

MAXIMIZING EFFICIENCY BY MASTERING APU MAINTENANCE COSTS

APUs are sophisticated components that involve various mechanical, electrical, and electronic systems. The complexity of maintaining these systems, including the turbine, gearbox, generator, and control systems, contributes significantly to maintenance costs. Freighter Trends understand that implementing regular inspections and maintenance at specified intervals can reduce the likelihood of major failures. Using data-driven strategies like reliability-centered maintenance (RCM) can help extend the intervals between overhauls, thus reducing the frequency of costly overhauls. Investing in high-quality parts and materials for repairs can reduce the frequency of part failures and extend the life of the APU. Here are the details

In your opinion, what are the primary reasons behind APU maintenance costs, and how can these be effectively managed?

Noelia Hernandez, Strategic Asset Manager, AJW Group - As a supplier, AJW sources APUs through various channels, including aircraft teardowns, spare packages, and surplus market opportunities. By focusing on younger aircraft with relatively low utilisation hours, we can acquire APUs in serviceable condition, minimising the need for extensive repairs and reducing maintenance costs. However, even newer APUs can exhibit wear and tear. Components, especially those in the hot section, degrade due to thermal stress and mechanical fatigue, necessitating regular servicing and repair, which can contribute

to significant maintenance costs. APU maintenance is complex and influenced by several factors, including component aging, necessary maintenance due to wear and tear, the high cost of spare parts, and potential supply chain constraints, all of which significantly impact costs. Additionally, a shortage of skilled labour, insufficient workmanship, and the technician hours required have further contributed to the overall expenses, which have been increasing over the past year.

AJW has strategically partnered with reliable MRO providers to maximise efficiencies. Experience shows that direct replacements, if a repair is not viable, can significantly increase costs, particularly on the high-value components and

subcomponents. As a supplier, it is imperative to partner with an MRO with a strong background that including established OEM partnerships to ensure high-quality repairs, extended component life, and reduced downtime, which will ultimately lead to extended time on wing and enhanced reliability.

Hany Sarhan, Vice-President Regional & APU, Pratt & Whitney Canada - An airline's top priority for auxiliary power units (APUs) is reliability and dispatch availability. As with any mechanical device in regular use, an APU must be maintained on a regular basis. Working directly with the product's original equipment manufacturer (OEM) or with one of its approved maintenance, repair, and overhaul (MRO) network facilities, ensures maintenance is carried out at



Noelia Hernandez

high-quality standards. An OEM maintenance program is an effective way to achieve this.

Managing APU maintenance is often best achieved through one of the many specialized programs Pratt & Whitney Canada offers its customers - including pay-per-hour programs. We can also design APU maintenance plans specific to an individual customer's needs. For example, in 2023 PGWC signed an agreement with Emirates to maintain and support the airline's 116 PW890 APUs for its Airbus A380 aircraft.

For APUs in need of extensive repairs, PGWC offers a Fleet Enhancement Program which exchanges a used APS3200 or APS2300 core for a new one of the same model at an approximate 30% price reduction. Pratt & Whitney Canada also has a New Parts Enhancement Program for select APUs, part of our PGWCSMART portfolio.

Jay Meshay, Vice President of Power Solutions, GA Telesis - APU maintenance costs vary significantly depending on how an airline manages their maintenance program. Some airlines implement robust trend-monitoring programs that track performance metrics, allowing them to proactively remove APUs when they detect early signs of degradation. This preventive maintenance approach helps optimize the overall cost of ownership by addressing



Photo: AJW Group

issues before they escalate.

Others may use soft time limits, removing APUs based on predetermined intervals to control costs and avoid major component failures. Meanwhile, some airlines adopt a "run-to-fail" policy, operating APUs until failure occurs and then routing them to a shop for repair or overhaul. Each strategy balances cost, reliability, and operational demands differently, underscoring the importance of tailoring maintenance practices to an airline's specific needs.



Roger Willis

Roger Willis, APU Program Director, StandardAero - With aging APU fleets, cost increases are primarily driven by life limited part (LLP) replacements and unscheduled removals, caused by blade or bearing failures. Maintenance practices such as borescope inspections and timed blade inspections can help prevent unscheduled removals from occurring.

Can you discuss the benefits and challenges of using OEM parts versus USM in APU maintenance?

Noelia Hernandez - As an APU supplier, we

have observed a growing trend in the acceptance of USM components for APU maintenance. While OEM parts provide the assurance of being new, USM components offer a compelling alternative, especially when considering the extended lead times and higher costs associated with OEM parts.

This growing acceptance within the aviation industry is allowing airlines to optimise maintenance schedules, reduce costs, and minimise aircraft downtime. By carefully evaluating the specific needs of each maintenance event, we can effectively balance the benefits and challenges of OEM and USM parts to achieve optimal outcomes.

Hany Sarhan - Pratt & Whitney Canada offers "used serviceable parts" which have been repaired in one of our approved MRO network facilities. These parts are typically sold for less than the price of a comparable new part. Since PGWC's inventory of used serviceable parts have been repaired to our standards that are an attractive option for customers. PGWC's warranty for new parts is longer than for used serviceable parts.

Jay Meshay - The challenges with OEM parts, particularly supply chain delays, have been widely reported. Lead times for OEM components often exceed what is acceptable for maintenance and AOG (Aircraft on Ground) events. To mitigate these challenges, GA Telesis maintains a robust inventory of USM (Used Serviceable Material) parts, which allows us to support maintenance needs promptly and cost-effectively.

USM offers GA Telesis and its customers the advantage of availability at competitive pricing, enabling quicker turnarounds and reduced overall maintenance costs. By leveraging USM, we've seen significant improvements in lead times and cost efficiencies for both our fleet and our customers' operations.



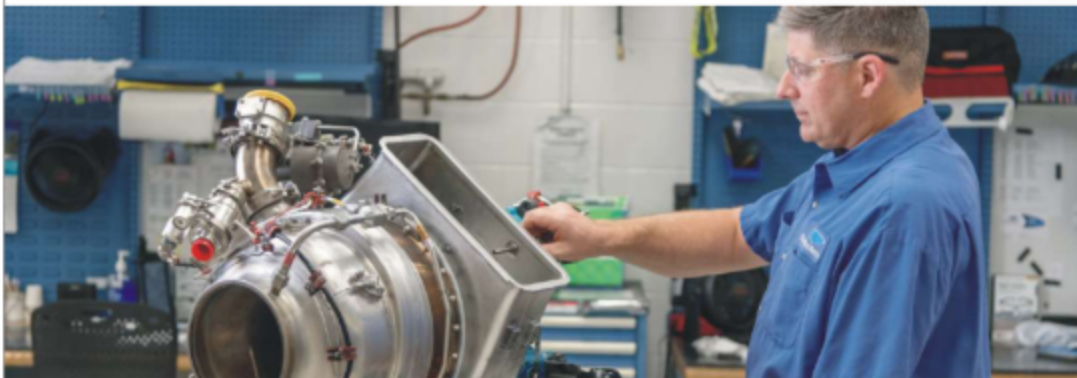
Jay Meshay

However, ensuring the quality and traceability of USM parts remains a critical consideration to maintain operational safety and reliability.

Roger Willis - Traditionally OEM parts offer longer in-service lives and better reliability, while used serviceable material (USM) parts may offer cost savings and more immediate availability. In current market conditions, however, we are seeing challenges with both new OEM parts supply and USM. Availability issues affecting OEM parts (driven by raw material and manpower issues) is driving demand for USM, but at the same time these same parts delays are also increasing demand for serviceable APUs (e.g. for lease), which is in turn limiting the availability of USM.

What do you think about the trend towards more electrification in newer aircraft and its impact on APU maintenance?

Noelia Hernandez - Electrification will undoubtedly impact the role of APUs. While they will remain crucial for critical functions like engine starting and emergency power, their usage may decrease as aircraft become more





electrified and the need for APU-powered functions, such as cabin cooling, may diminish. There is some speculation about the future role that APUs will play and how electrification may impact the APU design and maintenance as we know them today.

Hany Sarhan - Pratt & Whitney Canada is ahead of this trend, having developed the all-electric APS5000A for the Boeing 787 Dreamliner. We continue to work closely with our OEMs on their future needs and/or technologies for APUs.

Jay Meshay - While aftermarket experience with the A350 and 787 APUs is somewhat limited, initial observations suggest that these units have a lower MTBR (Mean Time Between Removals) compared to traditional APUs. Repair costs are anticipated to improve over time, but this has yet to be fully validated.

For example, the A350 APU from P&W has undergone three part number upgrades, likely aimed at addressing design and reliability challenges associated with a

newer-generation APU. While electrification offers potential benefits in efficiency and environmental performance, the industry is still adapting to its implications for reliability and maintenance practices.

Roger Willis - This trend is in part being driven by demand for 'greener' APUs, with fuel efficiency and emissions both being considerations for operators. The most obvious difference in maintenance procedures for all-electric APUs such as the Pratt & Whitney Canada APS5000 and the Safran eAPU60 is the lack of any hydraulics or bleed air system to service.

How are operators adapting to the supply chain challenges, especially with new and used parts becoming limited?

Noelia Hernandez - All industry stakeholders are facing significant supply chain challenges, with both new and used parts becoming increasingly scarce. To navigate these issues, airlines are turning to strategic planning and partnerships with established stockists such as AJW Group, which specialise in comprehensive inventory management. AJW's advanced inventory management systems are designed to integrate demand forecasts for new contracts, ensuring we procure stock ahead of contract start dates to support our global customers effectively. This proactive approach helps mitigate the risk of sudden adjustments due to shifts in demand or supply. If market trends necessitate changes to the predictive variables within our tools, these adjustments can be made swiftly, allowing us to implement the updated models promptly. Additionally, we also employ a comprehensive pooling strategy, strategically positioning inventory worldwide to facilitate efficient access and distribution for our regional customers. By collaborating with reliable stockists, operators can secure a consistent supply of quality parts, ensuring minimal disruption to maintenance schedules.

Jay Meshay - Airline operators and MROs are increasingly exploring alternative solutions to navigate supply chain constraints. These include a greater reliance on DER (Designated Engineering Representative) repairs to extend the life of existing components, as well as wider adoption of PMA (Parts Manufacturer Approval) parts for both individual components and entire assemblies.

While PMA strategies are not in use by GA Telesis, these strategies do help mitigate supply shortages but also reduce maintenance costs and minimize downtime. The increased acceptance of these alternatives highlights the aviation industry's adaptability in maintaining operations despite supply chain challenges.

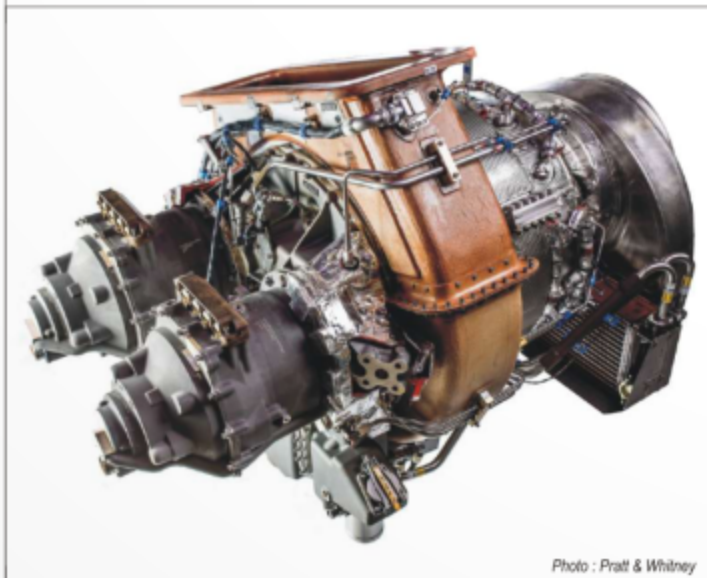


Photo : Pratt & Whitney



Photo : Pratt & Whitney

Hany Sarhan - Pratt & Whitney continues to invest in its workforce and increase its MRO capacity worldwide to meet the rising demands on the global supply chain.

Roger Willis - The limited availability of new and used material is driving operators to keep more spare units on hand, as well as driving demand for leased APUs.

What practices would you recommend to airlines for scheduling APU maintenance to balance both safety and cost-effectiveness?

Noelia Hernandez - It is important that operators follow a structured maintenance plan that combines the manufacturer recommended intervals as well as on condition-based monitoring. We're also seeing a growing trend among MROs to utilize advanced live data software systems. These systems enable real-time monitoring of engine health, allowing for early detection of potential issues and preventing future damage. By leveraging

these technologies, operators can make informed decisions and reduce the risk of unexpected failures and optimise maintenance costs. AJW's extensive inventory pool allows for flexible loan and exchange programs, ensuring minimal downtime for operators and access to both OEM and high-quality USM parts. This, coupled with our technical expertise, enables tailored solutions to meet customers' specific maintenance needs.

Combining a proactive maintenance approach, advanced technology, and strategic partnerships with experienced MRO providers like AJW, airlines can optimise APU maintenance, reduce costs, and enhance operational reliability.

Hany Sarhan - With any gas turbine engine, proper maintenance is a must. We recommend that customers follow all Pratt & Whitney Canada recommendations for maintaining their PGWC products. While



Hany Sarhan

many of our customers follow an on-condition strategy for maintaining their APU, PGWC has a well-established commercial service portfolio to support our APU products, including diagnostic, prognostic and health management tools for some of our products.

Our commercial products are designed to manage APU maintenance on an ongoing basis to ensure dispatch availability, minimize costs, and avoid costly surprises.

Jay Meshay - Beyond partnering with experienced providers like GA Telesis for parts, exchanges, and whole asset leasing, airlines should strictly adhere to their planned maintenance schedules. Proactive maintenance is crucial. For instance, deferring APU removal when issues like high EGT (Exhaust Gas Temperature), cabin odor, or low bleed air are observed often results in higher costs and longer turnaround times at the shop.

Additionally, ensuring adequate spare provisioning and strategically positioning spare units can reduce unplanned downtime, balancing operational safety with cost-effectiveness. This proactive approach is essential for maintaining fleet reliability and minimizing disruptions.

Roger Willis - Proper troubleshooting is key to minimizing unscheduled removal events, with proper tracking of APU times, cycles and ratios to properly scheduled LLP events also being a key recommendation. A properly trained team troubleshooting issues on an APU can prevent a removal, thereby avoiding the associated maintenance costs. Understanding and properly tracking times and cycles can reduce high-cost events such as blade or bearing failures.



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How do you assess the current state of the air cargo industry, and what are the prospects for the next fiscal year? How Turkish Cargo overcome these issues?

Ali Türk, the Chief Cargo Officer of Turkish Airlines - The global economy, particularly the logistics sector, has faced numerous crises in recent years, starting with pandemic and continuing with various conflicts around the world. Despite these challenging conditions, Turkish Cargo has demonstrated superior performance. Our

resilient structure and 90 years of experience have powered our steady rise during this difficult period. Today, Turkish Cargo has become one of the largest air cargo brands in the world.

However, Turkish Cargo's success cannot be attributed to a single factor. Key internal factors include a strong flight network, dynamic capacity management, increased utilization, the proactive approach of the field sales team, and effective revenue management. External

factors also play a significant role, such as the change in market dynamics and high unit revenues from the Red Sea crisis, the rise in e-commerce volume from the Far East, and the strategic advantage of our natural market and geopolitical location.

Ultimately, combination of these developments and our ability to benefit from these situations in an optimum way effected our performance successfully. We are making steady progress toward our goal of becoming the best air cargo brand in the

