

SEPTEMBER 2024

InsideMRO

Strained Capacity

Engine Market Tackles Turnarounds

Seeking Stability

Boeing Global Services' New Strategy

SIAEC Seizes Opportunities

Digital Edition Copyright Notice

The content contained in this digital edition ("Digital Material"), as well as its selection and arrangement, is owned by Informa and its affiliated companies, licensors, and suppliers, and is protected by their respective copyright, trademark and other proprietary rights.

Upon payment of the subscription price, if applicable, you are hereby authorized to view, download, copy, and print Digital Material solely for your own personal, non-commercial use, provided that by doing any of the foregoing, you acknowledge that (i) you do not and will not acquire any ownership rights of any kind in the Digital Material or any portion thereof, (ii) you must preserve all copyright and other proprietary notices included in any downloaded Digital Material, and (iii) you must comply in all respects with the use restrictions set forth below and in the Informa Privacy Policy and the Informa Terms of Use (the "Use Restrictions"), each of which is hereby incorporated by reference. Any use not in accordance with, and any failure to comply fully with, the Use Restrictions is expressly prohibited by law, and may result in severe civil and criminal penalties. Violators will be prosecuted to the maximum possible extent.

You may not modify, publish, license, transmit (including by way of email, facsimile or other electronic means), transfer, sell, reproduce (including by copying or posting on any network computer), create derivative works from, display, store, or in any way exploit, broadcast, disseminate or distribute, in any format or media of any kind, any of the Digital Material, in whole or in part, without the express prior written consent of Informa. To request content for commercial use or Informa's approval of any other restricted activity described above, please contact the Reprints Department at (877) 652-5295. Without in any way limiting the foregoing, you may not use spiders, robots, data mining techniques or other automated techniques to catalog, download or otherwise reproduce, store or distribute any Digital Material.

NEITHER Informa NOR ANY THIRD PARTY CONTENT PROVIDER OR THEIR AGENTS SHALL BE LIABLE FOR ANY ACT, DIRECT OR INDIRECT, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OF OR ACCESS TO ANY DIGITAL MATERIAL, AND/OR ANY INFORMATION CONTAINED THEREIN.



We're right where you need us.

With the aviation market growing rapidly around the globe, our strategically placed pool locations ensure the very best support is close at hand.

With the largest portfolio of CFM engines, and with over 35 years' experience, we are the CFM Specialist Lessor. And, whenever you operate, we'll be there for you, with one objective – to keep you flying.

Joan

Joan Philippe
VP Sales & Marketing

SES. The CFM Specialist Lessor
ses.aero

SES
Fly Certain

MRO 4 NEWS BRIEFS & CONTRACTS

SAFETY & REGULATORY

MRO 5 International Reassessment

MRO 6 A Layer Cake?

DATA TOOL

MRO 7 Powering Up in the Asia-Pacific

AIRLINE INSIGHT

MRO 8 Japan Airlines

ENGINES

MRO 12 Boom and Gloom

The engine market is straining to boost capacity while managing long turnaround times for airlines

MRO 16 Painful Projections

OPERATIONS

MRO 18 Leap Forward

MRO 20 Insulated Aftermarket

MRO 22 'Stable Execution'

Boeing Global Services president and CEO talks about growth, workforce and shortening lead times

MRO 24 Services Boom

WORKFORCE

MRO 26 East Meets West

TECHNOLOGY

MRO 28 AI Approach

REGIONAL

MRO 30 Capturing Opportunity

SIAEC bets on growth in the Asia-Pacific region and artificial intelligence to drive new business

ENGINE EVOLUTION

MRO 32 Enhancement Upgrades

MRO 32 Durability Improvements

ENGINEERED

MRO 34 APU Adaptations

MARKETPLACE

MRO 38 Enhancing Avionics

VIEWPOINT

MRO 40 Inigo Uriarte del Palacio, Resource Group

MAINTENANCE CHECK

The 'In-Between'

When I looked at this issue's table of contents, "the in-between" popped into my head—perhaps because last night the cast of Netflix's *Stranger Things* appeared in a post in my social media feed.

Unlike the scary "in-between" on the show, this issue of *Inside MRO* should not make you lose sleep. However, it highlights the many things in our industry that are in flux.

Take the engine MRO market. OEMs are producing and delivering new engines at historic highs but struggling to generate enough parts to satisfy demand for new and existing engines. Simultaneously, CFM needs to retrofit its Leap 1A and 1B engines with a reverse bleed system to prevent carbon deposits in fuel nozzles, a phenomenon known as coking, while Pratt & Whitney PW1000Gs are coming off wing for contaminated powder metal inspections.

"The surge of [Pratt & Whitney] premature shop visits hit an overhaul network already at capacity from swapping parts out to correct a series of unrelated durability issues," writes Sean Broderick in "Painful Projections" (page MRO 16).

Then those narrowbody engine predecessors, the CFM56 and IAE V2500, are staying on wing longer due to aircraft and engine delivery delays, meaning the mature platforms also are generating more aftermarket demand. Both ends of the market—new and mature—are pulling MRO resources.

GE Aerospace, in fact, saw a higher volume of time-and-material work and heavier worksopes in the second quarter as mature engines came in for third shop visits, which boosted the company's revenue and profit. Read more about the engine market in Alex Derber's "Boom and Gloom" feature (page MRO 12).

While narrowbody engines are dominating demand, on the widebody side, Rolls-Royce is testing new high-



"Both ends of the market—new and mature—are pulling MRO resources."

pressure turbine blades on the Trent 1000, which powers the Boeing 787 (page MRO 32).

Meanwhile, to help meet demand, engine MRO providers are adding partners for targeted worksopes such as module swaps. FTAI Aviation and partner Vortex Aviation contracted Indonesian MRO Batam Aero Technic to replace CFM56 modules. Lufthansa Technik contracted Woodward to repair certain engine components. SR Technics inducted its first Pratt & Whitney geared turbofan (GTF) engine in Zurich for overhaul, making that facility Pratt's 17th active GTF MRO facility. And CFM appointed Israel Aerospace Industries, through its Bedek Aviation division, to conduct quick-turn repair services for the Leap 1A (see James Pozzi's article on page MRO 18).

More of the "in-between" is happening at Boeing Global Services, whose new CEO Chris Raymond talks about moving forward and bringing "stable execution" to the business (page MRO 22).

Add artificial intelligence (AI) to the MRO market, and it takes on some of the surreal aspect of *Stranger Things*. See how companies plan to implement AI (page MRO 28) and learn about SIA Engineering's own generative AI system called Newton (page MRO 30).

Enjoy this issue!

—Lee Ann Shay

Access InsideMRO Online
Go to: AviationWeek.com/MRO



Highlights

Air India Outlines Plans for In-House MRO

Air India is planning for in-house maintenance operations that initially will focus on servicing the group's fleet but eventually could consider third-party operators.

Air India announced plans this year to establish its base maintenance facility in Bengaluru in southern India in partnership with Singapore-based SIA Engineering Company (SIAEC), separate from the carrier's former MRO division, AI Engineering Services (AIESL).

"We're breaking ground imminently and will look to have that operational by the end of 2025," Air India CEO Campbell Wilson said at the Farnborough International Airshow.

Wilson envisages the operation conducting base maintenance initially for Air India's narrowbody and widebody fleets, but this could be expanded eventually to service third-party customers. He said Air India is in the process of bringing its line maintenance in house, with much of the work performed by AIESL.

Wilson noted that Air India also is readying training capabilities in anticipation of its growing fleet. The airline plans to build a new training institute in Amravati, Maharashtra, and to open it by the first quarter of 2026.



Air India's fleet is expected to grow substantially following last year's huge firm order for 470 new Boeing and Airbus aircraft.

SIAEC Blames Longer Hangar Visits on Supply Chain Constraints

SIAEC has reported a decrease in the number of aircraft it is welcoming to its shop for maintenance, saying supply chain constraints and visits from older aircraft have lengthened hangar time (page MRO 30).

The MRO affiliate of Singapore Airlines posted an 11.5% year-over-year increase in line maintenance at Changi Airport for the first quarter of its fiscal 2024-25.

SIAEC said heavy checks were down to 18 from 23 year over year, while light checks dropped slightly to 171 from 173. The company reported performing more checks on older aircraft that required more work and that longer lead times to secure spare parts due to supply chain constraints also stretched the duration of certain checks.

"Demand for MRO services continues to look healthy as the level of flight activity remains on an upward trajectory," SIAEC said in a statement. "On the other hand, concerns over a tight labor market, supply chain issues and elevated costs still persist in the industry."

LHT Acquires ETP Thermal Dynamics

Through its U.S. holding company, Lufthansa Technik North America Holding Corp., Lufthansa Technik (LHT) has acquired 80% ownership of ETP Thermal Dynamics from Campbell Holdings Group to expand its footprint in the Americas and strengthen its supply chain security.

Based in Tulsa, Oklahoma, ETP Thermal Dynamics specializes in MRO services for heat exchangers, as well as oil coolers, fuel heaters, and electro-mechanical and hydraulic components. The company was established in 2016, and its customer base includes LHT and Lufthansa, as well as a variety of airlines, MROs, OEMs and suppliers.

Lufthansa Technik Component Services is also based in Tulsa, and LHT says the proximity "further facilitates post-acquisition activities and integration." Kenny Walling, director of production and engineering at LTCS, will also take on the role of CEO at ETP Thermal Dynamics. ☘

Contracts

AJW Group won an **Ascend Airways** contract to provide Boeing 737NG/MAX component support on a power-by-hour basis out of Montreal.

Austrian Airlines selected **Lufthansa Technik** to provide total component support for 11 Boeing 787s through 2032.

Batam Aero Technic was selected by **FTAI Aviation** and **Vortex Aviation** to replace CFM International CFM56 modules on site.

Epcor was licensed by **Honeywell** to maintain HGT1700 auxiliary power units at Amsterdam Schiphol-Rijk.

Flynas selected **Rolls-Royce** to provide TotalCare services for 15 Trent 7000-powered Airbus A330-900s.

HAECO extended a Boeing 747-400ERF base maintenance contract with Cargolux through 2028. HAECO will perform the work in Xiamen, China.

Lufthansa Technik has won a **Guangxi Beibu Gulf Airlines** contract to provide CFM Leap 1A engine maintenance.

Rolls-Royce has received a **Cathay Pacific Airways** contract to provide TotalCare support for 30 Trent 7000-powered A330-900s.

StandardAero was selected by **Avianca** to provide Leap 1A engine maintenance support out of San Antonio.

Turkish Technic was chosen by Indonesia's **Citilink** to provide Airbus A320 component support.

Woodward has won a five-year **Lufthansa Technik** contract to provide MRO services for its engine components.

Contract Source: SpeedNews

International Reassessment

Two years after its most recent major revamp and 32 years after the program was launched, the U.S. FAA plans to revise aspects of its foreign civil aviation authority audit program.

The agency in mid-August suspended a September 2022 policy change to its International Aviation Safety Assessment (IASA) program, citing a lack of clarity among stakeholders, and recommended a few updates. But unlike the previous changes, the latest proposed revamp will go through a public comment process before final adoption.

The proposed new policy drops what the FAA termed an “informal” engagement process introduced two years ago. Under the process, countries and their respective civil aviation authorities that are at risk of being downgraded could, after consultation with the FAA, address risks before the U.S. agency launches a formal IASA audit.

Portugal is one of 78 countries rated FAA IASA Category 1. Five others are in Category 2.

The policy does, however, recommend a 90-day window for foreign civil aviation authorities with audit findings to develop plans to mitigate their noncompliances.

“If the FAA determines that the foreign [civil aviation authority] has not corrected its oversight deficiencies after the conclusion of the final discussion, the country will . . . receive an official determination of Category 2 status,” the proposed rule states.

Under IASA’s purview, the FAA audits civil aviation authorities with operational links to the U.S.—either direct flights by an airline they oversee or codeshare flights between a U.S. carrier and one of their certificate holders. Audits are done based on International Civil Aviation Organization (ICAO) standards that countries have agreed to follow, focusing on eight areas, including: aviation legislation; operating regulations, organization structure and safety oversight functions; technical staff qualification and training; technical guidance; certification personnel and procedures; surveillance obligations; and resolution of safety issues.

FAA auditors review each area, focusing on how it applies to airlines operating the flights that prompted the reviews, not necessarily the civil aviation authority’s overall effectiveness. Countries are placed into two general categories based on audit results: Category 1 signifies compliance; noncompliance in any element subjects a country to a Category 2 rating.

Category 1 signifies a country complies with agreed-upon ICAO standards based on an IASA audit. Category 2



countries do not comply, and their airlines face operational restrictions on routes that include U.S. destinations.

The FAA’s proposed update introduces Category 1* alongside the existing Category 1. The asterisk signifies that a country “has been notified through official channels for a reassessment based on identified risks of possible noncompliance with ICAO standards,” the policy document states. “The asterisk . . . will be removed once a reassessment is complete and the country either retains its Category 1, or the country is assessed as not meeting ICAO standards and is subsequently assigned a Category 2 rating.”

Under the September 2022 policy, once the FAA determined a reassessment of a country’s Category 1 rating was necessary, levels of direct service to the U.S. as well as codesharing between U.S. carriers and airlines from the affected country were frozen. Before then, the limits were not put in place until the reassessment was complete. The proposed policy drops the

2022 change, but the FAA’s update does not detail any of the concerns expressed with the 2022 policy changes.

“The Sept. 28, 2022, policy statement . . . (now suspended) announced certain changes to the IASA program and provided clarification to other aspects of the IASA policy,” the August FAA document states. “Since that publication, the FAA and [U.S. Transportation Department] have received inquiries and questions that warrant reassessment of those changes and clarifications and an opportunity for public comment before they are adopted permanently.”

The Transportation Department’s Office of Inspector General (OIG) was concerned enough about the IASA program’s direction to launch a formal review this year.

“The FAA has recently made changes to IASA program policies, including clarifications intended to promote greater transparency and enhance engagement with [civil aviation authorities] through pre- and post-IASA assessments,” the OIG said in a January announcement. “However, it remains uncertain how these changes impact the program’s ability to oversee foreign [civil aviation authorities’] policies and verify that the foreign [civil aviation authorities] are in continued compliance with ICAO standards.” The review is ongoing.

Meanwhile, the FAA is accepting public comments on its proposed IASA changes. Comments can be filed online at [regulations.gov/commenton/FAA-2013-0259-4037](https://www.regulations.gov/commenton/FAA-2013-0259-4037). ☞

—Sean Broderick

ARSA UPDATE

A Layer Cake?

AN EFFECTIVE SAFETY MANAGEMENT SYSTEM CANNOT be “bolted on” to existing manuals and procedures, ARSA Executive Director Sarah MacLeod explained in her digital *Inside MRO* column in August. The editorial continued ARSA’s series—which appears in installments in its own

corrective action based on guidance or preference rather than the safety analysis required by the rules.”

Regardless of which regulator is the competent authority, a repair station or approved maintenance organization would do well to layer its SMS within existing quality control systems. At its core, safety management is a human factors discipline, training in which is already required for U.S. facilities holding EASA certification under the bilateral. Those certificate holders integrate “lessons learned” from within the quality system into “lessons received” by personnel to prevent future escapes—a considerable step toward SMS implementation. Closing the gap between how things work in a repair station’s systems and applying it to what the company does to control organizational risk is the key to a successful program.

ARSA’s ongoing communications about SMS installation are dissecting the PEAR Human Factors Model—People, Environment, Actions, Resources—as a foundation for safety risk management. In a maintenance facility, each element in this model helps focus the organization on airworthiness. Tending to these characteristics ultimately enables the company to “do . . . work in such a manner and use materials of such a quality that the condition of the aircraft, airframe, aircraft engine, propeller or appliance worked on will be at least equal to its original or properly altered condition,” according to §43.13(b). This performance standard is attained through human factors as a foundation of SMS.

SMS implementation is not a new project and should not result in a separate manual sitting on the shelf. Between now and December 2025, U.S. repair stations can take simple steps to layer the “new” requirement into existing quality systems—which have for the last century been quite effective at managing safety. 📍

Brett Levanto is vice president of operations at Obadal, Filler, MacLeod & Klein, managing firm and client communications in conjunction with regulatory and legislative policy initiatives. He provides strategic and logistical support for the Aeronautical Repair Station Association.



communications as well as in the pages of the industry trade press—explaining its safety management system implementation philosophy.

The series kicked off with the rush created in June when a European Union Aviation Safety Agency (EASA) announcement from the stage of the International Aviation Safety Conference and an FAA Information for Operators started the clock on a December 2025 deadline for U.S. repair stations to implement safety management systems (SMS) to comply with the EASA-FAA bilateral agreement. Although the actual requirement has not yet been included in the EASA-FAA Maintenance Annex Guidance’s Special Conditions, pragmatism demands taking that deadline seriously.

In her “bolted on” editorial, MacLeod hinted at differences between American and European regulators’ approaches to SMS: “On one side are the regulators who believe an agency’s role is to find compliance through a corporate culture more conducive to open communications—the backbone of safety management. The other, government (which do you think?), takes the more hide-bound approach of hunting noncompliance and forcing

Powering Up in the Asia-Pacific

Engines on Airbus A320s and A330-300s and Boeing 737-800s expected to drive MRO work

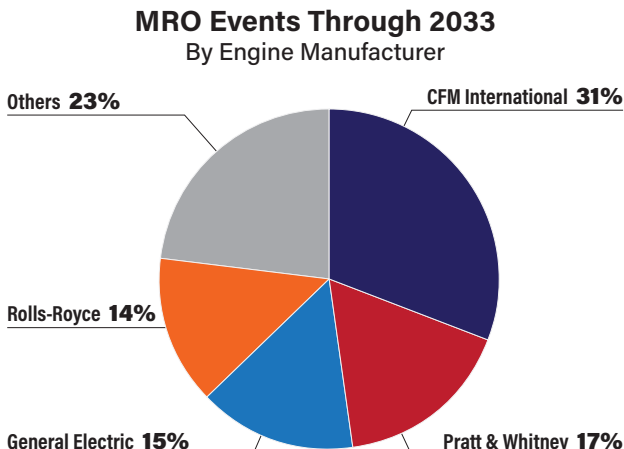
Christian Albertson

Commercial engine MRO demand in the Asia-Pacific region is projected to surpass \$101.8 billion with more than 22,950 MRO events, including over 16,320 engine overhaul events through 2033, according to Aviation Week Network's Commercial Aviation Fleet & MRO Forecast.

The commercial aircraft engine fleet is expected to grow to at least 15,450 engines in 2033 from just over 10,080 in 2024, according to the forecast, which envisions how the world's aircraft fleet and aftermarket will evolve over the next 10 years. This engine fleet expansion is anticipated to translate directly to higher MRO demand during the forecast period.

Required engine MRO for commercial aircraft engines is expected to develop at a compound annual growth rate of 17%.

Commercial engine MRO will be dominated in the Asia-Pacific market by CFM International, which will capture 31% of the market, according to the forecast, while Pratt & Whitney is expected to garner the next-highest share, with 17%.



Source: Aviation Week Network 2024 Commercial Aviation Fleet & MRO Forecast

Aircraft types in the region that are expected to require the largest amount of engine MRO work are the Airbus A320 and A330, followed closely by the Boeing 737-800, the forecast states. 📍

DASI

Access a Global Inventory

Anytime, Anywhere, Any Part.

Visit Us at MRO Asia-Pacific Booth #1023!

www.dasi.com

Japan Airlines

Yuki Nakai, senior director of maintenance corporate planning and finance at Japan Airlines (JAL), discusses with **James Pozzi** how the airline leverages its in-house MRO operation and why it is prioritizing technology and workforce investments.

What does JAL look for in an MRO partner? The evaluation criteria are not solely based on low prices. I believe that is probably the most significant difference from other airlines. However, it is also important whether they can ensure the high quality that Japanese customers expect and whether they can be a stable business partner in the long term.

What are your in-house maintenance capabilities, and which types of MRO work does JAL choose to outsource to third-party providers? This includes

operational maintenance for all aircraft, heavy maintenance, component maintenance including landing gear, and some engine maintenance for our fleet. Specifically, for the landing gear of Boeing 787-8 aircraft, we perform maintenance as a Boeing-certified facility. We outsource heavy maintenance for approximately half of our aircraft to ST Engineering and the HAECO Group. For heavy maintenance that requires significant labor and would be burdensome to perform domestically, we often carry it out overseas. Approximately half of our heavy maintenance is outsourced to overseas MRO providers.

For engines, we outsource the Rolls-Royce Trent XWB engines for Airbus A350 aircraft to Rolls-Royce. We also frequently outsource tasks such as cargo aircraft modifications and large-scale cabin refurbishments.

For other tasks, we carefully balance and consider our in-house maintenance resources. For major component maintenance of aircraft such as Boeing 737-800 and 787, Airbus A350, Embraer ERJ and ATR aircraft, we rely on external contractors, but we perform maintenance on some critical components in-house.

What are the benefits of having JAL's particular in-house MRO capabilities?

Through diverse capabilities, we can enhance the quality of our fleet. Additionally, we can control the turn-around time in-house. We have an

ultimate goal called Zero Zero One Hundred. The first zero means zero irregular operations, the second zero means zero flight defects, and the 100 means zero delays caused by aircraft—in other words, achieving a 100% on-time departure rate. Do you think this is a pretty crazy goal? I think so, too. How-

ever, we believe that providing the best service to our customers can be achieved by reaching such an ultimate goal. For this reason, we strive to diversify our capabilities.

Which technologies are you looking to invest in for maintenance? We

actively invest in initiatives that leverage digital transformation to reduce workloads and enhance aircraft quality, such as analyzing diverse sensor data for failure prediction and automating operational maintenance planning using quantum computers. Additionally, we believe that updating outdated equipment to enable more efficient work for our maintenance engineers is also an important investment.

JAL migrated its MRO system to the Lufthansa NetLine/Ops system this year. What were the benefits of doing so? This system is used in a limited

capacity, specifically for assigning aircraft to schedules (which we call routing) and for some aspects of operational maintenance planning. We continue to use SAP ECC 6.0 as our core system, handling most of our operations, from work planning,

JAPAN AIRLINES



Yuki Nakai

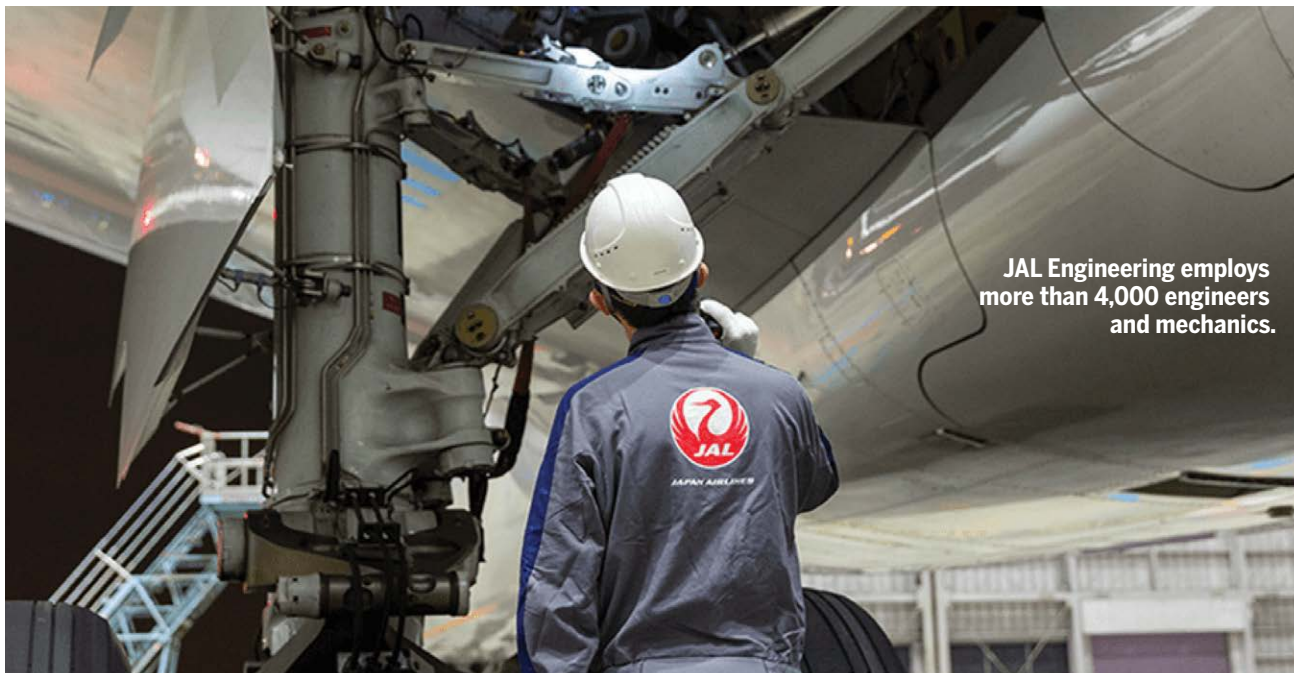
Japan Airlines Fact File

HEADQUARTERS: Shinagawa, Tokyo

HISTORY: Established in 1951 as a government-owned airline, Japan Airlines became the national carrier of Japan two years later and operated for several decades before being privatized in 1987. Over the decades, the airline has expanded in size, and it merged with Japan Air System in 2002. Today, the carrier is part of the JAL Group, which has stakes in several other regional and domestic carriers including J-Air, Japan Air Commuter, Japan Transocean Air, Hokkaido Air System and Ryukyu Air Commuter. It also operates JAL Cargo for freight and mail services. The flag carrier's main hubs are located at Tokyo's Narita and Haneda airports, as well as Osaka's Kansai and Itami airports.

FLEET: Japan Airlines operates a fleet of just fewer than 150 aircraft, most of which are owned rather than leased. The flag carrier's fleet consists of Boeing 737-800, 767-300ER, 777-300ER, 787-8 and -9 aircraft, and Airbus A350-900 and -1000 aircraft. JAL's cargo airline division operates two 767-300BCFs. The airline has orders and commitments in place for more 787s and A350s widebodies. For narrowbodies, it has orders in place for 737 MAX and A321neo aircraft.

MRO: JAL Engineering, established in 2009, undertakes a mix of JAL Group aircraft maintenance work while also being contracted by more than 50 companies globally to carry out maintenance services. Its MRO division employs more than 4,000 engineers and mechanics and operates bases at Tokyo Haneda and Narita airports as well as at Itami airport in Osaka.



JAL Engineering employs more than 4,000 engineers and mechanics.

parts supply and qualification management to accounting. However, as you may know, the maintenance period for this system is soon coming to an end. Therefore, we plan to update it over the next few years and are in the process of selecting a successor product. As we update our core system, we plan to actively invest in improving aircraft quality and productivity, focusing on failure prediction.

How has the JAL supply chain performed? Have there been challenges? How have you improved this in recent times? I believe this is the same for every company, but the situation remains quite challenging. I thought things would improve with time after COVID, but the impact has lasted longer than expected, and I sometimes pessimistically think that we may never return to the pre-COVID state. We are struggling particularly with issues related to passenger seats.

Have you found difficulties in securing slot availability for maintenance? How do you navigate this? Fortunately, we are not currently facing difficulties, thanks to our good relationships with our partners. However, there is a significant possibility

that we may encounter challenges in the near future. Therefore, we will continue to maintain careful communication with our partners, such as sharing detailed future demand projections over the long term. JAL has not significantly increased the number of newly received aircraft in recent years, but even if this did increase, we will still have capacity.

How is the current labor market for skilled technicians in Japan? Is it challenging to find the right people to fit certain roles? This is a very important and serious issue. It is not limited to the aviation industry, but in Japan, which is facing a structural population decline, it is becoming increasingly difficult to find skilled technicians. This has become even more challenging amid the rapid economic recovery following COVID. Additionally, in Japan, labor mobility is low, and there is a strong tendency for people to work long-term at the company they first join after graduating from school. Job changes are not very common. This means we need to secure young workers right after graduation. But unfortunately, the aviation industry is becoming a less popular career choice. There are various reasons for this, but one significant factor might be that many peo-

ple now perceive it as a highly volatile industry due to COVID.

How has JAL looked to overcome these labor-related challenges?

Fortunately, the government, including the Japan Civil Aviation Bureau, recognizes this as an industrywide issue, and various initiatives are being undertaken in cooperation between the public and private sectors. These initiatives include the recruitment of foreign workers, which has not been common in Japan until now. We are working with local schools in countries such as Mongolia, the Philippines and Thailand to bring skilled young people to work in Japan.

Additionally, we are actively collaborating with Japanese schools and have started initiatives to spark interest in the aviation industry from a younger age, such as visiting elementary and middle schools. There are also challenges, such as the longer time required to obtain maintenance engineer qualifications compared with other countries, and a review of the qualification and examination systems is being considered. In this way, comprehensive efforts are being made with a sense of urgency, from recruitment to training. 🌐

Incheon Airport to Become the Centerpiece of Global MRO Beyond a Global Aviation Hub

Hag Jae Lee, the President & CEO of Incheon International Airport Corporation (IIAC), took office on June 19, 2023 when the COVID-19 pandemic was coming to an end. Lee dedicated himself to successfully bringing back the normal operation of Incheon International Airport and now dreams of taking a new leap forward. Since taking office, Lee sought various measures to sharpen Incheon International Airport's competitive edge in the future, thereby establishing new visions and strategies in July this year. This interview underscores his vision for the future of Incheon International Airport and the maintenance, repair and operation (MRO) project at its center.

Please describe your new vision for Incheon International Airport and strategies regarding the MRO complex development.

To respond to the paradigm shift in global macro-environments and the airport industry, Incheon International Airport set the following four strategies on July 1, 2024 under the slogan, "Beyond an Airport, Changing the World": (a) Digital and Airport Infrastructure Innovation; (b) Hyper-connected Mobility Hub; (c) Convergence & Innovation Ecosystem; and (d) Progression to Global Airport Group. Furthermore, we plan to go beyond serving as a top-level air transportation facility (Incheon Airport 2.0) and providing unparalleled user experiences (Incheon Airport 3.0) to unleash the era of "Incheon Airport 4.0" where companies, talents, and technologies come together, creating technologies, innovations, and wisdoms that spread across the globe and creating new values. In particular, we included "Building Global No. 1 MRO Hub" as the strategic task of the creation of a convergence & innovation ecosystem, one of the four core strategies. Based on these efforts, we will establish a global one-stop aviation MRO complex under the name "The High-Tech Aviation Complex."

What was the background in terms of strategic decision-making for the development of the High-Tech Aviation Complex at Incheon International Airport?

Currently, we're undergoing a phase 4 construction project for Incheon International Airport, expected to be complete in October. It will become the world's third-largest airport in terms of international flight scale, with a capacity to handle 160 million passengers and around 600,000 flights per year. Incheon International Airport already lives up to such a title, being ranked first in the world for customer service and third in the world for international air cargo. However, when I analyzed the airport's competitiveness in each area after becoming the CEO, one area I found relatively lacking compared to major overseas airports was "systematic maintenance services." Contrary to other major global airports, Incheon International Airport only has four hangars and does not have an infrastructure that could be called a maintenance complex. Due to this lack of infrastructure, domestic airlines are highly dependent on overseas MRO services. Demand for aircraft maintenance is expected to increase by an average of 1.8% per year over the next decade, with the total market size expected to



reach approximately USD 124.1 billion by 2034. The current market leaders are North American and West European companies, but the industry will reshape itself in years to come, allowing the Asia-Pacific to hold the initiative. In particular, the maintenance industry is closely related to aircraft safety. As an airport operator, aviation safety is the most important value that cannot be compromised, and we have decided that we need to establish a support system for a systematic and comprehensive maintenance system to secure safe aircraft operations at the nation's gateway airport used by all citizens. The blueprint for the High-Tech Aviation Complex development project attempts to turn crises into opportunities by actively responding to external environmental changes encompassing airport expansion, increased maintenance demand, and an emphasis on safety.

Since IIAC is a public agency, do you think the government's policy decisions play an important role in guiding the MRO project's direction?

Of course, the central government is investing heavily in the project, considering it as one of Korea's core future industries. In August 2021, the government announced the "MRO Industry Competitiveness Reinforcement Measures," strengthening investments in the MRO industry in full swing. Following this action, the government proposed four reinforcement plans, including support for domestic MRO volume expansion, securing price competitiveness, strengthening technical capacity, and laying the groundwork for the MRO industry's growth. Furthermore, in July 2022, the government listed the MRO industry as one of the national tasks and successfully held the groundbreaking ceremony for the Incheon International Airport's High-Tech Aviation Complex with key government officials, including the Minister of Land, Infrastructure and Transport. IIAC will constantly communicate with the government to help the High-Tech Aviation Complex become the centerpiece of the global MRO industry.

Do you have a specific plan for implementing the High-Tech Aviation Complex project?

The project is planned to be developed in three phases. The first phase (2020s) involves attracting global anchor companies in each MRO field, including aircraft, engines, parts, and aviation supply chain management (SCM). The second phase (early 2030s) is the scale-up of the complex scale through MRO facility integration and the full-fledged storage of overseas maintenance demands. Lastly, the third stage (2030s to 2040s) involves linking with the airport economic zone surrounding Incheon International Airport to establish a background support complex including education and training facilities and integrate the most advanced technologies, including robotics and AI, to complete the High-Tech Aviation Complex that heads for the future. The specific site areas for each phase are approximately 620,000 m² (1st), 900,000 m² (2nd), and 810,000 m² (3rd). We are currently attracting companies for the 1st-stage area and plan to attract companies for the 2nd-stage area starting next year.

Which partnership model is IIAC considering for the High-Tech Aviation Complex project, and what will be its role?

IIAC is considering leveraging a suitable combination of various partnership models, including private investment after land lease, entrustment of operation rights, quota investment, and direct development. We will tailor to each company and project stage based on the target company's intentions and profitability. We will also serve as a business partner, pioneering sales routes by connecting with enterprises in and out of Korea. This means we will create a value chain with a wide range of Incheon International Airport's business partners regarding maintenance demand, the crucial factor of companies' investment decisions, and become a bridge between various domestic and overseas companies.

Do you expect any competition with the surrounding regions of Northeast Asian?

We expect competition with nations like Singapore, China, and Japan, which have already established a competitive edge within the industry. However, Incheon International Airport sits in an optimal location, equipped with excellent runway accessibility that considers the massive integration of relevant industries and future scalability. Another advantage of our High-Tech Aviation Complex is its relatively lower rental costs and customer-tailored rental service conditions. To offer these benefits, we have prepared various policies and incentives with the government and drew various support measures to create a company-friendly environment, including actions to operate an eco-friendly airport facility. As I mentioned before, the Asian-Pacific MRO market is anticipated to continue growing to hold the world's largest market share. We are building the High-Tech Aviation Complex in the Northeastern Asian area, the location with the highest growth potential within the Asian-Pacific region. We plan to create an aviation MRO hub with the best facilities in Northeast Asia by harnessing this advantage, added with various governmental support measures.

Will MRO businesses be the only ones to become the High-Tech Aviation Complex

tenants?

The High-Tech Aviation Complex will operate tourism-oriented Fixed Base Operation (FBO) services as well as MRO-related areas. By establishing FBO facilities, which converge tourism and business, we hope to leverage the most luxurious facilities near the airport, such as Inspire Resort and Paradise City, to reinvigorate the tourism industry. As Incheon International Airport is located near Seoul, we plan to use this geographical feature as our advantage and actively promote business-related projects. The FBO facility is situated at the southern end of the High-Tech Aviation Complex, closest to the terminal, and is planned to offer high-quality services connected to the private jet terminal, hangars, as well as adjacent MRO facilities. We are developing detailed strategies related to the FBO business and intend to attract partners to lead the FBO industry together next year.

Are there any MRO business partners that have already signed the tenant contract?

In 2022, we have successfully attracted the maintenance facility of Atlas Air, a U.S. airline offering the world's largest international cargo services through a global transportation network connecting 430 airports in 124 countries. Moreover, Israel Aerospace Industries (IAI), a state-owned company with the world's best cargo aircraft modification technology, selected Incheon Airport in 2023 as the first overseas production base for their Boeing B777 converted freighter, the world's first of its kind. The maintenance facility directly operated by Atlas Air is scheduled to begin operations in 2026, and IAI's cargo aircraft conversion facility is planned to start its operations in 2025. We are also consistently engaging with other prominent MRO companies in and out of Korea.

Which companies is the Incheon International Airport looking for?

The High-Tech Aviation Complex's goal is to offer one-stop MRO services. Therefore, it is wide open to all companies related to the MRO business, including those involved in aircraft conversion, heavy maintenance, parts/engine maintenance, parts supply and logistics centers, and key aircraft components. Even now, we are discussing with renowned overseas MRO companies to promote new projects within the High-Tech Aviation Complex. In particular, we aim to build foundations for a market ecosystem within the cluster by attracting global anchor companies, primarily focusing on leading international firms, by 2026, when the infrastructure work for the High-Tech Aviation Complex will be complete.

Are there any incentive policies for companies that become tenants of the High-Tech Aviation Complex?

MRO is an industry with a high initial investment cost. We've devised measures from various aspects to alleviate such burdens for companies hoping to enter the complex and actively attract subsequent investments. Through financial analysis, benchmarking of foreign airports, and review of relevant laws, we are developing plans to offer two types of incentives to tenant companies.

One of these incentives is related to rent; we will reduce rent for at least five years to a maximum of 10 years in proportion to the investment amount. The other incentive concerns landing fees for ferry flights conducted for maintenance.

If an airline operates a ferry flight to Incheon Airport for maintenance, we will exempt that company from landing fees.

What are the rental conditions for companies looking to enter the High-Tech Aviation Complex?

Contrary to the incentive schemes, the rental conditions are determined by individual contracts.

Rental fee rates will be the basis, and companies will be able to negotiate rates and special terms depending on their contracts.

IIAC constantly analyzes the latest global trends and will propose competitive rental rates based on the findings.

Tell us about the tax-related policy.

In early 2024, the government newly designated the High-Tech Aviation Complex as a free trade zone, creating an investment environment conducive to continuously attracting global MRO companies and OEMs.

As a result, a 100% tax-exempt benefit is now applied to aircraft maintenance parts within the complex. Since most aircraft maintenance parts are imported, they are highly sensitive to taxes, such as customs duties and value-added tax. I believe this tax-exempt measure will greatly benefit the tenant companies.

Moreover, we will implement tax reductions regarding acquisition and registration regarding the Act on Restriction on Special Cases Concerning Taxation. Customs procedures will also be streamlined, including the omission of customs declaration for works such as processing and repair required to transfer items between tenant companies and their value-added logistics activities.

IIAC will continue communicating closely with the government to provide tax policies that exceed global standards for our tenant companies.

Tell us about the airport economic circle business in connection with the High-Tech Aviation Complex.

The hotels and resorts I mentioned earlier are operating their business with flying colors. The "Fine Art Storage Service," planned to be built on the southern end of the High-Tech Aviation Complex, has secured an investment of around USD 281.1 million. Near the complex is



Oseongsan Mountain, where a massive tourist facility is under construction.

As such, various tourist attractions, accommodations, and F&B facilities will be established within five minutes of the High-Tech Aviation Complex. We plan to integrate them with the complex as a part of the airport economic zone and create synergy effects between each sector.

What is the future that Incheon International Airport dream of?

AI is being implemented in all industrial areas, ever-increasing their productivity. Given this condition, airports must step out of their comfort zones as passenger-oriented facilities.

We dream of utilizing Incheon International Airport's advantages, including its global network, cutting-edge digital infrastructure, vast airport area, and stable facility infrastructure, to build an airport of the future by actively integrating the latest industry trends. That is why we have come up with the four strategies I mentioned earlier.

In his book *A Week at the Airport*, Alain de Botton writes, "Had one been asked to take a Martian to visit a single place that neatly captures the gamut of themes running through our civilization, then it would have to be to the departures and arrivals halls that one would head. In a world full of chaos and irregularity, the terminal seemed a worthy and intriguing refuge of elegance and logic. It was the imaginative center of contemporary culture."

Airport will grow to become a global airport group based on facilities equipped with the most advanced technology. I have no doubt that by doing so, it will take its place at the imaginative center of contemporary culture.



BOOM AND GLOOM

The engine market is straining to boost capacity while managing long turnaround times for airlines

Alex Derber **London**

The health of the aerospace engine maintenance market comes down to perspective: OEMs and independent MRO providers are enjoying a glut of business as older engines run longer, but airlines are suffering from extended turnaround times as maintenance capacity and material supply struggle to keep pace with demand.

“The shop visits skewed toward time-and-material work, and then the worksopes were heavier as well,” GE Aerospace Chief Financial Officer Rahul Ghai explained on a recent earnings call. “And that helped both revenue and the profit on those shop visits.”

While this is good news for GE and other maintenance providers, the picture is different for airlines, with Bain & Co. predicting that engine MRO capacity will fail to meet demand through the end of this decade and warning that the sector has “become a choke point for commercial aviation.”

The consultancy highlighted new aircraft delivery delays, supply chain and parts supply problems and pent-up maintenance demand from the COVID-19 pandemic for the imbalance



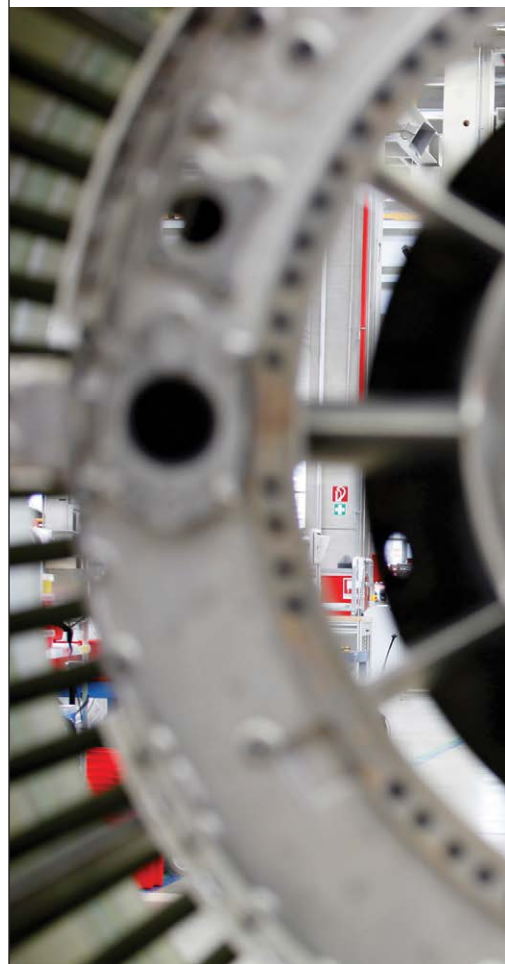
StandardAero added CFM56-7B MRO capacity at Dallas-Fort Worth International Airport and Leap 1A and 1B capacity in San Antonio.

Perhaps the most important dynamic concerns the extended service lives of CFM International CFM56 and IAE V2500 engines as airlines seek to bridge capacity shortages caused by delayed deliveries of new-generation Airbus A320neo and Boeing 737 MAX aircraft and by durability issues with their Pratt & Whitney PW1100G and CFM International Leap 1A and 1B engines.

This benefits the independent engine maintenance market, which tends to focus on CFM56 and V2500 engines, and the OEMs, which receive a larger

share of the most profitable time-and-materials work as older equipment drifts out of full-service, flight-hour-based support contracts.

This trend is set to continue, with GE Aerospace predicting that shop visits for the market-leading CFM56 will peak in 2025 and remain at roughly the same level for another two years. The second-quarter operating profit growth of 21% for the company's commercial engines and services division this year was driven by a 14% rise in services revenue to \$4.7 billion.



and forecast that 2026 would be a crunch year for engine maintenance, when demand is likely to exceed supply by the most.

Bain & Co. also warned that if engine MRO capacity growth continues along its historical trajectory, a considerable maintenance capacity shortfall will occur in 2030 as new-generation engines reach their first shop visits.

ON THE SHOP FLOOR

“We are seeing strong demand across all of our engine lines, and we are continuing to add capacity, especially for the CFM56-7B at [Dallas-Forth Worth] International Airport and the Leap 1A and 1B at San Antonio,” says Will Pitcher, StandardAero’s senior vice president of sales, marketing and customers. “We expect to see demand remain robust for the foreseeable future.”

The view from Europe is the same, with Lufthansa Technik (LHT) pushing to ramp up engine maintenance capacity in response to a buoyant market.

“On legacy engines, the peak of CFM56 shop visits and a continued high demand for the next years requires a consistently large team on the shop floor,” observes Martin Mueller, head of business development engine services at LHT.

Other service providers also are doing well. Estonia-based Magnetic MRO focuses on engine hospital visits and quick repairs, which means its shop was full even during the pandemic, when many airlines avoided expensive full overhauls in a bid to conserve cash.

“Delivery delays and problems with new-gen engines have significantly boosted maintenance demand for current-gen equipment,” says Filip Stanisic, head of Magnetic Engines. “We can see that the pressure continues to rise, [and we] do not expect that the situation will change significantly in the next three years.”

While airlines will welcome these developments, the delays extend be-

yond the shop floor. Bain & Co. estimates that while shop visits of legacy engines are 50% longer than in 2019, at 120 days now, total wing-to-wing turn-around time (TAT)—from removal to reinstallation of an engine—is also 50% longer, at up to 210 days, as engines queue up for maintenance. Airlines are waiting even longer—up to 300 days—for new-generation engines to return.

At StandardAero, Pitcher notes that TATs vary according to engine or auxiliary power unit type. “We do, unfortunately, have engines awaiting induction at a number of facilities due both to strong demand and continuing supply chain issues,” he says. “We work hard to help customers anticipate their shop visit requirements as far out as possible.”

Magnetic MRO also reports queueing. “Yes, there are some engines that are waiting for inductions in our storage, with a waiting period of up to three weeks, but if the customer needs an engine fast, we are doing our utmost to fulfill that need,” Stanisic says.

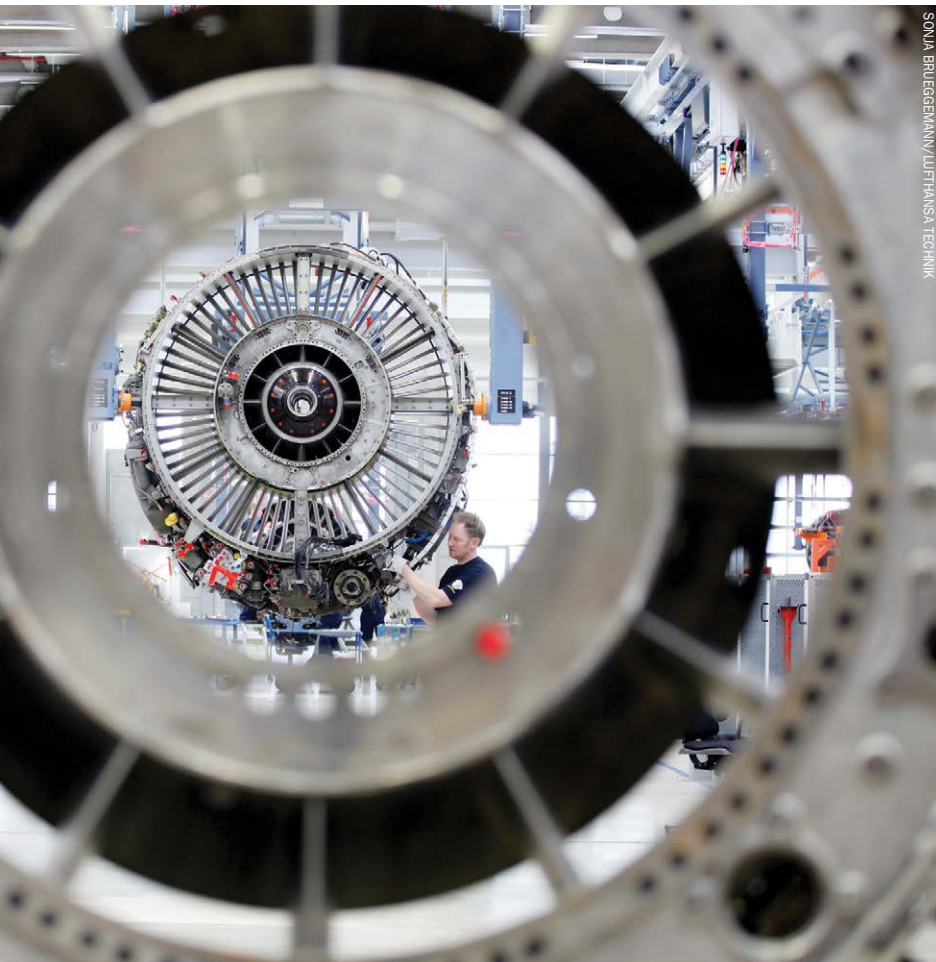
WHAT IS DRIVING DELAYS?

While aviation supply chain stresses have probably peaked, few within the industry expect them to be fully resolved within the next two years.

“Supply chain issues for new material and subcontracted repairs are still challenging, as the global capacity shortage within the industry remains,” Mueller explains. He says LHT is working closely with OEMs and suppliers and “has established joint measures and enhancement programs to improve the situation and is confident that they will be sufficient to ensure customers an industry-standard turn-around time.”

Bain & Co. estimates that demand for OEM parts is outpacing supply 10-20%. Some of the longest lead times are for replacement parts for the newest engines as those manufacturers divert production to their engine lines to meet airframer ramp-up goals. Exacerbating the situation is the fact that little to no used serviceable material (USM) or repairs exist for new engines, leaving MRO providers wait-

Legacy engines and CFM56 shop visits are driving larger workforce demand at Lufthansa Technik.



SONJA BRUEGGEMANN/LUFTHANSA TECHNIK

ing on deliveries of spare parts from the OEMs.

“We are unfortunately continuing to experience long lead times on certain parts, which is driving TATs on a number of our platforms,” Pitcher says. “While such delays are not uncommon on older legacy platforms, the post-COVID supply chain issues are unusual in that they have led to extended lead times on some popular engine products still in production. As such, the MRO industry has found itself competing with the OEMs’ new-build production line for certain parts.”

Another pinch point is labor as MRO providers fight to build back head count and replace the many skilled maintenance technicians who either left during the pandemic or retired shortly after.

“On new engine types, the continuous ramp-up and higher man-hour volume per shop visits compared to legacy engines increase the pressure for skilled personnel,” Mueller says.

Nevertheless, large MRO providers have restored and even expanded their labor pools well. “Recruiting strategies, training concepts and internationalization of our business show good effects,” Mueller notes.

StandardAero, meanwhile, continues to invest in recruitment and training, including in its new San Antonio-based training academy and close relationships with local technical colleges. As a result, it has 1,500 more employees than in 2019, at around 7,500 people.

But smaller organizations, especially specialized repair shops, have found it more difficult to restaff. This has made third-party repairs another bottleneck in the engine aftermarket.

“The problem is in the parts that go outside for repair and the backlog that still exists in the subcontracted repairs,” Ana Bidarra, engine shop planning and control manager for TAP Portugal, said at Aviation Week Network’s Engine Leasing, Trading & Finance Europe conference in London in June.

Alistair Forbes, senior market analyst for MTU Maintenance, noted at the conference that smaller repair providers continue to struggle with labor shortages. “Most of the big people have been able to recruit and train, but some of the smaller outfits are finding it harder to get people in, and that’s

where we’re probably seeing the pinch point,” he said. “You can have 99.9% of the parts for an engine, but you can’t dispatch it until you get that last part.”

MRO providers are more optimistic now, however. “With global capacities coming back online, the overall situation and turnaround time of subcontracted repairs are improving,” Mueller says.

Stanisic agrees. “Third-party repairs are still lasting longer than pre-COVID, but TATs for material repair have dropped significantly compared to post-COVID days when they delayed

The supply-demand imbalance means that the price of USM on popular engines such as the CFM56 has shot up—Magnetic MRO reports that used high-pressure turbine (HPT) nozzle guide vanes have doubled in price in recent years while HPT blades and low-pressure turbine guide vanes have tripled.

“Pricing has gone up drastically for USM in the last 24 months, and sourcing USM presents certain challenges,” Stanisic says. “In some cases, we were surprised that material that was always available as USM is currently in



MAGNETIC MRO

Magnetic MRO focuses on engine hospital visits and quick repairs.

engine repair TAT drastically,” he says. “Most of the repair vendors are doing their best to cope with the demand and return repair TAT to what we had before COVID. On some materials, we are already at the level of 30-40 days, and it’s a huge improvement from the 120-180 days we saw a couple of years ago.”

OPTIONAL SOLUTIONS

One avenue to mitigate long lead times for new parts is USM, although this market is also under pressure from high demand and fewer teardowns as airlines keep potential part-out candidates in service for longer. Of course, USM is not an option for new-gen engines, which are still many years from their first wave of retirements.

real shortage. Due to the wave of upcoming shop visits for CFM56 engines, we expect that prices for USM will remain high for the next several years.”

While StandardAero also has experienced price increases, Pitcher says the company “has been able to rely on our in-house asset management subsidiary, PTS Aviation, and its strong industry relationships to help address most of our in-house USM requirements and those of our customers.”

Mueller says LHT pursues a multiple-source strategy for parts procurement, including the purchase of full teardown engines. “So far, Lufthansa Technik has been mostly successful in moderating price increases,” he notes.

For airlines wanting to avoid lengthy

TATs for full overhauls, which are exacerbated by a shortage of spare engines, alternative approaches such as module exchanges are gaining popularity. Often the decision to pursue these or lighter workscopes depends on how long an airline expects to operate the engine in question.

“Certain customers—such as those bringing back older aircraft to meet their capacity requirements on an interim basis—are understandably more interested in tailored workscopes to meet their specific cycle requirements, while module swaps may work as a temporary solution for operators who would otherwise face aircraft downtime due to a lack of spare engine assets,” Pitcher says.

Meanwhile, it has become “quite routine” for customers to pursue spare engine modules, Stanislav says, noting that “customers tend to accept more minor workscopes and hospital repairs on CFM56-7B or -5B engines compared to full overhauls to extend their life for a certain time only.”

On the other hand, the economics of alternative approaches start to break down if the engine is to be operated beyond a few years. At that point, a full overhaul may more sense

“You can have 99.9% of the parts for an engine, but you can’t dispatch it until you get that last part.”

on a cost-per-cycle basis. Choosing an option may come down to how long an operator expects supply chain problems and aircraft delivery delays to persist.

Mueller reports relatively low demand for overhaul alternatives within LHT, but he says the company “expects an increasing demand in the future for narrowbody legacy engines due to their life-cycle phase and the accelerating rollover of the fleet.”

Following its analysis of engine maintenance bottlenecks, Bain & Co. recommends that MRO providers seek scale to cater to larger fleets and improve productivity through better use of technologies such as artificial intelligence. The consultancy also urges investment in USM and repairs.

MRO providers appear to have the same idea. “To reduce the exposure to excessive repair TATs, Lufthansa Technik has adjusted internal repair capacities and increased material stocks for critical parts,” Mueller notes. Pitcher says StandardAero “will be continuing to introduce new technologies to streamline our processes and maximize our production efficiencies while further expanding our service offerings.”

Stanislav says Magnetic is focused on building out its CFM56 and Leap capabilities and on boosting capacity. “We can work on up to six CFM56 simultaneously now, with the goal of working on 12 engines in parallel in 2027,” he says. 🇺🇸

SpeedNews⁺

Reliable News, Concise Format

SpeedNews is the source for relevant insights, news and information powering commercial aviation. Sent electronically, top executives rely on its unique, quick-read format to:

- Monitor your competition.
- Uncover new business opportunities.
- Connect and network with industry leaders.

Learn More at
aviationweek.com/speednews-info

AVIATION WEEK
NETWORK



CERTIFICATIONS: FAA • E.A.S.A • I.S.O

AIR SHUNT

INSTRUMENTS, INC.

“WE’RE UP THERE WITH YOU”

SPECIALIZING IN MILITARY AND COMMERCIAL AVIONICS INSTRUMENT REPAIR

WORLDWIDE SUPPORT OF:

- ALTIMETERS
- GYROS
- FUEL QUANTITY INDICATORS
- AIR SPEED INDICATORS
- RECEIVER TRANSMITTERS
- TRANSPONDERS

SUPPORTING PRODUCTS MANUFACTURED BY:

ROCKWELL COLLINS • ALLIED SIGNAL • MARCONI • GENERAL ELECTRIC • KOLLSMAN • AEROSONIC • LITTON • GULL ELECTRONICS • ASTRONAUTICS • GRIMES • LEAR SIEGLER • HONEYWELL • LORAL • R.C. ALLEN • TELEDYNE

WWW.AIRSHUNT.COM

Air Shunt Instruments, Inc. | 19101 Winnetka Ave. | Chatsworth, CA 91311 | T: (818) 700.1616 | F: (818) 700.2882

WE HOUSE OVER 10 MILLION SPARE PARTS FOR ALL AIRCRAFT

Painful Projections

Pratt & Whitney is working to ease the pain from geared turbofan-related aircraft groundings

Sean Broderick **Washington**

Pratt & Whitney's plan for inspecting thousands of critical PW1000G engine parts with contaminated powder metal is progressing largely as the manufacturer projected when it kicked off a year ago, although that astute forecasting offers little consolation for operators grappling with grounded aircraft.

The plan, unveiled in the middle of summer last year, called for engine removals starting last September for in-

ever, so Pratt and PW1000G risk-sharing partner MTU Aero Engines developed tailored worksopes to help ensure that engines going back out can stay on wing as long as possible.

But a lack of available full-life parts means not all contaminated parts are being swapped. A parts crunch is also contributing to long shop visit times, forcing Pratt to balance longer TATs with worksopes that benefit operators in the long term.

deliveries of Pratt-powered aircraft.

Instead, Pratt kept producing engines and directed new, full-life parts to its PW1000G production line as quickly as possible. Once all new engines, including designated spares, were being shipped with full-life parts, attention turned to the MRO shops.

"MRO was always a phased ramp-up," Christopher Calio, president of Pratt parent RTX, said on a late July earnings call. "We'll start to see this ramp up here in the second half of the year, and it's going to continue to accelerate into 2025 and into 2026."

Fewer than 1% of affected parts have failed shop inspections so far. While this helps keep engines moving through the MRO process, the powerplants still must return for repetitive checks based on reduced life limits. The most restrictive reductions, applying to Airbus A320neos with the highest-thrust variant PW1100Gs, mean engines must come back within 2,800 cycles—less than one year of activity for the busiest A320neos in the global fleet.

The combination of unscheduled overhauls, already crowded shops and a shortage of spares to serve not just the PM issue but also the unexpected run of shop visits drives Pratt's most critical projection: total aircraft on ground (AOG).

Pratt's calculations saw a sharp rise in PW1000G-powered AOG in late 2023 and into 2024, peaking at around 650 by midyear. As engines begin to return from their overhauls and TATs increase, the figure is expected to fall to about 350 aircraft and stay there through 2026.

The projections are proving accurate—and in some cases, conservative. The AOG peak occurred in May and slightly below Pratt's expectations.

But the long TATs—a 300-day turn means engines removed in January will not be flying again until around Nov. 1—are keeping AOG relatively high. Aviation Week Network Fleet Discovery data showed total PW-1000G-powered aircraft groundings at about 630 aircraft on Aug. 20. The figure includes aircraft out of service for any reason, not just the PM inspections. But most are sidelined awaiting engines going through the PM fleet management plan.



JOE PRESAWATION.NET

Groundings of Spirit Airlines' Airbus A320neos could triple in 2025.

spections of specific life-limited parts (LLP) for cracks in forged parts containing powder metal (PM). Many of the inspections were accelerated compared with Pratt's projected overhaul intervals for the PW1000G engines.

The surge of premature shop visits hit an overhaul network already at capacity from swapping parts out to correct a series of unrelated durability issues. The combination led Pratt to lay out some dire projections.

Chief among them: Wing-to-wing turnaround times (TAT) would run about 300 days, thanks to a combination of long waits to put engines into shops and heavy worksopes.

The PM inspections require a special angle scanner but are not particularly complicated or time-consuming. Pulling an engine off wing to inspect one part is a poor use of resources, how-

MTU is putting considerable effort into optimizing worksopes to minimize time engines spend on the shop floor. Among its focus areas is making sure parts are available before work begins. Those efforts are bearing fruit: Some PW1000Gs have come and gone from MTU's shops in under 100 days, CEO Lars Wagner said on an Aug. 1 earnings call. Pratt's 300-day estimate includes about 150 days of in-shop time.

Meanwhile, Pratt is ramping up spare parts production. The PM problem was corrected at the component level in late 2021, but supply-chain dynamics meant Pratt was still delivering new-build engines with contaminated parts to Airbus as recently as late 2023. The alternative—disposing of the remaining suspect inventory—would have forced Airbus to pause

GTF-Powered Fleet Status*

Engine Type	Aircraft	Parked/ Stored**	Percent of Fleet
PW1100G	A320neo	541	33%
PW1500G	A220	74	21%
PW1900G	E190	11	11%
	Total:	626	

*As of Aug. 20

**On ground 30+ days

Source: Aviation Week Network Fleet Discovery

The plan targets LLPs made between Nov. 1, 2015, and Sept. 1, 2021. Parts affected are high-pressure turbine Stage 1 and 2 disks as well as high-pressure compressor (HPC) seventh and eighth integrally bladed rotors, and aft disks. Most of them are installed on PW1000G variants, but some are on other engine types that power business jets and even Lockheed Martin F-35s. The commercial fleet's activity levels make it most subject to the problem's ramifications—premature cracking made worse by usage.

Within the PW1000G fleet, the PW1100G-powered A320neo variants have been the hardest hit due to the number of affected aircraft, high utilization rates and longer time in service. But A220 operators are not much better off.

All-A220 operator AirBaltic expects to be without as many as 36 PW1500G engines during its upcoming winter season. The carrier has 48 A220s and 20 more on order, meaning the inspections could put about a third of its fleet on the ground.

"Parts are not available, and slots in the shops are not available," CEO Martin Gauss said at the recent Aviation Week Network MRO BEER conference.

The FAA issued a draft of its latest mandate for the A220's PW1500Gs and Embraer E2's PW1900Gs on Aug. 19. This set of inspections—like the others, based on FAA-vetted, Pratt-issued service bulletins—targets HPC seventh-stage axial rotors. The initial inspection threshold is 10,000 cycles, far above where most of the affected fleet stands. Only about 10 of the 335 A220s in service have hit the threshold, and none of the E2s have.

Pratt issued the related service bulletins in May and August; the directive is not expected to be finalized until late this year at the soonest.

As both initial and repetitive inspections mount, Pratt is bolstering resources. Increasing spare parts production is the most direct response. The company also is accelerating its planned expansion of PW1000 MRO capacity (see article below).

While expanded parts production and shop capacity are alleviating the fleetwide ramifications, some airlines' situations will worsen. Spirit Airlines expects its full-year 2024 average of 20 Pratt-powered AOG to triple in 2025.

"There's simply not enough spares in the system, and there's not enough

throughput yet on the MRO side," Spirit CEO Ted Christie said on an earnings call. He also cited TATs "north of 400 days" as a contributor.

RTX's Calio and MTU's Wagner said TATs on the heavy-shop visits completed thus far have been closer to 300 days, and a senior executive with a European operator described turn times as better than expected.

The lingering uncertainty helped convince JetBlue Airways, citing both the PM issue and unrelated durability issues as major headwinds, to defer delivery of 44 PW1100G-powered A321neos on order until after 2030. The carrier plans to invest in older-generation A320s to help offset the loss of the A321neo seats. ☒

BOOSTING CAPACITY

Lindsay Bjerregaard **Alverca, Portugal**

Faced with a sudden surge in unscheduled overhauls on top of durability-related shop visits, Pratt & Whitney has been working to bring online more PW1000G geared turbofan-capable shops to address the capacity crunch. In the spring of 2023, the OEM had 12 PW1000G-capable shops but acknowledged it needed to ramp up its service network to handle upgrades related to several long-running durability challenges.

Then the powder metal crisis hit. That prompted inspection mandates and, as a result, unscheduled shop visits.

Last year Pratt also announced three geared turbofan (GTF) MRO facility expansions and six shop activations. This July, two more MRO facilities for the engine family opened in Europe at SR Technics' Zurich facility and OGMA's campus in Alverca, Portugal, bringing the total number of GTF shops worldwide to 18.

During OGMA's engine induction ceremony, Embraer Services and Support President Carlos Naufel said the company expected to induct 20-25 GTF engines this year and to ramp up to around 240 annually by 2030.

Bringing OGMA's capacity online was no small undertaking. Company CEO Paulo Monginho said during the ceremony that setting up the facility cost more than €90 million (\$100 million) and required considerable time and labor. The facility incorporates capabilities such as an automatic line for cleaning, balancing of static and rotating components, CNC-assisted grinding, a new logistics center and what OGMA says is the largest test cell in the country.

OGMA expects the new GTF business line to provide returns quickly, estimating that it will triple its revenues once it reaches full capacity. The shop has also generated about 200 jobs.

Not all shops perform the special angled ultrasonic inspections needed to find powder metal-related contamination in affected parts. But OGMA and other GTF network shops can take on some of the more standard PW1000G work.

Christopher Calio, president of Pratt parent RTX, addressed the shortage during a July earnings call and suggested the added capacity is contributing to a promising trend. "MRO output is the key enabler," he said. "We're focused on improving the material flow, better processes in the shops and we've added some capacity on this front. We saw some good signs of progress here in the first half of the year. Output was up 10% from Q1 to Q2. And first-half output on the [PW1100G] is up over 30% versus the first half in 2023." ☒

Leap Forward

IAI aims to capitalize on engine MRO demand while adding capacity for its conversion activities

James Pozzi **Farnborough**

Engine manufacturer CFM International has sought extra capacity for its Leap engine network as demand for quick-turn repairs and hospital shop visits climbs. In the past few years, several MRO providers with engine specializations have added Leap capabilities.

The latest to do so is Israel Aerospace Industries (IAI) through its Tel

Aviv-based Bedek Aviation Group's Engines division. IAI recently gained FAA and European Union Aviation Safety Agency (EASA) approval for quick-turn repair services for the Leap 1A, which powers Airbus A320neo-family aircraft. Shmuel Kuzi, executive vice president of the Aviation Group at IAI, says it received a request to add Leap capability from Safran, one of the partners in the program alongside GE Aerospace. Kuzi believes adding Leap capability is a natural progression, given IAI's experience on the Leap predecessor, the CFM56. Future long-term demand for the Leap is expected to be strong, despite some initial durability issues related to the engine's fuel-nozzle coking system on both production and in-service engines. This has led to a spike in Leap shop visits as the OEM is rolling out fixes this year, aiming to improve the engine's durability by installing a retrofittable external

1A engine induction by year-end. "By this time, we will be able to service more than one engine at a time because we will have the capacity and the human resources," he says. He confirms that IAI is considering adding more capacity and slot availability for the forthcoming engine types. One possibility is a new engine shop on its existing site in Tel Aviv that would double its capacity for engine repairs. Kuzi estimates that IAI maintains about 200 engines annually now. He expects quick-turn services for the Leap 1B, the sole engine option for the Boeing 737 MAX, to follow either by year-end or in early 2025. "This certification will be a relatively smooth process once the first Leap 1A has been inducted," Kuzi adds.

The first wave of Leap overhauls is still some years away, but IAI says it will prepare for this eventuality in the near future once it has further familiarized itself with the engine parts and repair processes. Kuzi says next year will be too early to ramp up to full overhaul capability, but he sees this as very likely within the next few years. The new capability will add to IAI's existing narrowbody services consisting of a full scope of CFM56 and International Aero Engines V2500 engine repairs. In the past few years, as passenger traffic has picked up post-COVID-19, IAI has experienced a strong flow of work for these powerplants that has put its engine shop in Tel Aviv at full capacity, where it operates several engine lines in addition to seven test cells able to handle up to 70,000 lb. of thrust.

Given its existing V2500 capability, the company also expects to introduce quick-turn MRO services for its Pratt & Whitney geared turbofan successor engine for A320neo-family aircraft as soon as next year. Kuzi says this will occur only after quick-turn services for the Leap 1A and 1B variants are up and running, and that could take longer, depending on its ability to meet Leap time frames.

In addition to the narrowbody engines, IAI also services the PW4000—an engine option for multiple widebody aircraft, many of which are running today as powerplants for Boeing 747 and 767 variants mostly flying as cargo aircraft. Kuzi says he is surprised by the volume of demand for this particular engine type but identifies the cause



To accommodate newly awarded quick-turn services for Leap 1A engines, pictured at the manufacturing site near Paris, IAI is considering building a new engine shop at its Tel Aviv site, which would double capacity there.

Aviv-based Bedek Aviation Group's Engines division. IAI recently gained FAA and European Union Aviation Safety Agency (EASA) approval for quick-turn repair services for the Leap 1A, which powers Airbus A320neo-family aircraft.

Shmuel Kuzi, executive vice president of the Aviation Group at IAI, says it received a request to add Leap capability from Safran, one of the partners in the program alongside GE Aerospace. Kuzi believes adding Leap capability is a natural progression, given IAI's experience on the Leap predecessor,

the device called the reverse bleed system. "Issues with brand-new engines in the market are common, but these issues will be solved over time," Kuzi says of the durability issues. To prepare for Leap quick-turn capability, Kuzi says IAI spent about 6-7 months investing in the necessary tooling, identifying the facilities required and sending engine technicians overseas to undergo the required Leap training.

Having already acquired regulatory licenses from the U.S. and Europe's regulators, Kuzi expects the first Leap

GONZALO FUENTES/POOL/AFP/GETTY IMAGES

as stemming from the relatively small number of repair providers for the engine type as cargo demand remains robust. “A lot of PW4000 specialists have closed these lines of maintenance, and suddenly there are not a lot of

In converting a Boeing 777-300ER from a passenger to a freighter aircraft, IAI removes a 7-m (23-ft.) part of the cabin, one-third of the aircraft's circumference, to install a cargo door.

MRO providers for this engine,” he says. “But there is still a lot of demand.” Kuzi expects that IAI will conduct maintenance on the PW4000 for at least another five years.

IAI also conducts base maintenance services in Tel Aviv. Seventeen slots are divided between its base maintenance and passenger-to-freighter (P2F) conversion activities. Its airframe MRO services cover all Boeing commercial aircraft types as well as all Airbus aircraft except the A350 and A380. Identifying strong demand for aircraft C checks particularly, and the crossover with P2F work taking place in the same facilities, Kuzi says IAI is planning to build another “one, maybe two” hangars at the site close to Ben Gurion International Airport. He anticipates that construction of the extra hangars will be completed in the next two years. “We don’t have any other



choice because all the slots are full,” he says of its dual base maintenance and P2F operation. “As we’ll also be doing P2F conversions on [Airbus] A330 and [Boeing] 777 aircraft, which could use as many as 100,000 labor hours, we will need the platforms and the structure to do all of this.”

In order to maximize capacity, particularly for its P2F operation, IAI has actively looked outside of Israel in the past few years by building up its partner network on P2F conversion programs. These partnerships include a cooperation with Etihad Engineering for 777-300ER P2F work in Abu Dhabi as well as in South Korea partnering with Sharp Technics K at Incheon Interna-

tional Airport for 777-200ER and 777-300ER P2F conversions. The South Korea operation is expected to start by year-end and will target the conversion of six aircraft annually.

IAI also has two U.S. operations: one in Marana, Arizona, with Ascent Aviation Services, and one in Cincinnati. The manufacturer expects the number of U.S. conversion lines to expand to six from four by next year, owing to strong demand. IAI also expects more P2F work to be carried out with Serbia-based Jat Tehnika. Having worked with the company previously on 767-300ER P2F projects, IAI is exploring the possibility of 777 work in Belgrade, depending on the need. ☒



ASCENT

AVIATION SERVICES



ascentmro.com



MAINTAINING

THE MAGIC OF FLIGHT

HEAVY MAINTENANCE, FLIGHT LINE, STORAGE, RECLAMATION
MODIFICATIONS, PAINT & INTERIORS

WIDE BODY, NARROW BODY, REGIONAL AIRCRAFT

FAA - EASA - TCCA - BCCA - CAACI - NCAA - ANAC - 2-REG - Aruba

EXPERT SERVICE FOR YOUR ENTIRE FLEET

Insulated Aftermarket

Demand for MRO services remains strong despite airline capacity reductions

Sean Broderick **Washington**

Some airlines are pulling down capacity amid signs of softening demand, but aftermarket providers should not see the moves as a precursor to an imminent downturn. That is the consensus of industry executives and financial analysts following a generally positive midyear earnings report season.

are generally holding strong in the U.S. market while the smaller carriers are beginning to see signs of domestic overcapacity. That is leading to some capacity reduction and, in turn, lower aircraft utilization.

But demand for MRO is so strong that any excess shop capacity does not last long.

ters, was up 13.4% on 11.6% more capacity through June, IATA says. Among major geographic regions, only North America showed a decline in percentage of seats filled compared with 2023, due in part to too many seats in the U.S. domestic market.

DEMAND DRIVERS

Some airlines, such as Southwest and JetBlue Airways, are tweaking schedules to cut unprofitable capacity. Although this approach will lead to a related reduction in MRO work, other trends will continue to drive demand for aftermarket support, particularly for older aircraft.

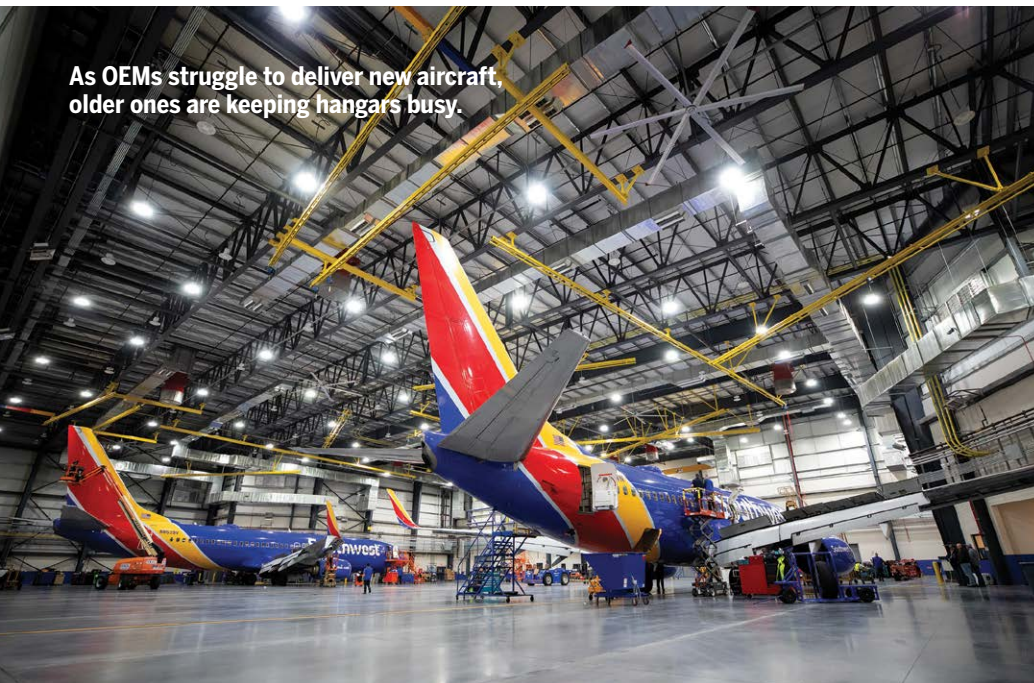
Chief among those trends are continued struggles for some key current-generation programs. Boeing's narrowbody and widebody deliveries are well below levels forecasted coming out of the pandemic due to a spate of quality control and supply chain issues.

Airbus recently acknowledged that supply chain constraints, largely affecting engines, will lead to fewer-than-expected deliveries in 2024 and a slower-than-planned A320-family production-rate ramp-up over the next few years.

Mix in groundings of 350 Pratt & Whitney PW1000G-powered A320neos, A220s and Embraer E2s on any given day through the end of 2026 due to required life-limited parts inspections (*InsideMRO* September 2023, page MRO 18), and the current generation of aircraft leaves a lot of planned available seat miles capacity unfilled. For MRO providers, that means more parts sales and unplanned late-life overhauls to keep older equipment in service longer.

“We have seen a bit of a shift,” AAR President and CEO John Holmes said on the company’s fiscal 2024 fourth-quarter earnings call in mid-July. “We continue to see exceptionally strong demand out of the larger carriers, [but] we’ve seen a little bit of a pull-back from the lower-cost carriers.”

As OEMs struggle to deliver new aircraft, older ones are keeping hangars busy.



SOUTHWEST AIRLINES

AAR’s largest customers include full-service carriers Delta Air Lines and United Airlines as well as domestic-focused low-cost carriers, such as Southwest Airlines. The Big Three—Delta, United and American Airlines—

“The larger carriers have been very quick to fill up any demand softness we’re seeing,” Holmes said. “Demand remains extremely strong for all that we do from a maintenance perspective, from a component repair perspective and . . . from a parts perspective.”

Any demand softness is regional or within specific sectors, such as low-cost airlines. Globally, air travel demand remains strong, International Air Transport Association (IATA) figures show.

Year-to-date global traffic, as measured in revenue passenger kilome-

“We’ve seen a surge in demand for CFM56 engines,” says Rudy Bryce, president and CEO of CFM Materials. “In fact, demand for CFM56-5B engines for the A320ceo family has recently increased to the level we’ve been seeing for CFM56-7B engines for the 737NG family.”

The venerable engine that powers the entire 737 Next-Generation fleet

and many A320ceo is expected to generate nearly 30% of all engine MRO demand this year, a Naveo Consultancy analysis of Aviation Week Network forecast data shows. That's about the same percentage as the next two platforms, the Rolls-Royce Trent (all models) and GE90, combined, and three times more than the IAE V2500.

That trend will not stop anytime soon. In fact, the CFM International CFM56's imminent shop visit peak, pegged at 2,000-2,500 heavy overhauls per year and long forecasted for the mid-2020s, is morphing into a multi-year event.

"We do expect that shop visits will probably plateau at that 2025 level for maybe another couple of years and then start declining," GE Aerospace Chief Financial Officer Rahul Ghai said on the company's recent earnings call. "We are seeing that the platform is getting used, and the shop visits will be higher for an extended period of time. We will see third-shop visits."

In the near term, MRO demand is expected to drive double-digit year-over-year sales increases. Although the figure is down from 2023's growth, the drop reflects more difficult comparables, since the market was stronger last year compared with 2022.

RBC Capital Markets analysts talked to "a number" of manufacturers and parts distributors in the first half of August in an attempt to pin down signs of a parts-sales slowdown.

"We are not hearing about any incremental risk, which is consistent with the commentary from the public companies," RBC analyst Ken Herbert wrote in a mid-August research note. "We do believe that the industry is seeing steady normalization, or moderation, to the aftermarket demand, but specifically we have not heard about any incremental risk to parts pricing or inventory levels at the airlines or MROs."

Bank of America (BoA) analysts offer a similar outlook with a note of caution for 2025 if overcapacity spreads beyond select markets and operators.

"Airlines have been warning about consumer weakness," BoA wrote in an Aug. 12 research note. "But we don't see this as a significant risk into [the second half of 2024] given the lead time for shop visits, but [it] could be a factor into 2025 if airlines reduce capacity strongly." 🗞

MROProspector⁷

Aftermarket Opportunities at Your Fingertips

The only solution dedicated to commercial aftermarket professionals, MRO Prospector contains accurate and reliable MRO data and intelligence so you can find new opportunities.



Details on thousands of contracts covering 37,000 aircraft and 80,000 engines



Discover maintenance opportunities, including component repairs by ATA Chapter.



Research operator's fleets by tail number, including age, hours, cycles and lease status.

Visit aviationweek.com/MROP to schedule your demo.



Or call Melissa Crum at
+1 (913) 284-2951
melissa.crum@aviationweek.com

**AVIATION
WEEK**
NETWORK

‘Stable Execution’

Boeing Global Services president and CEO on growth, workforce and shortening lead times

James Pozzi **Farnborough**

Last year’s management reshuffle at aerospace giant Boeing brought a new leader to the helm of its aftermarket business.

Chris Raymond, a 34-year company veteran who oversaw environmental initiatives as chief sustainability officer, became president and CEO of Boeing Global Services (BGS) on Jan. 1. Succeeding Stephanie Pope, who moved to head up Boeing Commercial Airplanes (BCA), Raymond took the reins amid turbulence within the broader company as it battles issues with the supply chain, safety and quality control.

Raymond’s immediate responsibility is to bring “stable execution” to Boeing’s aftermarket services business, reflecting the airframer’s wider goals, he told *Inside MRO* at the Farnborough International Airshow in July. “We’ve just got to get things more stable, and some of that’s on us,” he said. “Some of that is getting the supply chain healthier. And that’s first and foremost what we’ve got to do.

“The second thing is looking at how the businesses help one another, because we have five businesses in our services area,” he continued. “[BGS] is not a holding company. There are some linkages between those businesses.”

In the near term, Raymond is aiming for “profitable, sustained growth” at BGS, in contrast to some of the lofty aspirations outlined in the division’s first few years. “There were unintended consequences where [previous targets] drove some bad behavior,” he said. “If it’s growth at all costs, that’s usually not disciplined, and that can lead you to some bad places.”

Despite a more moderate approach to growth projections in recent years, BGS has not ruled out acquisitions or expanding capacity. At a press briefing in London on the eve of Farnborough, Raymond said the division would always look for “tuck-in” capability and

consider “things that we should do inorganically.”

Much of BGS’ immediate focus is on operations, specifically quality control. Boeing has been carrying out quality stand-downs, starting within BCA and extending into BGS this year.

“Those subjects of strengthening safety, strengthening quality, looking for ways to improve are not going to be just isolated to the production floors—they’re going to find their way to the MRO floors,” Raymond said. “We wanted to get ahead of that, and so we started conducting our own stand-downs.”

Raymond said BGS has solicited feedback from every part of the business, either in person or virtually, and is processing its findings. Headquartered in Plano, Texas, BGS employs about 22,300 people across 300 locations in 70 countries. Every operation in the division was included in the stand-downs, Raymond added.

While BGS is still analyzing the results of these stand-downs, the division has drawn initial lessons on workforce training. “We probably didn’t fully appreciate the loss of experience that occurred in the industry [in the past few years]—not just at Boeing, but certainly we were in that pile, too,” Raymond said. “So the emphasis right now on when you onboard new people, and when you do on-the-job training of new people, is much more intense, so we’ve got to keep focused on that. That’s not unique to the mechanics on the floor—it’s really any function.”

Raymond expects some simplification of work instructions as industry adopts more technology. “Some of that

will be to migrate to digital more over time,” he said. “Inside your average MRO, you’ll see a lot of paperwork instruction, quality assurance stamps on paper. We can make work orders more visual and simpler. I think there will be a trend toward digitizing and embedding them with instructional videos and simplifying work orders in MRO shops.”

Raymond remarked that BGS needs to adopt more digital and lean practices to thrive in a strong future aftermarket that is expected to be driven by projected commercial fleet growth

over the next decade. “This can be done by better matching the flow and lead-time expectations to customers,” he said. “We also need to focus on creating new offerings, because digital can enter our parts business or it can enter our maintenance business. Creating new offerings using the breadth of our business is another area of focus.”

Raymond anticipates that aircraft cabin modifications, particularly

interior and connectivity mods, will remain strong, although this has produced some capacity constraints. The need for greater modification capacity is one impetus for Boeing’s new partnership with German MRO giant Luftansa Technik (LHT).

At the start of Farnborough, Boeing confirmed LHT as its first licensed partner for cabin modifications work on 787 aircraft. That program, expected to begin in 2025, should see a larger aftermarket over the next 5-10 years. Having authorized partner status will enable LHT to design a new 787 interior, provide related engineering services and perform upgrades as well as project certification.

Although the 787 is a younger aircraft program, having first entered service nearly 13 years ago, and has longer maintenance intervals than predecessors, Raymond said the market is entering a period in which some 787s will be coming off lease. Subsequently, operators will request cabin or modi-



Chris Raymond,
president and CEO
of Boeing Global Services

BOEING IMAGES

fication configuration changes before leasing again. “787s are going to come into that window where there’s going to be more mods or heavy maintenance activity,” he stated.

Raymond identified shortening lead times for these modification projects as an immediate priority, asserting that they are still too long. “I think some of that is related to parts instability and getting what is required to do the mod work,” he said. “Part of it is related to our certification time, and we’ve got to manage that reality. Some of it’s probably related to our own engineering flow times, so we’re focused on how we can reduce those flow times.”

While identifying constraints in the modifications segment, Raymond also contended that capacity is tight for MRO shops. He estimated that Boeing has about 50 MRO partners worldwide, in addition to its own facilities, and noted that booking maintenance slots in advance while distributing the right labor volumes to operations is an ongoing challenge for providers.

“And that footprint of where you need and want this capability changes

over time as the global industry changes,” he added. “You’ve got to work with your customers and try to develop that capacity, closer to where they want it in some cases.”

Raymond also cited Boeing Shanghai Aviation Services, a joint venture among Boeing, China Eastern Airlines and the Shanghai Airport Authority, as another example of adding aftermarket capacity. The venture broke ground on a new MRO facility in Shanghai’s Lin-gang Special Area in June.

In recent years, Boeing has expanded its passenger-to-freighter conversion lines to nearly 20 worldwide; such programs as the 737-800 converted freighter have enjoyed high customer demand. The company is also considering the possibility of a 787 converted freighter option. However, Raymond noted a slight softening in this market; capacity is returning to belly cargo on passenger aircraft as post-pandemic flight volumes continue to rise.

As Boeing’s former chief sustainability officer, Raymond also envisages more attention to that issue. He said

the OEM’s digital business is integrating more tools into FliteDeck Pro, a mobile charting application developed by subsidiary Jeppesen. “Efficient routings, emissions reporting . . . we’re even working on contrails now,” he noted. “Did we create a contrail or not? What is the impact of that on emissions? That’s a whole field of study in and of itself right now.”

For BGS, Raymond pointed to aircraft modifications as ripe for improving recyclability in the interior. Boeing’s ecoDemonstrator project, which tests aviation safety and sustainability projects on a 777-200ER, has been a platform for some of these initiatives.

“We’re working with things like stow bins being recycled, plastics, the carpeting,” he explained. “Can we make that more biodegradable at the end of its life? We know how to do aluminum and titanium, as those are well-formed recycling industries. By right, an aircraft is pretty recyclable, but we still throw away pieces of interiors at end of life, so we’ve got to work on the recyclability of the interior parts of the aircraft.” ☒

Lufthansa Technik became the first Boeing 787 cabin modification partner in July.



Services Boom

Embraer's services business plans expansions in facilities, technology and capabilities

Lindsay Bjerregaard **Alverca, Portugal**

Embraer is doubling down on its Services and Support business through a variety of new developments, including investments in new facilities, technologies and potential business lines.

The OEM announced a slew of expansions to its global services network at July's Farnborough International Airshow. During the event, Embraer also announced the opening of a

gan Stanley projected that the business would double by 2028 and would account for 31% of Embraer's revenue.

One new business line that could contribute to this growth is Embraer's passenger-to-freighter conversions. Embraer debuted its first E190F conversion at Farnborough. Naufel says that the ESS team in Brazil performed all the modifications. The company is working on a service bulletin for the

we have production lines, so we can leverage on that."

Naufel also met with several parts manufacturer approval (PMA) companies at Farnborough to consider opportunities in this area. "Maybe that would be a forbidden subject for some OEMs, but being on the other side opened my eyes that we could have partnerships with PMA providers," Naufel says, referring to his time leading Azul's technical department. "I don't see that as a problem or a competition."

On the technology side, ESS highlighted growth in its flight simulator, Wi-Fi connectivity offerings and Aircraft Health Analysis and Diagnosis (AHEAD) platform. In partnership with CAE, Embraer opened the Asia-Pacific region's first E-Jets E2 simulator in Singapore this year and launched a new full-flight simulator in the UK for Phenom 300s. Embraer will soon add a new simulator for the C-390 Millennium at an undisclosed location.

Naufel says one airline is modifying 30 aircraft with the company's E-Jets Wi-Fi connectivity system, which leverages K_a- and K_u-band satellites, and it hopes to grow its connectivity offerings further.

The AHEAD platform—Embraer's prognostic and predictive maintenance tool for the E1 and E2 aircraft families—recently received improvements to its functionality. For example, Naufel says enhancements were added to its fuel consumption module to help operators monitor auxiliary power unit usage. Insights from that monitoring can help airlines better manage power to burn less fuel, he adds, which is an approach that some airlines have been investigating.

Although ESS is keeping most details quiet for now, Naufel says it is also making headway with efforts to evaluate artificial intelligence (AI) for MRO. Naufel tells *Inside MRO* that ESS is running about five projects to evaluate how it could achieve better efficiency through AI. For instance, it is evaluating use cases where AI could assist with better parts planning. Naufel suggests AI could be used to learn parts needs and to process orders more quickly—processing up to 1,000 transactions per minute. He says AI also could help Embraer better predict labor needs and turnaround times. ☛



Embraer is working on American and European certifications for its E190F conversion service bulletin.

new Pratt & Whitney geared turbofan maintenance facility in Portugal through its subsidiary OGMA that is expected to triple the company's revenue by 2030.

After recently doubling its maintenance capacity for its executive jets in the U.S. by opening three new MRO facilities, Embraer is planning to double its capacity for executive jets in Le Bourget by 2027. Carlos Naufel, president of Embraer Services and Support (ESS), tells *Inside MRO* that Embraer is in final negotiations to launch another "big MRO" for commercial aviation at an undisclosed location.

Naufel says ESS has reached a record \$3.1 billion backlog this year. Mor-

conversion and has certified it with the National Civil Aviation Agency of Brazil. Embraer is working on FAA and European Union Aviation Safety Agency approvals, which it hopes to have by year-end.

Another growing business for ESS is its Pool Program. Naufel says more than 180 E-Jets have joined the Pool Program since last year and 100% of its E-Jet E2 customers are participating.

"We are still living in a challenging supply chain environment, so to me, [the Pool Program] is a natural solution, and I think everybody is realizing that," he says. Naufel adds that the Pool Program model allows Embraer to "derisk the supply chain because we have more power for negotiation and



Thank
you,

*to the greatest team in aviation.
Together, you make CFM extraordinary;
the future is in very good hands.*

*Gaël Méhenni
President & CEO, CFM International*

East Meets West

MHIRJ drives improvements by merging Japanese strategies and West Virginia workforce

Lindsay Bjerregaard Bridgeport, West Virginia

What do you get when you combine Japanese continuous improvement strategies with a mechanically savvy former coal mining community in need of job opportunities? Aircraft maintenance provider MHIRJ hopes this pairing will propel considerable workforce growth, faster turnarounds and happier employees as it seeks to expand its business.

service center in Bridgeport, West Virginia, MHIRJ employs about 400 technicians, but Chief Operating Officer Ismail Mokabel notes that the company needs more than 200 additional technicians for the work in its pipeline over the next 18 months—and it plans to grow beyond that.

“The industry is short on technicians right now, and one of the areas where

400 applicants—more than 300 of whom heard about the program from current employees.

Michael Genin, director of operations at MHIRJ’s Bridgeport facility, says the area was primed for this type of program by job losses in its previously booming industries, including coal, oil and gas. In addition to participants who are transitioning from technical industries of that sort, recent high school graduates are joining the academy as well.

“The [students] who came here used to be car mechanics or were working in a hardware store, and within eight weeks, they’re actually doing very complex sheet metal projects that are aviation-grade,” Mokabel says. “Fast-

DOMINIQUE MURRAY PHOTOGRAPHY/MHIRJ



MHIRJ Academy graduated its first class of aviation sheet metal trainees on June 27.

The company has launched two new initiatives: a Bay of Excellence concept based on the engineering efficiency strategies of its parent company, Mitsubishi Heavy Industries, and an in-house training program called MHIRJ Academy that provides career upskilling for the local community.

As MHIRJ has moved beyond its sole focus of providing CRJ maintenance to more platform-agnostic work, the company’s growing business has begun to require a larger labor pool and new strategies to complete work faster.

“We have more business opportunities coming at us than we can possibly fulfill with the number of employees we have today,” says Ross Mitchell, MHIRJ senior vice president of strategy and business development. At its

we’re really feeling the pressure is with structures technicians,” says Chad Hill, director of MHIRJ’s quality assurance service center network. “The market’s just not there. To come up with a solution to inject some talent into our business, we really wanted to lean on the local community who have excellent mechanical abilities but lack the transition into the aviation industry.”

Launched in May, MHIRJ Academy is a tuition-free, eight-week program that pays participants while they receive technical training in aviation sheet metal. If students pass all course requirements, they are offered a job with MHIRJ upon completion.

Although MHIRJ advertised the program on social media, the majority of interest so far has been generated through word of mouth in the local community. By the time MHIRJ Academy graduated its first cohort of students in June, it had reached close to

forward five years, and I truly believe this will be the center for creating sheet metal technicians in the U.S.”

Mokabel says this local recruiting model has been crucial to achieving high retention and engagement because participants are looking to build a new career locally instead of opting for temporary jobs. “They build economic benefit for the community, it raises the level of workforce around us, and as we attract and grow [participants], we help the community grow as well,” he says.

MHIRJ Academy instructor Kenny Sinclair says that although the inaugural class went through some growing pains, the lessons learned will help the program continue to succeed. “Eight weeks is really not a lot of time to learn a structures technician position, but we feel that we’ve given [students] a really good foundation to pursue this career, and we’re going to continue

learning,” he says. Sinclair also hopes to keep growing the percentage of women involved in the program.

Hill says MHIRJ has boosted efforts over the past decade to recruit more women. “What we do is not heavy lifting. It’s not big wrenches and diesel mechanics—it’s fine manipulation, attention to detail and following instructions,” he says, noting that women often excel at such skills. “All of [the women] we’ve brought into the workforce have done extremely well,” he says.

MHIRJ is looking at expanding the MHIRJ Academy to other locations, such as MHIRJ’s service center in Tucson, Arizona, or into other types of training. “It’s the reason we labeled it the ‘academy’ rather than the ‘sheet metal training facility’ or something like that,” Hill says. “This will be used for future generations for employee development across the business.”

Meanwhile, the Bridgeport facility continues to recruit labor through other traditional methods, such as its apprenticeship program and collaborations with local colleges. Two new college programs recently launched in West Virginia—Marshall University’s aviation maintenance technician program at Huntington Tri-State Airport and Pierpont Community and Technical College’s new aviation maintenance training facility at North Central West Virginia Airport. Genin says the latter program, which will enable Pierpont to increase annual enrollment to 200 students, is expected to be a particularly prolific pipeline for MHIRJ.

Genin says MHIRJ’s apprenticeship recruiting strategy mirrors that of MHIRJ Academy. “I’m looking for people who love working on tractors and things like that because they have a little bit of that mechanical aptitude already in their back pocket,” he says. “Everybody’s fishing out of the same pond and looking for the same people, so that’s one way we can separate ourselves. It’s a short-term program for a long-term fix, and we’re going to reap the benefits.”

INNOVATING WORKFLOWS

MHIRJ also is rolling out strategies to simplify workflows for its existing workforce through its Bay of Excellence initiative, which tests new technologies and strategies.



MHIRJ has freed up hangar space and created a cleaner footprint by establishing dedicated tool rooms.

LINDSAY BJERREGAARD/AW&ST

“Bay of Excellence is a merger between the Japanese continuous improvement mindset and American and Canadian ingenuity to bring these concepts together for the first time in MRO at that level and that scale,” Mokabel says, referring to MHIRJ’s parent company, Mitsubishi Heavy Industries, and its engineering operations in Canada.

To formulate the concept, MHIRJ brought together industrial engineers, its IT organization and technicians to determine ways to reduce distractions and wasted time inside the hangar. The aim was to embed industrial engineering motions in how MHIRJ flows aircraft through its facilities and bring information to technicians’ fingertips.

One seemingly simple way MHIRJ has streamlined operations is through tool-control efforts. It established rooms specifically dedicated to storing technician toolboxes, which has freed up hangar floor space. “It seems like a simple thing, but it’s a big thing,” Genin says. “It keeps everything clean, and cleanliness is happiness.”

MHIRJ also has deployed EmpowerMX software as part of efforts to go paperless. Technicians can access information via iPads running the software, which Mokabel says “really helps us flow the aircraft and manage the resource allocation on the aircraft in the most optimal way.”

In initial Bay of Excellence testing, Ismail says MHIRJ has seen a 10-15% improvement in productivity, which he believes can grow to 20% as the concept is deployed more widely and refined.

Mokabel says employees are happier with the improvements. “I’d say employee engagement is the highest it’s ever been. It’s one of the projects

that really showed the most amount of bottom-up engagement because we spoke to our employees, and we’ve simplified their lives,” he says. “We want to fix all the irritants they used to go through in their daily activities. It’s really tailored toward creating the ideal experience for our employees.”

MHIRJ is looking at ways to incorporate artificial intelligence (AI) to further enhance its Bay of Excellence innovations. When asked whether the technology might be met with skepticism, Mokabel said obtaining buy-in would be like translating suggestions from Japanese industrial engineers through the Bay of Excellence.

“It’s our job to showcase how these tools are going to improve and enhance their experience,” he says. “As long as we use the same formula as the Bay of Excellence, . . . I think there will be mass adoption of AI and the benefits it brings to the floor. There will be buy-in if we do our job right.”

Genin notes that the Bridgeport facility has implemented regular processes to solicit employee feedback and suggestions, such as a quarterly roundtable meeting with representatives from various departments. He says this format was more fruitful than asking for feedback during large meetings where employees might be too timid to ask tough questions.

“It’s a more intimate situation. I basically sit down, shut up and just let them talk, and that’s a big thing. I want to make sure they have a say,” Genin says. “We can’t get everything they want, but [when] they see we’re working on it and making improvements from their suggestions, you get the buy-in from the team, and you’re going to have much better success.” ☺

AI Approach

Experts consider strategies for implementing artificial intelligence in maintenance planning

Keith Mwanalushi **London**

The advent of artificial intelligence is forcing operators to revisit data platforms and data quality—including input sources, information processing and validation—to ensure those systems add value to their maintenance planning.

Artificial intelligence (AI)-driven solutions usually start with the integration of those new tools into existing infrastructures. MROs and technology developers are seeing increasing opportunities for applications in aircraft maintenance planning.

Rob Mather, vice president of aerospace and defense industries at enterprise software provider IFS, identifies two main routes for introducing AI into the IT ecosystem: standalone systems or those already integrated into enterprise resource planning (ERP) or MRO software.

Stand-alone solutions could be bespoke or off-the-shelf. “In this mode, the AI typically sits on top of the data infrastructure, such as a data lake, for instance, but not integrated with operational systems,” Mather says. “This stage can provide a decent level of insight, but implementing them would require additional steps.” The second approach deploys systems that are already integrated into ERP or MRO software—for example, implementing AI-driven insights directly into the operational systems, he explains.

Saravanan Rajarajan, director of

Governing data collection processes will be crucial to ensuring AI systems can yield good results.

aviation solution consulting at Ramco Systems, suggests that companies first evaluate the data capabilities and quality of the source systems. “Existing infrastructure should have a clear process and workflow to collect the right data, and collected data should be governed by the right workflow controls,” he says.

Rajarajan also highlights the importance of training AI systems to distinguish different types of data and their context, as well as relationships among structured and unstructured datasets. “Accuracy issues require constant intervention from the data engineers and business until the AI systems bring in real value,” he says.

MODELING AND SIMULATION

MROs can use AI modeling and simulation techniques to make informed decisions and to predict outcomes of maintenance strategies.

Simon Miles, head of AI at startup Aerogility, says model-based AI can help aircraft operators create holistic, accurate digital portrayals of their entire operation. Each key element—a component, a facility or a person—is represented as an agent and configured with specific characteristics. Each individual agent operates and

interacts with others over a period of time to simulate the operation.

“This provides an enterprise digital twin, allowing diverse stakeholders to see different views on the same virtual model and make strategic decisions that are complementary and coordinated,” Miles explains.

Simulation tool experts at engineering software developer Ansys say AI’s ability to build reduced-order models quickly offers the biggest value to MROs. These models can be probed in real time to investigate the impact of a particular flight cycle. “It is possible to evaluate the impact on materials and better plan maintenance schedules or reengineer components to extend the amount of time between required overhauls,” says Mike Slack, Ansys senior technical account manager.

Meanwhile, Aerogility says its AI capability helps aircraft operators manage complex data and knowledge, augmenting both long-term strategic and immediate tactical decisions. According to the company, well-engineered AI software should be able to accommodate larger quantities and varieties of perspectives because it can model and gauge how organizational demands interact rather than just considering each in isolation. For example, planning to maximize aircraft availability or maintenance yield depends on supply chains, budgeting constraints, staff availability and

management, among other factors.

“All aircraft maintenance checks can be modeled within Aerogility while accounting for multiple utilization drivers,” Miles says. If a C check is due on Day 730 at 7,500 flying hours or after 5,000 cycles, for instance, the program will schedule the check when the aircraft reaches one of these limits, he says. Additionally, the program can merge checks that are within close proximity to one another.

ADVANCING PREDICTIVE CAPABILITIES

Identifying failures before they occur has benefited aircraft operators in cost savings and operational efficiency. Pre-

label all the data and guide the learning,” he notes.

Mather suggests the industry is at an “unsupervised learning” stage. “It sounds scary, but it just means we don’t need to label the data, and that’s a much faster and less expensive proposition,” he says.

Mather asserts that current predictive maintenance processes will still produce effective results, but using AI lowers costs and increases access. He says AI also enables anomaly detection models to discover previously undetectable correlations in data. “It doesn’t need to know why something happens; it’s just recognizing patterns,” Mather says. “All this drives a

spares pool to ensure operations can keep working smoothly.

Miles adds that many often overlooked financial aspects of an operation—such as negotiating new MRO contracts and visualizing multiple offerings—can be modeled to assess their impact on cost and ground time.

PREVENTING BAD DATA ENTRY

Mather stresses that data is the food on which AI grows; good data will yield good results and vice versa. He believes it is easier to correct the data at the point of entry using systems that record at a very granular level and help improve data quality by enforcing rules on and guiding the technician. “It makes it easier to get it right and hard to get it wrong,” he says.

Ramco’s Rajarajan advises that operators should audit data sources regularly to identify inconsistencies. “AI systems should have data filters to prevent malicious or nonstandard data from entering through any of the input sources,” he says. AI systems also should detect and flag outliers for elimination or manual assessment.

Unstructured data such as PDFs hold a wealth of information, but Rajarajan contends that their nonstandard nature poses risks to data quality and security. “The right tools and processes are essential to extract and

validate the data before it is pushed to ERP and AI systems,” he says.

Ansys’ Slack recommends that users ensure they understand the source and context of the original data, which will be directly relevant to the tools they derive from it. For simulation-based AI, he stresses the importance of knowing the extent of the operating and design variations from which learned outcomes are drawn. “To this end, simulation and data management tools will be key to providing this context and enriching the value of a company’s stored data,” he says.

Moreover, tools derived from AI or machine learning can help refine modeling and in turn optimize the design of the engineering system or how it is managed in service, Slack adds. ☼

Aerogility says AI modeling could benefit operators’ financial considerations, such as negotiating MRO contracts or assessing services based on cost impacts.

dictive maintenance is not new, but it has evolved over the years from the big data concepts of the early 2000s to the emergence of machine learning in the mid-2010s.

In parallel, the development of connected aircraft, such as the Boeing 787 and Airbus A380, brought terabytes of new data with every flight. Mather from IFS says the ability to generate and interpret real-time data became more widely available around the start of the 2020s. “But you still needed those pricey and rare data scientists to

higher degree of accuracy in the predictions, but [AI is] really more about being available more widely.”

From a modeling perspective, AI lets users plan for large and small maintenance events—expected and unexpected—as well as the associated costs, and improve their understanding of the likelihood and severity of financial impact variables.

Miles at Aerogility says he thinks companies can use the technology to examine these issues, identify the most likely scenarios and make better business-critical decisions. For instance, if a forecast anticipates aircraft maintenance delays when specific spares are unavailable, users can plan and simulate the best response by modeling the impact of an expanding or shrinking



AEROGILITY

Capturing Opportunity

SIAEC bets on Asia-Pacific growth and artificial intelligence to drive new business

Chen Chuanren Singapore

Singapore's rapid border reopening and the operational readiness of flag carrier Singapore Airlines have helped the country and its air transport industry bounce back from the depths of the COVID-19 pandemic. In the first half of 2024, passenger traffic at Changi Airport hit nearly 100% of 2019 levels, and SIA Engineering Co. has captured booming growth from its parent airline.

However, as with the entire MRO industry, SIA Engineering Co. (SIAEC) is faced with a range of headwinds, including supply chain disruptions, talent and labor constraints, and inflationary challenges. On top of these are global geopolitical and macroeconomic uncertainties.

After 16 years at SIAEC, Wong Yue Jeen was appointed as chief commercial officer April 1 with an aim to expand the company's capacity. "We see a lot of constraints [in] the supply chain and capacity and talent," Wong tells *Inside MRO* from SIAEC's newly renovated office. "But if I take a longer view, I still will look at a sustainable growth for SIAEC and the foundation of . . . how we build and optimize our capacity. I think we should see how we can increase our capacity to take in more work across the board, but at the right pace as well, and not to rush into overbuilding capacity."

While the company has always prepared for planned events, Wong says it is critical to be ready to support customers for unscheduled events in a timely manner. SIAEC has seen an uptick in unplanned events, especially with numerous OEM issues such as Pratt & Whitney's geared turbofan engine groundings and service provider capacity constraints, which have led to more work coming into SIAEC.

Wong did not reveal how much additional capacity the company plans for these events, but he says it has always prepared more resources than for planned events and, more important, has a good system to escalate situations like these.

The company also is starting to see longer aircraft visits to the hangar due to more work on older aircraft, paired with supply chain delays. Airlines are keeping older aircraft in service longer, too, as aircraft manufacturers take more time to fulfill backlogs and delivery delays.

"We see this as an opportunity for us to support the high demand for airframe capacity; hence, it ties in very well with our expansion plans in Malaysia," Wong says. "We are already in a very strong position to continue to support the current leads because this is the capability that we already have today. At the same time, we have continuously invested

in the new-generation fleets—for example, the [Airbus] A350s—so we are prepared [to deal with the demand] for both scenarios."

SIAEC will lease two hangars at Sultan Abdul Aziz Shah Airport in Selangor, Malaysia, capable of handling four widebody aircraft simultaneously, making it the third base maintenance site in Asia. The lease will run for 15 years, with the option for 15 more.

INDIA AND CHINA

One of the most important breakthroughs for SIAEC is the strategic partnership with Air India to build an MRO facility in Bangalore, which will involve the planning, construction, development and operationalization of widebody and narrowbody base maintenance hangars beginning in 2026.

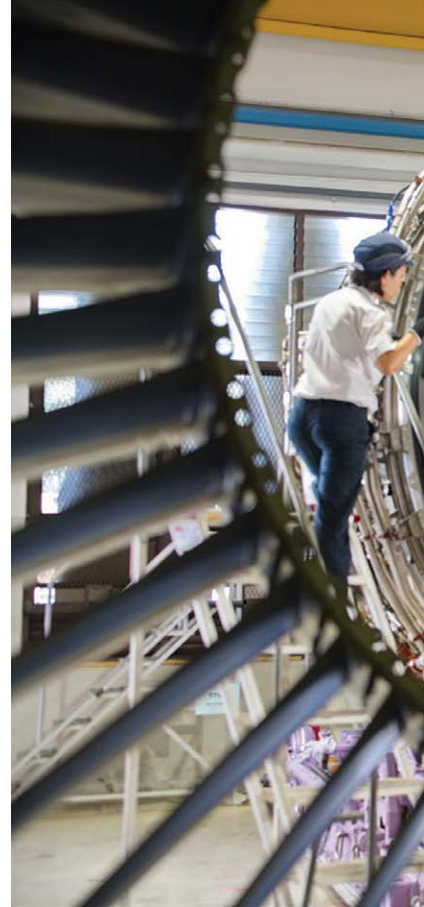
Wong says while India is one of the fastest-growing aviation markets in the world, the country does not have MRO capability to support the rapid growth.

Air India, which is undergoing a merger with AirAsia India and Singapore Airlines affiliate Vistara under the new Tata Group ownership, has invested in 470 new aircraft, including 210 Airbus A320neos, 40 A350s, 190 Boeing 737 MAXs, 20 787s and 10 777Xs. This will give SIAEC a healthy base-load to operate around in the future.

"Tata is [familiar] with the regulatory and business environment, and I think that's an important factor to be strong and be able to operate successfully in India," Wong says, adding that the Air India-Tata group has solid leadership—some stemming from the SIA Group that contributes to the whole fabric.

SIAEC is in the preliminary stage of setting up the primary capabilities for Air India, enabling the flag carrier to possess MRO resilience.

On the China front, Wong says SIAEC is "late to the game," with numerous players already having entered the country that is set to be the world's largest single market.



SIAEC PHOTOS



Wong Yue Jeen,
SIAEC Chief Commercial Officer



OEM issues, such as Pratt & Whitney's geared turbofan groundings, are driving work to SIAEC.

SIAEC is dabbling with generative artificial intelligence (AI) in the form of its own closed ChatGPT system known as Newton, where staff can submit queries on large sets of data and derive trends and analysis.

Wong says that despite the ongoing trend in digitalization and AI, engineering skills will remain the bedrock of MRO operations.

"We cannot [ignore that] for a person to work in the hangar or engine shop, the basic skill set to be able to perform repair work must still be there," he says. "Robots have not replaced the pair of

Nonetheless, there are still "pockets of opportunities" for SIAEC to explore, he notes. SIAEC signed a memorandum of understanding in September 2023 with Xiamen Iport Group to explore MRO opportunities in Fujian province.

Iport operates airports in Xiamen, Fuzhou, Wuyishan and Longyan, which Wong sees as untapped Tier 2 and Tier 3 cities for MRO work.

With this promising growth, SIAEC says it is still the right strategy to revolve its geographical expansion around the Asia-Pacific region.

TALENT, AI AND SKILLS

As capacity increases, the company continues to invest in and evolve its talent pool. While SIAEC has continued to see interest from new applicants, Wong says the challenge in the MRO industry is always retaining new hires for the long-term future.

"We feel very strongly that many of these people eventually want to see their career beyond the shop floor," Wong says. "Hence, the rescaling and upskilling of people to go into areas such as operational support, planning, and even gaining some digital skill sets of continuous improvement . . . to lead other parts of the company's operational and nonoperational areas."

SIAEC has embarked on its so-called Lean principle, with more than 1,000 staff undergoing training so far to gain skills to identify problem statements and objectives for improvement. The aim is for the entire company to have an inherent culture of continual improvement and innovation.

hands to perform much of the repair work on aircraft. Similarly, a licensed engineer still has to certify and sign off on the work . . . not a robot or an AI machine."

AI will instead help improve the efficiency of engineers and technicians, for example, by planning materials, predicting the scope of work when an engine or component comes in, and providing a clearer, defined scope of work.



"Over time, we need a newer skill set to apply these AI tools more effectively to support the shop floor," Wong says. "A generational change will take place as more tools become available and easier to use, and we will also have to align the training to cater to these new tools and skills." 🛩️

Enhancement Upgrades

Rolls-Royce starts testing Trent 1000s with an enhanced high-pressure turbine

Robert Wall **London**

Rolls-Royce has begun flight tests of a major upgrade to the Trent 1000 engine powering some Boeing 787s. The upgrade addresses long-running durability problems that have marred the product's in-service operations and commercial success.

Flight testing of a Trent 1000 with an enhanced high-pressure turbine (HPT) began July 31 with a flight of 75 min., Rolls-Royce CEO Tufan Erginbilgic said Aug. 1 on the company's first-half earnings call. Flight testing should last about eight weeks and lead to FAA approval before year-end, he added.

The company is seeking to more than double the Trent 1000's time on wing with the upgrade, Erginbilgic

said. The HPT upgrade is complete on about half of Trent 7000 engines that Rolls-Royce provides for Airbus A330neo widebodies, he added.

The upgrades are part of Rolls' effort to improve the performance of its turbofans that power widebodies, including those used on the Airbus A350.

Rolls-Royce is seeking to more than double the Trent 1000's time on wing with its high-pressure turbine upgrade.

The engine-maker also said that it had completed design work on further enhancements to deliver an incremental 25-30% time-on-wing improvement for the Trent 1000 and Trent 7000 next year.

Erginbilgic said these Trent 1000 upgrades will help Rolls regain market share on the 787, which has fallen sharply. The other engine option, GE Aerospace's GENx, is increasingly dominating 787 orders. ☼



ROLLS-ROYCE

Durability Improvements

Retrofit kits for CFM Leap 1A engines will soon address reverse bleed system coking issues

Sean Broderick **Farnborough** and Guy Norris **Cincinnati**

Operators of CFM International Leap 1A engines now have access to reverse bleed system retrofit kits, the engine manufacturer announced, hitting its goal of having the durability improvement kits available around the middle of the year.

CFM released a service bulletin in late July detailing the retrofit process. Kits have been prepositioned to help keep up with expected demand for the solution to a nagging problem.

CFM developed the reverse bleed system (RBS) to prevent coking, or temperature-induced evaporation of unburned fuel around nozzles that inject fuel into the combustor. The condition is a result of residual heat in the engine core hardware "soaking back" after shutdown.

If the fuel nozzle temperature exceeds the coke formation threshold, solid carbon forms. Eventually, the de-



The retrofit kit addresses a coking issue that has led to high rates of fuel-nozzle replacements.

posits can affect fuel flow and cause uneven internal combustor temperatures, which lead to reduced on-wing life and, in the most extreme cases, in-service issues such as inflight shutdowns.

The coking has led to high rates of fuel-nozzle replacements. Some operators have been replacing up to 10 fuel nozzles during performance restora-

tions, and the goal is to reduce replacements to one, says GE Aerospace, which is a 50-50 partner with Safran in CFM. The Leap 1A has 19 fuel nozzles, while the Leap 1B has 18.

New Leap 1As began shipping with the line-fit RBS configuration this year. At that time, CFM said a retrofit kit would be available by "midsummer."

Operator feedback on the line-fit RBS has been positive, CFM President and CEO Gael Meheust says, adding: "We're seeing good results from more than 140 RBS-equipped engines already in service with 40 customers."

CFM says some of its branded service agreements and other licensed third-party shops are expected to offer the retrofits. The engine-maker's overhaul network comprises five CFM Branded Service Agreement facilities and 11 other approved shops alongside 19 OEM-owned repair stations.

A similar system is being developed for the Leap 1B and is slated to be available in 2025.

Meanwhile, early testing on the GE9X, which powers the Boeing 777-9, revealed signs of coking conditions, so GE added an RBS to its newest wide-body turbofan. ☼

September 24-26, 2024
Singapore

The Essential Commercial Aviation MRO Event in Asia-Pacific.

Gain insight into regional capabilities
and foster collaboration.



Yaw Chek Chee
VP Commercial,
DHL Express (Singapore)
Pte Ltd



Brian Douglas
Head of Maintenance,
Nauru Airlines



Shanthi Krishna
Product Strategy Head,
Ramco Aviation



Yuki Nakai
Senior Director
Maintenance Corporate
Planning and Finance,
Japan Airlines



Tan Yen Ping
SVP and Head of
Cabin Interiors and
Engineering Solutions,
ST Engineering



Benjamin Scheidel
CEO – Hong Kong,
HAECO



Cyrille Schwob
Head of Research
and Technology
Development APAC,
Airbus Singapore



Shevantha Weerasekera
VP of Engineering and
Maintenance,
Cebu Pacific Air

**FEATURING A SOLD-OUT EXHIBITION FLOOR WITH
NEARLY 250 SOLUTION AND SERVICE PROVIDERS**

APU Adaptations

Specialists adjust repair strategies for more efficient and technologically advanced units

James Pozzi **London**

Built in the tail end of an aircraft to provide electric and pneumatic power for onboard subsystems, an auxiliary power unit is typically maintained over average cycles with maintenance driven by factors such as fleet size, utilization and operating environment.

Auxiliary power unit (APU) repairs are carried out whenever condition necessitates removal—owing to factors such as high exhaust gas temperatures, oil consumption and cabin vibration, for example—and usually during an

“Depending on the age and condition of the APU, the maintenance will either be repaired to correct the symptoms and findings found on the APU, or a refurbishment of the APU power section and load compressor plus modifications to a higher standard to improve the APU reliability,” adds Rob van de Graaf, commercial director at Netherlands-based APU specialist EPCOR.

There are relatively few APU specialists like TurbineAero and EPCOR operating today, and the number of designated APU MRO providers, par-

vice centers to maintain its products.

Another OEM with a sizeable market share is Pratt & Whitney, which provides the APS3200 for the Airbus A320, APS5000 for the Boeing 787, PW980 for the Airbus A380 and APS2300 for Embraer 170/195 aircraft. The engine manufacturer also has a global network of its own shops and designated repair facilities.

CYCLES AND CONTRACTS

Reflecting other maintenance segments, much of the repair demand in the commercial APU segment is related to Boeing 737 and Airbus A320 aircraft both classic and new. This is due to narrowbody aircraft typically having higher cycle utilization, resulting in more frequent APU shop visits. The 737NG and MAX models use the Honeywell 131-9B APU, while the



EPCOR repairs six types of APUs at its shop in the Netherlands.

EPCOR

overnight stop rather than as part of a scheduled base maintenance check.

“Different airlines have different approaches to APU maintenance, but in general, most elect ‘on-condition maintenance,’ where modern monitoring capabilities exist,” says Peter Gille, CEO of U.S.-based APU repair specialist TurbineAero, which has APU repair shops in Chandler, Arizona, and Chonburi, Thailand. The company also operates APU and engine component (piece part) repair and component manufacturing and coatings facilities near Phoenix.

ticularly in-house at airline shops, has declined in the past few decades. Several larger multiservice MRO providers, such as Lufthansa Technik, operate APU repair businesses, while OEMs have always been traditionally strong in the aftermarket.

Among the largest commercial aircraft APU manufacturers is Honeywell, which provides APU models for multiple Boeing and Airbus aircraft programs. The company often enters into long-term APU aftermarket service agreements with operators and also has a network of approved ser-

A320 family predominantly is equipped with the Honeywell 131-9A, while some in the family use the Pratt & Whitney APS3200, says Dominic Ryan, general manager of base maintenance and APU at Dublin Aerospace. He also notes that some widebody APU repair markets have experienced an upturn in recent times, “such as the Honeywell GTCP 331-350C for the A330 and the GTCP 331-200ER for Boeing 767 freighters.”

Gille says TurbineAero also sees strong demand for the Honeywell GTCP331-500B model found on the Boeing 777. It also services mature

HEICO

*Your Challenges, **Our Engineered Solutions***

ARE YOU BEING SUPPORTED?



*Harnessing the Power of a Large Enterprise,
Infused with Small-Business Values –
Where Every Customer is Treated as **Our Only Priority**.*



PARTS GROUP

*World's Largest Independent
Supplier of FAA-PMA Approved
Engine and Component Parts.*



REPAIR GROUP

*Advanced Repair Solutions
Focused on Cost-saving &
Reliability and TAT
Improvements.*



DISTRIBUTION GROUP

*Leading Global Distributor of
OEM Replacement Parts,
Offering Full-spectrum
Engineering Solutions.*

www.HEICO.com

widebody APU models for which OEMs have either diminished or discontinued support, such as APUs on Boeing 747, 757 and 767 aircraft and Airbus A330s and A340s.

MAINTENANCE SCHEDULES

Dublin Aerospace operates one APU repair shop at its facility at the Irish capital's airport and maintains relationships with four other APU repair shops in its network. Additionally, it collaborates with several specialized component and piece-part repair shops for APU parts.

In terms of repair cycles, the APU is removed from aircraft at different periods, depending on the model.

"For narrowbody APUs like the Honeywell 131-9A and 131-9B, the time between overhauls typically ranges from 6,000 to 8,000 hr.," Ryan says. He explains that these intervals can vary depending on operating conditions, with harsher environments potentially leading to shorter time on wing due to increased erosion and contamination. "High utilization rates can also reduce the time between overhauls," Ryan says.

TurbineAero's Gille says typical mean times between removals vary from 4,500 APU operating hours on the GTCP331-200/-250 models to 6,500 APU operating hours on the GTCP331-500 or even exceeding 10,000 APU operating hours in the case of the newer GTCP131-9B and PW901A/C APUs. In terms of cycles, Roger Willis, APU program director at StandardAero's Maryville, Tennessee, repair shop, says while this varies according to the specific model of APU as life limits are different, the average time of removal is typically between 20,000 and 35,000 cycles. "There are some [life-limited part] items such as the compressor that can see up to 65,000 cycles," Willis adds.

In Maryville, Willis says a typical overhaul of an APU is 25-30 days, but these repair times have extended recently. "We have seen this increase due to material constraints on parts such as life-limited part items, bearings and seals," Willis explains. "Most of the delays are due to raw material shortages and the quicker-than-expected recovery in flight volumes after COVID."

A similar estimate is made by EPCOR's van de Graaf, who cites generally 30 days for narrowbody APUs and

40 days for widebody models. The process involves teams working in logistics, inspection, disassembly, cleaning, repair, assembly and testing.

EPCOR, a subsidiary of Air France Industries KLM Engineering & Maintenance, services six APU models under license as well as pneumatic components from its shop at Amsterdam Schiphol Airport. It plans to add its seventh license, for the HGT1700 installed on the A350, by early 2025.

The wider market for APU repairs is seeing some capacity constraints felt by other repair segments—such as the wheels and brakes repair market—albeit to varying degrees.

"Currently, there are available slots for APU repairs at our Dublin facility, although there are some delays in the supply chain and with turnaround times for component and piece-part repairs. These delays are manageable within the overall APU repair cycle," Ryan says. Typically, there is a push toward more power-by-the-hour (PBH) contracts for newer operators over time and material agreements, he says.

"Time-and-material customers typically prefer minimal repairs to reduce shop visit costs, which often depends on fleet utilization and age," Ryan notes. "In contrast, PBH customers aim to maximize the benefits of a shop visit by extending the APU's time on wing until the next scheduled visit. Generally, operators of newer fleets are more likely to choose PBH agreements."

The preference for PBH agreements for APU repairs is also supply chain-related, van de Graaf says. "Given the supply chain issues and current geopolitical situation, more and more operators tend to spread their risk on receiving units back in time," he says. Van de Graaf adds that time and material contracts are normally used by single shop visits and short-term contracts while PBH is for long-term agreements as well as on newer aircraft types. "This provides financial stability for both the operators and the MROs," he says.

EFFICIENCY IMPROVEMENTS

APU models have evolved considerably over the decades to become more efficient. "Earlier generations had more mechanical control with minimal electronics and took bleed air from the power section, reducing efficiency,"

Ryan says. "Over time, APUs incorporated more electronic controls and data collection capabilities, with load compressors added to enhance efficiency." He adds that the latest APU models have eliminated the need for bleed air and moved from fixed-speed to variable-speed designs, improving efficiency under different load conditions.

StandardAero's Willis cites fuel efficiency and emissions as the current drivers of advancements in new-gen APU models, with the latest APUs delivering 10-15% improvements over older modules. "We have also seen the development of all-electric APUs, such as the Pratt & Whitney APS5000 on the 787 and the Safran eAPU60," he adds.

Repairs for new-generation APUs are also still in development as the market continues to mature. However, many new-gen aircraft APUs are based on similar older-generation models, which is an advantage to repair shops with older-gen capabilities.

"Newer APU models are often a derivative of previous models with common components and parts and so the type of required repairs is common," says EPCOR's van de Graaf, who cites the biggest difference being that new APUs there undergo fewer modifications.

"They use similar core components and line replaceable units, although advanced alloys and machining techniques tend to make new-generation APUs more performant and better able to endure higher pressures and temperatures," Gille adds. TurbineAero has invested in improved machining and rework capabilities and modernized engine test cell equipment in recent years to meet new requirements, he notes.

APU maintenance on newer models also involves predictive tools to determine the APU's health and performance in between maintenance cycles. Gille says TurbineAero, like other APU providers, is developing an in-house trends monitoring program, influenced partly by the shift toward PBH programs, and determining when to remove the APU before it fails. This could also help teams identify the APU issue and remove the unit before it becomes unrepairable and is subsequently scrapped. "When you let it run until there's a problem and wait until then to repair it, the cost will be high," Gille says. ☛

PREDICTIVE INTELLIGENCE

THAT DRIVES RESULTS



Fleets, Trends
and Projections



MRO Future
Demand



Predictive View
of Market Share

**Minimize Risk and Maximize Revenue
with a 10-Year Outlook**

2025 Fleet & MRO
Forecast **COMING SOON!**



For more information, visit
aviationweek.com/forecasts

or call Melissa Crum at +1 913 284-2951
melissa.crum@aviationweek.com

Enhancing Avionics

Paul Seidenman **San Francisco**

1. Global Customer Support

Company: Collins Aerospace

Product: Collins Aerospace's avionics business unit designs, develops and supports advanced flight deck solutions including cockpit displays and vision systems; communication, navigation and surveillance systems; sensor systems; and fire protection systems for commercial and military customers. The company's products have line-fit and retrofit applications in key segments of the commercial avionics market, including narrowbodies, widebodies and regional jets. Its avionics retrofit solutions include upgrades for improved aircraft performance, reliability and regulatory compliance. Collins' MRO services are provided by in-house facilities and several dedicated repair centers at strategic global locations.

marketplace.aviationweek.com/company/collins-aerospace

2. Cutting-Edge Architecture

Company: GE Aerospace

Product: GE Aerospace's commercial aviation retrofit and line-fit avionics products include computing and networking systems, displays, integrated vehicle health management, and flight management systems for single-aisle and widebody aircraft. The company says its recent avionics developments include an open architecture digital backbone—enabling the customer to make next-generation system modifications—and its TrueCourse flight management system (FMS). TrueCourse features a modular design using common components across multiple aircraft platforms and the capability to tailor the modules to a specific aircraft. GE Aerospace has also developed a Cloud FMS prototype derived from its connected FMS technology, which it says is well suited for the TrueCourse architecture.

marketplace.aviationweek.com/company/ge-aerospace



COLLINS AEROSPACE



GE AEROSPACE



GARMIN



HONEYWELL AEROSPACE TECHNOLOGIES

3. Upgrading the CJ2 Cockpit

Company: Garmin

Product: Garmin has just certified a total cockpit upgrade solution for the Cessna Citation CJ2. The fully integrated retrofit will replace the light jet's legacy systems and include Garmin's TXi flight displays, GTN Xi navigators and GFC 600 digital autopilot. Garmin's key products for commercial and business aircraft include its G3000 and G5000 integrated flight decks, which the OEM says are popular across the Part 23 and Part 25 OEM forward-fit market. In addition, the company's TXi flight displays, GTN Xi navigators and GFC 600 digital autopilot options are also seeing success in the retrofit market. Other products include weather radar, radar altimeter and standby flight instruments for forward fit and retrofit.

marketplace.aviationweek.com/company/garmin-inc

4. Runway Incursion Prevention

Company: Honeywell Aerospace Technologies

Product: Honeywell Aerospace Technologies expects to certify its Surface Alert (Surf-A) runway incursion prevention product as a software upgrade to its Mk. V-A enhanced ground proximity warning system by early 2026. Surf-A will join a myriad of Honeywell products for commercial and business aircraft, including displays, flight management systems, radios, data links, flight controls, inertial measurement units, satellite communications and radars. All are marketed for line fit and retrofit. The manufacturer is also working toward certification of its Honeywell Anthem integrated flight deck. As Honeywell's sixth-generation avionics system and first cloud-connected configuration, Anthem's core architecture offers a

50% reduction in size, weight and power compared with its Primus Epic integrated flight deck. Anthem can be customized for most aircraft types.

marketplace.aviationweek.com/company/honeywell-aerospace-0

5. Integrated Cockpit Innovations

Company: Universal Avionics

Product: Among Universal Avionics' most recent product releases is ClearVision, with enhanced flight visual system technology. ClearVision combines Universal Avionics' EVS-5000 multisensor camera and InSight display technology with SkyLens, a wearable helmet-mounted

display. Recently certified through a supplemental type certificate for the Boeing 737NG under the AirAware name, the system is available exclusively through Universal Avionics and AerSale. The company says ClearVision has been adopted by regional airlines operating at smaller airports with challenging terrain or weather patterns. Universal Avionics also reports it is expanding the availability of FlightPartner, its connected avionics solution, which enables pilots to use a tablet bidirectionally for flight



UNIVERSAL AVIONICS

planning and connected analytics.
marketplace.aviationweek.com/company/universal-avionics-systems-corporation

Go to **marketplace.aviationweek.com** for more information.



5 - 7 NOVEMBER 2024
HONG KONG ASIAWORLD-EXPO

Asia's Pioneering Passenger and Cargo Terminal Design, Construction and Operations Event

Redefine the Passenger & Cargo Handling Experience in Asia with Super Terminal Expo



Get your paid
conference passes
and gain actionable insights
from **industry leaders**



Explore our **FREE** exhibition
with over **300 exhibitors**
presenting the latest products
and cutting-edge technologies
for next-gen airports!



Hear from **100+ expert speakers** across **80+ content sessions** as they tackle key industry issues, share groundbreaking ideas, and unveil the latest innovations!



Take centre stage at the
STE Awards 2024



Connect with industry leads
and peers with numerous
networking opportunities.



Sign up
for your **free**
exhibition passes today!

Don't miss the opportunity to lead in Asia's booming aviation sector
Email us at **visit@superterminalexpo.com** to find out how you can become a hosted buyer today!

Organizer		Strategic Partners				Official Venue Partner		Supporting Association			
											
											
Diamond Sponsor				Platinum Sponsors				Gold Sponsor		Silver Sponsors	
 Creating a safer world											
										 	
											



By INIGO URIARTE DEL PALACIO

Del Palacio, director of operations at Resource Group, is an expert on international aviation recruitment and employment.

Haste Makes Waste

Under pressure to hire and onboard workers quickly, MROs face compliance challenges

The reactive nature of modern aircraft MRO operations has led to an increased need to find talent quickly. However, the current skills constraints in the personnel market can have a direct effect on business approaches and attitudes toward compliance when it comes to human resource planning; compliance with applicable labor law, security and quality requirements all can be compromised.

regulations to operating without the necessary licenses or insurance to deploy labor in specific regions—all of which pose considerable short- and long-term risks to all parties.

Regulatory risk is only part of the issue. Operational considerations—such as working hours, health and safety, security vetting and associated processes, and quality assurance checks—can be fast-tracked in the name of reactivity and competitive advantage.

The reality is that organizations cannot turn a blind eye to a supply of labor that is noncompliant. As the end user and economic beneficiary, organizations always will be at financial, operational and reputational risk in the event of an accident, finding or audit—regardless of any brokers, third-party employers or intermediaries involved. The onus is on the organization to work with reputable suppliers and ensure their own business standards are met when it comes to human resource management.

This is where the real competitive advantage lies. The edge comes from not only having access to the right skills but also being positioned to legally onboard, utilize and foster those skills in the organization. Achieving this objective requires robust processes, flexibility and associated internal policies.

Choosing the right labor supplier is crucial. Due diligence around employment knowledge and approach, in-house legal expertise and track record are required, and conducting periodic supplier audits will stand MROs in good stead when it comes to outperforming in the market. As tempting as it is, outsourcing regulatory compliance is not an option.

As we wait for labor flows to loosen with the arrival of newly trained engineers and technicians, the community must remain vigilant, uphold expectations and standards and be more focused than ever on employing people with the right skills in the right way. The bedrock of this corporate policy and approach will long outlast the skills shortage and contribute to the sector's sustainability and resilience in the years ahead. ☪



PETER DEVLIN/ALAMY STOCK PHOTO

The community must remain vigilant, uphold expectations and standards and be more focused than ever on employing people with the right skills in the right way.

In a sector that has largely recovered, MRO organizations face considerable pressure to ensure that all necessary personnel are in place to deliver planned operations in an extremely competitive market.

Many businesses are routinely supplementing permanent workforces with temporary staff to manage production peaks and introduce specific skills and qualifications into their operations at the right time.

Fierce competition for such scarce skills, rising employment costs and increasingly restrictive labor and employment regulations are making it

more challenging to identify, fund and quickly onboard these workers. From a labor perspective, the reactivity of maintainers is arguably not what it used to be. These pressures heighten the temptation to rush through the hiring and training processes.

With demanding customers at hangar doors, the pressure to secure labor can lead to hurried employment contracts, cutting of corners and deployment by unscrupulous intermediaries of workers who do not meet local employment requirements. These practices can range from not addressing local Social Security and taxation



**NEWLY
ENHANCED!**

Any **part**. Any **service**.
Any **time**. Any **place**.

Marketplace

Join the interactive Marketplace and easily reach aviation and aerospace professionals looking for **YOUR** products and services.

This turnkey marketing solution includes: access to a **robust community**, connecting you with aftermarket buyers and decision makers, **lead generation** programs, and increased exposure around **industry events including the MRO Conference & Exhibition Series**.

Join the Marketplace today at

AviationWeek.com/Marketplace/ConnectToday

**Visit Us at Booth #1500
at MRO Asia-Pacific**

AVIATION WEEK 
Marketplace

**AVIATION
WEEK**
NETWORK

Aviation Week Marketplace is an online service that connects **buyers and sellers** in the MRO industry. Become a power user by registering at marketplace.aviationweek.com/register. Registration is **FREE**, enabling you to find hundreds of products like the ones featured below and to connect with more than 8000 companies. You can create a personalized save list, learn about companies' specialties, get contact details and request information at marketplace.aviationweek.com.

To advertise in the Marketplace, contact **Elizabeth Zlitni at 212-600-3713 or elizabeth.zlitni@aviationweek.com**.

AVIATION WEEK MRO BEER

MRO BEER (Baltics, Eastern Europe Region) is happening on June 26-27, 2024 in Vilnius, Lithuania. Secure your place at the region's largest MRO event to network with 450+ local market leaders and regional airlines, and to gain critical insight from expert led discussions on regional aircraft maintenance issues. This event features an integrated conference and showcase featuring more than 40 exhibitors to create an unparalleled forum where key intelligence is gathered, real business leads are generated, and partnerships are forged. **Use promo code: LINKS20 to obtain 20% discount on registration fees.** For more information on participating exhibitors, conference speakers or to register for the event please visit: mrobeer.aviationweek.com.

Visit aviationweek.com/events for more information, including complete exhibitor listings!

WICHITA AIRPORT AUTHORITY

Parcel 12 - Airfield Access - 48.82 Acres

Parcel 12 offers over 48 acres of developable land with existing airfield access and property frontage along two runways.

The Wichita Airport Authority leases land and improvements on a long-term basis to tenants who receive these potential benefits from the Authority's tax-exempt status: • No general property taxes payable on the land owned by the Authority • No general property taxes payable on improvements owned by the Authority • Improvements can be financed with municipal bonds at tax-exempt rates of interest • Sales tax exemption for development on airport property



Airfield Access Parcels Available for Development Expand in Wichita, the Air Capital of the World!

www.flywichita.com

<https://marketplace.aviationweek.com/product/parcel-12>

Services

TECHNOLOGY

AVIATION WEEK **Marketplace** Where **Buyers** Meet **Suppliers**.



Join **12,000+** Global Suppliers and Growing

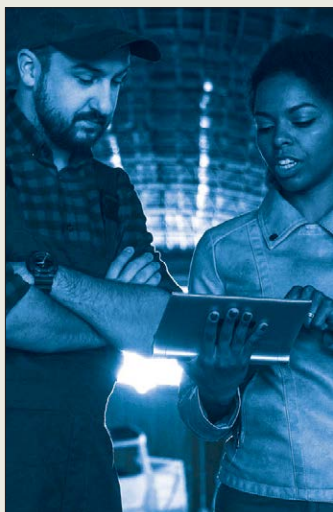
Aviation Week Marketplace is the next generation interactive supplier directory. Buyers turn to Aviation Week Marketplace to find, research, and connect to products and services around the world.

Learn more at AviationWeek.com/Marketplace

AVIATION WEEK
NETWORK



TECHNOLOGY



AVIATION WEEK **Marketplace** Where **Buyers** Meet **Suppliers**.

Join **12,000+** Global Suppliers and Growing

Aviation Week Marketplace is the next generation interactive supplier directory. Buyers turn to Aviation Week Marketplace to find, research, and connect to products and services around the world.

Join the Marketplace today and easily reach aerospace professionals looking for **YOUR** products and services.

Learn more at AviationWeek.com/Marketplace

AVIATION WEEK
NETWORK



Go to marketplace.aviationweek.com for more information.

AVIATION WEEK
MRO
EUROPE

OCTOBER 2024
CONFERENCE: 22-23
EXHIBITION: 23-24
BARCELONA, SPAIN

Be a part of the largest MRO event in Europe

Connect with Industry Experts Featured in the
Conference and *Go Live! Theater*



William A. Ampofo
VP Parts, Distribution
Services and Supply Chain,
Boeing



Miriam Hujiser
CTO and Co-Founder,
Aiir Innovations



**Praveeni Witharana
Nelson**
Team & Fleet Manager
Powerplant,
SAS - Scandinavian Airlines



Basil Papayoti
VP Commercial MRO,
Delta TechOps



Andreas Perotti
CMO Europe,
EHang



Jaime Ramirez
Supply Chain Procurement
and Contracts Manager,
Air Europa Airlines



Enrique Robledo
Maintenance Director,
Iberia



Daniela Serafini
VP, Head of Flight
Hour Services,
Airbus

SECURE YOUR PLACE

Early bird tickets available until September 13

Visit mroeurope.aviationweek.com
Or scan the QR code to register



#MROE     

AVIATION WEEK
NETWORK



FROM TAKEOFF TO TOUCHDOWN. YOUR ONE STOP SHOP.

FAA Certified Repair Station No. K93R093Y
EASA No. 145.6545

www.NASMRO.com

NAS MRO Services is dedicated to providing top-notch aircraft maintenance and repair services. With a legacy of excellence, our team leverages cutting-edge technology and industry expertise to minimize downtime and maximize performance.



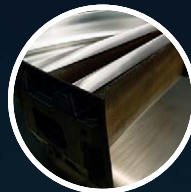
RADOMES



ENGINE MOUNTS



WIRE HARNESSES



OUTLET VANE GUIDE



ACOUSTICAL PANELS



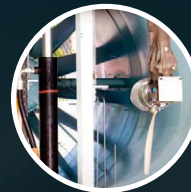
FAN BLADES



WINDOWS



FUEL SYSTEMS



RAM AIR TURBINE



SERVICE GUARANTEE

- 24/7 AOG Support
- Specialized Customer Care
- Guaranteed turn-around-time (TAT) and preferential customer pricing
- Customized logistics programs, pricing and warranty solutions
- 18 Month Overhaul Warranty and 12 Month Repair Warranty
- Exchange/Loan/Lease programs
- Maintenance Repair Programs
- Flat Rate Pricing on Maintenance and Repair Service Agreements
- Repair of components on commercial, regional and non-commercial aircraft
- On-wing and nacelle inspection and repair services

Limited Repair Ratings: Airframe, Powerplant, Accessories, Instrument, Radio, and Emergency Equipment

Specialization in Repairs: Nacelles, Wire Harnesses, Galley Equipment, Windows, Engine Mounts, Lavatory, Outlet Vane Guide (OVG), Acoustical Panels, Fan Blades, Flight Controls, and Radomes (Including in-house Radome Test Facility)