01957), granted on February 6, 2026, confirms compliance with UK Part-145 requirements and authorises the company to carry out maintenance on components, including landing gear parts, within its approved scope of work. This certification allows the company to work directly with UK-registered operators, removing regulatory barriers and enabling support for a broader customer base across its existing component maintenance portfolio. "Obtaining UK CAA approval is an important milestone for our wheels and brakes business," said Vytautas Jankauskas, CEO of FL Technics Wheels and Brakes. "It enables us to directly support UK-registered operators and expands the range of customers we can serve within our component maintenance activities." FL Technics Wheels and Brakes operates across multiple European locations, providing repair and overhaul services for wheels, brakes and landing gear components. The UK CAA approval complements the company's existing EASA Part-145 certification (under Germany's Luftfahrt-Bundesamt, LBA) and reinforces its strategy to ensure comprehensive regional coverage, respond effectively to client needs, and further strengthen its component MRO capabilities across Europe and beyond.

JetBlue deal anchors Punta Cana's rise as MRO powerhouse

© JetBlue

FL Technics has secured a landmark agreement to service JetBlue aircraft at its forthcoming maintenance, repair and overhaul (MRO) facility in Punta Cana, signalling a major step in the Dominican Republic's emergence as a regional aviation hub. The deal not only provides an early commercial anchor for the new site but also reflects a shared commitment by both companies to expand their operational footprint in the Caribbean. The Punta Cana facility is being developed through a US$70 million joint investment between FL Technics and Grupo Puntacana, a prominent player in tourism and financial development. Conceived as a phased project, the infrastructure will scale progressively, beginning with the creation of around 300 skilled jobs and ultimately expanding to as many as 2,000 roles in technical and support functions. This staged growth underscores a long-term strategy to build sustainable aviation capabilities within the region. Strategically located near one of the Caribbean's busiest airports, the MRO centre is designed to serve both airlines and aircraft leasing firms. Its presence is expected to enhance operational efficiency by allowing carriers to conduct heavy maintenance locally rather than sending aircraft abroad. This shift could significantly reduce downtime, lower logistical costs, and improve fleet reliability across the region. More broadly, the agreement highlights Punta Cana's growing strategic importance within global aviation maintenance networks. By establishing a high-capacity, modern MRO hub in the Dominican Republic, FL Technics and its partners aim to strengthen regional self-sufficiency while integrating the Caribbean more deeply into international aerospace service chains.

Turkish Technic and Centrum Air sign component pool deal

Turkish Technic has signed a multi-year component pool agreement for the Airbus A320 fleet of Centrum Air, Uzbekistan's largest private airline and part of Centrum Holding, an international logistics and transportation group. Under the agreement, Turkish Technic will provide comprehensive component support to ensure the continued operational efficiency and reliability of Centrum Air's growing A320 fleet. The programme forms part of Turkish Technic's broader strategy to expand its global footprint and deliver integrated support solutions to airlines across emerging markets. This agreement marks the beginning of a strategic collaboration between Turkish Technic and Centrum Air and represents the first partnership Turkish Technic has established with an airline based in Uzbekistan. It also highlights the increasing demand for high-quality MRO services in the Central Asian aviation market. Through this collaboration, both organisations aim to enhance operational performance while strengthening their positions within the international aviation ecosystem.

Centrum Air Airbus A320 © *AirTeamImages*

Liebherr-Aerospace to expand Lindenberg site

Aerial view of Liebherr-Aerospace Lindenberg GmbH © *Liebherr Aerospace*

Liebherr-Aerospace is set to significantly expand its Lindenberg, Germany, site from 2026, reinforcing its capacity to meet growing demand across both production and aftermarket services in the aviation sector. The long-planned development reflects sustained market growth, particularly in maintenance, repair and overhaul (MRO) activities, as well as increasing requirements for advanced aircraft systems. Central to the expansion is the enlargement of customer service and assembly areas by approximately 6,000 m². To accommodate this, the site's oldest administration building will be demolished, making way for modernised facilities designed to support higher throughput and operational efficiency. The project also includes the extension of the employee restaurant, aligning workplace infrastructure with the anticipated increase in workforce and activity levels. In parallel, Liebherr-Aerospace plans to construct a new office complex spanning around 10,000 m². This development is intended to provide long-term flexibility, enabling the company to adapt to evolving operational and staffing needs. As with all new Liebherr buildings, the project will incorporate advanced environmental standards, including heat recovery systems and green roofing equipped with photovoltaic installations, underlining the company's commitment to sustainable production alongside more environmentally responsible aviation technologies. A key driver behind the expansion is the expected ramp-up in MRO demand, particularly linked to the Airbus A350 programme. Liebherr-Aerospace is responsible for major systems on the aircraft, including the slat actuation system and the nose landing gear—the latter being the largest landing gear produced at the Lindenberg facility. As the global A350 fleet matures, demand for overhaul and servicing of these components is set to increase significantly, requiring additional space and specialised infrastructure. Liebherr-Aerospace management highlighted the strong momentum across the aviation industry, noting that the expansion is a direct response to sustained customer demand and a robust order pipeline. The investment positions the company to support both current programmes and future growth while maintaining high standards of technical capability and service delivery.

GE Aerospace and Waygate launch AI engine inspection Tech

© GE Aerospace

Waygate Technologies, a Baker Hughes business specialising in non-destructive testing (NDT), and GE Aerospace have introduced new automated inspection templates designed to modernise engine maintenance processes. The Menu Directed Inspection (MDI) templates, developed for GEnx-1B and -2B engines, mark an important step towards greater standardisation and automation in borescope inspections. The rollout forms part of an ongoing Joint Technology Development Agreement (JTDA) between the two companies, initiated in 2023. The new functionality is integrated into Waygate's Mentor Visual iQ+ video borescope, building on earlier AI-assisted capabilities to enhance defect detection and inspection accuracy in commercial aviation engines. At the core of the innovation is a guided, structured workflow supported by artificial intelligence (AI). This ensures inspectors consistently capture high-quality images during each inspection, reducing variability between operators and accelerating skill development. The result is a more efficient and reliable inspection process, with improved confidence in maintenance assessments. The MDI templates also introduce advanced visual guidance features, specifically tailored to critical engine components such as High-Pressure Turbine (HPT) stage 1 and stage 2 blades. By aligning directly with Aircraft Maintenance Manual requirements, the system helps inspectors achieve precise, standardised views. On-screen overlays and reference imagery further support consistency, while reducing the likelihood of human error. In addition, the system incorporates both automated and manual 3-D measurement tools, enabling detailed analysis of component condition. Inspectors can assess parameters such as line, area, depth, and surface profiles, streamlining both defect identification and subsequent maintenance decisions. Overall, the collaboration between Waygate Technologies and GE Aerospace demonstrates how AI and automation are reshaping maintenance, repair and overhaul (MRO) operations. By improving efficiency, consistency, and data quality, these advancements are setting new benchmarks for safety, productivity, and digital transformation in engine inspection.

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Sumitomo completes Air Lease take-over, creates Sumisho Air Lease

Sumitomo Corporation has completed the acquisition of US-based aircraft leasing company Air Lease Corporation, alongside co-investors SMBC Aviation Capital, Apollo and Brookfield. The transaction, first announced in September 2025, closed on April 8, (EDT), with Air Lease delisted from the New York Stock Exchange and rebranded as Sumisho Air Lease. The deal creates one of the world's largest aircraft leasing businesses by fleet size, positioning the group to capitalise on sustained growth in global air travel and rising demand for more fuel-efficient, next-generation aircraft. Airlines are increasingly turning to leasing to improve capital efficiency and accelerate fleet renewal, reinforcing the strategic importance of lessors. Sumisho Air Lease will combine Air Lease's established customer base and asset management capabilities with Sumitomo Corporation's aviation expertise and global network. The company aims to expand investment in advanced, environmentally efficient aircraft, strengthen earnings stability and enhance access to global capital markets. Led by an experienced management team, the business will deepen collaboration with Sumitomo Corporation Group and SMBC Aviation Capital, building an integrated operating model spanning aircraft procurement, lease structuring, portfolio management and sustainability initiatives to boost global competitiveness. The acquisition is not expected to affect Sumitomo Corporation's results for the financial year ending 2025. Any financial impact will be reflected in its 2026 full-year earnings forecast.

Air Lease has been delisted from the New York Stock Exchange and taken private. The business has been renamed "Sumisho Air Lease" *© Sumitomo Corporation*

RECARO and Iberia trial sustainable cabin seating

RECARO Aircraft Seating (RECARO) has announced an innovative sustainability-focused trial in partnership with Iberia. The initiative will launch this spring aboard an Iberia A320neo, where passengers will experience new environmentally conscious seating features within a hybrid cabin fitted with R1 and R2 economy-class seats. As part of a RECARO modification kit, 186 seats will be installed in a selected A320neo for a trial period of at least six months. Iberia becomes the first RECARO customer to collaborate on the introduction of these more sustainable seating solutions, highlighting a shared commitment to combining passenger comfort and premium design with improved environmental performance. The development process followed a structured approach, including the creation of seating mock-ups, qualification testing and final material certification, enabling these innovations to be introduced into an operational cabin environment. Both R1 and R2 seats will incorporate several sustainability-driven features, including literature pockets made from upcycled fishing nets and a real wood inlay element. The recycled literature pockets utilise discarded fishing nets previously polluting marine environments. For a single-aisle aircraft such as the A320, this equates to the removal of approximately two kilograms of waste material from the oceans per shipset. In addition, the seating design integrates a real wood-based component within the seat bumper, introducing a natural material into the cabin while maintaining durability and aesthetic quality.

The Iberia A320neo cabin with sustainable seating features © *RECARO*

Skymark deal extends ST Engineering MRO partnership

Representatives from Skymark Airlines and ST Engineering Commercial Aerospace © *ST Engineering*

ST Engineering Commercial Aerospace has secured a Boeing 737 MAX component maintenance-by-the-hour (MBH) programme, alongside a 737NG landing gear overhaul contract, from Skymark Airlines—Japan's first Boeing 737 MAX operator. The award marks a fresh milestone in a longstanding partnership that began in 2013, built on trust and delivery performance. ST Engineering looks forward to supporting Skymark Airlines' component MRO requirements as it continues to make high-quality air travel widely accessible in the Japanese aviation market and progresses into the next phase of its fleet development. Its component MBH programmes and landing gear MRO solutions provide predictable cost structures and high fleet availability, supported by AI-driven analytics, automation and advanced MRO capabilities. Together, they form part of ST Engineering's integrated aviation lifecycle solutions, designed to support airlines over the long term.

AVIAHEADS secures Part-CAMO approval

AVIAHEADS OÜ has received approval as a standalone Continuing Airworthiness Management Organisation (Part-CAMO) from the Estonian Transport Administration under approval reference EE.CAMO.0033. The current approved scope covers the Airbus A318/A319/A320/A321 family, Airbus A330 and Boeing 737 aircraft, with airworthiness review certification (ARC) included within the approved scope. This milestone marks a significant step in AVIAHEADS' development as an aviation technical services provider. With its standalone Part-CAMO approval based in Estonia, AVIAHEADS further strengthens its capability to support continuing airworthiness activities through an EASA-based platform built on structured procedures, compliance control and technical oversight. The approval enhances AVIAHEADS' ability to support airlines, business aviation clients and eligible operators seeking a trusted partner for continuing airworthiness management within the approved aircraft scope and applicable regulatory framework. This includes clients across Europe, operators of aircraft registered in EASA Member States, and selected international markets where EASA-registered aircraft operate or where local regulatory frameworks closely align with EASA-based standards, always subject to local authority requirements. This strengthened capability also supports AVIAHEADS' work with lessors during aircraft transitions and storage periods between lessee terms, particularly where EASA-registered aircraft or EASA-aligned requirements apply.

Mammoth secures FAA approval for 777-200LR Freighter

Mammoth Freighter 777-200LRMF © *Mammoth Freighters*

Mammoth Freighters has received Federal Aviation Administration (FAA) certification for its 777-200LR Mammoth Freighter (777-200LRMF), marking a significant step in expanding its next-generation wide-body freighter portfolio. The certification confirms the aircraft's design, engineering and performance, clearing it for commercial service. The platform combines long-range capability with payload efficiency and operational reliability, positioning it as a flexible option for global cargo operators. Built on the Boeing 777 platform, the converted freighter features a large main-deck cargo door, reinforced flooring and an advanced cargo handling system, optimised for both long-haul and regional operations. Launch customer Jetran said the aircraft meets expectations and is expected to deliver strong value for end users including DHL, Qatar Airways and Ethiopian Airlines. With approval secured, Mammoth is preparing for entry into service and deliveries, while continuing development of its 777-300ER freighter conversion, which is expected to receive FAA certification later this year.

HEICO takes majority stake in Sherwood

HEICO Flight Support Group has acquired 80% of the stock of Sherwood Avionics and Accessories *© HEICO Flight Support Group*

HEICO's Flight Support Group has acquired an 80% stake in Sherwood Avionics and Accessories (Sherwood), with the remaining ownership retained by members of Sherwood's management team. Terms of the transaction were not disclosed. HEICO said it expects the acquisition to be earnings accretive within the first year following completion. Founded in 1992 and headquartered near Miami's Opa-locka Airport, Sherwood is an FAA and EASA Part 145 repair station specialising in the maintenance, repair and overhaul (MRO) of complex, mission-critical mechanical and electromechanical components for defence and selected commercial aviation platforms. Its capabilities span auxiliary power units (APUs), landing gear systems, wheels and brakes, pneumatics, hydraulics, fuel and lighting systems, avionics components and related accessories. The company also provides OEM-authorised distribution, engineering services and manufacturing capabilities. Sherwood supports a broad range of fixed- and rotary-wing aircraft, including the C-130, CH-47, F-15, F-16 and UH-60, among other defence platforms. It operates from two adjacent facilities totalling around 70,000 square feet and employs approximately 150 staff. Bryan Farrell, a member of Sherwood's leadership team, will continue to lead operations from the company's current facilities. HEICO Corporation focuses on the design, production, servicing and distribution of products and services for niche segments within the aviation, defence, space, medical, telecommunications and electronics sectors, through its Hollywood, Florida-based Flight Support Group and Miami-based Electronic Technologies Group.

ATC expands MRO footprint with PAS MRO acquisition

Air Transport Components (ATC Group) has announced the acquisition of PAS MRO, a specialised provider of bearing repair services. The strategic move strengthens ATC Group's expanding portfolio of capabilities and broadens its presence in high-value component repair, enhancing service offerings to airline, OEM and aftermarket customers worldwide. PAS MRO, based in Bristow, Oklahoma, brings a strong reputation for technical expertise, quality and customer responsiveness. The addition complements ATC Group's existing operations in Tulsa, Oklahoma, and Gilbert, Arizona, creating operational synergies and extending repair capabilities across key product lines. "PAS MRO is a natural fit for ATC Group," said Jimmy Newman, Chief Executive Officer of ATC Group. "Their technical depth, customer relationships and commitment to quality align closely with our platform. This acquisition enables us to broaden our capabilities while continuing to deliver the speed, reliability and service our customers expect." "Joining ATC Group marks an exciting new chapter for PAS MRO," said Jim Agee, President of PAS MRO. "ATC Group has built a strong reputation for operational excellence and customer focus. By combining our expertise and capabilities, we are well positioned to deliver even greater value to our customers while continuing to grow our business." PAS MRO will continue to operate with its existing team and leadership, ensuring continuity for customers and employees while benefiting from ATC Group's broader infrastructure and resources. The acquisition represents a further step in ATC Group's strategy to build a scaled, diversified MRO platform, supported by AE Industrial Partners, positioning the company for continued growth across the aerospace aftermarket.

Setna expands credit facility to fuel global growth

Setna iO (Setna) has announced the successful amendment and expansion of its commercial credit facility, increasing total borrowing capacity to US$550 million. This development underscores the company's strong financial position, characterised by robust earnings, low leverage, and a scalable global platform. The expanded facility reflects the continued confidence of six leading commercial banks in Setna's long-term strategy, operational model, and consistent execution. It provides additional financial flexibility to support ongoing investment across key business units, including Setnix, Setnix UK, PartsLab, Zulu, and LGT, while further strengthening the company's global parts trading and MRO capabilities. The anticipated addition of J&C Aero to the group is also set to enhance Setna's international reach and broaden its service offering. Setna remains focused on disciplined, sustainable growth, maintaining high standards of operational excellence and delivering reliable value to customers and partners.
Over the past decade, the company has evolved from an initial concept into a scaled global platform, supported by a committed and high-performing team. Looking ahead, Setna views its current position as an early stage in a longer growth trajectory. Its ambition is to establish itself as a global leader within the aviation aftermarket and services sector. The company has expressed appreciation for the continued support of its banking partners, business collaborators, and employees, whose collective efforts underpin its ongoing success.


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Marubeni secures full control of DASI

© DASI warehouse

Marubeni Corporation has completed the acquisition of the remaining 50% stake in DASI, a prominent global provider of commercial aviation inventory solutions, thereby making it a wholly owned subsidiary. The transaction was executed through Marubeni Aviation Asset Investment LLC, its U.S.-based aviation aftermarket and asset trading arm. This move reflects Marubeni's strategic intent to strengthen its position in a growing aviation maintenance and aftermarket sector. The acquisition comes at a time when global demand for aircraft maintenance is rising steadily. This growth is being driven by increasing passenger and cargo traffic, a larger global aircraft fleet, and extended use of older aircraft due to ongoing supply chain constraints and delays in new aircraft deliveries. As a result, the aircraft maintenance market is projected to expand at a compound annual growth rate of approximately 3.3%, reaching around US$215 billion by 2035. In parallel, the aviation aftermarket parts segment is expected to grow significantly, reaching approximately US$23.5 billion by the same year—around 1.5-times its 2024 size. DASI plays a central role in this ecosystem as a leading distributor of aviation aftermarket parts. The company manages around 2.5 million stock keeping units, including both factory-new and surplus components, and serves over 3,500 customers globally. Its competitive advantage lies in its data-driven pricing capabilities, efficient inventory monetisation services for suppliers, and an integrated operational platform combining warehouses, an online marketplace, and proprietary systems. This enables rapid delivery and a broad product offering tailored to diverse customer requirements. Within Marubeni's Mid-Term Management Strategy GC2027, businesses with scalability and high value-added services—termed "Strategic Platform Businesses"—are prioritised. Aviation aftermarket and asset trading is identified as a core pillar, alongside Magellan Aviation Group, another wholly owned subsidiary specialising in used serviceable materials from retired aircraft. By fully integrating DASI, Marubeni aims to unlock synergies with Magellan, combining expertise in surplus and used parts with a wide inventory of new components. This is expected to enhance its overall platform and competitiveness in the aviation aftermarket. Ultimately, Marubeni seeks to support the aviation industry's sustainable growth through reliable parts supply and more efficient procurement systems, while continuing to strengthen its corporate value.

Safran establishes new Wallonia subsidiary with €125m investment

François Lepot, Chief Executive Officer of Safran Aero Boosters, has announced the creation of a new subsidiary, Safran Booster Components, located in Welkenraedt, Wallonia, Belgium. The announcement, made in the presence of Pierre-Yves Jeholet, Vice-President of the Walloon Government and Minister for the Economy, Industry and Employment, supports Wallonia's reindustrialisation efforts. The new industrial site will manufacture aircraft engine compressor components, strengthening Safran Aero Boosters' position in its field of excellence and within the region. The project, representing an investment of €125 million (US$144 million), has been made possible through a strong partnership with Walloon and Belgian federal public authorities, Wallonie Entreprendre (33%) and the Belgian Federal Holding and Investment Company – SFPIM (11%), both shareholders alongside Safran Aero Boosters (56%). This decision comes at a time of strong acceleration in global demand across several civil aircraft programmes. Production rates for LEAP (Boeing 737 MAX, Airbus A320neo and COMAC C919), GEnx (Boeing 787) and GE9X (Boeing 777X) engines are set to increase significantly in the coming years. To support this acceleration, Safran is strengthening its industrial capacity, notably by duplicating production sources to prevent any supply disruptions, thereby meeting the expectations of its main customers, Safran Aircraft Engines and GE Aerospace. This new facility complements Safran Aero Boosters' existing industrial ecosystem. Together, the Milmort, Liers, Marchin and Welkenraedt sites will support Safran's sustainable growth while securing its global supply chain. The facility, which will be operational in 2028, will be housed in an 18,000 m² building previously occupied by Copeland, which is currently in the process of gradually winding down its operations at the site. This choice enables the reuse of existing infrastructure without any additional land take. The future plant will incorporate Safran's most advanced industrial technologies in production, digitalisation and robotics, in order to meet the most demanding global standards. It will also contribute to the creation of approximately 100 jobs.

FIGEAC AÉRO secures new Mexico production contracts

FIGEAC AÉRO has signed new agreements for the production of mechanical components in Mexico © FIGEAC AÉRO

FIGEAC AÉRO, an established partner to major aerospace manufacturers, has announced the signing of new agreements for the production in Mexico of mechanical components for the assembly of passenger seats, electrical harnesses and landing gear, to be fitted to commercial aircraft. Following three separate tenders in North America, FIGEAC AÉRO has been selected to produce parts for the assembly of equipment destined for several Airbus, Boeing and Bombardier aircraft families. The first batch includes components for passenger seats selected by airlines and subsequently installed on numerous aircraft types; the second covers a range of housings and support kits for the installation of electrical harnesses intended for Boeing aircraft families; and the third relates to machined aluminium landing gear parts for Bombardier business jets. All production will take place at the Group's plant in Chihuahua, Mexico. In addition to the proven expertise of its teams, the site's proximity to customer facilities was a key factor in the decision, alongside the high technological standard of its production capabilities and assembly operations, reflecting the Group's proactive reinvestment strategy in Mexico following the sale of its Hermosillo site in 2022. FIGEAC AÉRO anticipates annual revenue of US$1.5 million from these agreements, which will help optimise utilisation of the Mexican site and support the continued recovery of profitability. First deliveries are scheduled for 2026. Under its PILOT 28 plan, the Group identified North America as a major area for commercial development. While the Wichita and Chihuahua sites accounted for only around 5% of total business as of March 31, 2025, the region now represents approximately one-third of new business secured since the launch of PILOT 28.

Philippine Airlines, AFI KLM E&M renew GE90 engine support

Sealing the deal for GE90 engine support, representatives from Philippine Airlines and AFI KLM E&M *© AFI KLM E&M*

Philippine Airlines and Air France Industries KLM Engineering & Maintenance (AFI KLM E&M) have renewed and extended their long-term maintenance agreement covering the airline's GE90 engines, reinforcing one of the longest-standing GE90 partnerships in the Asia-Pacific region. The amended contract was formally signed on March 25, 2026, at Philippine Airlines' headquarters in Manila. As one of the earliest GE90 operators in Asia-Pacific, Philippine Airlines continues to rely on AFI KLM E&M's expertise to support the next phase of its fleet lifecycle. Under the renewed agreement, AFI KLM E&M will continue to deliver comprehensive long-term support, including shop visits, predictive maintenance solutions, spare parts support, on-wing services (OWS), and engine line replaceable unit (LRU) pool support. The enhanced framework has been specifically tailored to meet the operational and cost-efficiency requirements of a fleet entering a more mature phase. In a competitive regional landscape, the extension underscores Philippine Airlines' continued confidence in AFI KLM E&M's operational performance, technical expertise and extensive GE90 experience. Beyond the GE90 programme, the partnership also continues for the CFM56-5B engine, supported by a dedicated local presence (OWS Corner) providing tailored services for Philippine Airlines' A320 fleet.

RECARO surges ahead with strong 2025 performance

RECARO Holding has released its 2025 financial results, reporting total revenue of €723 million and marking another year of double-digit growth. With an order book approaching €3 billion, the company recorded a highly successful year driven by new products and strong order intake. This momentum is expected to continue into 2026 as RECARO Gaming and RECARO Rail expand their presence, while RECARO Aircraft Seating undergoes a significant ramp-up in the aviation sector. To support industry growth, the company continues to allocate more than 10% of its resources to innovation, product development and new projects. Increased investment will be directed towards composite technologies to meet rising demand in aviation. In parallel, RECARO Aircraft Seating is advancing its "space2grow" initiatives to better serve customers and prepare its facilities for future expansion. A key example is a recently announced multi-million-euro investment in infrastructure at its Poland site, aimed at increasing office and production capacity while enhancing technological capabilities. The global workforce has grown to nearly 3,400 employees, with 250 new hires over the past year, including 150 at the Aircraft Seating headquarters in Schwäbisch Hall, Germany. This expansion comes alongside ongoing efficiency measures and the integration of AI-driven solutions across the business. Following another record-breaking year, RECARO produced nearly 120,000 passenger seats across all classes in 2025. The Aircraft Seating division is now preparing to scale up production of its R3 long-haul economy seat, already in service with airlines such as Iberia, Aer Lingus and Malaysia Airlines. At the same time, the company is targeting market leadership in the business class segment, with its R7 seat delivering enhanced comfort for passengers flying with carriers including Iberia and LATAM. (€1.00 = US$1.16 at time of publication).


RECARO R7 business-class seats *© RECARO*

AA selects Direct Maintenance for Boeing 777 and 787 support

© Magnetic Line (Direct Maintenance)

Direct Maintenance, operating under the brand name Magnetic Line, has signed a line maintenance agreement with American Airlines to support its Boeing 777 and 787 operations at Dublin Airport (DUB). The agreement covers full technical handling services, including ETOPS support. American Airlines operates approximately one to two daily flights to Dublin during the winter season, increasing to up to five per day in summer. "As the largest independent Part-145 maintenance provider in Dublin, American Airlines represents a strategic addition to our client portfolio," said James Dyer, Station Manager at Direct Maintenance Dublin. "Supporting up to five daily wide-body operations during peak season requires significant technical capability and operational flexibility." To support the contract, the Dublin station will relocate to a larger facility at the airport, with expanded storage and office space. The local engineering team will also be increased to meet operational requirements. "American Airlines operates one of the most demanding schedules in the industry, and we're proud to have been entrusted to perform line maintenance that directly impacts their operational performance," stated Getter Kägu, Commercial Representative at Direct Maintenance. "This agreement validates our technical capabilities and represents a significant milestone in our growth."

EU backs Rolls-Royce UltraFan project with €64 million

Rolls-Royce has secured €64m to advance the UltraFan 30 demonstrator © Rolls-Royce

Rolls-Royce has secured €64 million (US$73.6 million) in funding from the European Union's Clean Aviation Joint Undertaking (CAJU) to lead UNIFIED (Ultra Novel and Innovative Fully Integrated Engine Demonstrations), a collaborative research programme supporting the development and planned ground testing of the UltraFan 30 demonstrator. The project will focus on maturing and advancing next-generation propulsion technologies for future narrow-body applications, supporting planned ground testing of the UltraFan 30 demonstrator in 2028 and helping to establish a credible pathway towards a future flight test. Led by Rolls-Royce, the UNIFIED consortium brings together industrial, academic and research partners from across France, Germany, the Netherlands, Norway, Spain and the United Kingdom. By combining expertise across the European aerospace sector — including the UK through its association with Horizon Europe — the partnership will strengthen industrial capability, enhance supply chain resilience and build the technology readiness required for future narrow-body applications. Rolls-Royce Director of Research and Technology Alan Newby said: "UNIFIED is an important step in advancing the UltraFan technologies that could underpin a future narrow-body application. The narrow-body segment is central to global aviation growth, and delivering step-change improvements in efficiency in this market is key to long-term sustainability. "Through Clean Aviation, we are accelerating technology readiness in collaboration with leading industrial, academic and research partners, strengthening the foundations required for future narrow-body opportunities."

Ryanair opens €25 million Madrid mega maintenance hub

Official opening of Ryanair's new MRO hub in Madrid © *Ryanair*

Ryanair has inaugurated its new €25 million maintenance centre at Madrid Barajas Airport—the largest in its network. With capacity for seven aircraft, the 22,000 m² state-of-the-art facility, located in the airport's industrial zone, will create 700 highly skilled jobs, including engineers, mechanics and support staff, further strengthening Madrid and Spain's position as a leading European aviation hub. The new hangar complements Ryanair's existing maintenance facility at Barajas, increasing total capacity to eight aircraft maintenance lines. In addition, Ryanair operates a modern five-bay maintenance centre in Seville, opened in 2019 and expanded in 2021, representing a further €30 million investment in Spain. The Madrid facility now plays a central role in Ryanair's maintenance engineering network across seven EU locations, carrying out both routine A-checks and more specialised engineering work. The airline is also collaborating with leading aviation schools in Madrid to train and recruit engineers and mechanics through its in-house Engineer Development Programme. Ryanair is also one of Spain's biggest foreign investors and a key contributor to tourism and industry. With 62 million passengers annually in Spain, a fleet of 109 aircraft across 11 bases, two maintenance centres, a recently commissioned crew training facility, and an IT innovation hub in central Madrid, Ryanair's total investment in Spain now stands at €11 billion.
(€1.00 = US$1.15 at time of publication).

Aerotec bolsters European MRO reach with newest acquisition

Aerotec Europe GmbH (Aerotec) has announced the acquisition of Global Aerotech d.o.o, a Croatia-based provider of aircraft MRO services. The company specialises in base maintenance, line maintenance and component repair. Financial terms of the transaction have not been disclosed. Aerotec, together with its subsidiary Airplane Equipment & Services A.E.S. GmbH, has been pursuing a targeted growth strategy since its acquisition by Borromin Capital Fund IV in September 2022. This strategy focuses on both organic development and the integration of complementary add-on businesses to strengthen its position in the aviation aftermarket. The acquisition of Global Aerotech represents the latest step in this expansion trajectory. It follows a series of strategic transactions aimed at building a comprehensive MRO and aftermarket platform. In June 2024, Aerotec acquired aviationscouts, a leading player in the aircraft interior aftermarket with a strong focus on refurbished seating solutions. This was followed in July 2025 by the acquisition of Opremic trade GmbH, an IT company enhancing

Aerotec Europe GmbH has acquired Global Aerotech, a company specialised in base maintenance, line maintenance and component repair © Global Aerotech

Aerotec's digital capabilities, particularly in MRO documentation and process optimisation. Most recently, in November 2025, Aerotec expanded its international footprint with the acquisition of a Dubai-based component maintenance facility specialising in the design, production, refurbishment and certification of aircraft cabin interiors. With the addition of Global Aerotech, Aerotec further strengthens its technical capabilities and geographic reach within Europe, reinforcing its ambition to build an integrated, digitally enabled MRO platform. The move enhances its ability to deliver a broader range of services to airline and aviation customers while supporting continued growth across key segments of the aerospace aftermarket.

TAT posts record year as growth streak continues

© Shutterstock

TAT Technologies (TAT) has reported strong results for the full year 2025 and the fourth quarter, delivering record performance and marking its third consecutive year of growth and improvement across all key financial metrics. For the full year, TAT achieved record revenue of US$178 million, alongside margin expansion across all profitability measures, including a record EBITDA margin. The company demonstrated its ability to grow organically at pace within the sector while improving margins quarter on quarter. Fourth-quarter revenue followed a seasonal pattern, resulting in a stabilisation compared with earlier periods. Nevertheless, TAT delivered organic growth of over 13%, outperforming broader industry growth rates. The company ended the year with a backlog and long-term agreements valued at approximately US$550 million, up from US$429 million at the start of 2025. This provides strong revenue visibility and supports its objective of continued growth through 2026. With sustained demand across the aviation MRO market, TAT remains focused on executing its strategy, expanding capabilities, and pursuing M&A opportunities to strengthen its position in thermal management and power systems.

GE Aerospace commits €110 million to expand European operations

GE Aerospace plans to invest more than €110 million across its European manufacturing sites this year as it seeks to expand production capacity, accelerate advanced manufacturing and strengthen delivery performance for customers. The investment programme is accompanied by plans to recruit more than 1,000 new employees across Europe in 2026. A substantial share of the investment will be directed towards state-of-the-art engine test cells, advanced machining equipment, the expansion of additive manufacturing, and upgrades to buildings and infrastructure. These enhancements will support a range of commercial narrowbody and widebody engine programmes, as well as military fighter jet and helicopter engines. The investment will be distributed across five European countries, with €77 million allocated to Italy to enhance advanced manufacturing and testing capabilities across multiple commercial and defence engine programmes, including new and upgraded test cells, machining equipment, additive manufacturing expansion and site improvements. Poland will receive €15 million to support advanced grinding and machining equipment, welding and inspection tooling, and facility upgrades. In the Czech Republic, €8 million will be invested in precision machining and grinding systems, quality inspection technology, assembly tooling and infrastructure improvements. The United Kingdom will see €10 million invested in upgraded test and manufacturing equipment, expanded electronics and component manufacturing capabilities, and modernised facilities. Romania will receive €3 million for metal-cutting machines, tooling, fixtures and building upgrades. In addition, GE Aerospace plans to invest approximately €40 million across its European maintenance, repair and overhaul (MRO) and component repair facilities this year, forming part of a previously announced global US$1 billion investment in MRO capabilities. Alongside its manufacturing expansion, GE Aerospace is addressing the shortage of skilled labour in high-tech industries by investing in workforce development across Europe. This includes recruiting new talent and supporting both current manufacturing personnel and future engineers through training initiatives and grants to vocational schools in the UK and Italy, expected to reach more than 800 students this year. The company is also expanding its 'Next Engineers' programme in Warsaw, Poland, which is set to engage more than 4,000 students.

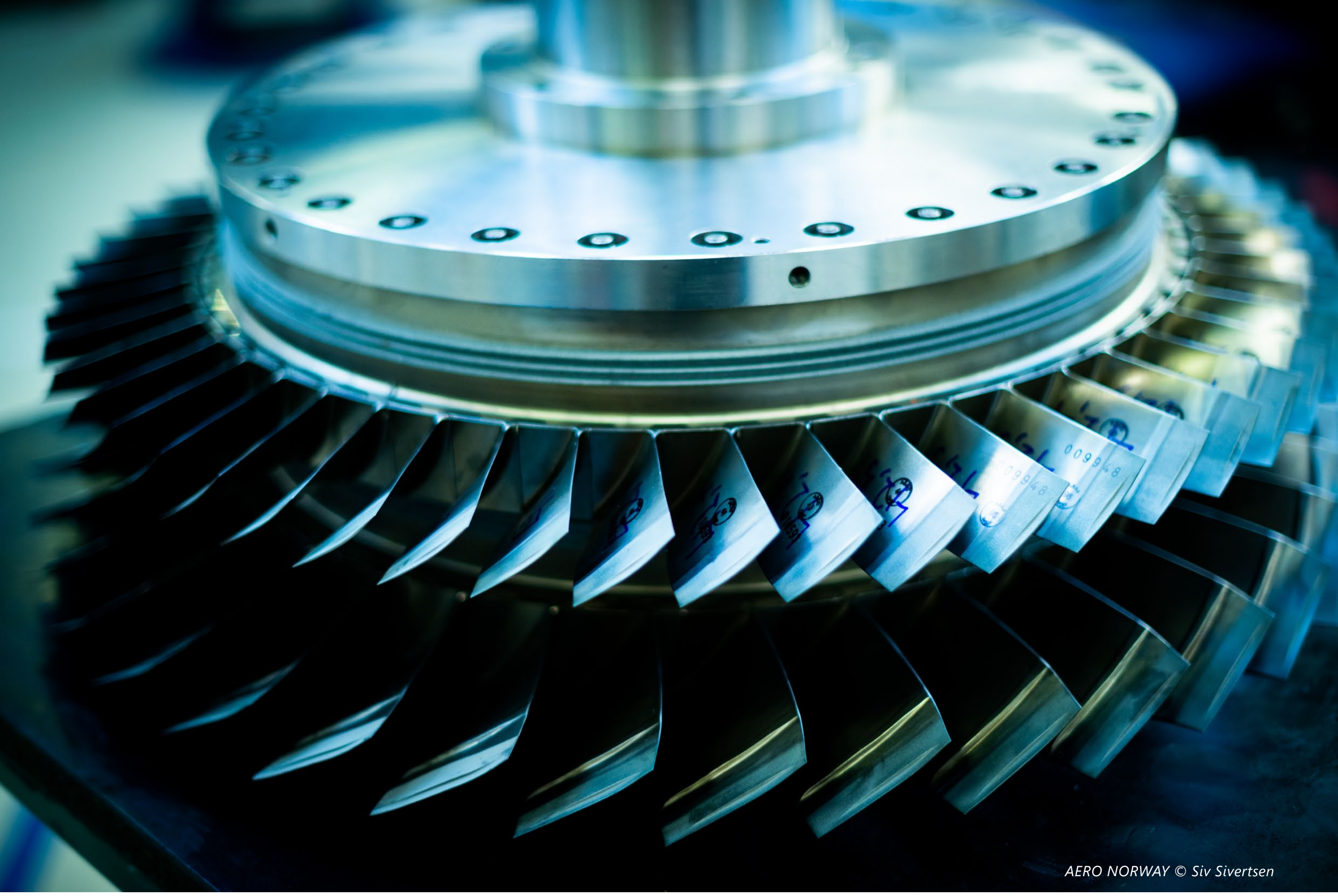
AFI KLM E&M and Air Mauritius extend A350 support deal

Air Mauritius A350 © *AirTeamImages*

Air France Industries KLM Engineering & Maintenance (AFI KLM E&M) and Air Mauritius have announced a multi-year extension of their agreement covering component support, including full pool and repair services, as well as Auxiliary Power Unit (APU) support for the airlines Airbus A350 fleet. The extension reflects the strong and ongoing alignment between the two organisations. Under the renewed agreement, AFI KLM E&M will continue to provide maintenance expertise and support for Air Mauritius' A350 operations, helping to ensure high levels of safety, reliability and operational efficiency. "AFI KLM E&M has been a trusted partner for so many years now in supporting our A350 operations. The extension of this agreement underscores our confidence in their capacities. We are eager to continue this productive collaboration and unlock further operational excellence" stated Ravindranath Ramroop, Head of Technical Services of Air Mauritius. Pierre Teboul, Senior Vice President Commercial at AFI KLM E&M acknowledged the extended partnership with the airline: "This renewed agreement reflects the strength of the long-standing relationship between our teams and our shared commitment to operational reliability. We look forward to pursuing this collaboration and supporting Air Mauritius in the continued success of their operations."

BOC Aviation delivers record profit and expands portfolio

BOC Aviation has posted its audited results for the year ended December 31, 2025, reporting a net profit after tax (NPAT) of US$787 million. Performance was driven by an 18% increase in underlying earnings, which rose to US$746 million from US$633 million in the previous year. Reflecting its earnings strength, robust balance sheet and record cash flows, the Board has recommended a final dividend of US$0.3061 per share. This represents the company's highest-ever final dividend and, when combined with the interim distribution, brings total dividends to US$0.45371 per share. The company has also increased its dividend policy payout ratio to up to 40% of NPAT, compared with 35% previously. BOC Aviation's balance sheet expanded to more than US$26 billion, with total equity reaching US$6.8 billion. The company generated a record US$2.2 billion in operating cash flow net of interest expense. Investment activity remained strong, with US$4.2 billion in new capital expenditure in 2025, exceeding the company's target. During the year, BOC Aviation also committed to acquiring a further 160 aircraft, ending the period with total committed capital expenditure of US$19 billion and an order book of 337 aircraft. "We achieved strong underlying earnings growth in 2025 as we took delivery of aircraft as scheduled and hit our investment goals," said Steven Townend, Chief Executive Officer and Managing Director, BOC Aviation. "Looking ahead, we have our company's largest ever orderbook and ended the year with the largest ever amount of committed liquidity, providing us with a strong base to achieve our long-term growth targets."


AERO NORWAY © Siv Sivertsen

Effective Engine LLP Management – So Much More Than Timing?

The different challenges faced with life limited parts (LLPs) because unlike other engine parts, LLPs cannot be "repaired," "refurbished," or "overhauled" to extend their life once they reach their certified limit.

By David Dundas

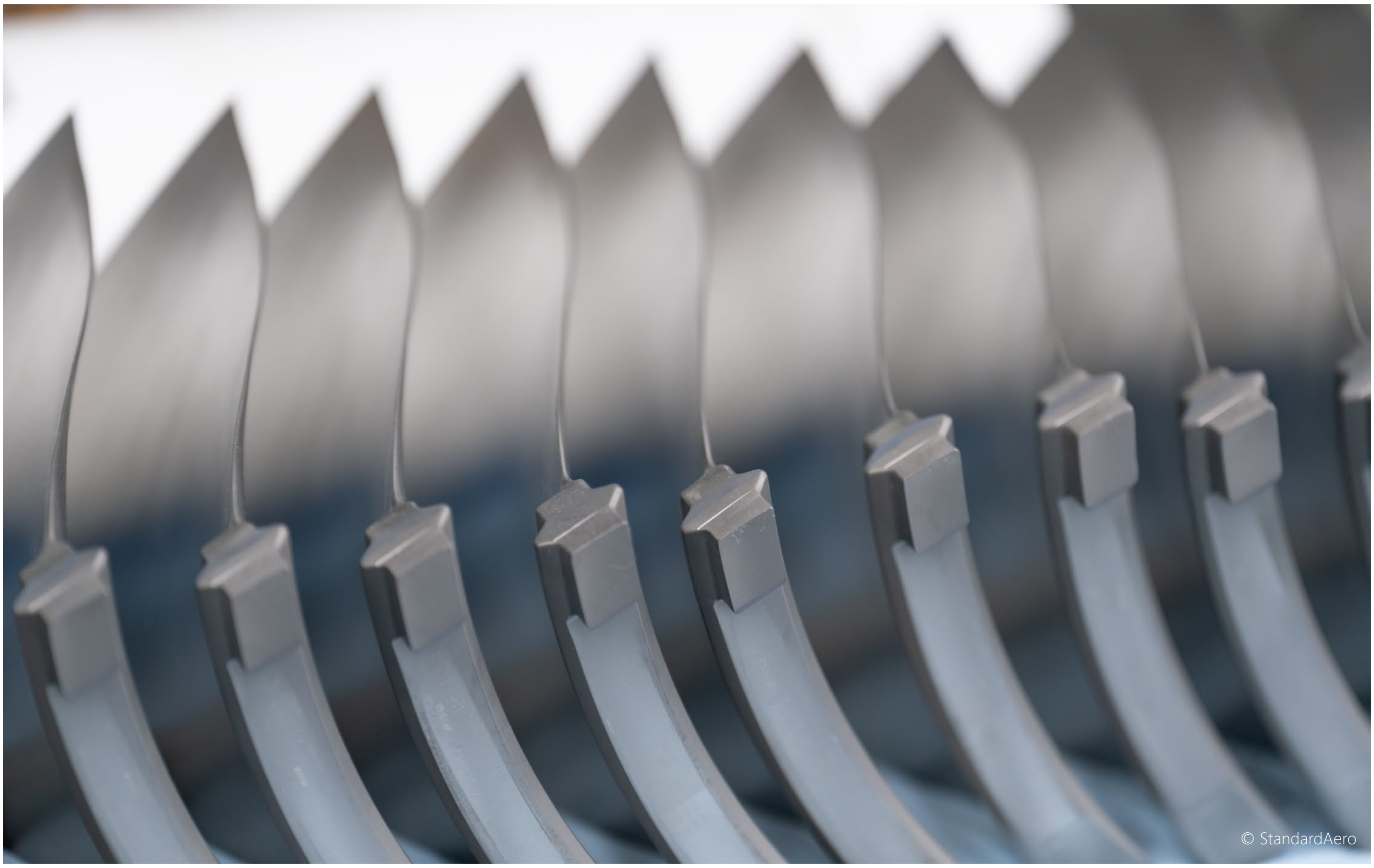
With the cost of a jet engine for a commercial aircraft like the CFM LEAP or P&W GTF families running well into eight figures, it is hardly a surprise that the cost of engine maintenance is also hugely expensive. Consequently, carriers and MRO operators are both constantly looking for ways to reduce these costs, but the problems faced are exacerbated by the fact that there are generally two types of part for an engine. First, you have parts which are repairable, which can be overhauled, and which can have their lifespan extended through careful maintenance. Then you have your life-limited parts, or LLPs as they are known. These are parts which are manufactured to a specific design, using approved materials, and while requiring maintenance, this cannot extend their lifespan as this is predetermined in terms of cycles or hours used. So, already you can see one of the main challenges, as when do you choose to replace an LLP when shop visits rarely coincide exactly with their expiry? Similarly, when an engine is nearing its lifespan, it makes little sense to use costly brand-new LLPs that will outlast the engine. Fortunately, the market for ‘green time’ LLPs seems to help overcome a number of problems.

To learn more about the effective management of life limited parts we approached several specialists in the field of engine MRO and quizzed them further on the challenges they face.

How does LLP planning influence engine shop visit timing?

We wanted to establish just how important the lifespan of LLPs is to the overall maintenance schedule of aircraft, and the problems created if it is not successfully factored into the equation.

LLP planning shapes shop visit timing because LLPs set the hard cycle limits that ultimately dictate when an engine must come off wing. As the lowest remaining cycle part in the stack approaches expiry, it becomes the primary driver of removal timing—often overriding performance health, EGT margin, or other technical indicators. For smaller and midsize operators and lessors, this creates a fixed


© StandardAero

window in which a shop visit has to occur, which can compress planning horizons and force earlier than ideal removals. Virgil D Pizer, CEO, Pem-Air Turbine Engine Services goes on to explain further: "LLP status also influences the type of visit that makes sense. When an aircraft has several years of service ahead, operators may justify a full restoration and full or partial LLP stack replacement. When the aircraft is closer to phase out or lease return, a lighter, module-focused visit—or even a green-time engine—can be more economical than investing in high value LLPs. Because LLP exposure affects both cost and remaining life, it becomes a central factor in deciding whether to restore, defer, or pivot to an alternative strategy. Unscheduled removals add another layer of pressure. If an engine with limited LLP life suffers an unexpected event, operators may be forced into an early shop visit that accelerates LLP spend and disrupts fleet availability. With smaller fleets and limited spare coverage, this can have an outsized operational and financial impact. Lessors feel the same timing pressure from the other side: LLP cycles remaining influence mid-life lease pricing, redelivery conditions, and asset value protection. As a result, LLP planning often determines not just when an engine is removed, but how the asset is positioned for the next lease cycle."


Virgil D Pizer, CEO, Pem-Air Turbine Engine Services

In the opinion of Dave Hobbs, VP Sales, AerFin, "Life Limited Parts (LLPs) sit at the centre of engine maintenance planning. With fixed cycle limits set by the OEM, they create non-negotiable deadlines that operators must work around. In practice, the goal is to align LLP replacement with scheduled shop visits - whether that's for performance restoration or a full overhaul. Done well, this avoids the need for additional, unplanned maintenance events. If LLPs aren't aligned properly, the impact is immediate. Engines can be forced off wing earlier than expected, or require incremental shop visits, both of which drive up cost and disruption." He then concludes that: "Effective LLP planning focuses on balance. By managing the consumption of LLPs across the engine, operators can maximise time on-wing and extract full value before removal." Dag Johnsen, COO, Aero Norway is of a like mind, highlighting the criticality of optimum engine life and shop visit timing. He tells us that: "LLP

> ***"LLP cycles remaining influence mid-life lease pricing, redelivery conditions, and asset value protection. As a result, LLP planning often determines not just when an engine is removed, but how the asset is positioned for the next lease cycle."***
>
> *Virgil D Pizer, CEO, Pem-Air Turbine Engine Services*

management is not just compliance, it controls shop visit cost, engine availability, and asset value. Those operators who manage LLPs proactively spend less and extract maximum life out of every engine. From Aero Norway's perspective as a CFM56 engine specialist, LLP planning is less theoretical and much more operational, it directly drives induction timing, workscope design, and ultimately shop profitability. For a CFM56 engine (whether -5B/-5C or -7B), LLPs are often the primary drivers of EGT margin strategy in the hardware. The goal is to provide the optimum engine life and shop visit timing, not just performance deterioration. Shop visits are planned around 'hard LLP limits' in the HPT/LPT disks and shafts. If LLPs are nearing expiry, we'll work with our airline customers to find ways to advance a shop visit even if the engine is still performing. Conversely, if LLP life is strong, we can find ways to extend on-wing time using minor workscopes." He then ends with sound advice, acknowledging that "It's important to note that the lowest LLP in the stack defines the engine's remaining service life so our team finds ways to align LLP consumption with performance deterioration for maximum economic efficiency."

To round things off, Bruce Ansell, Technical Manager Engine Division, APOC Aviation, Lee Carey, CIO, EirTrade Aviation, Andrew Storch, VP Asset Management, Setna iO and Guillermo Soto, Director-Pricing and Evaluation, Enterprise Asset Management Team, StandardAero have additional, more succinct thoughts on the matter. "LLPs have hard limits which determine replacement, while other components have soft limits and are generally replaced on condition, or to match LLP limits. Effective planning is a key factor in optimising shop visit timing and avoiding unnecessary maintenance events, suggests Ansell, while Carey feels that: "LLP limiters are one of the primary reasons for engine removals and engine shop visits. In many instances operators will aim to align LLP replacement with performance restoration." "Successful engine maintenance planning is optimising for cost minimisation while maximising the performance of the engine, all within the constraints of the LLP life limits. Said differently, the asset owner wants the engine to burn the least amount of fuel for as long as possible, with the upper bound of time on wing represented by the lowest LLP limiter," Storch adds into the mix, while Soto concludes the responses: "LLP planning is key for operators in two respects: stub life optimisation, that is to say making the most of the LLP life in an engine, to avoid wasted value; and determining the correct mix of new (or part-life) LLPs being incorporated during overhaul, in order to meet the operator's specific operational needs while minimising MRO spend."

What are the risks of mixing LLPs with significantly different remaining cycles?

Here we wanted to find out if there is a price to pay for mixing LLPs which had differing life cycles, or if there was a solution that could limit potentially unnecessary shop visits.

Dave Hobbs is quite blunt in his response. "Mixing LLPs with uneven remaining life creates inefficiency across the entire engine. The most immediate risk is premature shop visits. A single low-life LLP can dictate removal timing, even if the rest of the stack still has significant usable life. That leads to more frequent maintenance events and unnecessary cost. There's also a compounding financial impact. Repeated disassembly, replacement and rebuild activity increases maintenance spend and reduces overall efficiency. From an asset perspective, it weakens market appeal. Engines with non-uniform LLP stacks are less attractive to buyers and lessors. In cases where high-life LLPs sit within an engine nearing the end of its operational life, the cost per cycle rises sharply - high investment, but limited time on wing." He then sums up the situation very clearly: "Consistency across the LLP stack isn't just a technical preference, it's key to maintaining value and controlling cost." Bruce Ansell is little different to Hobbs in terms of making the pitfalls abundantly clear, warning that: "This runs the risk of throwing money away. LLPs must be replaced upon reaching their life limits; if they are mismatched then the engine will be removed at the lowest limit, leading to decisions about changing those LLPs with remaining life to avoid another costly shop visit in the near future. It is rare for LLPs with sub-5K CR to realise their true value if removed. APOC actively helps customers mitigate these issues trough better lifecycle alignment."

Being cautious seems to be a recurring theme where responses are concerned. On a slightly different tack, Lee Carey suggests that: "Mixing LLPs with significantly different remaining cycles can be the cause of driving a future shop visit sooner due to a lower LLP limit. Furthermore, this can have a significant impact on the cost of the shop visit, by resulting in the need to replace more LLPs during the next shop visit depending on the engine build standard and hinder the ability to manage the stub life as the engine matures."

Mixing LLPs with very different remaining cycles creates a structural imbalance in the engine's lifecycle that almost always shows up later as higher cost, compressed shop visit timing, and reduced flexibility. When one or two LLPs sit far below the rest of the stack, they become the pacing items that dictate when the engine must come off wing, even if every other module still has meaningful life left. For smaller and midsize operators and lessors, this imbalance can force premature removals, disrupt cash flow

> ***"Consistency across the LLP stack isn't just a technical preference, it's key to maintaining value and controlling cost."***
>
> *Dave Hobbs, VP Sales, AerFin*

Dave Hobbs, VP Sales, AerFin

Enterprise Asset Management Team, StandardAero

> *[The] biggest risk associated with mixing LLP with dissimilar cycles remaining (CR) is that of hitting a life limit for a single part only, thereby necessitating a premature shop visit (and, potentially, wasted stub life).*
>
> *Enterprise Asset Management Team, StandardAero*

planning, and undermine the ability to align shop visits with lease return or fleet retirement timelines suggests Virgil D Pizer. He then continues: "When a single LLP is significantly lower than the rest, it becomes the limiting factor that pulls the entire engine into the shop early. This means operators may be replacing or restoring modules that still have substantial life remaining simply because one part has reached its limit. The result is a visit that is technically necessary but economically inefficient. A wide spread between LLP cycles often leads to "stranded life" — remaining cycles on high life LLPs that cannot be fully used before the next removal. That unused life represents sunk cost, especially when LLPs were recently replaced or sourced at a premium. Over time, repeated mismatches compound into higher lifecycle cost. Engines with balanced LLP cycles allow operators to choose between full restorations, partial stack replacements, or green-time strategies. Engines with mismatched cycles lose that flexibility. The lowest cycle LLP dictates the workscope, and operators may be forced into a deeper visit than they would otherwise choose. Especially, lessors rely on predictable LLP cycles to manage mid life transitions and redelivery conditions. A mixed cycle stack complicates valuation, increases the risk of redelivery shortfalls, and can force a lessee into an unplanned visit to meet contractual minimums. For operators, this can mean absorbing a major LLP cost at an inconvenient point in the aircraft's lifecycle." He rounds off his comprehensive response by telling us that "Engines with uneven LLP cycles are more vulnerable to unplanned removals becoming economically disruptive. If an unscheduled event occurs close to the expiry of a low cycle LLP, the operator may be forced into a full visit earlier than planned, accelerating spend and reducing the ability to use green-time or teardown-based alternatives."

"My understanding is that the real risk of installing lower cycle LLPs alongside higher cycle LLPs is that the engine is driven off wing while it is still performing well, i.e., producing low EGT margin but needs removal due to LLP limit. Additionally, an asset owner may inadvertently pay for extra cycles on certain LLPs that will not ultimately be used if the engine is driven off wing earlier than anticipated," Andrew Storch advises with a cautionary tone. Gullermo Soto would also appear to be of a similar mind to everyone else when he considers the "... biggest risk associated with mixing LLP with dissimilar cycles remaining (CR) is that of hitting a life limit for a single part only, thereby necessitating a premature shop visit (and, potentially, wasted stub life). This risk highlights the need for LLP CRs to match as closely as possible, in order to maximise maintenance efficiencies."

What are the most common findings during audits related to LLP documentation?

Here we suspected it would be all about traceability and repercussions if paperwork wasn't complete, but there is clearly more to this question than might be anticipated.

Lee Carey gives as a clear overview of the situation, as he explains: "The minimum technical paperwork requirement from an airworthiness perspective differs greatly to the standard which the market requires from a commercial perspective. In almost all circumstances, EirTrade witnesses that the requirement of the market is far more arduous from a commercial perspective." He goes further, adding that: "When a used LLP is being sold, buyers expect to receive full commercial traceability for each LLP including the commercial history of the engine(s) in which the LLP has been prior installed. This becomes very burdensome when an LLP has previously operated in another engine to which the owner of the current engine does not have access to the technical records. While this LLP can technically be fitted without the commercial trace of the original engine, most buyers will reject the unit, as they would expect the full traceability of the LLP and any engines

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>
> *Lee Carey, CIO, EirTrade Aviation*

Lee Carey, CIO, EirTrade Aviation

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in which it was prior installed." Dag Johnsen is particularly knowledgeable where the CFM56 engine is concerned, telling us that: "In the CFM56 world - where engines often change hands multiple times - data integrity degrades over time. Across audits (regulatory, lessor, or customer), Aero Norway sees the same LLP documentation issues arise frequently. Documentation quality can directly impact whether an LLP is usable - or scrap. These include gaps in back-to-birth traceability; mismatched physical serial numbers and records; cycle accumulation errors (especially after engine/module swaps); missing shop visit release documentation (8130 / EASA Form 1); poor tracking of piece-part exposure during previous repairs."

Virgil D Pizer provides a very comprehensive response where he identifies the most common 'repeat offences' and the cause of the problem. "Audits of LLP records tend to surface the same recurring issues, and almost all of them trace back to gaps in traceability, incomplete historical data, or inconsistencies between what is documented and what the engine has actually experienced. For smaller and midsize operators and lessors, these findings matter because LLP documentation is often the deciding factor in whether an engine can be inducted for a shop visit, accepted at redelivery, or valued accurately during a transaction. The most common finding is a break in the chain of custody for one or more LLPs. Our audits frequently encounter missing birth records, incomplete ownership transfers, or gaps in the documentation that should link each LLP from manufacture to its current installation. Even a small break in this chain can render an LLP unusable or significantly reduce its market value. Audits often reveal discrepancies between operator logs, maintenance tracking systems, and shop visit records. These inconsistencies can stem from manual data entry, legacy system migrations, or changes in utilisation patterns. When cycle counts don't align across documents, auditors must assume the highest plausible value, which reduces remaining life and can trigger unplanned removals. LLPs that have been swapped, re installed, or transferred between engines require precise documentation of each event. Our audits often uncover missing installation/removal tags, absent shop visit workscopes, or incomplete teardown reports. Without these, the LLP's remaining life cannot be validated. It is not uncommon to find mismatches between the physical LLP installed, the part number listed in the records, and the configuration required by the latest service bulletins. These errors create uncertainty about airworthiness and can delay shop visits or lease transitions. Even when records exist, they may not meet the formatting, certification, or regulatory requirements expected by operators, lessors, MROs, or authorities. This includes missing authorised signatures, improper document formatting, or lack of required endorsements." He then concludes: "Auditors sometimes find LLP documentation that does not match the engine's current module configuration, especially after partial stack replacements or green-time strategies. This misalignment can complicate planning for the next shop visit and reduce confidence in the engine's lifecycle data."

Andrew Storch comments on an area of concern not highlighted by others but certainly important, and that relates to a specific scenario where ownership of an aircraft is being transferred. As he points out: "Setna Asset Management has occasionally seen insufficient documentation when assets transfer ownership under distressed financial situations, for example, when an operator goes bankrupt and the assets go into receivership. This tends to be more common with older assets, as the industry has generally improved its recordkeeping practices. In these instances, phase in/phase out documentation may be lost

> ***"USM is critical for finding LLPs with correct matching life to suit any installed or planned LLP changes; part-life LLPs are also installed to match the expected OH life of the engine."***
>
> *Bruce Ansell, Technical Manager Engine Division, APOC Aviation*

Bruce Ansell, Technical Manager Engine Division, APOC Aviation

and there may exist gaps in non-incident statement coverage." Bruce Ansell more succinctly identifies several key areas that clearly are not on-off events, advising that: "Full back-to-birth trace is required, often there are problems with incorrect calculations if the engine has operated at different thrust ratings, or is missing history due to ferry flights, engine swaps, and similar."

Guillermo Soto brings responses to a close with confirmation of common findings, which he informs us "... tend to be incomplete back-to-birth (BTB) traceability, for example due to missing or incomplete records, and data discrepancies within the documentation. These are often accidental errors relating to incorrect cycles or hours having been recorded, or incorrect engine variant (or thrust rating) information having been recorded."

How important is the secondary market for LLP sourcing?

With it being next to impossible to schedule all elements of aircraft maintenance around expiry dates or cycles for LLPs, one of the many challenges for MROs is deciding on the optimum time for scheduled maintenance and the replacement of LLPs despite them not having reached the end of their life. We wanted to discover how strong the market is for used serviceable LLPs and what influence that may have on maintenance scheduling decisions.

At AerFin Dave Hobbs provides several reasons why the secondary market has great value in terms of problem solving. "The secondary market plays a critical role in how the industry manages LLPs. It offers a more cost-effective alternative to OEM supply, allowing airlines, lessors and MROs to access material at a significantly lower price point. That has a direct impact on maintenance budgets and overall asset strategy," he tells us, adding that: "Beyond cost, it also provides flexibility. Operators can extend engine life and respond more dynamically to maintenance requirements without being fully reliant on new production. This becomes even more important during periods of OEM constraint. With ongoing supply chain challenges and long lead times, the secondary market helps keep fleets moving by ensuring material remains available when it's needed."

Aero Norway's Dag Johnsen and APOC Aviation's Bruce Ansell both go one step further, using the term 'critical' where the importance of a secondary market for green-time LLPs is concerned. "As Aero Norway specialises in CFM56 engine MRO, the secondary market is absolutely critical. The large global fleet is mature, operators are cost-sensitive and new LLP pricing from the OEM is high relative to engine value. We rely heavily on USM (Used Serviceable Material) and without this market, shop visit costs would increase making many older CFM56 engines uneconomical to maintain," Johnsen advises, while Ansell also highlights the value of used LLPs for end-of-lease aircraft. "USM is critical for finding LLPs with correct matching life to suit any installed or planned LLP changes; part-life LLPs are also installed to match the expected OH life of the engine. If the engine is leased, there are lease return conditions to be met, these often state how many flight cycles should be remaining on the LLPs. APOC works with several operators who now consider this requirement and plan for replacement well in advance of any shop visit," he says.

Lee Carey at EirTrade makes a useful reference to LLPs for older engines, noting that: "EirTrade would observe that the secondary LLP market is hugely important as it allows engine owners access to LLPs for shorter build standards, rather than the need to install new LLPs. For more mature engines this can be important when trying to utilise the stub life of an engine whereby a shorter cycle build may be required on one module within the engine to maximise utility from the rest of the engine." In a similar manner to Carey, Andrew Storch at Setna iO looks at less obvious areas where green-time LLPs have tremendous advantages over brand-new ones, pointing out that: "Secondary market LLP availability facilitates increased asset owner optionality, both financially and technically. Operators and asset owners can save money by not over-building power plants for which there exist plentiful LLPs on the secondary market. This is particularly true for twin-aisle legacy platforms which may only operate a fraction of typical single-aisle utilisation, so asset owners may opt to install lower-cycle LLPs sourced from the secondary market for extra insurance that the engine will perform as planned right up until the cycle limiter."

At Pem-Air, Virgil D Pizer acknowledges the huge importance of the secondary market for LLPs, but exercises caution owing to supply and demand problems, especially for ageing engines. As he explains, in detail, "The secondary market has become imperative for LLP sourcing because it is the only place where operators can reliably find life-limited parts at prices and cycle ranges that match the realities of aging engines. New OEM LLPs are expensive, often out of proportion to the remaining economic life of the aircraft, and lead times remain long. In today's environment—defined by tight teardown supply, elevated shop visit demand, and operators holding onto aircraft longer than planned—the secondary market is the practical backbone of LLP strategy. The current market is short on mid-life teardown engines, which limits the availability of LLPs with usable remaining cycles. At the same time, shop visit volumes remain high across several mature platforms, pushing more buyers into the same constrained USM pool. This imbalance drives volatility in pricing and makes it harder to source LLPs with the right remaining life. For many operators, the secondary market is no longer just a cost-saving option—it is the only viable path to keeping engines serviceable without committing to uneconomic full stack replacements. Aging engines rarely justify installing brand new LLPs with full a lifespan. What operators need are LLPs with remaining cycles that match the aircraft's planned horizon, whether that's a short bridge to retirement or a few more years of service. Only the secondary market provides this range of life options. Without it, operators would face stranded life, premature removals, or shop visits that no longer make financial sense." He then concludes: "PMA has already replaced many LLPs on certain platforms, and where approved, it can be a powerful stabiliser in a tight market. PMA LLPs offer more predictable pricing, shorter lead times, and independence from OEM supply constraints. In environments where teardown flow is thin and USM pricing is inflated, PMA can restore economic balance by providing new life LLPs at materially lower cost. For operators managing mature fleets, PMA can be the difference between extending an engine's life economically and retiring it early." Meanwhile, at StandardAero, Guillermo Soto is succinct in his assessment of the situation: "The secondary market is extremely important for LLP sourcing, especially for those operators looking to short-build an engine for a specific number of cycles or hours. Access to used serviceable material (USM) enables operators to avoid potentially wasted investment in zero-time material when it's not required," he concludes.

Andrew Storch, VP Asset Management, Setna iO

What pricing dynamics influence LLP trading?

As with so many aspects of parts' management, there are several differing factors which can affect the value and pricing dynamics of LLPs, and we wanted to learn a little more about what has the greatest influence.

Here Virgil D Pizer and Dag Johnsen both identify the same three clear factors. "We at Pem-Air see that pricing in the LLP market is shaped by a few predictable forces that interact with each other: supply scarcity, platform maturity, and the remaining cycles on the part itself. The tight teardown pipeline keeps mid life LLPs in short supply, which pushes prices up—especially for high demand disks and hubs on platforms with heavy shop visit activity. At the same time, OEM list prices continue to rise, creating a wide gap between new and secondary market material and anchoring USM pricing at elevated levels. Cycle life is the final driver: LLPs with "right sized" remaining life command a premium because they allow operators to match spend to their remaining service horizon, while full-life or very-low-life parts trade at discounts due to limited applicability. These dynamics make LLP pricing highly sensitive to timing, platform-specific demand, and the availability of teardown engines," says Pizer. In turn, Johnsen backs this up, saying: "LLP value is directly proportional to remaining cycles but heavily adjusted for market demand and documentation quality. Full LLP sets can command a premium, whereas 'odd-life' parts are harder to place and discounted. Aero Norway sees that LLP pricing is very dynamic and focused on remaining cycles, engine variant demand, teardown supply, traceability quality." Dave Hobbs agrees with both Pizer and Johnsen in identifying the three key factors affecting price, but adds to that when he tells us that: "Remaining cycles is the most influential. The more life left in a part, the higher its value. Engine type also plays a key role. LLPs from active, in-demand platforms typically command stronger pricing due to consistent utilisation and demand. Availability is another factor. Scarcer material will naturally achieve a premium, particularly where sourcing options are limited." He then adds that "Interchangeability can work the other way. Where LLPs are widely interchangeable and readily available across platforms, increased supply can soften pricing, while concluding: "Finally, documentation matters. Strong back-to-birth traceability, particularly for first-run or single-operator parts, supports faster transactions and often commands a premium."

While there may be a number of factors affecting the value of LLPs, Andrew Storch feels that pricing is relatively predictable, pointing out that "LLPs are arguably some of the most predictable parts in terms of pricing and availability, since their value always behaves as a function of variables such as scrap rates, published list price, and life-limits. Further, LLPs are very rarely found to be "beyond economical repair," or BER, since the repair costs are usually a fraction of the list price. Generally, the highest-demand LLPs are the ones that support the largest fleets and have the highest scrap rates. LLPs with the lowest yields are usually found in the hottest sections of the engines, namely the high-pressure turbines, followed by the high-pressure compressors, followed by the front stages of the low-pressure turbines." Guillermo Soto also has some interesting points to make in terms of engine types and aircraft models, telling us that "The current level of demand for a specific engine type will obviously influence LLP pricing (and demand), as will the availability – or lack thereof – or new parts. These dynamics have been particularly noticeable in the market for CFM56 and V2500 LLPs in recent years, reflecting the strong demand for Airbus A320ceo and Boeing 737 NG aircraft, and the low level of retirements." To conclude, Lee Carey has some key observations to report. "LLP pricing in the context of used LLPs is a function of supply, demand, and the list price of a new unit. LLPs typically increase at a rate of 6%

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>
> *Andrew Storch, VP Asset Management, Setna iO*

however, in recent years, EirTrade has noted that the annual Catalogue List Price increase has far exceeded this," he notes.

What advice would you give to technical directors managing aging fleets?

Delays in aircraft deliveries are not only frustrating for carriers, but they have exacerbated an already existing shortfall in available USM, including LLPs, especially for certain engine types. With more and more aircraft remaining operational beyond their anticipated retirement age, we wanted to know how technical directors were handling the situation.

Bruce Ansell has sage words, advising: "Firstly, assess how long you need the engine to remain flying, then identify what parts and maintenance are likely to be required to reach this target, and finally, investigate what parts are available in the market and at what price. If your plan is fixed, it is always worth reserving or buying the right components when they are available, otherwise you run the risk of low availability and higher prices when the parts are needed. Suppliers like APOC support operators throughout this process, helping secure the right components at the right time." Dave Hobbs is equally enlightening as he suggests: "Start with a clear view of the engine's remaining operational life. That defines the build goal and shapes every decision that follows. From there, planning becomes critical. Align the work scope with that end goal, select the right MRO partner early, and secure material in advance.

Pre-purchasing LLPs and other components gives you greater control - over availability, pricing, and the time needed to properly review documentation. In aging fleets, reactive decisions are costly. A forward-looking approach allows you to manage risk, control spend and get the most out of the asset."

Andrew Storch is very committed and has gone 'all in' on one specific aspect of parts' inventory, as he comments: "Throughout my career, adoption of used serviceable material (USM), including LLPs, has seemed to monotonically increase year over year. This is due to the impressive reliability of component MROs' products, and the substantial cost savings of USM compared to factory new list pricing. I cannot recall a technical director that was not happy with his or her decision to onboard more USM, and I would advise ageing fleet managers to increase their adoption of USM to improve the financial performance of their fleets." Further sound advice comes from Virgil D Pizer, especially in terms of being proactive, as he explains: "Technical directors managing aging fleets benefit most from treating LLP exposure as a forward-looking economic signal rather than a reactive maintenance item. The engines that stay reliable and affordable late in life are the ones whose LLP cycles, documentation, and sourcing strategy are planned well ahead of the next shop visit. That planning starts with mapping remaining LLP life against the aircraft's intended service horizon so the workscope matches the value of the asset—full restorations when the aircraft has years ahead, targeted module work or partial stacks when it doesn't, and green time or teardown-based solutions when LLP investment no longer makes sense. Aging fleets also depend on clean, defensible documentation. LLP traceability gaps remain one of the most common and costly audit findings, and even small breaks in back-to-birth records can delay shop visits or reduce asset value. Directors who maintain disciplined cycle tracking and complete installation/removal histories avoid those surprises and keep their engines eligible for induction, transition, or sale. Market conditions make sourcing strategy just as important. Tight teardown supply and elevated shop visit demand have pushed mid-life LLPs into short availability, so securing the right parts early—well before a visit is due—helps avoid last minute procurement at inflated prices. PMA LLPs, where approved, now play a meaningful role in stabilising cost and availability, offering new life parts without OEM premiums and helping operators extend service life economically when USM is scarce." He rounds things off by suggesting that: "The most effective directors align workscope depth with economic reality, using flexible, lifecycle-appropriate maintenance rather than defaulting to full restorations. That balance—technical condition, remaining cycles, and financial horizon—is what keeps ageing fleets viable."

Guillermo Soto has two recommendations, and that is: "to plan ahead, especially for those engines in high demand where LLPs may have a long lead-time, and work closely with your MRO provider, since they will have experience in matching operator requirements to shop visit schedules, along with an extensive network of LLP suppliers." To then conclude this article on engine LLP management, Dag Johnsen is quite clear. "From Aero Norway's hands-on MRO experience, these are our words of advice: collaborate early with your MRO. The best outcomes happen when LLP planning is done before induction, not decided mid-shop visit, when costs can escalate. We advise operators to plan engines as complete life packages and align LLP life with performance life. Do not install very low-life LLPs just to defer costs, make sure you target a balanced exit condition after a shop visit. Try to use the secondary market strategically and buy LLPs when market is soft - this avoids panic buys during an AOG or capacity shortages. Importantly, protect your records like assets. Good LLP paperwork has real monetary value, but poor records can destroy resale or lease return value. Segment your fleet, some engines should be run to part-out, others require investment in LLPs to extend life."

"From Aero Norway's hands-on MRO experience, these are our words of advice: collaborate early with your MRO. The best outcomes happen when LLP planning is done before induction, not decided mid-shop visit, when costs can escalate."

Dag Johnsen, COO, Aero Norway

Dag Johnsen, COO, Aero Norway

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Maintenance Mythbusters: "Newer Aircraft Require Less Maintenance"

Have maintenance requirements for new aircraft dropped, or is it more a case that the nature of maintenance has simply changed?

By David Dundas

The Misconception of the "Low-Maintenance" Modern Aircraft

Appearances can be deceptive. To look at a brand-new aircraft stood next to a five-year-old previous-generation version and you might easily assume that the new aircraft would require less maintenance. In truth, the matter is wholly subjective and the phrase 'requiring maintenance' can be interpreted in many ways. Does it mean 'there and then' or does it mean 'over its operating lifetime'? More to the point, does the level of maintenance required relate to the man hours spent maintaining the aircraft, or does it mean the number of procedures that need to be performed during routine maintenance?

Yes, it might be reasonable to assume that for a brand-new aircraft fewer parts are likely to need replacement at the next check, whether it be an A or D check, but a greater part of the maintenance involves checking, not replacing parts. Certainly, today's technology has seen many advancements in aircraft construction and materials used, massive changes in avionics, and the introduction of new ways to perform established tasks, plus the introduction of new diagnostics equipment. But surely there has to be a cost to that.

Be Very Wary of Statistics

Everything in the construction of today's aircraft, be it the fuselage, the engines or the avionics is designed for maximum efficiency. That includes ongoing maintenance. But be wary of statistics when comparing old with new. If we were to go by manufacturers' promotional material, today's new-generation aircraft are less costly to maintain. For example:

The **Airbus A320neo** offers an average maintenance cost reduction of **15% to 20%** per flight hour compared to the previous-generation A320ceo.

While the aircraft maintains over 95% commonality with its predecessor, specific efficiency gains are achieved through several key areas:

Maintenance Cost Reductions by Category:

- **Airframe Maintenance:** According to ***Airbus Facts and Figures***, the A320neo provides **5% lower airframe maintenance costs**.
- **Engine Maintenance:** The next-generation engines (LEAP-1A or PW1100G) are projected to reduce engine-related maintenance costs by approximately 20% per hour.
- **Structural Repairs:** The use of advanced materials (composites and Al-Li alloys) leads to an expected **30% reduction** in structural repairs due to improved corrosion and fatigue resistance.
- **AOG (Aircraft on Ground) Time:** Advanced monitoring systems enable early fault detection, potentially reducing AOG time by up to **40%**.

Now that all looks very impressive, but there is an often-quoted phrase – "Lies, damned lies and statistics" – that springs to mind. In no way am I implying that Airbus is lying. Far from it as their statistics are likely 100% accurate. However, without the whole picture, statistics can be misleading.


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In many ways it is similar to the oath sworn in British law courts when giving evidence that you will tell "the truth, the whole truth, and nothing but the truth". Here the key element of that phrase is "the whole truth". In other words, to form an accurate opinion, you need all the facts, not just some of them.

For an MRO operator, to achieve the maintenance cost savings suggested requires considerable investment in new tooling, diagnostics equipment, training of mechanics and engineers, the list goes on. So, in order to save on ongoing maintenance costs, you have to invest heavily in new operating procedures. All may therefore not be exactly as it seems. So, let's dig a little deeper at individual factors relating to aircraft maintenance.

Maintenance Does Not Decline — It Evolves

Modern aircraft are designed to reduce certain types of wear and improve system reliability, but this does not eliminate the need for maintenance. Instead, the maintenance burden shifts from traditional mechanical tasks toward more specialised inspections, advanced troubleshooting, and digital system management. While older aircraft may require more frequent attention for corrosion, fatigue cracking, or analog component wear, newer aircraft introduce entirely new maintenance challenges, particularly in areas such as software, composite structures, and highly integrated avionics.

The idea that "newer means less maintenance" oversimplifies the reality that aviation maintenance is driven not only by age, but by complexity.

New Technologies Bring New Failure Modes

New-generation aircraft incorporate systems that are fundamentally different from those found on older variants. Fly-by-wire architectures, integrated modular avionics, advanced engine control systems, and predictive monitoring tools all improve operational performance, but they also introduce new failure modes that maintenance organisations must be prepared to manage.

For example, modern avionics faults are often intermittent, software-related, or data-network dependent. Troubleshooting such issues requires diagnostic expertise far beyond traditional component replacement. Similarly, next-generation engines such as geared turbofan and high-efficiency turbofan families operate at higher temperatures and tighter tolerances, leading to different inspection demands and evolving shop visit requirements.

The consequence? It may well be that new aircraft will experience fewer routine failures, but when issues arise, they are often more complex to diagnose and resolve.

Composite Structures: Less Corrosion, More Specialised Repair

One of the most significant shifts in the construction of modern aircraft is the widespread use of composite materials. Compared with aluminium, composites offer weight savings and are corrosion resistant, contributing to improved fuel efficiency and lifecycle performance. However, composite structures present their own unique set of challenges where inspection and maintenance are concerned.

Damage in composites is not always visible externally. Internal delamination or impact damage can exist beneath


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the surface without obvious dents or cracks as a tell-tale. Inspection often requires specialised non-destructive testing methods, and repairs demand specific training, tooling, and, of course, certification. As a consequence, while composites reduce some traditional structural maintenance tasks, they create a requirement for new competencies and repair capabilities.

Digital Aircraft Still Require Human Discipline

Modern aircraft are often described as "connected" or "smart," equipped with onboard health monitoring systems that automatically generate fault codes and maintenance messages. These systems support condition-based maintenance and can reduce unscheduled events, but they do not remove the need for skilled technicians and disciplined processes.

Digital alerts still require interpretation, troubleshooting, and corrective action. Maintenance teams must manage software updates, configuration control, cybersecurity considerations, and electronic documentation requirements. In many cases, the challenge is not identifying that something is wrong, but understanding what the data truly means and how best to respond. Is it not more a case of today's technology supporting maintenance rather than actually replacing or reducing it?

The Economic Reality: New Aircraft Are Expensive to Correctly Maintain

Another reason the myth persists is that operators often associate newer aircraft with lower operating cost. While maintenance intervals may be optimised and dispatch reliability may improve, the cost of maintaining modern systems can be higher due to specialised labour, advanced tooling, and limited parts availability.

New aircraft often depend heavily on OEM-supported maintenance ecosystems, with proprietary components, restricted repair networks, and high-cost spares. MROs may face longer lead times for parts and higher training investment to build capability. The maintenance may be less frequent in some areas, but it is not necessarily cheaper and, in many cases, certainly not simpler.

A Shift Toward Skills and Specialisation

It is not a case of splitting hairs, but maybe what is nearer the truth is that newer aircraft require different maintenance, not less maintenance. The industry is shifting toward a world where MROs have no option but to develop expertise in data analytics, avionics diagnostics, composite repair, and next-generation propulsion systems.

This evolution represents both a challenge and an opportunity. MRO providers that invest in training, digital infrastructure, and specialised capabilities will be positioned to support the future fleet effectively. Those who assume modern aircraft are "low maintenance" risk underestimating what, exactly, is required to keep them airworthy.

Conclusion: New Aircraft Still Depend on Maintenance Excellence

Modern aircraft may reduce certain traditional tasks, but they introduce new layers of complexity that demand advanced skills, new inspection methods, and deeper system knowledge. Maintenance remains the foundation of airworthiness, regardless of aircraft age, so perhaps the real difference is that the maintenance of today may look very different from the maintenance of yesterday, but these new maintenance techniques may not so much eliminate certain procedures, but more a case that they redefine them.

Warehouse
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Inventory Optimisation – Change is Not Optional

Have inventory strategies changed that much since supply chain problems entered the equation, and does demand forecasting help to mitigate certain supply challenges?

By David Dundas

Unexpected Aircraft on Ground (AOG) instances are every carrier's nightmare, and costly in the extreme. Whether a carrier performs MRO operations in house or contracts them out to a specialist operator, when an aircraft is grounded and requires repairs, speed is of the essence. Aside from the fact that it is not generating any profit while on the ground, if an aircraft is on lease, then you are losing anything up to US$15,000 per day on top of that for, say, an A320 or 737MAX.

For MRO operators, there are the standard challenges faced with having to hold inventory for hugely expensive parts and whether to opt for used serviceable material (USM), original equipment manufacturer (OEM) parts, 3-D printed parts or risk sourcing on an as-and-when-needed basis. There is then the question of how much reliance to place on external pools, as well as trying to identify where inefficiencies lie.

To cover every aspect of inventory management it would be possible to write something that might challenge Leo Tolstoy's *War and Peace* in terms of length, so for now we decided to concentrate on asking a number of professionals on the front line for their thoughts on areas of the supply chain that are undergoing radical changes.

How has the post-pandemic recovery and supply chain volatility changed inventory strategies?

Here we wanted to find out if, post pandemic, and with the latest challenge of supply chain shortfalls, we have only seen the instigation of reactive changes to inventory strategies, or whether those reactive changes have morphed into proactive adjustments.

According to Rhiannon Sheppard, VP Engine Supply Chain, AerFin Ltd, "In the immediate aftermath of COVID-19, many operators moved towards a more defensive, "just-in-case" approach - increasing stock levels to protect against disruption, long lead times, and constrained supplier capacity. As repair networks have recovered and supply chains have become more predictable, that position is shifting. We're now seeing a move away from bulk stockpiling towards more balanced, demand-led planning. Inventory is being managed with greater precision, using structured approaches such as EOQ models and consignment stock to optimise availability without tying up unnecessary capital." She then concludes that: "The focus today is on agility. Rather than reacting to uncertainty, businesses are building more responsive supply chains that can adapt as conditions change - maintaining reliability while improving working capital efficiency." To add to this approach, Lindsay Cooper, Head of Asset Management at the AJW Group tells us that: "The industry has moved from lean efficiency to resilience and optionality. Where businesses may previously have been selective about inventory sources, there is now far greater openness to alternatives such as USM, driven by the need to maintain service levels in a constrained supply environment." She then adds: "At AJW, we've responded by taking a more balanced and deliberate approach to inventory, not just investing in stock but investing in the right stock. That means aligning short-term availability with long-term value, improving collaboration across the supply chain, and continuously refining how we manage and position inventory globally."

Morten Espenhein, Chief Operating Officer & Co-founder of Corax is very clearly of the opinion that there have been significant changes since the pandemic, pointing out that: "In today's market, the focus is on having stock readily available, which means maintaining higher buffer levels to prevent shortages of high-demand components." Meanwhile, Eoin Doherty, Pricing Director at EirTrade Aviation delves a little deeper into what is causing changes in how inventory is manages, including the broad-reaching effects of delays in aircraft deliveries. "Following the COVID-19 pandemic, the production of new aircraft material faced significant delays from the OEMs. It also resulted in Used Serviceable (USM) material becoming more expensive driven by the lack of supply to keep up with the demands of the industry. OEM inefficiencies during this time also meant longer lead times, which benefited parts traders and suppliers of used serviceable material, making the market for harvested parts from teardowns a lot stronger," he advises, before acknowledging that "... many airlines have chosen to extend current leases to alleviate the delay of new aircraft deliveries. To optimise the operation of these more mature aircraft, operators have become more receptive and focused on the repair and purchasing of USM, instead of replacing them with new surplus components. As a result of all this, parts trading companies like EirTrade Aviation ensure their inventories are sufficiently stocked with high-demand material in serviceable condition, to support asset owners during critical and AOG requirements."

Ashley Neeley, VP Product Services, Inventory Locator Service

Beyond the above, Ashley Neeley, VP of Product Services at Inventory Locator Service (ILS) acknowledges that: "Post-pandemic supply chain volatility has pushed some airlines away from lean, just-in-time inventory models toward more resilient, buffer-based strategies... or 'just-in-case availability without just-in-case ownership'". However, she also suggests that: "To balance out the added cost and risk of holding more stock, airlines are getting creative. Some are offloading certain parts packages or using consignment models, so they can access what they need without tying up as much capital. At the same time, there's a shift toward shared, network-based inventory, where suppliers and MROs manage pooled stock across multiple operators," before concluding: "Overall, I believe the priority has shifted. It's no longer just about minimising inventory. It's about making sure the right parts are available when and where they're needed to keep operations running smoothly." James Roché, SVP Global Parts Trading, Setna iO on the other hand has identified USM as a key area, commenting that: "The post-pandemic recovery, combined with persistent supply chain volatility, has fundamentally shifted airline aftermarket inventory strategies from lean, just-in-time models toward resilient, buffer-heavy approaches. OEM production delays, extended repair turnaround times, and labour shortages require airlines to increasingly rely on the Used Serviceable Material (USM) aftermarket to ensure component availability amid shortages. USM has transitioned from a pure cost-saving tactic to a frontline availability strategy. With production delays from Boeing and Airbus and persistent new-generation engine issues there have been slower retirements. With ageing fleets come more maintenance occurrences, further increasing component demand. As the aftermarket looks to secure component and material supply for airlines, competition for end-of-life assets continues to increase." He then adds that: "In addition, many airlines and lessors who traditionally would not accept PMA parts or DER repairs have shifted their policies due to OEM shortcomings. In the MRO space, these are becoming more common place to ensure faster TATs and increase overall component reliability. The focus has moved from minimizing holding costs to balancing availability risk." Tony Kondo, President and CEO, Werner Aero, LLC is of a like mind to Roché when he explains that: "Because of both factors, there are less available aircraft for teardown (because there is strong demand for used aircraft as a 'flyer') and less availability of USM. Also, because of supply chain volatility, some parts from OEMs tends to have very long TAT, so we see there is more demand for USM than pre-pandemic."

What data inputs are most critical for accurate demand forecasting?

With this question, we wanted answers to focus on a proactive as opposed to reactive element of inventory management,

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and that is the challenge of demand forecasting, and in particular which data inputs are the most critical.

Lindsay Cooper gives us an excellent overview of the entire forecasting scenario. “Forecasting starts with clean, reliable demand history, but it’s the context around that data that drives accuracy. We don’t just look at what sold; we break demand down into routine consumption, high-frequency items, and AOG-driven events, because each behaves very differently. Treating them the same is where forecasting often goes wrong. Beyond that, operational data is key - flight hours, cycles, fleet plans, and maintenance schedules. Through our PBH (Power-By-the-Hour) programmes, we gain visibility of upcoming events, which allows us to move from reactive supply to proactive positioning,” she informs us, before rounding off with a word of caution: “Ultimately, it’s not one dataset that matters most, it’s how well you connect them to build a realistic picture of future demand.” For Craig Skilton, VP Components, APOC Aviation, it isn’t so much a question of quantity of data but more about its integration. “Accurate demand forecasting relies on the integration of multiple, high-quality data inputs rather than solely being based on historical consumption alone. As a supplier, we at APOC consider inputs from our customers such as utilisation, removal trends and maintenance schedules. From an MRO standpoint, we need to consider OEM Service Bulletins and ADs, supplier turnaround times and capacity. It is also important we consider external factors, which can have a considerable impact on demand, especially given recent global conflicts. The challenge isn’t always a lack of data but rather the integration of data across various different inputs and systems.”

For Morten Espenheim, agility seems to be a key factor, acknowledging that: “Historical demand is essential, but it’s just as important to apply sound judgment to any model. That means factoring in real-time demand drivers such as sudden OEM supply chain disruptions, geopolitical developments, or overnight tariff changes. Ultimately, success comes down to staying agile and being able to respond quickly to minimise inventory risk.” That said, Eoin Doherty looks at two additional areas in detail. “EirTrade relies on real-time market data and trading activity to help forecast component demand accurately. With the help of our internal ERP system and historical data, we can forecast the demand for USM by analysing requests for quotes (RFQs) for components, historical sales history & frequency, current inventory levels and pricing fluctuations. Component scrap rates and failure rates also provide a good indication of component failure rates. Through the analysis of all these data points, we can accurately forecast demand and have various components ready to go on the shelf for critical requirements,” he says.

Over at ILS James Scott, VP of Information Services looks at the situation from both the consumer- as well as the supply-side of the situation. He points out that: “The most critical inputs for accurate demand forecasting start with buyer-intent data. Search activity, including part-number lookups, keyword trends, and repeated searches for the same components, often provides the earliest signal of rising market interest. RFQ volume is equally important because it reflects stronger buying intent, especially when measured by part number, condition, quantity, and urgency. In an aviation industry where many transactions still move offline through phone, fax, and email, these marketplace signals are especially valuable because they reveal demand patterns even when final order data is not fully visible.” He then adds that: “Just as important are the supply-side and market-response inputs that help explain whether demand can be met. Quote activity, including no-quote rates, supplier response times, and price variation, can indicate tightening supply or growing urgency in the market. The number of active suppliers per part, visible inventory, lead times, and inventory updates—especially decreases in available quantity that may suggest fulfilment—also provide important forecasting context. To make these signals accurate, they must be supported by clean part master data such as normalised part numbers, interchangeability, condition codes, and aircraft applicability. Together, these inputs can provide a clearer view of demand by combining buyer behaviour, supplier responsiveness, and market availability.”

James Roché acknowledges the challenges demand forecasting comes with, noting that those with access to information have an edge in predicting accurate component demand. He points to six critical data inputs as being: “1. Aircraft utilisation metrics: Flight hours, cycles, and daily utilization rates, which directly correlate with part wear and failure probability. 2. Maintenance schedules and history: Scheduled checks (e.g., C-checks, D-checks), unscheduled events, and back-to-birth traceability records for serialised parts. 3. Fleet composition and age data: Aircraft type, age, configuration, and retirement forecasts, as older fleets drive higher and more variable demand. 4. Historical demand and consumption patterns: Time-series data on part usage, including intermittent “lumpy” demand for high-value rotables, adjusted for AOG events. 5. Repair and supply chain variables: Current TATs, repair queue data, OEM lead times, and supplier performance metrics. 6. Real-time operational/sensor data: Engine and component health monitoring, predictive maintenance alerts from sensors/IoT, and market trends (e.g., route changes or utilisation spikes).”

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> **Strong forecasting starts with a clear view of historical demand - understanding usage patterns, seasonality, and recurring trends. But on its own, that's not enough. Real-time operational data is just as important.**
>
> *Rhiannon Sheppard, VP Engine Supply Chain, Aerfin Ltd*

Rhiannon Sheppard, VP Engine Supply Chain, Aerfin Ltd

To round off the answers to this particular question, Rhiannon Shepperd discusses the merits of combining elements to create effective models: "Strong forecasting starts with a clear view of historical demand - understanding usage patterns, seasonality, and recurring trends. But on its own, that's not enough. Real-time operational data is just as important. Inputs such as shop visit rates, component removals, and utilisation trends give a much clearer picture of near-term demand and help ensure inventory is positioned where it's needed. OEM-driven inputs also play a key role. Airworthiness Directives, Service Bulletins, and repair developments can all shift demand quickly, so they need to be factored into any forward view. The most effective models bring these elements together - combining historical insight, live operational data, and forward-looking triggers to create a forecast that is both accurate and responsive."

What are the biggest inefficiencies today: overstocking, understocking, misallocation, or data quality?

We suspected that data quality may well be a primary consideration here, but we were interested to see if responses would see data quality as an inefficiency alongside overstocking, understocking and misallocation, or whether these three elements were affected by data quality.

Among other concerns, Eoin Doherty includes documentation problems for retired aircraft in terms of part traceability. "Stocking issues in general can cause large inefficiencies. A common issue is overstocking low demand components due to large volumes of certain aircraft being retired, or some components becoming obsolete. EirTrade notes that component demand can fluctuate quickly as more of the same aircraft type are retired. This can have a negative impact on storage space and result in sunk costs if these parts are repaired or overhauled. On the flip side of this, parts traders need to anticipate the demand for stock items which often need to be replaced because of high failure rates, and long lead times. Other inefficiencies can include poor quality data from technical records which can hinder the purchasing of components and assets. The standards of technical paperwork and records have become increasingly important in recent years. However, when aircraft are being retired, much of the documentation that requires complete traceability is either difficult to obtain or has inconsistencies in the record history. This increases the time to conclude transactions and increases the risk of transactions failing due to documentation issues."

For James Roché, Ashley Neeley and Rhiannon Sheppard, once again the quality of the data is key, as Roché explains: "Todays biggest inefficiency stems from data quality. With perfect information, forecasters could make perfect decisions on stocking material to have the right component, at the right place, at the right time. However, OEMs, airlines, MROs, and the aftermarket have limited scope to data availability through the whole supply chain to make perfect decisions. Due to this, many of the decisions that are made are educated guesses. With many aging ERP systems and siloed data, it is challenging to paint a perfect picture of demand, so many components are overstocked, understocked, or misallocated." Ashley Neeley believes that: "... the biggest inefficiency in aviation today is poor data quality, which drives many downstream problems across inventory and operations. Because systems are fragmented and data is inconsistent, companies can struggle with accurate forecasting and real-time visibility. This leads to misallocation, where parts exist within the network but are in the wrong locations, often causing costly AOG situations. To compensate for uncertainty, companies can overstock inventory, tying up capital, while still experiencing pockets of understocking when critical parts aren't available where needed." Last, but not least, Sheppard sees data sitting at the centre of all the challenges mentioned. "Overstocking, understocking, and

James Roché, SVP Global Parts Trading, Setna iO

> **OEMs, airlines, MROs, and the aftermarket have limited scope to data availability through the whole supply chain to make perfect decisions. Due to this, many of the decisions that are made are educated guesses.**
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> *James Roché, SVP Global Parts Trading, Setna iO*

misallocation are often symptoms - the root cause is incomplete, inconsistent, or poorly structured data. As the industry moves towards more automated and AI-driven forecasting, the reliance on accurate data has only increased. Without it, forecasting models become unreliable, manual intervention increases, and decision-making slows down. When the data is right, inventory can be managed with confidence - stock is held at the right levels, in the right place, at the right time. When it isn't, inefficiencies quickly follow. Getting the data foundation right isn't a technical detail - it's fundamental to making inventory strategies work," she shares with us.

Lindsay Cooper feels that all four elements are linked, suggesting that most issues stem from data quality and decision-making discipline. She adds that: "If your data isn't right, you end up overstocked in the wrong areas, understocked where it matters, and constantly repositioning inventory to compensate. That drives cost and impacts service. The real challenge is misallocation of capital. Holding inventory isn't the problem, however, holding the wrong inventory is. The focus must be on understanding what truly moves, what supports your customers, and what is simply tying up cash. Getting that balance right is where strong inventory management adds real value." Tony Kondo is of the opinion that there are not a lot of airlines who buys USM for future utilization based on plan / prediction. Therefore, he sees more of the AOG type of requirements and thinks that from an efficiency point of view, "... airlines in general should buy more USM for future utilization to avoid AOG situation, which eventually costs more," he suggests.

How do pooling agreements influence internal stocking levels?

We were curious to see if the responses to this question would reveal if pooling agreements were a positive alternative to individual management of stocking levels, or if they were a solution where effective inventory optimisation was proving problematical.

Pooling agreements (including traditional rotable pools, consignment programs, repair-by-the-hour bundles, and virtual/data-driven pools) significantly reduce internal stocking levels by shifting from full ownership of redundant spares to shared, on-demand access. Instead of each airline maintaining its own complete set of high-value rotables at every station, operators contribute to or subscribe to a centralized managed pool. James Roché at Setna iO continues by advising that: "The operator pays predictable fees they can budget around in exchange for rapid dispatch. When a part fails, the pool supplies a serviceable unit; the unserviceable core returns for repair and re-entry. This eliminates duplicate capital investment, lowers holding costs, improves cash flow, and slashes AOG downtime. The net influence: internal stocking can drop dramatically—especially for smaller fleets or high-cost rotables—freeing capital while maintaining or improving service levels. Challenges like long-term commitments, quality/ownership concerns, and administration have limited broader adoption." Pooling allows airlines to rethink how much inventory they need to hold themselves. With access to a defined pool of components under agreed service levels, operators can reduce internal safety stock and rely on shared availability instead, Nick Breeze, VP Airframe Supply Chain at AerFin Ltd suggests, before expanding further: "This has a direct impact on capital. Fewer owned assets mean less cash tied up in inventory, particularly for low-utilisation or slow-moving parts that are more efficiently covered through a pool. There are also operational benefits. Reduced internal stock lowers warehousing requirements and simplifies logistics, while responsibility for repair cycles, movements, and exchanges shifts to the pool provider. That allows internal teams to focus on keeping aircraft flying, rather than managing assets. Pooling also limits exposure to risks such as obsolescence or SB/AD-driven changes, as ownership - and therefore depreciation risk - sits with the provider."

Meanwhile, at AJW Group, Lindsay Cooper feels that pooling and PBH agreements fundamentally shift inventory from a reactive model to a planned and structured one, adding that: "With visibility of fleet plans, utilisation, and maintenance events, we can build stock profiles that reflect expected demand rather than historic averages. That allows us to position inventory ahead of requirement, improving both availability and efficiency. At AJW, tools like Apollo support this by applying probabilistic modelling, helping us balance service levels with capital investment. The objective is simple: deliver resilience without overstocking." At EirTrade Aviation, Eoin Doherty makes a salient point when he mentions about components that rarely fail. "Some operators rely heavily on pooling agreements with third party providers to maintain the availability of parts for replacements, especially during AOG events. This means that airlines can have access to material with a third-party provider, instead of having to stock the inventory themselves. This can be particularly helpful when a component which rarely fails needs to be replaced, operators have faster access when this failure occurs. EirTrade observes that these pooling agreements can also benefit airlines by reducing the amount of capital that needs to be tied up in stockpiling inventory."

At ILS, Rob Suhs, the company VP of Global Sales sees pooling as a tool for

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>
> *Eoin Doherty Pricing Director, EirTrade Aviation*

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access, not a replacement for inventory strategy. He feels that its real value is that it gives operators a way to access high-value, lower-frequency material without having to own every unit themselves, adding that it can lower the capital tied up in inventory, but in the current environment, he does not think pooling is driving broad de-stocking. He goes further, saying: "What I am seeing instead is a more selective approach to internal stocking. Operators still need to protect the parts that are truly dispatch-critical or time-sensitive, especially when supply conditions remain uneven. So, the stronger model today is a hybrid one: hold the inventory that directly protects the operation, and use pooling to add flexibility where ownership is less efficient. That is also where market visibility becomes much more important. The better informed you are about supply options, the better decisions you can make about what to stock internally, what to source externally, and where pooling makes the most sense." To conclude, Tony Kondo at Werner Aero and Morten Espenhein at Corax both have succinct responses. "That will reduce stocking level for sure, but it does not necessarily mean cheaper option overall. There are airlines who do not have a pooling agreement but manage stock levels very efficiently based on future usage predictions," says Kondo, while Espenhein adds: "Airline demand is treated as actual demand. Any pooling agreements they have are already factored into the determination of stocking levels."

Lindsay Cooper, Head of Asset Management, AJW Group

What are the operational risks of over-relying on external pools?

It is rare that any solution to a problem doesn't have additional factors that have to be taken into consideration. That is very much the case with over reliance on external inventory pools, as you will discover from the responses below.

"Operators may become dependent on their provider's inventory depth, forecasting capability, and financial stability and any weakness in these areas directly impacts their own operations. By relying on shared inventory models, they have less individual buying power compared to large-scale providers, like AJW, which can affect pricing, priority access during supply constraints, and the ability to influence stock positioning decisions. In short, the risk is dependency. Operators lose the flexibility and must trust that their provider's forecasting models accurately

> **"Operators lose the flexibility and must trust that their provider's forecasting models accurately anticipate their needs, making them more vulnerable to disruptions that fall outside their provider's standard forecasting assumptions."**
>
> *Lindsay Cooper, Head of Asset Management, AJW Group*

anticipate their needs, making them more vulnerable to disruptions that fall outside their provider's standard forecasting assumptions," Lindsay Cooper warns us, while Morten Espenheim is equally cautious when he advises that: "Relying on external pools and providers carries significant risks, as it means losing control over ensuring a streamlined product flow through a third party. Timely delivery could become an issue, and gaining immediate visibility and updates on the status may also be challenging."

Eoin Doherty continues the cautious theme, identifying risks in several different areas. "The potential risks of relying on pooling agreements are varied. If, for example, the demand of a particular component spikes across a certain fleet due to SBs/ADs, reliability issues or any other reason, the availability of acquiring a replacement may become more limited. Also, depending on the location of the parts, the response time may be slower than if the part was held in stock internally, especially with possible customs or logistics delays. There is also a lack of control for the operator when it comes to inventory ownership. The provider could prioritise other parts, or other customers, which may cause delays for certain airlines." Rob Suhs, however, sees positivity as well as the need for caution. To begin with, he sees that: "... the biggest risk is loss of control. A pool can work very well when conditions are stable, but when the market tightens, the question is no longer whether a part exists somewhere. The question becomes whether it is available in the right place, at the right time, with enough certainty to protect the operation. That is where over-reliance can become a problem. If too much of your strategy depends on outside access, you can end up exposed to slower response times, lower priority in a constrained environment, and higher AOG risk when multiple operators are competing for the same material." However, he also believes that: "... pooling is most effective when it is part of a broader resilience strategy, not the entire strategy. Operators still need enough internal protection, enough sourcing flexibility, and enough visibility into alternatives to avoid turning an external pool into a single point of failure."

James Roché takes a pragmatic view in terms of the risk-reward balance. He explains in greater detail: "Although external pools can reduce capital tied up in inventory and improve overall availability for high-value and intermittent-demand parts, over-relying on external pooling agreements introduces several operational risks including loss of direct inventory control and prioritisation (especially for larger pools on scarce assets). Long tail costs such as penalties for BER cores and late core returns can add unplanned costs to the pool agreement. In practice, many operators mitigate these by maintaining minimal internal buffers for critical items, diversifying across multiple pool providers, or blending pools with owned/leased stock. The risk-reward balance favours pooling for most rotables, but over-reliance without contingency planning can turn availability advantages into operational vulnerabilities." Once again Tony Kondo gives us a succinct response, this time to encapsulate the risk of over reliance, when he says: "A pooling agreement always has a level of guarantee of availability, but it's not always 100%. Therefore, it's better for airlines not to over-rely on external pools."

How do you see AI influencing spare parts forecasting?

It is impossible to avoid the influence of AI in business today, but it is still in its infancy as everyone comes to terms with its capabilities as well as its limitations. The MRO industry is no different, and the effects it is having on inventory management are already profound. However, on has to ask if these effects are foolproof, or simply improvements on a far-from-perfect set-up?

Tony Kondo cuts straight to the chase when it comes to hurdles AI will face. "AI will help airlines / USM players to analyse data for sure, but the difficult part of this industry is that we not only deal with a huge variety of parts, but also the requirement for each part is limited. Therefore, there are a lot of factors impacting on supply / demand of each part, which is hard for AI to predict based on past data, so this is where only experience will give us the right answer," he advises. Rhiannon Sheppard sees AI as neither a replacement for fundamentals, nor a shortcut, pointing out that: "AI is already starting to reshape how forecasting is approached. It allows operators to move beyond static models, analysing large and complex datasets to identify patterns, adjust forecasts in real time, and respond more quickly to changing conditions. This can drive more accurate demand planning, with automated adjustments to reorder points and replenishment cycles helping to maintain availability while reducing excess stock. But AI isn't a shortcut. Its effectiveness depends entirely on the quality of the data behind it. Without strong data governance, even the most advanced models will produce unreliable outputs. Used properly, AI is a powerful enabler - not a replacement for good fundamentals, but a way to strengthen them and make inventory management more responsive and efficient."

In a market where capital efficiency and availability are both critical, that ability to balance service, risk, and investment in real time is where AI delivers a genuine competitive edge, Lindsay Cooper confidently believes, based on the fact that "AI is already reshaping forecasting; but the real differentiator is how effectively it's applied in a commercial environment." She adds that "AJW has developed its

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Tony Kondo, CEO and President, Werner Aero own in-house optimisation tool, Apollo, which goes beyond traditional forecasting. By applying probabilistic modelling, we're not just predicting demand, we're quantifying risk, understanding variability, and making ROI-driven inventory decisions. What sets us apart is the combination of data, technology, and real operational insight. We're integrating inputs from PBH programmes, fleet plans, and live demand signals to continuously refine how and where we position inventory across our global network. This allows us to move away from static forecasting models and towards a dynamic, decision-led approach to ensure we're not just reacting to demand but actively shaping our inventory strategy around it." Craig Skilton is one of many who have, throughout this topic, touched on the adage of "rubbish in : rubbish out" in that AI has to be trained on accurate data, or else... "AI is expected to be transformative, particularly in moving from reactive to predictive inventory management. Machine learning models can be used that incorporate real-time operational and environmental data, whilst the addition of predictive maintenance further enhances the quality of that output. The transformative change is however dependant on high quality, structured data and being able to share data in a constructive, collaborative manner across engineering, supply chain and MRO," he says.

Greg Creekmore, Regional Sales Manager at ILS would seem to be a proponent of there being no substitute for experience, although he does see "... AI taking a lot of the guesswork out of spare parts forecasting, which has always been part science, part experience. It builds on historical usage and seasonality but goes further by processing far more variables and surfacing patterns you'd otherwise miss, like failure trends, shifts in demand, and early reliability signals," then adding that: "That lets one forecast more accurately and adjust stocking before issues hit operations. It also helps strike a better balance between availability and cost, so operators can run leaner without increasing risk. Tools like ILS add another layer by bringing in real-time market data and sourcing visibility, strengthening both forecasting and supply decisions." He concludes: "That said, AI doesn't replace experience. It's a tool. You still need someone who understands the operation, the fleet, and AOG realities. The best results come from combining AI, trusted data sources like ILS, and practical judgment."

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Morten Espenheim, COO & Co-Founder, Corax

James Roché sees AI changing the landscape from one of a reactive nature to a proactive one as he explains: "AI is rapidly transforming spare parts forecasting in the airline aftermarket from reactive, history-based methods to proactive, multi-dimensional predictive models. AI ingests continuous streams of data and consistently iterates on itself at speed that humans are incapable of. AI can pull from IoT sensors, flight data, predictive maintenance alerts, repair queues, and external factors (supplier TATs, OEM delays, MRO lead-time, market trends) to make accurate real-time decisions. Models auto-retrain with fresh data, shifting from static forecasts to living predictions that adjust for emerging patterns." And to conclude the article, Morten Espenheim has some very sage words of advice. "To some extent, yes, it can be useful. However, from our perspective, common sense will always outperform AI when it comes to managing inventory in the aviation aftermarket. A prime example is the 1906 experiment on the "wisdom of the crowd": if everyone blindly followed the crowd, they would end up stocking the wrong inventory. The real advantage goes to those who apply an extra layer of common sense on top of AI insights."

> **"... common sense will always outperform AI when it comes to managing inventory in the aviation aftermarket."**
>
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Tool Calibration and Tool Control in Aircraft Maintenance

Precision, Accountability, and the Invisible Backbone of Safety

By David Dundas

The Tools Behind a Task Are a Key Part of the Foundation of Safety

If you walk through any aircraft maintenance hangar and you will see rows of toolboxes, shadow boards, and calibrated instruments—torque wrenches neatly stored, mustimeters ready for use, specialised gauges prepared for precision work. To anyone else, to the inexperienced eye, these are just tools. However, to a licensed aircraft maintenance technician, these tools are not simply for performing a specific task, no. They are all extensions of responsibility.

When you consider everything more carefully, every fastener tightened, every pressure reading taken, every electrical value measured depends on one core assumption: that the tool you have used is accurate and controlled. Unlike visible system failures, tool-related issues are often silent. A mis-calibrated torque wrench is not obvious to the naked eye, or even a trained one. A missing tool does not immediately set off alarm bells as to the potential consequences. However, both can introduce latent risks into an aircraft—risks that may only surface later, when under stress, through vibration, or with the passage of time.

This is why tool calibration and tool control are not simply a necessary evil and time consuming; they are most definitely not administrative burdens either. In reality, they are nothing other than foundational safety systems embedded within aircraft maintenance operations.

Calibration: Trusting the Measurement

At its core, calibration is about trust. When a technician applies 120 Nm of torque, the expectation is not approximate—it is exact within defined tolerance. That expectation is only valid if the tool has been properly calibrated. Calibration is a structured, traceable process which involves comparing a tool's measurement against a certified reference standard, typically linked to national or international metrology institutes. Any deviation is recorded, and if necessary, the tool is adjusted back within allowable limits.

However, it is important to understand that calibration is more than a pass/fail exercise. It also helps to produce critical data:

• The as-found condition, indicating how far the tool has drifted
• The as-left condition, confirming compliance after adjustment
• The measurement uncertainty, defining confidence in accuracy

The consequence? Only this level of rigour can ensure that every measurement taken in maintenance is defensible, repeatable, and compliant with regulatory standards.

When Calibration Fails Quietly

Let's look at this possible scenario in a mid-sized MRO operation. Over a period of several weeks, quality inspections had begun to reveal inconsistent torque values on structural fasteners. Initially, this was attributed to human error, but then the issue persisted across multiple technicians and shifts. A deeper investigation subsequently uncovered the root cause: a set of torque wrenches had drifted beyond acceptable tolerance. Calibration intervals had been informally extended due to operational pressure, and no automated system flagged overdue tools.

Here the implications were highly significant. For this scenario we can assume aircraft had been released with fasteners that were either under- or over-torqued. Let's then say that no immediate incident occurred, but the structural integrity margins had been unknowingly compromised. In real life, the organisation would be forced into a costly cycle of re-inspection and corrective action.

This imaginary case highlights a critical reality: calibration failures rarely cause immediate problems—but they can most definitely create conditions where failures become possible.

Beyond Fixed Intervals: Smarter Calibration Strategies

Traditionally, calibration intervals were fixed and tools were usually checked every six or twelve months regardless of usage. However, while simple, this approach did not reflect operational reality. Today's MROs are more frequently adopting condition-based calibration. Instead of relying solely on time, calibration frequency is now being influenced by:

• Tool usage intensity
• Environmental exposure (temperature, humidity, contaminants)
• Historical drift behaviour
• Criticality of the tool's application

A torque wrench used on a daily basis in a heavy maintenance environment will not behave the same way as one used occasionally in line operations. By analysing calibration data over time, MROs can optimise intervals, tightening them where necessary and extending them where justified. The result means that this shift not only improves safety but also enhances efficiency by aligning calibration efforts with actual risk.


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Tool Control: Knowing Where Everything Is

If calibration ensures accuracy, tool control ensures accountability. The objective is straightforward in that every tool must be traceable 24/7/365. However, I am not talking solely about organisation, here I am talking is about eliminating one of aviation maintenance's most serious hazards: Foreign Object Debris (FOD). The result of a misplaced tool left inside an aircraft could appear to be totally disproportionate, with the potential to result in system damage, control interference, or catastrophic failure. Here, a robust tool control system is more than capable of mitigating this risk simply through structure and discipline.

Each tool is uniquely identified, often with barcodes or Radio-Frequency Identification (RFID) tags. Storage systems such as shadow boards or foam inserts provide immediate visual confirmation if a tool is missing. Check-in and check-out procedures help to ensure that responsibility is clearly assigned to individual technicians. Thus, at the end of a task or shift, tool inventories will be verified. Then, if a tool is unaccounted for, work will stop. The search will immediately begin, escalating as required—even to the point where inspecting the aircraft itself becomes necessary.

The Reality of Lost Tools

Despite supposed failsafe systems and procedures, tools do still get lost. Consequently, when they do, the response has to unquestionably be immediate and uncompromising.

A typical lost tool procedure includes:

• Halting ongoing work
• Conducting a localised search of the work area
• Expanding the search to the aircraft if necessary
• Documenting the event and initiating reporting protocols

Of course, this procedure can be remarkably disruptive, but there is no question that it is essential. The cost of any delay is insignificant compared to the risk of an undetected foreign object within a critical system. What is very important is that MROs that manage these situations the best tend to foster a no-blame reporting culture. It is of vital importance that technicians feel totally confident reporting missing tools without fear of punitive action as, if not, the risk shifts from being an operational one to a systemic one.

Digital Transformation in Tool Management

The traditional image of tool control such as clipboards, manual logs, and visual checks is rapidly evolving, primarily because digital technologies are reshaping how tools are tracked, calibrated, and managed. RFID-enabled systems now allow for the real-time tracking of tools within a hangar. Thus, if a tool leaves a designated area or is not returned as or when it should be, alerts can be automatically triggered. Today, integrated calibration management platforms track due dates, lock out overdue tools, and maintain digital records for audits. The consequence is that these systems eliminate reliance on memory and reduce administrative overhead.

Beyond compliance, data generated


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from these systems also provides valuable insights. MROs can now identify tools that drift frequently, detect usage patterns, and optimise inventory levels. The outcome has seen a shift from reactive control to predictive and data-driven management.

Human Factors: The Decisive Element

One thing that cannot be avoided is that even the most advanced systems depend on human behaviour. Thus, under time pressure such as during tight turnaround windows or AOG situations, procedural discipline can wane.

Common breakdowns include:
- Using tools beyond calibration due dates
- Skipping check-in/check-out steps
- Informal sharing of tools between technicians

It is rare for any of these violations to be deliberate and instead they are more likely to be symptoms of operational pressure and system design limitations. To therefore address these problems requires more than enforcement, instead designing processes that are intuitive, efficient, and aligned with how technicians actually work. Training now needs to emphasise not just the "how," but the "why" and connecting tool control directly to safety outcomes.

Regulatory Expectations and Audit Reality

Currently, regulatory frameworks such as EASA Part-145 and FAA Part 145 place clear obligations on maintenance organisations:
- Tools must be fit for purpose and calibrated
- Calibration must be traceable to recognised standards
- Tool control systems must ensure accountability and FOD prevention
- Records must be maintained and available for audit

Audits routinely scrutinise these areas, with findings related to tool calibration or control leading to corrective actions, increased oversight, or even suspension of approvals. In this context, tool management is not just operational but is directly tied to an MROs regulatory standing.

The Cost of Inattention

Failures in tool calibration or control rarely manifest as immediate incidents but instead introduce subtle deviations such as:
- Fasteners not tightened to specification
- Measurements leading to incorrect troubleshooting decisions
- Tools left behind, creating hidden hazards

These are latent conditions, the kind that align with other factors to produce failures later on. In aviation safety, preventing these conditions is as important as responding to visible defects and tool management most definitely plays a critical role in maintaining that safety margin.

Looking Forward: Smarter Tools, Safer Systems

The future of tool management is already taking shape as we now have smart tools equipped with sensors which can monitor their own calibration status. IoT-enabled toolboxes can also track inventory automatically while AI can predict when a tool is likely to drift out of tolerance. As a result, augmented reality may soon guide technicians through tool verification steps in real time, reducing reliance on memory and manual checks.

It is also worth noting that these innovations share a common goal, which is reducing human error while enhancing system reliability.

Conclusion: Precision as a Discipline

Aircraft maintenance is often associated with complex systems involving engines, avionics and flight controls, as examples. However, beneath all of these lies a simpler, often overlooked layer: the tools which used for maintenance. Their accuracy defines the quality of the work performed and their control defines the integrity of the process. So, when tool calibration and tool control function as intended, they are invisible. There are no headlines, no incidents, no disruptions, but their absence or failure can ripple through an entire operation.

In a field where precision is non-negotiable, these systems are not optional safeguards. They are essential disciplines.

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»»» on the move

Satheeshkumar Kumarasingam

Pratt & Whitney has appointed **Satheeshkumar "Kumar" Kumarasingam** as President of Pratt & Whitney Canada, effective June 1. He succeeds **Maria Della Posta**, who has announced her retirement, and will report to Pratt & Whitney President **Shane Eddy**. "Pratt & Whitney Canada holds a leading position across all its segments, with a portfolio of nearly 75,000 engines in service and 14,000 customers worldwide," said Eddy. "Kumar has been an instrumental leader across Pratt & Whitney and brings extensive experience, along with a deep understanding of customers and the markets in which Pratt & Whitney Canada operates. I am confident he will continue to drive innovative growth, deliver exceptional customer service, and maximise operational performance globally. I also thank Maria for her service and lasting impact on Pratt & Whitney Canada, a strong organisation that will play a key role in shaping RTX's future success." Kumarasingam joined Pratt & Whitney in 1995 and has held roles in engineering, quality, operations, sales and marketing, and customer service. He was appointed Chief Transformation and Strategy Officer in 2022 and Chief Digital Officer in 2025.

Jakub Dvořák

Job Air Technic a.s., a European provider of aircraft MRO services and part of the FL Technics Group, has appointed **Jakub Dvořák** as Chief Executive Officer with effect from May 1. He succeeds current CEO **Imrich Czére**. Dvořák will assume full leadership responsibilities, bringing more than 18 years of experience in aviation maintenance, spanning both technical and senior leadership roles across operations and strategy. He has spent the past seven years at Job Air Technic, holding several key positions, including Technical Director, and currently serves as a Member of the Management Board of Job Air Technic a.s. "I look forward to working closely with the team at Job Air Technic and ensuring a smooth transition, while maintaining the high standards of service our customers expect," said Jakub Dvořák. Job Air Technic will continue normal operations, maintaining its focus on delivering base maintenance services to airline customers across Europe. The company remains an integral part of FL Technics' European MRO network, with ongoing efforts to ensure operational continuity and consistent service quality.

Benoît Rollier

Air France Industries KLM Engineering & Maintenance (AFI KLM E&M) has announced the appointment of **Benoît Rollier** as Vice President of KLM Engine Services, effective April 1, 2026. He succeeds **Martijn de Vries**, who will assume the role of Senior Vice President Commercial on the same date. Rollier brings extensive experience within KLM and the wider aviation sector, having held a range of strategic and executive positions across engineering and maintenance, supply chain and finance. Most recently, he served as Vice President Engineering at KLM and as Chief Executive Officer and Managing Director of Spairliners, the joint venture with Lufthansa Technik. Over the course of his career, he has developed deep expertise in the engine business. With this broad perspective, he is expected to continue the current strategic direction and further advance the development of KLM Engine Services.

Giovanni Spitale

StandardAero has appointed **Giovanni Spitale** as President of its Business Aviation segment with immediate effect. He succeeds **Anthony (Tony) Brancato III**, who is retiring after nearly a decade in leadership roles at StandardAero and more than 40 years in the aviation industry. Spitale brings over 30 years of experience across engineering, operations and global leadership. He will be responsible for driving strategic growth, operational performance and customer support within StandardAero's Business Aviation division. Based at the company's headquarters in Scottsdale,

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Arizona, he will report to Chief Operating Officer **Kim Ernzen**. He joins StandardAero from Davis-Standard, LLC, where he served as Chief Executive Officer, leading a private equity-backed business with revenues of approximately US$1 billion through significant organic expansion and M&A activity. Prior to this, Spitale held senior executive roles at The Boeing Company, as well as leadership positions at Milacron Holdings Corp., GE Aviation, Moog and Honeywell International, working across a range of business aviation programmes.


Tommaso Auriemma

Air France Industries KLM Engineering & Maintenance (AFI KLM E&M) has announced that **Géry Mortreux**, Executive Vice President of Air France Industries, will leave Air France-KLM effective May 1, 2026, after nearly a decade in the role. He has chosen to begin a new chapter in his career. Alongside this transition, AFI KLM E&M has confirmed a series of senior management appointments. **Vincent d'Andrea** will be appointed Executive Vice President of Air France Industries from May 1, 2026. Reporting to Anne Rigail, CEO of Air France, he will continue to represent all maintenance activities within the Air France Executive Committee. A graduate of École Centrale de Paris, d'Andrea began his career at Air France in 1998. After leading subsidiary CRMA, he joined AFI KLM E&M in 2014 as Group Component Product Director, and since 2018 has served as SVP Engineering & Airframe Maintenance. **Gilles Mercier** will take on the role of SVP Airframe Maintenance from July 1, 2026, succeeding d'Andrea. He will transition from his position as CEO of Barfield, the group's US-based subsidiary, a role he has held for three years. Mercier joined the group in 2008 and has held a number of roles within Engineering & Maintenance, including Head of Costing and Pricing, Engine Business Unit Manager, Chief Transformation Officer and Chief of Staff to the EVP Engineering & Maintenance, before joining Barfield in 2019. **Tommaso Auriemma** has been appointed CEO of Barfield, effective July 1, 2026. He brings more than 26 years of experience in the global MRO sector. Currently Vice President Sales for the Asia-Pacific region at AFI KLM E&M and based in Singapore, he will relocate to Florida to lead the company from its headquarters. He began his career in Italy in component shops and base and line maintenance, before moving to France where he held senior roles in engineering and procurement. He later served for six years as Chief Executive Officer of Aerotechnic Industries in Morocco, overseeing base and line maintenance operations. **Magali Jobert** has been appointed Vice President Sales Asia Pacific, effective July 1, 2026. She began her career at the age of 16 at Air France's Training Centre, qualifying as an aircraft mechanic. With expertise spanning operational maintenance, industrial customer support and strategy, she has held a number of leadership roles, most recently as VP Component Asset Manager & Aerostructure, focusing on strategic asset management for industrial clients. She will now take up her new role in the Asia-Pacific region.


Mark Harris

Stratus Aero Partners has announced a leadership transition, with Chief Executive Officer **Mark Harris** set to retire on March 31, following a successful tenure at the company. Harris has played a key role in shaping the organisation and its subsidiaries, helping to strengthen relationships with customers and partners while positioning the business for continued growth. The company acknowledged his contribution and leadership, which have supported the development of Stratus into a well-established aviation platform. **Althea Arvin** will assume the role of Chief Executive Officer of Stratus Aero Partners from April 1, following a carefully managed transition period alongside the outgoing Harris. Having worked closely with the leadership team in recent months, she brings continuity as well as a clear strategic focus for the company's next phase of growth. Arvin is expected to build on the strong foundations established under her predecessor, maintaining Stratus' commitment to high levels of service, operational excellence and long-term partnerships with customers and stakeholders. Stratus said the transition has been structured to ensure continuity across the business, with customers and partners continuing to receive consistently high levels of service and support. The company expressed confidence in Althea Arvin's leadership as it moves into its next phase, thanking the continued support of employees, customers and partners as key to its future success.

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