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March 2024

The Silent Workhorse

Managing APU Maintenance



Line Maintenance
A night-shift experience with AIESL in Delhi

Parts Recovery
Exploring the business model of Powerturbine

Growth Plans
Interview with Owen McClave, CEO, SR Technics Group



aircraft walkaround
© *AviTrader*

Dear industry colleagues,

"It serves as the silent workhorse within every aircraft. We engaged with industry experts to delve into the latest trends in APU maintenance management."

"We also had the opportunity to speak with two CEOs. Owen McClave, CEO of SR Technics Group, shares insights into their growth plans, while Fred Grether, CEO of Powerturbine, provides intriguing perspectives on the company's business model."

Many of us spend our workdays at desks, in conferences and exhibitions, and always in meetings. The backbone of our industry comprises the thousands of aircraft mechanics. They typically work in shift systems, with the night shift presenting a particular challenge. We recently conducted a self-experiment by exchanging our desk with the Line Maintenance of AIESL in Delhi. Our colleague, Swaati, shares her experiences during a night shift in a male-dominated environment. You can find her report in this edition. I can say in advance, she handled herself bravely and did not fall asleep.



Best regards,

Peter Jorssen
Publisher

BTW: Do we see each other at the MRO Americas?

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APU maintenance at Standard Aero
© Standard Aero

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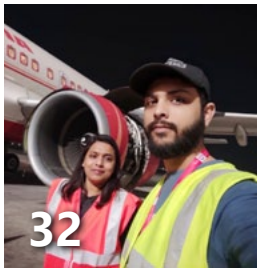


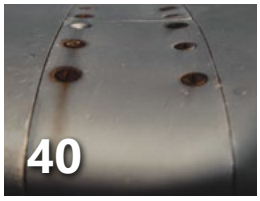
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TP Aerospace establishes MRO facility in Brisbane, Australia

In March 2023, TP Aerospace embarked on a journey to establish an additional wheel and brake maintenance and warehouse facility in Australia. After the final audit, the new facility in Brisbane is officially open. In January 2024, the facility in Brisbane passed the final audit and received approval from the Civil Aviation Safety Authority (CASA). The audit was successfully completed by CASA on January 17, 2024, with no findings, and subsequently the CASA certificate of approval was issued on the January 24, with the team ready to start production. The first wheel was completed and released to service on February 6, 2024, and since then, the activity has increased with more and more wheels being serviced. "There are still some minor adjustments required to the setup and processes, however the team and the facility will only grow from here and we look forward to adding more customers in the future," commented Regional COO of Oceania, Peter Luthaus. In the second quarter of 2023, TP Aerospace signed a new five-year exclusive agreement with long-time customer, Virgin Australia, covering the full fleet of 737NG and 737MAX aircraft. Virgin Australia has been partnering with TP Aerospace since 2016, when the company first entered the Australian market with a facility in Melbourne. The new facility in Brisbane is the company's second establishment in Australia and is a key to supporting the expansion of the partnership with Virgin Australia while also catering to other customers in the region.



Mechanics of the Brisbane facility showing the new certificate from CASA © *TP Aerospace*



Korean Air starts construction of engine maintenance facility in Unbuk, South Korea



Image of an aerial view of Korean Air's future engine maintenance cluster in Unbuk, Yeongjong Island, South Korea
© Korean Air

Korean Air has started construction of an aircraft engine maintenance cluster in Unbuk, near Incheon International Airport, which is slated to open in 2027. The new engine maintenance complex will be the largest in Asia and will bolster the airline's aircraft engine maintenance capabilities and fortify its aviation MRO business. The airline held a groundbreaking ceremony on March 14. The new engine maintenance plant features seven levels spanning more than 140,000 m². The construction of the 578 billion won facility will be undertaken by Kolon Global and will be strategically constructed adjacent to the existing engine test cell (ETC) that the airline operates since 2016. Korean Air has previously managed its engine maintenance at its Bucheon facility, complemented by final performance testing at the ETC in Unbuk. The engine maintenance cluster will streamline this process with a strategic consolidation, enhancing operational efficiency by bringing all phases of engine maintenance to a single, centralized site. Korean Air is also set to significantly enhance its aircraft engine maintenance capability from servicing 100 engines to 360 annually, across a broader spectrum of engine types. Currently, the airline conducts overhauls on six engine models, including Pratt & Whitney's PW4000 and GTF; CFM International's CFM56; and General Electric's GE90-115B. The expansion includes adding three more engine models to its portfolio, including GE's GEnx and CFMI's LEAP-1B. The airline is also exploring the possibility of servicing Asiana Airlines' engines, including the Rolls-Royce Trent XWB used in the Airbus A350. The new maintenance cluster is expected to generate over 1,000 new jobs to bolster the domestic aviation MRO industry's competitiveness and reduce dependence on international maintenance services. Korean Air is the sole operator of specialised facilities for civilian aircraft engine overhauls in Korea. The airline began overhauling Boeing 707 aircraft engines in 1976 and has since rebuilt nearly 5,000 engines and supplied engines to other airlines, including its subsidiary Jin Air, as well as international carriers like Delta Air Lines and China Southern Airlines. The airline's maintenance quality has earned recognition from numerous reputable bodies. Korean Air holds airworthiness certifications from 13 domestic and international authorities, including the Korean Federal Aviation Administration, the U.S. Federal Aviation Administration (FAA), the European Aviation Safety Agency (EASA) and the Civil Aviation Administration of China (CAAC).

Werner Aero acquires Boeing 737-800 to enhance spare parts inventory

Werner Aero has revealed the successful acquisition of one Boeing 737-800 aircraft, msn 28983. Formerly operated by Royal Air Maroc, the aircraft is currently under the custodianship of e-Cube in Wales, where it will undergo dismantling for spare parts. EVP Tony Kondo expressed the company's satisfaction, stating, "We are pleased to announce the acquisition of another 737-800 for teardown. The addition of this aircraft enhances our 737NG spare parts inventory, ensuring we meet the increasing demand from our customers. We remain committed to acquiring A320ceo/737NG and E-Jets, maintaining substantial inventories to deliver high-quality services to our valued customers." Known for its commitment to quality and customer satisfaction, Werner Aero is offering asset management and logistical solutions to global airlines. With a worldwide presence, the company specialises in innovative and comprehensive global transportation solutions, focusing on jet engines, rotables pooling and repair management. Werner is an ISO 9001 certified company and an FAA AC0056B approved supplier.

ACTSI obtains FAA approval for wheel and tire shop services



TJ Trinidad, Vice President - Business Development at ACTSI © *ACTSI*

Aviation Concepts Technical Services Incorporated (ACTSI), has recently completed and obtained FAA approval for wheel and tire shop services (WTSS) under its current Limited Accessory Rating. WTSS offers tire change, tear down and build up with NDT (as required) on 19 different wheel assembly part numbers ranging from Gulfstream models G280, GIV-X (G350/G450), GV-SP (G550), G650/G650ER, Textron Beechcraft King Air B200 / B300 models, Bombardier Global XRS and Global 7500 jets. With safety and quality always at the forefront, ACTSI remains committed to pushing the boundaries through unparalleled customer service and experience. The WTSS compliments ACTSI's current component support services such as its sheet metal repair shop and battery repair shop (NiCad and sealed lead acid battery (SLAB). "We are in constant pursuit of redefining MRO standards in the region and adding the Wheel and Tire shop to our suite of support services helps bolster our existing repair station services. This in turn helps solidify ACTSI's reputation as a key player in the MRO sector in Asia," commented TJ Trinidad, Vice President - Business Development at ACTSI. Established in 2010, Aviation Concepts Technical Services Inc. (ACTSI) was acquired by Razon & Co. in 2018 and is based in Subic Bay, Philippines. ACTSI is dedicated to providing quality services for corporate jets in Asia-Pacific including maintenance, repair and overhaul services and hangar parking. ACTSI is an FAA 145 Repair Station with other approvals such as Cayman AMO, Bermuda AMO, San Marino and Philippines CAAP AMO.

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A SATAIR SERVICE COMPANY

GE Aerospace to invest over US$650 million in manufacturing facilities, supply chain in 2024



GE Aerospace's investment plan calls for nearly US$450 million to go toward new machines, inspection equipment, building upgrades and new test cells and safety enhancements *© GE Aerospace*

GE Aerospace has revealed its intention to inject US$650 million into its manufacturing facilities and supply chain this year. The investment aims to boost production capabilities and enhance quality to better serve both commercial and defence clientele. H. Lawrence Culp, Jr., Chairman and CEO of GE and CEO of GE Aerospace, stated, "As GE Aerospace prepares to become a standalone company this spring, we are making significant investments in the future of flight and in the dozens of communities and supplier partners helping us build it. These investments are part of the next chapter for GE Aerospace, supporting cutting-edge equipment and safety enhancements that will help us meet our customers' growing needs." The 2024 investment plan allocates nearly US$450 million for new machines, inspection equipment, building upgrades and new test cells and safety enhancements across 22 GE Aerospace facilities in 14 states. An additional US$100 million will be directed to U.S.-based supplier partners. Specific investments include US$54 million to Auburn, Ala., for additional additive (3-D printing) machines and tooling to increase the production of military rotorcraft engine components, along with narrow- and wide-body commercial aircraft engines. Additive manufacturing enhances performance and fuel efficiency while reducing weight and part count. US$30 million will be allocated to Lynn, Mass., for engine assembly and testing, supporting the production of US and allied military helicopter and fighter jet engines. Additional funds will be used for facility maintenance and build on investments made in 2023. US$46 million will go to four North Carolina facilities producing parts and assembling engines for narrow- or wide-body commercial engines to meet growing demand. Specific allocations include US$11 million for high-precision machines in Asheville, more than US$7 million for tooling and equipment in Durham, almost US$5 million for quality inspection equipment and machinery in West Jefferson and US$22 million for machines and specialised tooling in Wilmington. US$107 million will be directed to facilities in the greater Cincinnati region for additional additive manufacturing machines, new tooling and equipment, and modernisation and upgrades to test cells, increasing production capacity for engines used in commercial aircraft and U.S. and allied military helicopter and fighter jets. The remaining US$100 million will fortify the U.S. supply chain, aiding suppliers in building and maintaining the necessary capacity and capabilities for sustained growth. These suppliers contribute materials (castings and forgings) and some early-stage parts for commercial and military engines. In addition, to support its global clientele, GE Aerospace plans to invest approximately US$100 million at some of its international sites in North America, Europe, and India.
(£1.00 = US$1.27 at time of publication).

Condor selects RECARO BL3710 and SL3710 seats for new fleet

RECARO Aircraft Seating has been chosen by German leisure airline Condor to supply the economy-class cabins of its new Airbus fleet with the popular BL3710 and lightweight SL3710 seats. Condor's new fleet includes 28 Airbus A321 and 13 A320 aircraft to be delivered between 2024 and 2028. The nearly 9,000 seats ordered will be installed in a hybrid-layout and will feature distinctive Condor branding elements. The BL3710 seat comes equipped with several comfort amenities, such as individual USB-power, an enhanced ergonomic seat bottom, an adaptable tray table, elongated armrests and a bring-your-own-device (BYOD) holder to tailor the entertainment experience in the cabin. The lightweight SL3710 model offers advanced ergonomics suitable for all body types, along with the convenience of USB-power access at each seat, an integrated cup holder, all fitted on an eight-kilogramme frame. A commitment to long-lasting performance is underscored by the customer service team at RECARO, dedicated to optimising the lifespan and functionality of Condor's seating. Moreover, common spare parts between the BL3710 and SL3710 models contribute to reduced maintenance expenses for the airline.



Condor aircraft equipped with RECARO BL3710 seats *© Condor*

Akaer to manufacture forward fuselage for new D328eco™ aircraft

The Brazilian aerospace and engineering company Akaer has been selected by German OEM Deutsche Aircraft to manufacture the forward fuselage of the D328eco, the sustainable 40-seater turboprop aircraft for the regional aviation market. Akaer will be responsible for the manufacturing of the forward fuselage, including industrialisation, tooling, prototype and related studies. Akaer's agreement with Deutsche Aircraft is a significant achievement that strengthens its position in the global aerospace industry. Deutsche Aircraft has recognised Akaer's expertise in design engineering and the comprehensive assembly of the forward fuselage as decisive advantages. This Brazilian company is capable of designing and delivering large structural assemblies for the aerospace industry worldwide and Brazil has solidified its position as the third-largest aircraft manufacturer in the world. Brazil has the fifth-largest airspace in the world and is currently focused on the expansion of regional aviation. Around US$ 600 million (£472 million) has been invested to connect the vast community by air and this collaboration will support Brazil's initiatives to enhance its expertise and capacity in both regional aviation and aerospace manufacturing. With the second-largest general aviation fleet worldwide, Brazil has the potential to



Akaer has been selected to manufacture the forward fuselage for the D328eco aircraft
© Deutsche Aircraft

upgrade with the multi-role configuration of the D328eco, which can cater to its executive, aeromedical and agricultural aviation demands. The turboprop market share in Brazil has grown by 344% over the last ten years. The first delivery of the D328eco forward fuselage is scheduled for the end of 2025 and will initially be produced in Brazil at the facilities in São José dos Campos.



AerCap signs component deal with OEMServices



AerCap has signed a seven-year component sale-and-leaseback agreement with OEM-Services *© AerCap*

AerCap has entered into a seven-year component sale-and-leaseback agreement with OEMServices S.A.S. (OEMServices). This strategic move underscores the ongoing collaboration between the two entities and marks a substantial development in their partnership.mAs part of this comprehensive agreement, AerCap Materials, an integral arm of AerCap, will provide an extensive inventory of crucial Airbus A220 aircraft components. The primary objective is to bolster OEMServices' support infrastructure for its extensive airline customer base. This collaboration is a testament to AerCap Materials' commitment to offering innovative and cost-effective inventory financing solutions to OEMServices, with a focus on various aircraft platforms, including the Airbus A320 and Airbus A380 lines.mAimee Craig, CEO of AerCap Materials, expressed her enthusiasm about the continuous growth of the company's inventory financing services. She highlighted the pivotal role played by AerCap Materials in delivering cutting-edge solutions to its diverse customer base. The extension of the strategic partnership with OEMServices signifies a mutual commitment to furthering their relationship and addressing the evolving needs of the aviation industry. Didier Granger, Group Chief Executive Officer of OEMServices, also shared his perspective on this latest development. He emphasised the significance of this step in the partnership, underlining the common understanding of the market and the quality of the relationship that has been cultivated over the years. Granger believes that this agreement will open up new avenues for collaboration between the two companies, presenting exciting opportunities in the future. OEMServices, renowned for its leadership in providing component, logistic and trading services for airlines and original equipment manufacturers (OEMs), was founded by industry giants such as Diehl Aerospace, Liebherr Aerospace, Thales Avionics, and Zodiac Aerospace. The company was established with the aim of offering airlines comprehensive, integrated support services by leveraging the capabilities, assets and expertise of multiple OEMs. Headquartered at Paris CDG airport, OEMServices operates major hubs in Europe, the U.S.A., the Middle East and Asia. In summary, this seven-year component sale-and-leaseback agreement not only strengthens the partnership between AerCap and OEMServices but also reflects the dynamic nature of the aviation industry. The collaboration aims to enhance support services for airlines worldwide, contributing to the growth and efficiency of both companies in the ever-evolving aviation landscape.

Satair and Joramco extend partnership with new expendables supply agreement

Satair, an Airbus Services company, and Joramco, the Amman-based MRO facility and engineering arm of Dubai Aerospace Enterprise (DAE), have signed an agreement covering the supply of expendables at MRO Middle East in Dubai, which took place from Tuesday, March 5, to Wednesday, March 6, 2024. The agreement ensures a consistent flow and regional availability of spare parts under a defined scope planned in accordance with Joramco's needs. This targeted approach brings relief and greater reliability to the supply chain while decreasing material management costs and minimising AOG risks. Satair and Joramco have done business together for more than 27 years, and the new agreement is testament to the two companies' strong relations and the aviation aftermarket opportunities in the Middle East region. Paul Lochab, CCO, Satair, said: "We are pleased to further strengthen our relationship with Joramco and continue playing an important role in their supply chain and material management operations." Commenting on the new agreement, Joramco's Vice President of Supply Chain, Petra Lindemann, said, "We are proud of our successful partnership, and we are pleased to renew our agreement with Satair. Our long-lasting partnership is a testament to the trust we place in Satair and the quality of services they provide. We look forward to working on additional future collaborations."



Satair and Joramco have signed a new supply agreement at MRO Middle East in Dubai *© Satair*

WLFC posts record financial results for 2023



WLFC has posted annual total revenues of US$418.6 million and pre-tax income of US$67.1 million © *Shutterstock*

Willis Lease Finance Corporation (WLFC) has posted annual total revenues of US$418.6 million and pre-tax income of US$67.1 million. Lease rent revenue increased by US$50.6 million, or 31.1%, to US$213.1 million in 2023, compared to US$162.6 million in 2022, primarily reflecting an increase in the number of engines acquired and placed on lease, including growth in utilisation compared to that of the prior period. WLFC reported maintenance reserve revenue of US$133.7 million in 2023, an increase of 60.2%, compared to US$83.4 million in 2022. Engines out on lease with "non-reimbursable" usage fees generated US$118.3 million of short-term maintenance revenues in 2023, compared to US$47.4 million in the prior year. There was US$15.4 million of long-term maintenance revenue recognised in 2023, compared to US$36.0 million in the prior year. As of December 31, 2023, and 2022, there were US$28.4 million and US$6.3 million, respectively, of deferred in-substance fixed payment use fees included in Unearned Revenue associated with engines on short-term leases. 2023 annual lease rent and maintenance reserve revenues represent all-time highs in the company's 40+ year history. WLFC's spare parts and equipment sales decreased to US$20.4 million in 2023, compared to US$27.0 million in 2022. The decrease in spare parts sales reflects variations in the timing of sales. Gain on sale of leased equipment was US$10.6 million in 2023, reflecting the sale of 28 engines, one airframe and other parts and equipment. Gain on sale of leased equipment was US$3.1 million in 2022, reflecting the sale of 25 engines. WLFC generated US$67.1 million of pre-tax income in 2023, compared to US$9.8 million in 2022. The book value of lease assets directly owned or through joint ventures, inclusive of the company's notes receivable, maintenance rights, and investments in sales-type leases, was US$2,495.4 million as of December 31, 2023. The company successfully accessed the capital markets on multiple occasions in 2023, raising US$410 million in Asset-Backed Security (ABS) financings, refinancing its credit facility, and accessing the Japanese Operating Lease with Call Option (JOLCO) market on numerous occasions. Diluted weighted average income per common share was US$6.23 for 2023, compared to US$0.33 in 2022. Book value per diluted weighted average common share outstanding increased to US$67.73 on December 31, 2023, compared to US$64.27 on December 31, 2022. (£1.00 = US$1.28 at time of publication).

Rolls-Royce to invest £55 million in the UK and Germany to meet demand for civil large engines

Rolls-Royce has announced significant investments in its assembly, test and shop visit capacity in the UK and Germany to address the increasing long-term demand for new civil large engines and enhance customer aftermarket support services for its global Trent engine fleet. According to projections outlined at last year's Capital Markets Day, Rolls-Royce anticipates an annual increase of 7 - 9% in Rolls-Royce-powered aircraft in service for the remainder of the decade. Additionally, the company forecasts engine flying hours to reach 120 - 130% mid-term compared to 2019 levels. To prepare for this growth trajectory, Rolls-Royce is investing £55 million and recruiting over 300 individuals, distributed between its operations in Derby, UK, and Dahlewitz, Germany. Approximately half of the investment and about two-thirds of the job opportunities will be located in Derby. The investments encompass: Expansion of engine build capacity in Derby, aiming to deliver over 40% more new engines per year starting from 2025, compared to the average deliveries over the last decade. This expansion will also augment service capacity. Utilization of existing engine test capability for civil large engines in Dahlewitz to meet near-term services demand before transitioning to assemble and test new Trent XWB-84 engines in 2026. These investments follow the recent announcement of a £1 billion investment in a continuous improvement program for the Trent engine family.

Crosslake Group expands portfolio with acquisition of two component MRO firms



© *Aeromax*

Crosslake Group, a private financial firm specialising in investments in privately held aerospace and defence enterprises, has successfully acquired two prominent maintenance, repair and overhaul (MRO) companies based in South Florida. The acquired companies, Continental Aircraft Support, Inc. (Continental) and Magnum Aircraft Repair Services, Inc. (M.A.R.S.), are now integral members of Crosslake's aftermarket aviation parts investment platform (Parts Platform). Led by Aeromax Industries (Aeromax), the Parts Platform offers tailored customer solutions, including parts manufacturing, repairs and overhauls, spare parts sourcing, parts exchange and comprehensive fleet management programmes. The collaboration between Aeromax, Continental and M.A.R.S. in MRO repair capabilities is set to provide an unparalleled integrated aftermarket parts strategy to international customers, surpassing offerings from industry giants, according to Frank Cowle, Amplified Strategic Growth, a key player in the acquisition process. Tom Brizes, Executive Vice President of Sales and Marketing at Aeromax, expressed enthusiasm about combining the capabilities and strengths of these exceptional companies to offer a wide range of solutions to their collective customer base. Crosslake's strategic objective is to position the Parts Platform as a vital and trusted supply chain partner favoured by governments, airlines and aftermarket integrators. The addition of Continental and M.A.R.S. represents a significant step towards achieving this goal. Grant Dunham, a partner at Crosslake, welcomed the new partners at Continental and M.A.R.S. – Carlos Rodriguez, Luis Ezra, and Sean McGinn. He highlighted their customer-focused approach in building component MRO businesses that strongly align with Crosslake's core values. Dunham expressed excitement about supporting and welcoming the new partners in their continued leadership roles, aiming to take these businesses to the next level. Founded in 2003 and headquartered in Fort Worth, Texas, with additional offices in Seattle, Washington, Crosslake has a successful track record of investing in various operating companies. The firm provides liquidity to existing owners of aerospace and defence businesses with gross revenues ranging from US$5 million to US$50 million. Beyond capital infusion, Crosslake's investment and operations team actively assists portfolio companies in strategic planning, risk management and finance. Crosslake remains actively engaged in its investment strategy and welcomes discussions with aerospace and defence companies that could benefit from its investment. (£1.00 = US$1.28 at time of publication).

CAMP Systems International to acquire a portfolio of aviation software businesses



CAMP has agreed to acquire Avinode Group and Aviation FBO software products from World Kinect Corporation © *Shutterstock*

CAMP Systems International (CAMP), a unit of Hearst, has agreed to acquire a portfolio of aviation software businesses from Miami-based World Kinect Corporation. The businesses include the Avinode Group, an air charter sourcing platform and World Kinect's portfolio of aviation software serving fixed-base operator's (FBO), delivering a range of aeronautical services such as fuelling, hangaring, tie-down and parking, aircraft maintenance. The announcement was made by Hearst President and CEO Steven R. Swartz and CAMP President and CEO Sean Lanagan. The closing of the transaction is subject to customary closing conditions. CAMP is the premier aircraft health management and enterprise information systems solution for business aviation. It also operates the largest digital marketplace for parts, services and aerospace business intelligence. Commenting on the acquisition, Lanagan said: "We are excited to acquire the Avinode Group and FBO products with their strong track record of delivering innovative, market-leading solutions. This acquisition represents a complementary extension of our business and platform, to bring exciting new opportunities to the market and better serve our expanding customer base." CAMP's aircraft health management services are provided to 20,000 aircraft and over 30,000 engines. CAMP's software solutions support over 1,500 service centre and maintenance, repair and overhaul organizations. Its global digital marketplaces enable over 30,000 users to execute millions of business transactions annually.

HEICO's net income increases 23% in the first quarter 2024

HEICO has reported an increase in net income of 23% to US$114.7 million in the first quarter of fiscal year 2024, up from US$93.0 million in the first quarter of fiscal year 2023. Net sales increased 44% to US$896.4 million in the first quarter of 2024, up from US$620.9 million in the first quarter of 2023. Operating income increased 39% to US$180.2 million up from US$129.4 million in the first quarter of 2023. The company's consolidated operating margin was 20.1% in the first quarter, as compared to 20.8% in the first quarter of 2023. HEICO's commercial aerospace sales growth has resulted in fourteen consecutive quarters of sequential growth in net sales at the Flight Support Group. EBITDA increased 43% to US$224.4 million in the first quarter of 2024, up from US$157.1 million in the first quarter 2023. Net income attributable to HEICO in the first quarter of fiscal 2024 and 2023 were both favourably impacted by a discrete income tax benefit from stock option exercises. The benefit in the first quarter 2024, net of non-controlling interests, was US$13.3 million, up from US$6.1 million in the first quarter of 2023. Total debt to net income attributable to HEICO ratio was 5.88x as of January 31, 2024, down from 6.14x as of October 31, 2023. The company's net debt to EBITDA ratio was 2.79x as of January 31, 2024, down from 3.04x as of October 31, 2023. Cash flow provided by operating activities increased 46% to US$111.7 million in the first quarter up from US$76.7 million in 2023. HEICO continues to forecast strong cash flow from operations for fiscal year 2024. For the remainder of the fiscal year 2024 the company continues to anticipate net sales growth in both the Flight Support Group and the Electronic Technologies Group, principally driven by contributions from its 2023 acquisitions and demand for the majority of its products. Additionally, HEICO plans to continue its commitment to developing new products and services and further market penetration, while maintaining its financial strength and flexibility. (£1.00 = US$1.27 at time of publication).



Representatives from Turkish Technic and Swiss-AS attending the signing of the LOI at the MRO Middle East show in Dubai *© Swiss-AS*

In a pivotal step towards modernising and automating its maintenance processes, **Turkish Technic** has formalised its intent to collaborate with **Swiss Aviation Software Ltd**. (Swiss-AS). The two companies have signed a letter of intent (LOI) during the MRO Middle East show in Dubai, to signify the strategic move to bolster operational efficiencies and foster data-driven decision-making capabilities. Turkish Technic, a globally recognised MRO provider, is set to elevate its position in the industry by aligning with Swiss-AS, a distinguished player in the MRO and IT sector. This collaboration aims to address Turkish Technic's distinctive MRO requirements, ensuring scalability, compliance and safety in the face of its rapid organisational expansion. Fabiano Faccoli, CEO of Swiss-AS, expresses enthusiasm about the potential partnership, stating, "This collaboration underscores our joint dedication to excellence, safety, and technological innovation in aviation maintenance. We eagerly anticipate supporting the growth and success of Turkish Technic, aspiring to achieve remarkable milestones together." Mikail Akbulut, CEO of Turkish Technic, shares his excitement about the digital transformation journey, stating, "We look forward to a potential partnership with Swiss-AS to advance our digital capabilities. By embracing digital solutions, we aim to augment our operational efficiency, optimize maintenance management, and ultimately deliver heightened value to our customers. This strategic move aligns with our pursuit of excellence and emphasises our unwavering commitment to continuous improvement."

BOC Aviation reports final results for year ended December 31, 2023

In the fiscal year ending on December 31, 2023, BOC Aviation's (BOC) financial performance demonstrated significant growth and resilience. Total revenues and other income experienced a notable 7% increase year-on-year, reaching US$2.5 billion. A remarkable net profit after tax of US$764 million was achieved, a substantial rise from US$20 million in 2022. Core net profit after tax stood at US$547 million, excluding US$217 million of net after-tax recoveries related to aircraft in Russia. This marked a slight increase from the core earnings of US$527 million in 2022, excluding the net impact of the write-down of aircraft in Russia. Earnings per share amounted to US$1.10, with net assets per share totalling US$8.28. Operating cash flow, net of interest, saw an 8% uptick, reaching US$1.6 billion. As of December 31, 2023, total assets surged to US$24.2 billion, marking a 10% rise from 2022. New debt financing of US$4.1 billion was successfully secured, consisting of US$2.5 billion in loans and US$1.7 billion in bonds. Strong liquidity was maintained, with US$5.6 billion on hand, including US$392 million in cash and cash equivalents, along with US$5.2 billion in undrawn committed credit facilities by the end of December 2023. (£1.00 = US$1.28 at time of publication).

SMBC Aero Engine Lease (SAEL) has opted for **Acumen's** SPARTA records data room, a centralised and secure online records management system (RMS) designed for the digitised storage, retrieval and collaboration of aircraft engine records. This choice aims to support SAEL's extensive engine portfolio and future growth needs, making it the inaugural customer for SPARTA's innovative continued airworthiness management module (CMM). SAEL specifically chose SPARTA's project management technical module, alongside its RMS, as an exclusive unified platform for planning, executing and scheduling fleet-wide inspection programmes. The platform also facilitates the management of open item lists, inspections, re-deliveries, shop visit reports and the secure filing and storage of digitised records. In addition to these features, SAEL benefits from SPARTA's continued airworthiness management module (CMM), incorporating track and trace functionalities for airworthiness directives (ADs) and service bulletins (SBs), along with customised asset configuration. Acumen, leveraging its profound domain knowledge, seamlessly interpreted and understood SAEL's requirements, enabling the delivery of tailored solutions in an expedited manner. This efficiency was further enhanced by SPARTA's open-source, modern technology architecture and a seasoned product development team. SPARTA, operating as a cloud-based integrated platform, is meticulously designed with a comprehensive understanding of aircraft asset management. It offers clients a seamless, connected, and intuitive means of organizing and controlling a vast array of data throughout the complete life cycle of multiple assets.

Trax, a global provider of digital aviation maintenance and engineering software, has announced a strategic partnership with **Singapore Airlines** (SIA) for the implementation of its eMRO and TraxDoc solutions. This collaboration aims to support SIA's advancing digital documentation requirements. SIA has chosen Trax's products to meet its needs for creating maintenance work instructions and related technical documentation through a comprehensive enterprise solution. The integration of Trax's eMRO will facilitate the seamless authoring, approval and packaging of maintenance tasks for SIA. Additionally, the incorporation of TraxDoc will provide supplementary advantages by importing original equipment manufacturer (OEM) and other content, automating the generation of digital task cards and relevant data without the necessity for managing extra databases. Jose Almeida, President of Trax, expressed gratitude for the opportunity to contribute advanced technological solutions to support SIA's digital transformation in technical documentation. Almeida stated, "This agreement not only enhances our presence in the Asia-Pacific region but also positions us strongly to assist other airlines in the area contemplating the replacement of their legacy maintenance systems with readily available cloud and mobile software solutions like Trax." Trax is a provider of aviation maintenance mobile and cloud products for the global aviation market and a wholly owned subsidiary of AAR CORP. Trax products support digital signatures, paperless working, including work packs and manuals, RFID-capability for logistics, biometric security, offline capability for its suite of mobile apps, web-based applications and the ability for users to work anywhere with easy access to real-time information. Through its eMRO and eMobility products, Trax provides comprehensive software solutions designed to manage all aspects of aircraft maintenance.

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Turning Potential Scrap into Cash

AviTrader spoke to Fred Grether, CEO of Powerturbine
By Peter Jorssen

The cost of engine spare parts is a major financial factor for airlines and leasing companies. However, there are interesting offers on the market to reduce these costs. AviTrader spoke to Fred Grether, CEO of California-based Powerturbine, Inc. The company successfully provides attractive turbine engine parts management services to airlines and MROs.

AviTrader MRO: Fred. Is Powerturbine a traditional parts broker?

Fred Grether: Powerturbine is not a parts broker. We have actually created and developed a parts management programme for airlines and MROs that we consider to be our programme partners where parts have been removed from engines during the course of an overhaul. A lot of the parts, about 20 - 25% are considered scrap. However, under contract with MRO enterprises such as Air France Industries, those parts are sent to us, and we manage this material, and we send the parts out for a second-opinion repair evaluation. Surprisingly enough, about 20% of the parts that were considered scrap and non-reparable were misdiagnosed as being non-reparable and when that is discovered, we go ahead and we then pay for the repair of those parts. Only after the parts have been certified do we sell the material into the surplus marketplace and then we send the sale proceeds back to the airline. In the case of one of the largest airlines in Europe, we've sent over $13 million in cash net; we found money for material that was simply going to be thrown away.

How do you see the outlook for your business? Are there specific engine types you focus on?

For the next five years we just see a steady increase. There's new engines, there's legacy engines and there's sunset engines. We don't focus on new engines at all, those are going to be hanging on the wing for six to seven years so we're looking at legacy engines like the CFM series. Also, sunset engines like the CF6 engine are extremely popular now

> **"We found money for material that was simply going to be thrown away."**



Fred Grether, Chief Executive Officer, Powerturbine



Peter Jorssen (AviTrader) and Fred Grether (Powerturbine). © *AviTrader*

because of the big buildup with the 767 freighter and most of those use CF6 engines. So, we're really happy. We just acquired all of the surplus CF6-80C engine material from an airline in Asia that closed their CF6-80C shop. So, we have over 50,000 CF6-80C parts not considered scrap but just removed off the engine. Now we're looking for a good home, a good target base for this CF6-80C material.

How long has Powerturbine been in business and how did you develop it?

I used to work for a parts broker starting back in 1985, so I've been in the business for almost 40 years. In 1988 I started Powerturbine myself out of my garage in my house with the limited number of parts that I acquired from a couple of Airlines in Latin America. Then it just started to grow and you hire people that are better than yourself which is easy for me because I'm lousy at a lot of things and so you just hire people that are better than you and things just take off.

You´ve got a unique business model. Can you tell us how it works in practise?

It's simple actually. When an engine goes in for repair, frontline inspectors will determine whether or not parts can be repaired. Or they send out to an outside MRO for a specialised inspection. Those parts that have been declared as non-reparable, (we hate that word scrap, but just non-repairable) - we arrange for their pickup, and these parts come to our warehouse. We inventory the material and we send the list back to the airline. They approve our inventory list and provide us with an ATA 106 form.
Then we try to commercialise this material. We don't want to invest our dollars in parts that are just going to sit on the shelf, even as they are overhauled. We want to select the material that we know we're going to be able to sell on behalf of the airline. After we market the material, we send the parts out to the second-

> **"We send the parts out to the second-opinion repair facilities that are FAA / EASA approved."**



Powerturbine facility. © *Powerturbine*

opinion repair facilities that are FAA / EASA approved. Once the parts been certified as airworthy, then and only then do we sell the material into the surplus marketplace.
So, is it about the misdiagnosis of parts or does it have to do with the know the alternative part repairs of through the DER repair process? Surprisingly enough less than 5% of the parts that we sell are DER repaired parts. When I give an official presentation to an airline, at the end of my conversation I'll have two turbine blades that have been rejected by an MRO and I have the paperwork for the rejections and the reason for rejections. When I show the parts to the customers one of the parts has been overhauled that had previously been determined to be scrap and was now determined to be repairable during the repair station's second-opinion repair evaluation. The amazing thing is that the overhauled part was repaired by the same MRO that rejected the part a year before. So, it all depends on the inspector, a new set of eyes, changes in the repair manual, repair capabilities, etc. There's lots of different influences that determine whether or not parts are going to be repaired or not.

Now how does it work financially between the parts owner and Powerturbine?

Well, that's through a negotiation in the contract that we have. Every part that we receive is under contract with the airline and we negotiate a gross profit split. After we sell a part, we back out the cost of the repair, a minor transportation charge and then after that we have a percentage split with the airline and that's negotiated. But the lion's share of the money goes back to the airline. However, we've got to stay in business, so we keep part of the money ourselves. If the parts actually turn out to be scrap and they can't be repaired, the airline authorizes us to sell the parts locally in Los Angeles. 100% of the metal value we return back to the airline. We don't participate in that financial gain at all. It's the airlines metal and it's their parts. We are only rewarded when we're successful in salvaging the parts.

Thank you, Fred for your insights. An interesting business model that perhaps not everybody is aware of.

powerturbine

www.powerturbine.com

parts management program

our services

Since 2000, Powerturbine has been singularly focused on our UNIQUE Parts Management Program (PMP). Powerturbine developed this program to assist Airlines and MROs in managing their unrepairable or “scrap” engine material. We have learned that by sending this so called “scrap” material out for 2nd and 3rd opinions to different FAA/EASA repair stations we are capable of yielding approximately 30-35% on material that was misdiagnosed as unrepairable, and going to be disposed of. After parts are successfully repaired, the parts are then sold into the surplus market with a percentage of the net profit sent to the Airline. In summary, we created the PMP to act as a SAFETY NET for parts that were going to be scrapped erroneously, and turn them into new-found cash for Airlines and MROs!

why choose us

Powerturbine has generated millions of dollars for more than 100 Airlines and MROs, for engine parts that were regularly going to be thrown away. We have generated over 10 million dollars for one European Airline alone! One of the greatest aspects of the PMP is that it is a ZERO COST program for Airlines and MROs. Powerturbine pays all incurred expenses upfront (including: transportation, repair costs, marketing, administrative expenses, etc.), adjusting expenses in the total sales value, with final net profit split between Airline and Powerturbine!



WOULD YOU LIKE TO KNOW MORE?

Contact us for more valuable information!

Shannon Chamberlin

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909-390-7777

Ask us about managing your consumable inventory!



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The Silent Workhorse

Talking About APU Maintenance Management

By David Dundas

The Auxiliary Power Unit (APU) stands as the silent powerhouse in every aircraft. Unlike its prominent siblings below the wings, it quietly announces its presence through subtle exhaust emissions at the rear of the aircraft. Affectionately referred to as the APU, this vital component plays a discreet yet indispensable role in aircraft operations. Here we delve into the nuances of APU maintenance, scrutinising the essential procedures and methodologies embraced by aviation professionals to ensure the reliability and endurance of these crucial units. From routine inspections to proactive troubleshooting techniques, we navigate through the domain of APU maintenance to unveil the fundamental principles driving operational excellence within this key element of the aviation sector.

To begin with, we wanted to gain a better understanding of what are seen as the key drivers influencing APU maintenance costs.

Marty Cervellione, General Manager at TAT Piedmont, part of TAT Technologies identified pricing of materials as critical. "In our opinion, the usage and pricing of the materials and repairs required for the APU shop visit are the primary drivers for maintenance costs. As a fully licensed OEM shop, we have the benefit of new-part discounted prices as well as the relationship with the OEM to represent their product with the highest degree of confidence. We have also made significant capital investments allowing TAT Piedmont to repair components on site, aiding in cost avoidance and shorter turn times." Richard Bulanda, CEO at Aero-Shield



Richard Bulanda, CEO, Aero-Shield Capital

Capital responded succinctly: "Establishing clear communication channels between pilots and maintenance personnel is crucial for documenting any deterioration related to the unit's performance."

Robert James, President Setnix LLC, part of Setna iO identified the option of looking at alternative repairs like ORIs and DERs, while also highlighting scrap replacement (sourcing cost-effective replacement parts that were found to be BER or non-repairable when building APUs, and weighing up PMA vs OEM. Anthony Robbins, Honeywell 36 Series APU Team Leader (UK) at StandardAero looks towards the USM market. "The used serviceable market (USM) is key, both for parts and for complete APUs. The use of USM directly enables cost-effective solutions to be passed on to the customer."

According to Ray Boyd, Sr. Director Large APUs at Honeywell Aerospace Technologies, reliability and the environment in which an aircraft is operated are key factors to maintenance costs. He cites environments such as heavy dust regions being more caustic to the engine/APU. Oliver Boro, CAMO Technical Consultant Engines at AMROS Global explains: "The APU consists of a modular



Robert James, President, Setnix © *Setnix*

> **The used serviceable market (USM) is key, both for parts and for complete APUs.**
>
> *Robert James, President, Setnix*

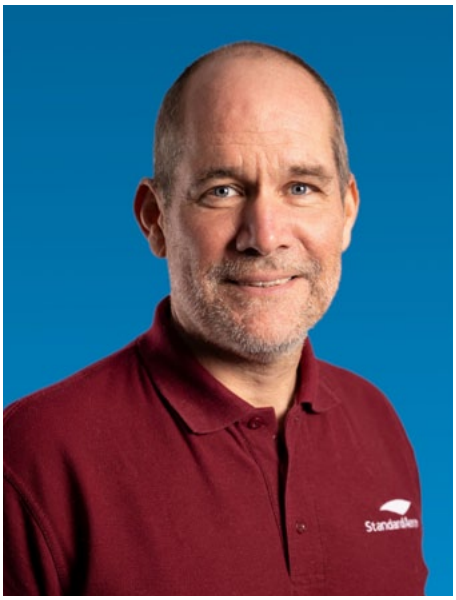
structure: load compressor, power section and gearbox. The Mean Time Between Removal (MTBR) of an APU, is the average time between removals for the scheduled removals, unscheduled removals, foreign object damage, and no fault found. APU maintenance costs and MTBR are sensitive to the type of operation the unit is exposed to. APUs that operates high cycles will tend to have shorter removal intervals and incur lower shop visit costs whereas those operating lower cycles will remain on-wing longer and incur greater hardware deterioration and higher costs. Major causes resulting from deterioration of rotating parts in the engine include high EGT, high oil consumption, metal in the system, and low pneumatic and/or electrical loads. Workscopes performed at removal are either for repair or major refurbishment. APUs that reach their MTBR will require overhaul/restoration to be performed. A key objective of the shop visit workscope is to restore EGT margin. The removal interval affects the material input level, which generally increases in proportion to the MTBR. The cost drivers of APU shop visits are material, repair and replacement costs. Material makes up approximately 70% of total cost while labour will account for approximately 30% of total shop visit cost.

We then asked participants to highlight the practices and schedules airlines should consider when managing APU maintenance to ensure both safety and cost-effectiveness.

In the opinion of Marty Cervellione at TAT Piedmont, "The recommendation to airlines and leasing companies is to start with communicating the intended use for either the individual APU or the entire installed base for a specific fleet depending on the situation at your company. We can tailor a work scope to meet the needs for a "one-off" unit needed for lease re-positioning or return, or multiple APU's that may have near-term fleet retirements and most importantly long-term fleet support solution for aircraft that will be around the next 10-20 years. TAT Piedmont then partners with our customer to review the operator's input and suggest workscopes and build standards that will result in us providing exclusively new OEM parts, or any combination of new and USM in the mode to achieve the desired targets.

Anthony Robbins at StandardAero highlighted workshop product expert relationships: "Get to know your workshop, and form working relationships with your workshop's product experts. A simple conversation with a workshop engineer can help to identify common faults and assist in developing checks that are over and above the maintenance manual requirements, thereby reducing risk and maximizing on-wing potential." Robert James at Setnix pinpoints the following elements: "APU fuel nozzles and fuel shrouds (Replacing every 1000 hours would extend the life of the power section and reduce erosion in the combustion chamber), replacing bearings with new or OH instead of the SVC inspected, and review of DMM data and metrics to observe trends and degradation of APU performance."

A Maintenance Service Agreement is top of the list for Ray Boyd at Honeywell Aerospace Technologies. "The airline should consider Maintenance Service Agreements from Honeywell when managing a fleet for operation. The Maintenance Service Agreement (MSA)



Anthony Robbins, Honeywell 36 Series APU Team Leader (UK), StandardAero

> **Get to know your workshop, and form working relationships with your workshop's product experts.**
>
> *Anthony Robbins, Honeywell 36 Series APU Team Leader (UK), StandardAero*

is a "power by the hour" program tailored for the airlines use of the aircraft and APU. The MSA provides the latest "recommended service bulletins" and reliability upgrades at each shop visit. In addition, the airline can participate in (PTMD) Predictive Trend Monitoring Program, that provides the active tracking of the "health" of the APU and maximizes "time on wing". Lastly, Honeywell offers the High Efficiency Mode, (HEM) as part of the Maintenance Service Agreement. This modification improves fuel efficiency up to 2% and increases "time on wing" by 1,200 hours."

Richard Bulanda, CEO at Aero-Shield Capital responded as follows: "It is important to note that prescribing universal best practices for all airlines and operational environments is not feasible. However, I can provide insight into our specific procedures. In our operational framework, we conduct regular recreational borescope inspections of the hot sections of our leased APUs. Furthermore, during shop visits upon lease returns, we prioritize the replacement of fuel nozzles with overhauled or new. This approach aims to extend the longevity of our APUs and is guided by factors such as the number of operational hours and cycles since the last nozzle replacement. These practices reflect a tailored strategy aligned with our lease operational needs and maintenance objectives."



Oliver Boro, Technical Consultant Engines, AMROS Global

Oliver Boro at AMROS Global is very clear. "APUs require dedicated maintenance related to the application of preventive and predictive maintenance. The application of preventive maintenance means applying OEM recommendations concerning periodic inspections, checks and performance monitoring. The on-wing trend monitoring provides an opportunity for early detection of potential failure. These can be addressed right away by simpler maintenance or with APU removal prior to failure. MTBR for APU varies by OEM. The average range is 6,000 APU FH for units operating on narrow-body aircraft and 8,000 APU FH for those on wide-body aircraft. The benefits would carry over into scheduled maintenance. Executed preventive maintenance should keep the cost down on scheduled shop visits."

Boro continued: "Predictive maintenance implies prediction how the engine will perform throughout its lifecycle and the maintenance work scope that must be undertaken to maintain reliability. The second element is predicting how much the maintenance of the APU will cost over its lifetime. Predictive maintenance practice could be participating in a pay-per-hour programme, with which the operator's maintenance costs are guaranteed. Operator's cash flow will not be diminished by unexpected maintenance costs."

We then wanted to investigate what strategies an airline should use to monitor the health of APUs in its fleet and to detect potential issues before they lead to operational disruptions.

Robert James was nicely succinct: "Monitoring the APU's GET, IGV offset and BSIs every 1000-1500 hours," while Anthony Robbins suggested two key strategies: "Regular spectrographic oil checks are generally the norm for power-by-the-hour type contracts, but logging faults against flight patterns with regular borescope inspections can also help to determine whether environmental factors (for example) might pose an operational issue."


APU shop of Standard Aero © *Standard Aero*

Marty Cervellione provided comprehensive detail on this topic. "There are several ways available to monitor the on-wing health of the engine and take preventive maintenance interventions based on data. For airlines with the resources to manage such activity, it can yield results. We are however of the opinion that it will have to go hand in hand with a maintenance strategy that is not based on lowest cost but focused on maximum value to the operator. We

> **"APUs require dedicated maintenance related to the application of preventive and predictive maintenance."**
>
> *Oliver Boro, CAMO Technical Consultant Engines, AMROS Global*



Ray Boyd, Sr. Director Large APUs, Honeywell Aerospace Technologies

encourage our customers to have a broad approach to the multiple approaches to address proactive steps to achieve maximum reliability. We pride ourselves in the details we provide in the shop teardown reports and the access when needed with our engineering team."

He continued: "Initial development of the proper build spec. is a starting point, but the MRO and operator need to stay closely aligned for any findings that show possible adverse trends that could be addressed in the future shop visits. Secondly, ensuring that aircraft on-board trend data is shared with our team will help us co-identify emerging problems with the airlines maintenance control and engineering teams as cooperative partners to keep the aircraft on schedule with the high utilizations needed to support the post pandemic flying schedules!"

Ray Boyd refers to "on-condition" maintenance. "As Honeywell APUs are "on-condition" maintenance, meaning they run until a failure. Predictive Trend Monitoring is a key feature tracking each APU's health and predicting an up-coming failure before it happens. This enables the airline to schedule an APU change for maintenance rather than disrupting a scheduled fight or stranding the aircraft."

> **"Predictive Trend Monitoring is a key feature tracking each APU's health and predicting an up-coming failure before it happens."**
>
> *Ray Boyd, Sr. Director Large APUs, Honeywell Aerospace Technologies*

Oliver Boro advises that: "Condition-based maintenance is a more recently developed strategy that recommends maintenance decisions based on the information collected through a Health Monitoring System and equipment failure prognostics. The system should have sensors for several variables, such as exhaust gas temperature, rotational speed, bleed pressure and fuel flow. The system modifies easily to adapt to multiple APU models across various aircraft platforms without needing any aircraft modifications. Some of the APU Maintenance Providers developed an APU Health Monitoring System as a useful tool offered to operators. This system monitors and record the status of an APU in near real-time, generating health and usage data. It is based on utilizing advance graphical applications, data analytics and expert knowledge to auto-generate maintenance alerts as a result of parameter and trend shifts."

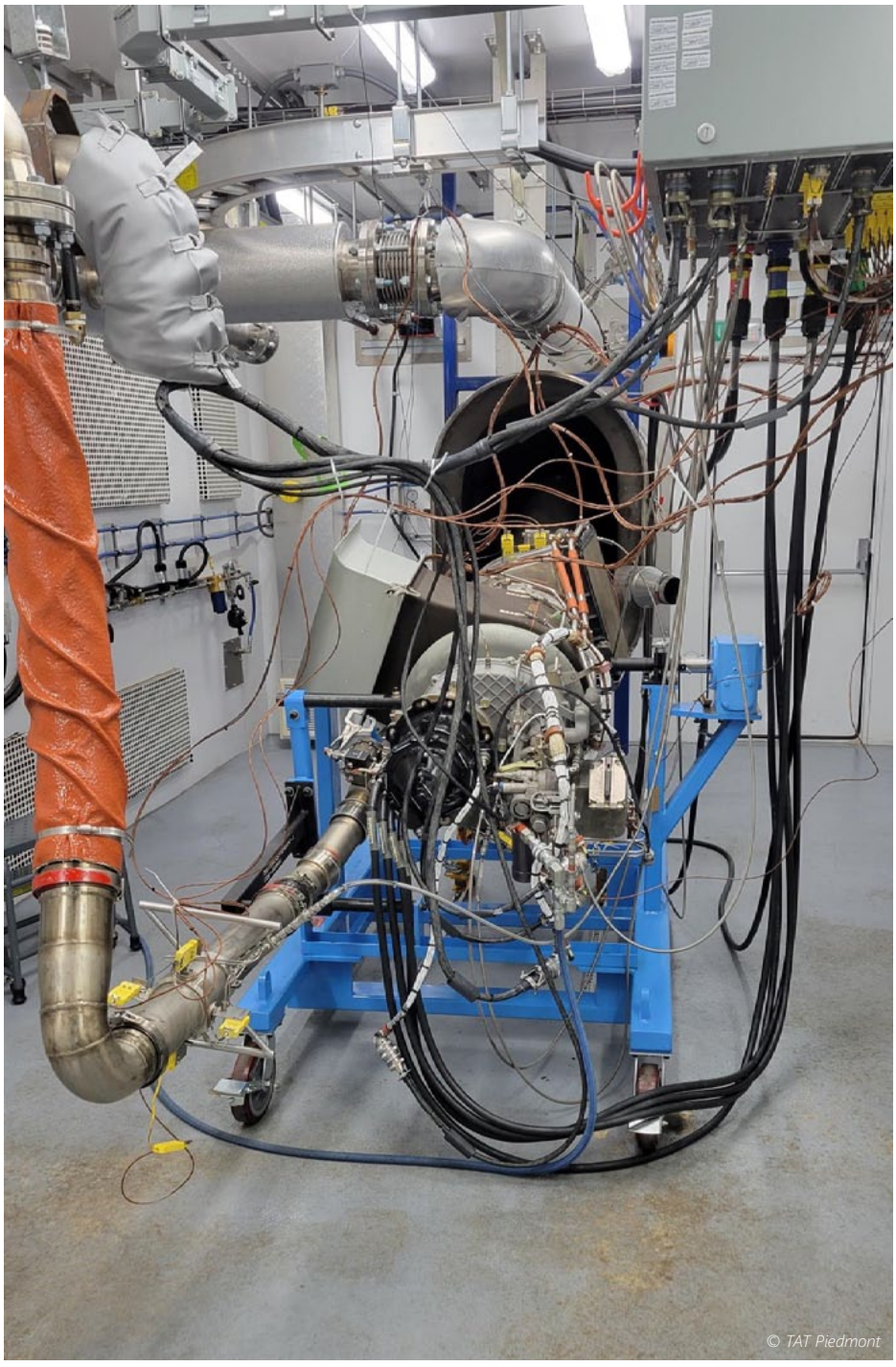
We then chose to delve deeper into the area of the role of data analytics and predictive maintenance in the management of APU maintenance.

"Data is a great tool for setting green time up between shop visits. You can set minimums and maximums for EGTs. As you track trends and metrics, you will be able to remove an APU before failure which will greatly reduce the shop visit cost," Robert James advises. Oliver Boro highlights the benefits of analysing flight data and maintenance logs: "The application of data analytics in the management of APU maintenance is growing, offering new possibilities to make maintenance more data-driven and evidence-based. Predictive maintenance analytics and data-driven maintenance are just a few examples of how data analytics can optimise an APU's maintenance programme. Predictive maintenance involves utilising data analytics to forecast maintenance requirements. By analysing flight data and maintenance logs, predictive maintenance algorithms can anticipate when APUs are likely to fail. Consequently, maintenance can be scheduled proactively, mitigating the risk of unexpected downtime. This approach also helps optimise maintenance costs by determining the most cost-effective schedule, safety can be enhanced, and efficiency can be increased."

Marty Cervellione talks about not keeping data 'siloed' between an airline and MRO engineering departments: "For every system and component in an aircraft, it makes sense to look at available data, whether traditional MTBUR/MTBF monitoring, and trigger-based 'classic' engineering analysis, or through current-technology modern sensor-equipped airframes that help us look at temperature, starting times, valve positions and timing and other relevant data for both core and LRU level information. These data sources will continue to improve with opportunities to employ Artificial Intelligence as these technologies mature. But one of the most important considerations of data analytics is to not keep the output "siloed" between the airline and MRO engineering departments as this information can be utilized in critical planning decisions for level loading removals, especially when peak summer fleet usage and harsher operating conditions may warrant a more strategic approach to scheduling shop visits. This output of trend

monitoring results into the maintenance planning phase is an excellent way to generate higher levels of communication between the airline and our production experts proactively ensure we have the right parts, at the right time in these challenging supply chain environments."

Anthony Robbins stresses that: "Most APUs are supported 'on condition,' with the current trend moving away from hot section inspection (HSI) intervals (with the exception of life-limited components). Trend analysis of common faults is essential, but even more important is training maintenance personnel to identify when early intervention is required, in order to avoid unscheduled removals," while Ray Boyd advises that: "Predictive Trend Monitoring plays a large role in tracking an airline's APU "health" with data downloaded daily. The "trends" provide a recommended maintenance action before a failure occurs."



We next wanted to establish when it was felt an APU should be replaced rather than repaired.

According to Aero-Shield Capital's Richard Bulanda, "When discussing the repairability of APU's it is essential to understand that all APUs can undergo a repair process unless they surpass the beyond economical repair threshold (BER). Once repair costs exceed the true aftermarket replacement value, it becomes necessary to consider scrapping the unit and opting for replacement. However, this decision involves various factors. For instance, during an aircraft lease return, there may be a requirement for the airline to provide the same serial number APU as initially received. Additionally, consideration such as turnaround time from the shop and the criticality of the window to reinstall an APU must be taken into account. Effective communication with both fleet management and finance teams is crucial in determining optimal timing for APU replacement." Setnix' Robert James is of a similar mindset, suggesting replacement as opposed to repair when: "APU repair costs are more than the cost of a replacement APU on the market."

AMROS Global's Oliver Boro suggests that: "When an APU is seriously damaged, beyond economic repair (BER), the operator will conclude that the APU is no longer feasible for repair and instead, will suggest APU replacement with a new or used APU. BER generally refers to when an APU repair requires repair costs 75% or above the market value or procurement cost of the APU." Honeywell Aerospace Technologies' Ray Boyd comes up with a surprising fact concerning lifespan: "Honeywell APUs are an integral part of the aircraft's secondary power system. As such, they are designed to last well over 30 years when maintained properly. Honeywell provides the most reliable APU in the market, enabling the longest "time on wing", reducing maintenance costs for the airline over the "life" of the aircraft."



Marty Cervellione, General Manager, TAT Piedmont

> **From a technical standpoint, an APU is always repairable.**
>
> *Marty Cervellione, General Manager, TAT Piedmont*

StandardAero's Anthony Robbins advises that the decision: "can be driven by used APU prices and market availability, which can vary according to the age of the aircraft platform and the number of APUs manufactured. Using the Pareto principle, approximately 80% of the value of an APU is represented by 20% of its parts, and as such identifying these high-value parts can help speed the process of determining whether an APU is beyond economical repair (BER)."

At TAT Piedmont, Marty Cervellione delves more deeply into the economic equation. "From a technical standpoint, an APU is always repairable, but of course it is not always economically feasible once the cost of repair approaches the cost of a new unit. There are many variables in that economic equation, like the previously mentioned long-term maintenance strategy including LLP considerations, fleet and asset plans and availability of new as well as used APU assets out in the market. TAT piedmont has been able to address these various dynamics with our "toolkit" of in-house repairs, attractive new parts pricing with OEM licenses, USM strategies with our trading group experts and of course our engineering teams involvement in the planning process. This allows TAT Piedmont to optimize the cost in the manner most acceptable to the client in the circumstances of that moment, and in cases where the repair is not economically feasible, we can immediately offer up loans and outright sales with our continuous inventory to keep the fleet flying on schedule!"

Lastly, we wanted to find out if there were any new and emerging trends APU maintenance managers should be aware of.

Oliver Boro noted that: "Operators are interested in maintenance providers who are able to develop customised programmes tailored to the operator's specific APU maintenance needs. Furthermore, these services can be combined with alternatives such as leasing in of an APU or exchanging an APU for the remaining period until phase-out. Operators are also showing interest in Time & Material programmes with not-to-exceed cost coverage which would enable more precise budgeting of costs for APU maintenance in the long term." Robert James briefly points out that: "DERs can save the airlines time and money on their APU builds. Take for example an LLP for the 131-9. A new T1 wheel is going to cost 100-125k (even on the market). The repair for this is very limited in the CMM. However, with new technology and an approved FAA DER, you can salvage the T1 for 25% of the cost of a new T1."

Ray Boyd identified two clear trends: "1) Lower emissions and fuel burn. Honeywell accomplishes this with modifications like High Efficiency Mode on the Narrow-body APU, 131-9 servicing the Airbus A320 and Boeing B737 Max aircraft and 2) More electrification - newer aircraft require more electrical capabilities to support electrically powered accessories instead of hydraulic or pneumatic. Additionally, the airline cabin now requires higher electrical loads to support more modern passenger comforts. Honeywell continues to work closely with aircraft OEMs to design more efficient, higher-powered aircraft supporting by Honeywell APUs." Marty Cervellione warns against relying used material sources from their MRO. We also ensure we invest in spares for our lease and exchange pool as these alternatives become more important as the industry continues to see challenges on both new and used material shortages driving constraint headwinds. Operators should be wary of relying solely on used material sources from their MRO for long-term agreement solutions as we have seen increasing examples of very limited parts out on the market, which can be further hampered if the airline desires back-to-birth traceability and minimum cycles remaining such as in the case of recent LLP's that we had reviewed for a customer. A strong MRO partner, that is licensed by the OEM to ensure a high-quality pedigree with affordable access to new parts, but with the ability to source alternatives when needed and communicate with the customer as partners is where we see the most important trend for success!"

Anthony Robbins has noticed a gravitation towards USM under specific circumstances: "The APU market is a faster-paced business than that associated with aeroengines and is more analogous to accessories and components. As such, reactivity, turn time and cost are factors in every decision. Due to the on-condition basis of APU maintenance management, there is no 'drumbeat' and no detailed event planning until a repair/intervention is required. Customers who are not on a power-by-the-hour type contract agreement will be less likely to have access to a rental unit, therefore making turn times and cost even more critical. In terms of trends, there has been a subtle increase in the willingness of certain OEMs to consider USM when their own supply chains are unable to source new-build components."

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Doubling Revenue by 2028

Talking to Owen McClave, Chief Executive Officer, SR Technics Group

AviTrader MRO: Owen, you have recently been appointed as the new CEO of SR Technics. Congratulations on your appointment. We wish you all the best and much success in your new position. Perhaps you've heard this question countless times already. However, it's the classic query posed to new CEOs. What have you set out to accomplish in your first 100 days in your new role?

Owen McClave: I am privileged to lead SR Technics as CEO, where I have been working since 2019 as Senior Vice President Engine Services. SR Technics has 90 years experience in this industry with many long term loyal and satisfied customers. For the upcoming months in this new role I want to engage with all stakeholders, customers, vendors, employees and partners to better understand the fast changing environment in which we now operate. Customers have different expectations, employees have different expectations and we in SR Technics cannot solely rely on our vast experience from the past to

> “I am privileged to lead SR Technics as CEO.”



Owen McClave, CEO, SR Technics Group



SR Technics engine maintenance © SR Technics

> **“The MRO industry has displayed remarkable resilience during the past years, and when it comes to workforce availability.”**

bring us into the future.
We will double our business in the next four years. We are building infrastructure in Zurich, opening new production facilities, and increasing our workforce by 500 people to extend our capabilities for the GTF and LEAP platforms.

SR Technics has a rich history, originating as the technical arm of Swissair, and later establishing itself as an independent entity, navigating the market without the backing of an airline. Throughout its journey, SR Technics has successfully overcome various challenges and adapted to market shifts. At present, what do you perceive as the most significant challenges facing SR Technics and the MRO market in general?

The MRO industry has recovered and is growing and this poses several challenges which must be addressed to ensure its sustained success. Effective labor and material cost management, tackling the shortage of qualified staff, and overcoming material supply chain disruptions are all critical areas that require attention. Third-party engine MRO providers with substantial in-house capabilities will have favorable trading conditions over the next decade.
From our perspective as an OEM service center, we feel our experience will be quite similar to that of the OEMs. Our global airline customers require the highest level of quality and having the OEM relationship supports that. SR Technics prides itself on having over 90% of repairs performed in-house to support the supply chain and having the OEM approvals as a licensed service center support this capability.
The MRO industry has displayed remarkable resilience during the past years, and when it comes to workforce availability, this is a global challenge for the year ahead. Nevertheless, SR Technics maintained its staff, and we are preparing for the increase in demand. Currently, SR Technics is one of the largest independent technical employers in the aviation sector in Switzerland with over 2,200 highly qualified employees worldwide. To meet the responsibility and the constantly growing customer needs, we invested a three-digit million number of Swiss francs in training programs, our test cells, modern machinery, digitization and growth at our Zurich location.



Preparation for engine test run © SR Technics

SR Technics operates in the MRO segments of Aircraft Maintenance, Engine Maintenance, and through STRADE, Component Maintenance. The recent investment in a new engine test cell implies that Engine Maintenance is the primary focus of the SR Technics. Would you confirm this assumption?

Yes, our strategy is to focus the company on the core business of Engine Services to enable profitable growth, increase focus on developing repairs instead of replacing parts, increase usage of used serviceable material (USM). We plan to double our business by 2028 and have therefore launched our strategy "Take Off 2028" with the focus on growth in engine maintenance with our existing platforms CFM56 and PW4000. The main additional growth drivers will be the entrance into the new engine platforms GTF and LEAP.

STRADE provides component solutions ranging from regional jets to widebody aircraft. This business is highly capital-intensive, considering STRADE's extensive inventory of components. Does the service also include providing components directly to the customer's warehouse?

STRADE provides component solutions ranging from regional jets to widebody aircraft. This business is highly capital-intensive, considering STRADE's extensive inventory of components. STRADE is a success story within the SR Technics Group and for its customers. Since its start, our subsidiary has grown quickly and independently, embracing the increasing importance of USM material in commercial aviation. With a keen market sense and investments in digital and warehouse operations, STRADE has built a sustainable business model that offers great value to its customers. The recently signed partnership agreements show that this can also be done in an asset flexible approach. STRADE serves airlines and MROs worldwide with a 24/7 customer service approach and local warehouses in Amsterdam, Miami, and Kuala Lumpur. Thus, ensuring fast and nearby support whenever and wherever our customers need it.

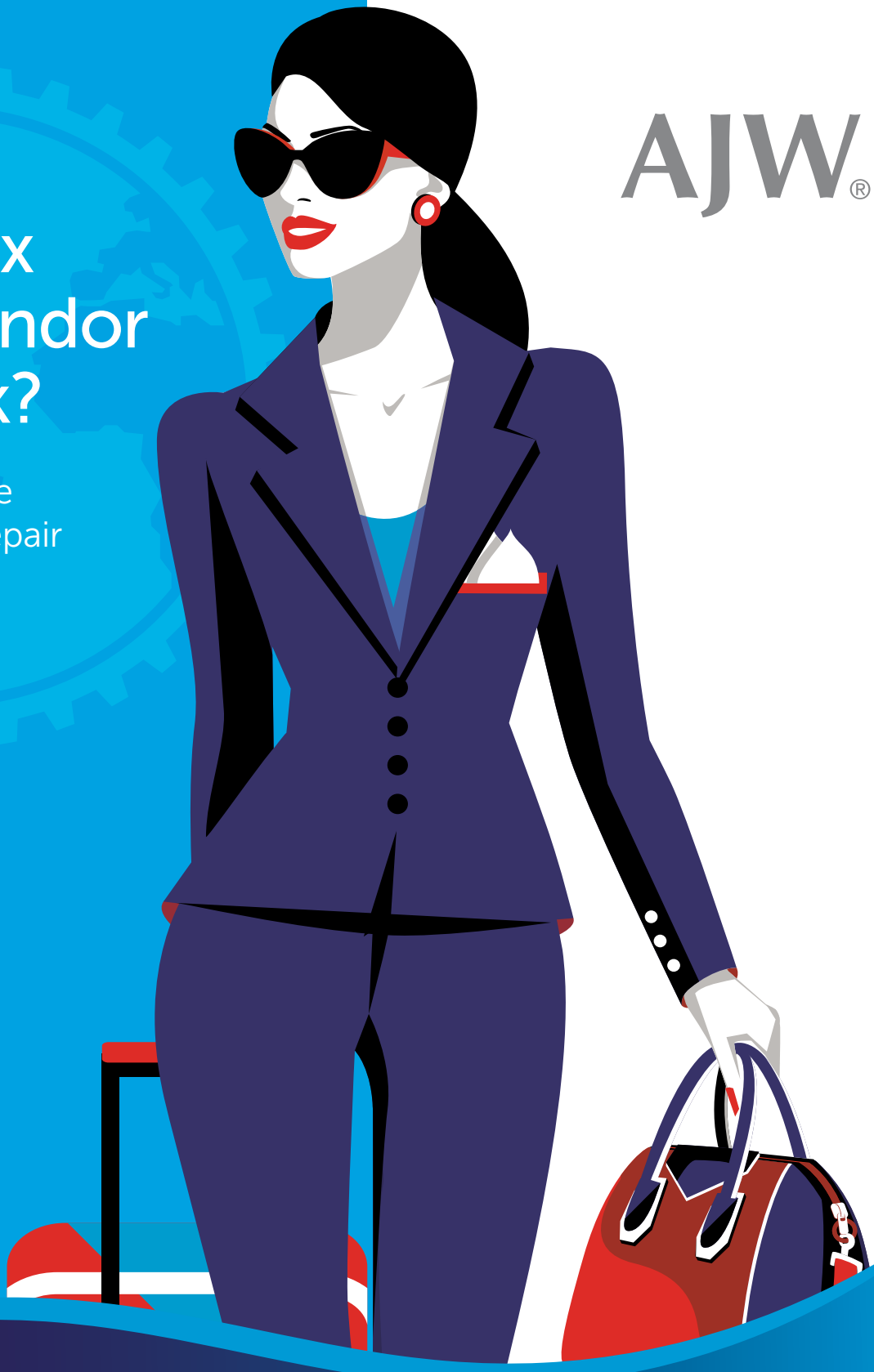
The maintenance business is subject to continual evolution. From your perspective, what do you anticipate will be the most significant changes in the future?

We all understand that there are supply chain challenges across the industry, partially driven by the challenges of the geopolitical situation, the reduction of capacities and the subsequent snap-back in demand that is occurring today. Market forces will prevail and supply and demand will balance out. Similarly we see labour and skill constraints. Market forces alone will not work here without considerable intervention and investment from industry. SR Technics will invest further in people through it`s World Class program where we value a holistic approach to human capital development and upskilling.
We anticipate a pivotal shift towards environmental sustainability, with a growing emphasis on energy-efficient processes and innovative technologies aimed at reducing carbon footprint. As the industry evolves, proactive measures to minimize environmental impact need to become integral to the core principles of engine MRO, reflecting a broader commitment to a greener and more sustainable aviation sector.
We believe also that it is imperative to keep looking at automation and innovation as much as possible. Artificial Intelligence (AI) is with us to stay and we must embrace it. Opportunities exist around languages, inspection and big data. Overarching all of the above is the safety of the passenger which is the singular non negotiable.

> "STRADE is a success story within the SR Technics Group and for its customers."

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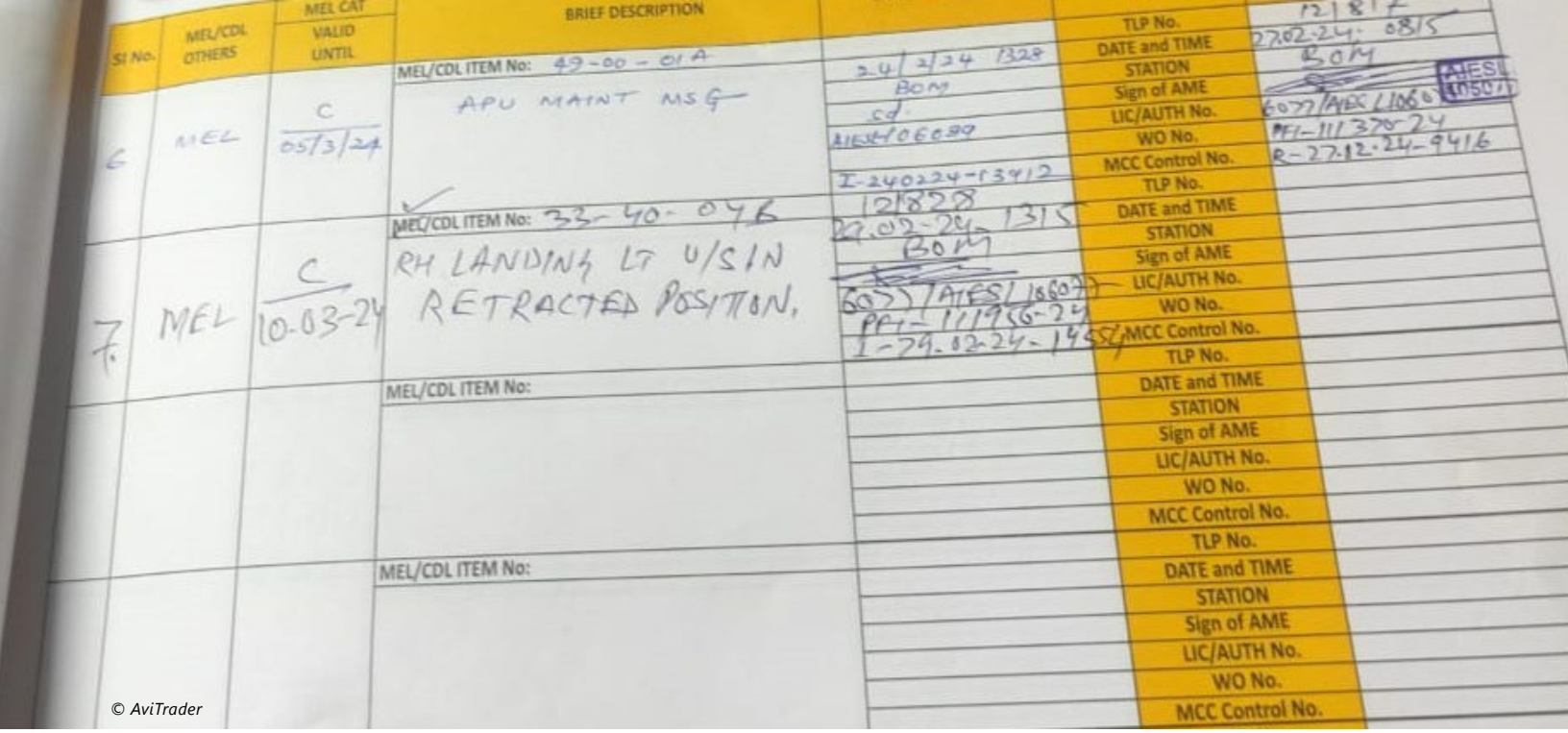


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Battling Through the Night with Delhi's Line Maintenance Teams

Exploring the Depths - A Night Shift Perspective at AIESL

By Swaati Ketkar

It was a warm Mumbai night, I was boarding a flight to Delhi around midnight, as usual I cleared the security and sat at the boarding gate, awaiting my flight, lost in thought. After a while boarding was announced and I entered a rather empty electric transit bus. Afraid to fall asleep if I sat down, I kept standing at the window, gazing at the clouds.

A few days back my editor threw an idea at me, let's do a story on line maintenance during night shifts. Excited, I didn't think twice before saying yes. I have been writing on line maintenance and the MRO sector for over six years now, so it was time to see for real how live line maintenance happened. Little did I anticipate the string of obstacles ahead of me.

As I was standing at the transit bus window my eyes drifted to a far away aircraft. It had just arrived. and a few engineers and technicians were rapidly moving towards it My interest piqued and I tried to gauge the work from a distance. Some engineers were inspecting the landing gear, some were looking at the engine. AHA! This is exactly what line maintenance is all about.

We all must have boarded hundreds of flights till now and must have spend hours at the boarding gate and on transit buses. But have you ever looked around the airport carefully enough to observe a group of people wearing safety harnesses working on a just-arrived aircraft? I had never given it a second thought until I actually had to do a story on it.

I received a call from the AIESL engineering team as I was approaching Delhi Airport. I was asked to come to Gate Number 10, the gate allocated for staff entry. I met Dharmveer, my guide/ supervisor for the night at the entrance. As we exchanged pleasantries, he told me he was an engineer and had worked with AIESL for the last six years. He led me to the security check-post. It was just as any normal security check point at the airport.



Landing gear inspection.

> **I was the only girl on the tarmac that night.**

My arrival at AIESL´s maintenance station in Delhi

I cleared the security and entered the privileged airport secured area with the AEP badge firmly clasped around my neck. I was ecstatic. My story had begun. Dharmveer led me to a car that took us to the apron area. The aircraft that I had seen at a distance from the transit bus were now up close. I could actually feel the anticipation building up inside me and my curiosity at understanding as much as possible within the span of one night overtook my nervousness.

He took me straight to the AIESL main office, where I met Puneet Goyal. He was a middle-aged man with a wealth of knowledge and he was extremely humble. I immediately took a liking to him. He shook my hand and welcomed me in the alien environment. I was the only girl on the tarmac that night. He introduced me to the shift in-charge of the afternoon shift and explained me the overall workings of the office. He showed me what a shift handover form looks like, complete, with detailed information on the task for the shift and action taken on the task. I was surprised to see that the process was manual, with a hand-written form. Goyal explained that this was easy, convenient and an age-old, tried-and-tested method. Although AIESL is exploring digital alternatives, it is still at a nascent stage and the complete transition from manual to digital will take years. "Currently the process we have here is a mix of manual and digital paperwork. We have customised the cumbersome documentation process to best suit our needs," Goyal further explained.



Swaati with her supervisor Mr. Goyal © *AviTrader*

He handed me a shift hand-over form from the previous shift which reflected the names of the shift-in-charge along with minute details like time and signature along with details of the work done during the shift. The form was pretty self-explanatory.

I had reached the facility a couple of hours early for the night shift to begin, so I decided to take the opportunity to understand other departments, how does the inter-departmental communication works, how does the work get assigned, and where do all the tools come from? I was full of questions. After a cup of tea I pored over some more documents like the night shift line maintenance form



Technicians fill the digital log © *AviTrader*

detailing information about the aircraft, the destination from where it arrived, parked at bay number, headed for which destination, task performed along with remarks. The form was a brief overview of the entire shift.

Mr. Goyal also explained AIESL's system of working in which there is a shift availability form. The engineers are listed as per the category – B1, B1 CAT A, B2 CAT A, B2 etc. There are approximately 34-35 engineers per shift with the work assigned as scheduled on flight duty, training, leave, etc. This form makes the task of a shift in charge easier to plan the shift duty as per the demand.

BA Department

As there was some time left for the actual shift handover, Mr. Goyal decided to give me a tour of all the related departments, starting with the first and foremost Breath Analyser (BA) Department. As per the requirements of the Indian Civil Aviation Ministry, the engineer or the technician has to blow into the BA apparatus and the results are displayed instantly. The entire process takes place in front of a live camera and is recorded for audit purposes. AIESL has a zero-tolerance policy towards drugs and alcohol.



Nitrogen trolley © *AviTrader*

Unique blend of digital & manual documentation

AIESL's work is a unique blend of digital and manual documentation, customised for the convenience of engineers and technicians. After the BA department, we went to the digital documentation department of the MRO where all the engineers make an online entry of the work done by them. The entries are carefully tabulated including details like aircraft type, the type of damage, the





Night at the tarmac © *AviTrader*

solution given along with the name and digital signature of the engineer.

The work begins

I was lucky enough to witness the actual documentation in progress in which one of the engineers detected a missing heat-shield bolt in one of the wheels. When the engineer was replacing the wheel, he realised that due to the missing bolt one of the pistons had become damaged. So, he replaced the entire wheel & brake assembly.

From here we headed to the tools department where AIESL stores its inventory of all spares, tools, etc. needed for line maintenance activities. While going to the tools department in another building I saw a nitrogen trolley which is used for compressor wash, a compressor/ engine wash cart, (the blades of the engine are removed and washed to remove the dust and debris) wheel and brake assembly, the complete digital apparatus required to inject air in aircraft tires, oxygen cylinders, a couple of tires, a trolley for changing the wheel and brake apparatus, etc. The apparatus was kept on the apron, easily accessible to the technicians for overhaul.

As we reached the tools department, I was in awe of the complete engineering set-up of AIESL and the hard work that goes on behind a simple line maintenance task.

The tools department

The first thing that grabbed my attention as we entered the tools department was the big board of do's and don't explaining the correct use of tools to ensure the safety of aircraft, users and others nearby. I was on high alert as I realized the importance of safety in aircraft maintenance and implications if taken too lightly. Some of the important dont's were "Improper Maintenance", "Modification" and "Misuse".

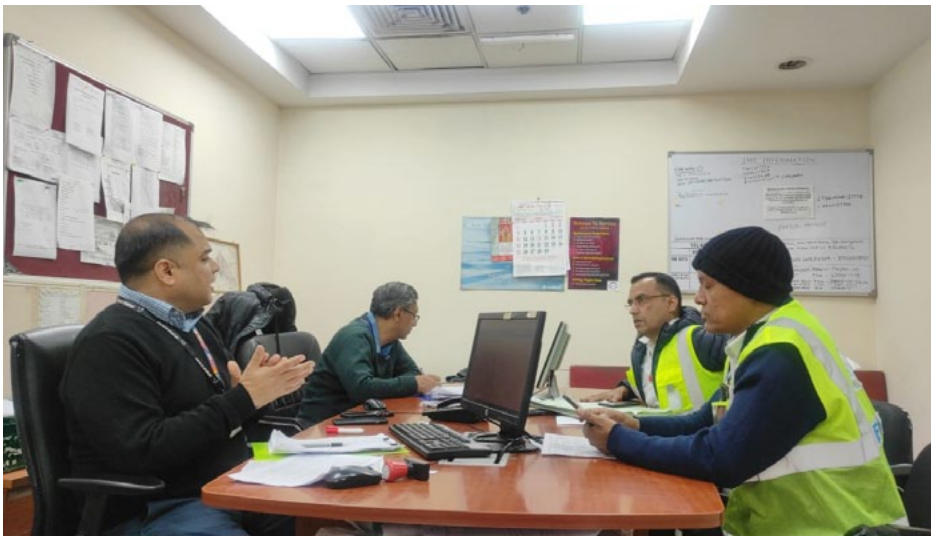
It was the most organized of all department with all the tools neatly placed on display or in boxes.

The tools ranged from the most simple ones like different density of torches and a safety harness to more complicated one's like an engine compressor wash kit, a big tool box, a variety of nuts and bolts, screws and hammers, a portable interphase unit, a fuel draining tool, a normal and high pressure-gauge to check the tyre pressure, a ball point Allen key, an ancillary tool kit and much more. All the tools are issued at the counter where a registered record is maintained. One of the most significant points of all the tools was that they were engraved with a serial number and placed serial-number wise. Even the smallest of the nuts and screws was engraved. This nullified any duplication of tools or parts used for maintenance thus ensuring



complete safety protocol. Also, all the tools were colour-coded and tagged as per their current status, for e.g, – a black tag is used for discrepancy, blue tag for scrapped and a green tag for in-use.

The entire tools inventory is maintained through a digital portal where the entries of all available tools, scrapped tools etc., is recorded. AIESL believes in a zero-tolerance policy when it comes to tool authenticity. There was a special section called the quarantine section. Whenever any tool broke or went missing it was documented in a manual register as well as online and the entire kit that included the tool was placed in quarantine. Next, we were headed to the aircraft tracking and technicians' department.



Discussion on a faulty sensor © *AviTrader*

Aircraft live tracking and technicians' department

This was another one of the most crucial of all the departments in AIESL MRO. I saw two senior officers seated in front of three monitor screens and tracking the aircraft live, its arrival at the airport, the departure, its time on tarmac, etc. There was a fuel and flight reader monitor which calculated the amount of fuel needed to fill each aircraft that comes for line maintenance. The officials deputed the technicians as per the tasks/requirements on the aircraft by live tracking.



Sensor replacement © *AviTrader*

All the technicians, helpers, cabin staff, avionics and B1 technicians report in this room and are assigned their roles as per the chart sheet.

Shift Hand-Over

By the time we finished with the tools department it was almost 21:00 and time for shift handover to start. We rushed back to the main office. The nightshift in charge had already arrived and was poring over a stack of papers. The entire office which was calm and quiet a couple of hours back was now a beehive of activity. I firmly sat in one corner and tried to understand the code language of engineers.

There were four senior engineers seated across the table, brainstorming on a possible snag onboard an aircraft due to a faulty sensor. The captain had reported an alarm when the flight was airborne and suspected a faulty temperature sensor. From what I could gauge, the discussion revolved around finding the specific sensor and checking all the related sensors in the aircraft that had triggered the Pressurization Air Conditioning Kit (PACK) overheat. As soon as the PACK was turned on, it didn't work at all and immediately triggered an overheat signal indicating a fault in one of the sensors.

Finally, it was decided that the faulty temperature sensor had to be replaced. Immediately a team of two avionic engineers were assigned to the task.



Preparing for boroscope inspection © *AviTrader*

I requested to go along with them to observe how a sensor replacement is done.

There was another aircraft, a rather old one that had come for a compressor wash and a boroscope inspection had to be done on one of the aircraft engines. It sure was a busy night for the line maintenance team. I was told the actual process will start after two or three hours once the engine cools down.

Until then then Mr. Goyal assigned another AME to help me understand what happens when the aircraft is deboarded and the actual line maintenance process starts. The time that I was waiting for the most had come, to get to see the actual line maintenance work, up close. By then it was almost 10.30 pm. I realized the shift handover lasted for over an hour. It also gave me a vague idea of the enormity of line maintenance work to be done in just one night

I went along with the new AME, excitement coursing through my veins to be live on the apron. Mr. Goyal also gave me his own deflector jacket, which I wore with great pride. I immediately understood the responsibility and respect that the AMEs command in the course of their job.

On the tarmac - on a cold chilly Delhi night

I tagged along with the new AME to the tarmac and to understand the actual step-by-step process as it happens once the aircraft comes onto the apron. As soon as the aircraft arrived a team of ground handling agents rushed forward with chokes to firmly fix the wheel in place so as to shut off the emergency brakes. Another team of ground handling agents rushed forward with a huge pipe-like structure that was fitted on the aircraft belly. It was the aircraft cooling device using ground power as both the engines were shut down.

Just as the aircraft was deboarded, all these activities took place below the aircraft. As we reached closer to the aircraft, the AME drew a huge torch from his pocket and told me that we will be conducting a walk around of the aircraft. He moved around the aircraft shining his torch all around, his keen, expert eye alert for any obvious defects or blemishes on the fuselage. To me, he moved like an experienced ballet dancer, sure of his every move, every step. Then annoying as reporters are, I shot out the long list of questions brewing inside me...

I was wondering how he recognizes any defect in an aircraft by just doing a walkaround. He explained to me with an example. "Do you see this oxygen discharger. Right now, it is green in color, but if it is white, there is a defect. He shone his torch on the nose landing gear, the avionics box just above the landing gear, inside the blades of the compressor to check for any bird strike or blemishes, the fuel meter, etc. Then he showed me a landing light that was tapped. He went on to explain that this is a part of the MEL or minimum equipment list. He further told me that sometimes there are no obvious snags or defects due to which an aircraft should remain AOG. However, sometimes there are deferred snags. These snags are put on the MEL, under specific categories, which essentially means the aircraft can be certified as airworthy without any safety issues. If the snag is put under category B on the MEL, it needs to be replaced in three days, for category C, the component needs replacement in ten days. Every snag has a specific time limit post where the component needs repair or replacement. For MEL category D the period is 120 days."

He told me that the tapped landing light was a part of the MEL. Next, we went to the cockpit to look at the captain's logbook, the AME wrote his comments on the side box and since there was no obvious defect, the aircraft was ready for its next flight. While we were in the cockpit, the cleaning crew came and cleaned the entire aircraft. Just as we were



Boroscope inspection © *AviTrader*

leaving, one of the cabin crew members drew our attention to one of the overhead bins lid that was not closing. The AME made a note of it.

There were other minute details on the aircraft like refilling the soap dispenser which was also noted and taken care of. During this time, I was told that it was the job of the cabin crew to check all the medical supplies on the aircraft along with the safety harness. If the aircraft or the crew is changed on any flight, the flight attendants check each and every safety harness on the flight as it is one of the most important parts of the safety protocol.

Before entering the aircraft, we had to sign a register, as a part of the AME protocol. As we came out of the cockpit, the AME showed me a black device, something imitating a rubber stamp. He told me that he was the authority to certify that the aircraft is airworthy, and then he stamped the log book with authority. He said, this way no one can copy, change or alter anyone's signature and the entire process remains completely foolproof.

Once the tech log book is signed by the AME, the captain performs a final check, a complete aircraft walkaround from his end to ensure everything is in place. The aircraft is then ready for boarding.

I was sort of hoping that he would find some major defect, and looking at my crestfallen face, he laughed and told me, there are plenty of aircraft around this apron with plenty of snags.

I was still wrapping my head around the excitement of sitting inside a real cockpit when he interrupted my thoughts with an aircraft undergoing the replacement of a faulty sensor. I immediately recalled that it was the same faulty temperature sensor that was discussed during the shift hand-over. I rushed over to observe the entire process of removal of the faulty sensor and replacement with a new one. The faulty sensor will be sent to the OEM for repair.

Compressor wash

Next my guide took me to another aircraft that was about to undergo a compressor wash. Two engineers were assigned the task of compressor washing. I saw one of the engineers had ear plugs and was communicating with the cockpit. He asked for the keys to open the engine cowl. Somone from the cockpit threw down the keys and both the engineers dived below the aircraft to open the engine. The engine was mounted on its stand and all the tools for the engine wash were kept ready. The next step was a bit complicated as the engine waterbar probe had to be inserted inside the engine until it fitted inside snugly, like a lock and key mechanism. Once the waterbar probe was in place, the nitrogen trolley was brought forward, the nitrogen in the cylinders would heat the water to about 60 degrees, post which the actual water wash process starts.

The water heating took another 10-15 minutes, and once the water was heated, one of the engineers pulled me away from the center of the engine as the water would splash everywhere once the process starts. Once the wash process starts, the first reading comes up with ten minutes. A typical wash comprises of three steps – chemical wash, water wash and engine run. The entire process lasts for about two and a half hours approximately.

By the time the first reading of compressor wash came in, it was way past 0200 hrs. I was as alert and active as any other AME and didn't even realize where the time went. My guide, Dharamveer took me to see the last overhaul process on my agenda – the boroscopic inspection. During the shift handover when I heard the term, I was a blank. It was then that Mr. Goyel explained to me that a boroscopic inspection is just like an endoscopy that is performed on humans. Except that here the boroscopic probe is inserted inside an engine and everything that goes on inside the engine is visible on a monitor along with readings. If just hearing about the process fascinated me, the actual feeling of excitement at watching a baroscopic probe insertion inside an engine and seeing what is going on inside can't be compared to anything.

Tired and impressed

After watching the process for a while, I realized it was time for me to head back. My guide took me back to the main office to collect my bag, and I thanked everyone there, I didn't want to disturb them more than I already had, so I quickly left, my mind full of all the maintenance work that I had just seen.

I boarded my flight back to Mumbai within the next four hours, exhausted but full of renewed respect for AMEs, the backbone behind an airworthy aircraft and mentally thanked the AMEs who had performed line maintenance on my flight back home.

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Understanding and Controlling Corrosion in Aircraft Structures

By AIda – carefully edited by our editors

Aluminium is renowned for its propensity to corrode. This is because, as a metal, aluminium has one of the strongest affinities to oxygen molecules, the result being a white powdery coating of aluminium oxide on the surface of bare metal. However, corrosion of aluminium is a very different 'beast' compared to rust. Rust is associated only with iron and steel, where flakes of iron oxide are formed, and the structural integrity of the iron is compromised. In general, oxidation of aluminium does not affect the metal's strength in the short term.

For oxidation to become a problem, this occurs when either chlorides or sulphides are present in the atmosphere in addition to oxygen and moisture (water). Sulphides and chlorides will attack the (protective) layer of aluminium oxide and gradually and continually erode the aluminium. Excluding carbon-fibre composites, aluminium and magnesium alloys makes up the bulk of materials used in the structure of today's narrow-body and wide-body commercial aircraft, so corrosion has the potential to be a major problem.

As for the presence of sulphides, these are invariably found in high concentrations in air pollution created by major cities through the combustion of petroleum-derived fuels which contain sulphur compounds. Chlorides will be found in high concentrations in the air above coastal waters as salt water contains sodium chloride, particles of which are borne by the wind. In addition, while aircraft are thoroughly washed at regular interviews, their design is such that there will always be hard-to-reach areas which make both cleaning and the detection of corrosion difficult.

So, what forms does corrosion on an aircraft take?

Filiform corrosion is more associated with aircraft from before 2000 and occurs under a protective coating and paintwork. It begins with a miniscule breach in the protective coating and then with moisture ingress, spreads out like the roots of a tree or looks like a worm that has been busy under the surface. Filiform corrosion tends to be 'superficial'.

Pitting corrosion is a more serious form of corrosion, literally forming pits in the metal's surface. As moisture is the primary culprit, locations that are difficult to access, e.g., crevices, are particularly vulnerable.

Surface corrosion is the easiest to spot, is also known as uniform corrosion and is a widespread form of metal degradation. Though initially not a threat to the structural integrity of an aircraft, it can



Regular deep washing is key to prevent corrosion © *Shutterstock*

affect it over time.

And there's more, including galvanic corrosion, stress-corrosion cracking, crevice corrosion, intergranular corrosion and dissimilar metal corrosion. So, what strategies can be adopted to counteract the problem of corrosion in aircraft?

Protective coatings are the first line of defence. If the elements cannot get to the aluminium, it can't corrode. However, protective coatings themselves can also deteriorate over time, so they are not a fool-proof solution. Chromate coatings have been banned or heavily restricted owing to the carcinogenic properties of zinc chromate and today considerable investment is being made into environmentally friendly coatings. As an example, cerium-based coatings would appear to be a viable replacement for chromate coatings, while polymer coatings, enhanced with corrosion inhibitors, represent a versatile solution. The incorporation of nanotechnology, particularly graphene and nanostructured coatings, is a major leap forward, offering both enhanced barrier properties and self-healing capabilities.

Regular inspections are critical as well as using non-destructive testing techniques including eddy current testing and ultrasonic testing. More recently, the visual inspection process has been made far simpler, more effective and less time-consuming through the introduction of drone technology in conjunction with UHD cameras, advanced sensors and thermal cameras. This technology is also proving to be a 'game-changer' for the MRO sector of the aviation industry.

Corrosion inhibitors are usually a two-pronged attack. The corrosion prevention case involves cleaning the surfaces and providing a protective surface finish through layers of coatings. For aluminium alloy surfaces, the coating of a corrosion-inhibiting primer is the first coat. For low-alloy steel components, the surface coating consists of a thin cadmium plating and a chemical corrosion inhibitor primer. Stainless-steel components are also cadmium-plated and primed, e.g., alloy steel components, as they may be connected to aluminium parts. In addition, a primer is used on titanium components. Corrosion-inhibitor primers are required to be hydraulic fluid-resistant polyurethanes and epoxies. There is then the application of water-resistant corrosion inhibitors such as ACF-50, while hangaring and frequent washing are also effective corrosion inhibitors. One should also remember that corrosion prevention is not solely an external process. Internally, the application of an anti-corrosion film such as Patco 1800



Corrosion © Shutterstock

in galleys, lavatories and entry ways is essential.

Environmental controls are also a key factor in restricting corrosion in aircraft. Whilst hangaring should help in theory, it only will if the environment within the hangar is conducive to restricting corrosion. Consequently, every effort should be made to control humidity and temperature levels, as well as exposure to harmful corrosive agents. In other words, when it comes to environmental controls, the simple ones include reducing exposure to moisture while complex alternatives include controlling the oxygen, sulphur, or chlorine levels in the immediate vicinity of the aircraft.

Design and material selection also play a major role in the war against corrosion in aircraft. Titanium is seen as an invaluable metal used in the construction of aircraft owing to the fact it does not corrode, even in the most challenging of environments, or tarnish. This is because when it is first exposed to oxygen, it naturally forms a thin layer of titanium oxide, which acts as a corrosion inhibitor in itself. In addition, we are already seeing major components in an aircraft fuselage manufactured from carbon fibre reinforced plastic (CFRP) with each Boeing 787 aircraft containing approximately 32,000 kg of CFRP composites. Reinforced glass fibre is also used, as well as many other composites such as laminated composites, sandwich composites, braided composites, auxetic composites, Nanocomposites and multi-scale composites, all of which, naturally, are not affected by the problem of corrosion.

The battle against corrosion in aircraft will never end. How can it when the surfaces of aircraft are subjected to massive differences in temperature, have to deal with airspeeds at around 700mph, and are exposed to extremely high doses of UV radiation as aircraft fly at altitudes up to 36,000 feet, well above any protective cloud cover. Add constant washing, cleaning and operating in heavily polluted environments, whether in big cities or in coastal environments, and it is easy to see why protective coatings can only last for so long. However, the joys of modern technology are such that there are constant scientific breakthroughs in all industries, and protection against corrosion has changed considerably over the past few decades. Current research is well supported, and new, environmentally protective coatings would appear to be the focus of much of today's attention.

About this article

Rapid technological developments are changing our work environment. We at AviTrader also do not want to ignore these developments and trends. Therefore, we have decided to launch AIda, an AI based article writer. However, AIda's drafts are thoroughly fact-checked by our editors.



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on the move


Jane P. Chappell

Spirit AeroSystems Holdings has released that **Jane P. Chappell** will join the company's Board of Directors, effective February 26, 2024. She will serve on the Corporate Governance and Nominating Committee and the Risk Committee. Chappell has more than four-decades of experience, 17 years at the executive level, providing operational and strategic leadership in the defence industry. Chappell serves as CEO of Altamira Technologies, a national security company in the defence and intelligence sectors. She is on the Board of Advisors for Lone Star Analysis. Before Altamira, Chappell was with RTX Corporation (formerly Raytheon) for 36 years.

Her service at RTX Corporation culminated with her role as Vice President of GeoSpatial Intelligence Solutions from 2015 to 2019. She partnered with customers and industry teammates in this position to shape markets and drive growth in the intelligence, commercial, and international space ground business. "Jane Chappell is an established leader in the American defence and intelligence sectors; we are thrilled that she will serve on Spirit's Board of Directors," said Spirit AeroSystems Board Chair **Robert D. Johnson**. "Her leadership and depth of experience are unparalleled – she will undoubtedly add tremendous value as we grow across our defence and space programmes. We look forward to her contributions." Chappell was named among Washington Exec's Top Space Executives in 2023 and one of Washingtonian's "Tech Titan in 2023." She won the National Reconnaissance Office Director and National Reconnaissance Office Ground Enterprise Directorate Director's Gold medal for outstanding contributions to the mission in 2020 and 2019. She earned the Raytheon CEO Leadership Award in 2008.

EBCO Aviation Insurance (EBCO), a wholly owned subsidiary of TITAN Aviation Fuels, has named **Jon Downey** as Chief Executive Officer (CEO). Downey is an experienced leader in the aviation insurance industry. He served as Vice President for United States Aviation Underwriters Inc., a role that progressed into Senior Vice President of Operations and Head of US Aviation for Allianz. Prior to being named CEO at EBCO, Downey was President and Managing Director of Assured Partners Aerospace. Downey holds a Bachelor of Science degree in Aviation Maintenance Management and an Associate of Science degree in Aviation Business Administration, both from Embry-Riddle Aeronautical University. He also holds a Private Pilot Certificate, SEL, LTA and an airframe and powerplant mechanic's license. **Terry Britt** (Atlanta) and **Rob Burchard** (Greensboro) will continue to lead EBCO as presidents of the retail and wholesale divisions. Together the EBCO leadership team has over 100 years of aviation insurance experience. EBCO provides complete coverage for all types of aviation insurance needs. From fixed-base operators, flight schools, flight departments, private pilots and beyond, EBCO's mission is to build lasting relationships. The EBCO team includes pilots, former FBO managers and aviation leaders, giving them a distinct understanding of a unique industry.


Jon Downey CEO of EBCO Aviation Insurance
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