

Keeping the world's fleets flying

aviationbusinessnews.com

JULY 2021 • VOLUME 23 • ISSUE 3

MRO

Management



PLAYING THEIR PART

To PMA, or not to PMA?

ROOM FOR GROWTH

Planning and building the perfect hangar

MOVING AHEAD

The dynamic world of wheels and brakes MRO

EXCELLING IN CRISIS

2Excel Engineering reconfigures for the future

AMOS.

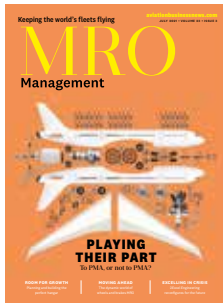


"The fact that the very first AMOS customer was also an air rescue company – who still relies on AMOS after almost 30 years – reflects the versatility of AMOS to cater for the unique needs of rotary wing as well as fixed wing aircraft."

says CEO Swiss AviationSoftware Ltd

AMOS – the best fit for helicopter operators.

AMOS complies with the special requirements of the helicopter maintenance industry by providing dedicated functions in the system only relevant for helicopters, such as vibration monitoring to identify early stages of helicopter component degradation, a complete suite of engineering requirements, dynamic counter options to optimise maintenance control and performance, mission logic or in-depth effectivity rule logic to track fleet uniformity or customer preference.



Cover design by Phil Couzens

EDITORIAL TEAM

EDITOR

Jason Holland
jason.holland@realresponsemedia.com

FEATURES EDITOR

Melissa Moody
melissa.moody@realresponsemedia.com

CONTRIBUTORS

Bernie Baldwin
Chris Kjølgaard

ART DIRECTOR

Phil Couzens

SUB-EDITOR

Heather Ford

GROUP PRODUCTION MANAGER

Barnaby Moore
barnaby.moore@realresponsemedia.com

COMMERCIAL MANAGER

Anthony Wilkinson
anthony.wilkinson@realresponsemedia.com

MARKETING DIRECTOR

James Gambling
james.gambling@realresponsemedia.com

CEO

Chris Pitchford
chris.pitchford@realresponsemedia.com

For subscriptions & enquiries:

Barnaby Moore

barnaby.moore@realresponsemedia.com

All enquiries

+44 (0) 20 8444 2554

Printed in the United Kingdom by Micropress.

Reproduction is not permitted without the express written consent of the editor. All efforts are made to ensure that factual accuracy is correct at time of publication.

All rights reserved. No part of this publication may be reproduced, duplicated, stored in any retrieval system or transmitted in any form by any means without prior written permission of the publishers.

MRO
Management

Published by

Real.
RESPONSE MEDIA

Unit 4D, Cally Yard,
445 Caledonian Road,
London, N7 9BG

Contents

JULY 2021



REGULARS

6 Hangar talk

The latest news from across the industry

8 Trend watch

New contracts, openings and services are driving business operations forward

10 Industry voices

MRO leaders and subject matter experts share their views – featuring SES' Ivan Graydon and Sherwin-Williams Aerospace Coatings' Julie Voisin

14 Legal matters

Assessing the import and export treatment of aircraft parts shipped internationally for repair

FEATURES

16 Moving forward

How MRO companies keep aircraft wheels and brakes turning

22 The right fit

PMA parts once had a chequered reputation, but their quality levels are now on par with – or better than – original parts, their manufacturers claim

26 On location: 2Excel Engineering

A culture shift and a Covid-19 reconfiguration plan have put 2Excel Engineering in a position to prosper in 2022 and beyond

30 Room for growth

The outlook for hangar design and construction looks bright as the aviation industry rebounds and opportunities emerge

36 Maintaining the GENx

GE Aviation's GENx is one of the most important large-turboprop engine families in service today – we survey the MRO landscape

42 Green sky

Liebherr-Aerospace is working on a performance plan with an overarching environmentally responsible approach

**Your parts have
a destination**
We know the way



Aviation Logistics Network



**GLOBAL NETWORK OF
SPECIALISTS IN AEROSPACE
TRANSPORTATION**

Do you have an urgent transportation challenge?

We're here for you 24 hours a day 365 days a year



**ROYAL
AERONAUTICAL
SOCIETY**
CORPORATE PARTNER

www.aln.aero

Contact us now on

**24/7/365 AOG Hotline:
00 8000 264 8326**



EDITOR'S LETTER

It's a natural human tendency to want to fit in. To be part of something greater, to not be isolated or alone.

But what about PMA parts? They, too, just want to fit in. Whether to use these replacement parts or not has long been the subject of industry debate.

As we find out in our cover story, the quality of PMA parts is not only at the regulated standard, but often at much higher levels. While some OEMs dissuade or disallow PMA usage, acceptance of them is growing – even among lessors, which was long a sticking point.

Every part of an aircraft must fit into a greater whole, of course, and the MRO industry plays a vital role in ensuring every last bit of a plane remains in safe working order. The maintenance of the wheels and brakes of an aircraft can perhaps be considered relatively simple, high-volume work, based on overhaul rather than repair – but there is a dynamic world beneath the surface that ensures these components keep on turning, and you can read a detailed report on page 16.

Elsewhere in this issue, we assess the outlook for hangar design and construction as the aviation industry rebounds and opportunities emerge, and survey the MRO landscape of GE Aviation's GEnx – one of the most important large-turbofan engine families in service today.

And as travel begins to return to normal, along with business meetings and events (varying by country, of course), I can tell you it was fantastic – and fascinating – to get out of the office recently for a tour of 2Excel Engineering's facilities in the south of England.

The company has an intriguing story to tell, which can be read in more detail on page 26, but at its heart involves going through two major business shifts in the past six years. The first was a complete cultural change after 2Excel Engineering was formed out of the ashes of ATC Lasham, which went into administration in 2015. The second has been a reconfiguration of the business to face a new reality following the Covid-19 crisis, putting it in a position to flourish next year, and beyond.

2Excel Engineering is a company that proves that, while it's often lovely to fit in, sometimes you've just got to stand out from the crowd.

Jason Holland

EDITOR

Jason.Holland@realresponsemedia.com

CONNECT ONLINE WITH AVIATION BUSINESS NEWS

@avbusinessnews

aviationbusinessnews.com

avbusinessnews

News from across the industry

HANGAR *talk*



AIRCRAFT

A return to service and a heavy upgrade

Iberia Maintenance has begun a major maintenance operation to return 29 A320 family aircraft into service for Iberia Group: 23 for Iberia and six for Iberia Express.

The aircraft have been preserved for more than a year, and Iberia Maintenance will perform required checks for their return into operation for the summer season. Checks are required for engines, hydraulic systems, avionics and other essential elements such as landing gear, brakes and wheels.

In some cases, heavy maintenance work will also have to be carried out at Iberia Maintenance's La Muñoza facilities, where an aircraft's entry

IBERIA MAINTENANCE HAS PRESERVED MORE THAN 150 AIRCRAFT SINCE THE BEGINNING OF THE COVID-19 CRISIS

into service coincides with a recurrent scheduled overhaul.

As a result of the increased demand for aircraft returning into service, Iberia Maintenance said it had developed a mobile application – RTO.com – so that operators can check the availability of days and book overhaul slots.

Iberia Maintenance has also committed to further developing its base

maintenance presence at Barcelona-El Prat Airport. Building on its current C check capabilities, the MRO will invest to become a full heavy maintenance facility, offering services to both IAG Group clients – starting with Vueling – and third-party customers. A team of 300 professionals in Barcelona will service initially Airbus A320 family aircraft, with a capacity of more than 300,000 man-hours per year. Line maintenance services will continue to be carried out.

The development of the hangar is part of a wider Iberia commitment to reinforce its presence at El Prat, consolidating the Barcelona airport as a major aeronautical hub.

8

MTU has signed an eight-year agreement for CF34 engines with GE Aviation

22,000

EirTrade Aviation is opening a new 22,000sq ft facility in Dallas Fort Worth

5

In a five-year deal, SR Technics Malaysia is now a licensee for Honeywell components



SUPPLY CHAIN

Magnetic MRO to “find hidden gems”

Estonia-headquartered Magnetic MRO is creating a fully integrated supply chain of aircraft parts with the assistance of robotic process automation.

The MRO company has extended a contract with SkySelect, which acts as an extended purchasing arm to airlines and MROs. SkySelect uses technology and algorithms to do the work of matching real-time demand from buyers with supply. The process scales up and down automatically depending on demand.

“SkySelect is a long-time partner of ours because of their unique ability to provide both technical innovation and unrivalled customer support,” said

Magnetic MRO’s head of supply chain Kaarle Karp. “We are used to having access to information in real-time. But for aircraft material, it’s not the case, we are still buying parts like we did 30 years ago. With its unique technology-enabled approach, SkySelect can process thousands of part requirements 24/7 to deliver savings of 20 per cent or more with a fully automated ordering process.”

SkySelect aims to integrate the supply chain in a way that eliminates manual effort by having less orders and suppliers to manage, while also driving cost savings “by working closely with buyers and sellers and constantly searching for the best options from the market”.

in brief

- AJW Group and Arena Investors have formed a joint venture focused on the selective acquisitions of commercial aircraft, engines and components. Through a newly formed entity based in Dublin, Ireland, AJW and Arena will jointly acquire a targeted portfolio of aircraft and engines to be managed and monetised through AJW’s global network. It will be funded with committed capital of up to US\$100 million.

- ● Canadian low-cost carrier Flair Airlines has contracted Lufthansa Technik to provide component repair and overhaul for its 737 MAX 8 aircraft. The ten-year ‘Total Component Support’ contract applies to up to 24 aircraft from the airline’s current and future fleet. Support for the aircraft started in April 2021. The new contract also includes support for engine related components. Lufthansa Technik already provides component support for Flair’s 737-800 aircraft and has also performed landing gear overhaul on these aircraft.

- ● ● German cargo airline AeroLogic has extended a contract with HAECO Hong Kong for heavy maintenance services. HAECO Hong Kong will work on AeroLogic’s 777-200 freighter fleet between 2021 and 2024, covering the current fleet of 18 777F aircraft. HAECO Hong Kong has been providing MRO support for AeroLogic since 2012.



01

01 Better engine health

Pratt & Whitney has signed an agreement with data delivery solutions provider Teledyne Controls to enhance engine health management services.

Teledyne Controls uses technology to collect, manage and deliver aircraft data to more than 300 global airlines. The collaboration focuses on Pratt & Whitney powered aircraft among Teledyne's customer base.

"Advanced engine parameter data points will paint a cohesive digital picture of aircrafts' health, enabling [us] to draw insights and provide predictive maintenance," Pratt & Whitney said.

02 Full scope

FL Technics Engine Services has added EASA Part 145 approved services for engine repair and maintenance. The company said it would now offer the "full scope of services" for CFM56 family engines, related to fan, hot section and low-pressure turbine repair.

Previously available services include engine external examination, boreblending, engine preservation and storage services, QEC/LRU removal and installation, top case repair and lease return services. These services will be provided at a new fully authorised three-bay quick-turn activities engine shop located at Kaunas International Airport.

Trend watch.

Features editor **Melissa Moody** discovers some of the latest contracts, openings and services in the MRO industry

02



03

03 A line of support

Global air and travel services provider dnata has partnered with Global Jet Technic to provide line maintenance support to airlines in Dubai.

The partnership will see dnata promote Global Jet Technic's ground handling, cargo and technical services at Dubai International and Dubai World Central airports to its customers.

"We are delighted to join forces with a reputable partner to expand our portfolio and provide a broader range of services to our airline customers in Dubai," said dnata's executive vice-president Steve Allen.





04



05



06



07

04 Sustainable solutions

AerFin has launched a new service called 'Engine MRO Lite'. It provides a range of in-house and off-wing engine maintenance solutions, including quick-turn services, hospital shop repairs and engine transitions across CF34-8, CFM56-5 & 7 and RB211-524 platforms. Work will be conducted at AerFin's 100,000sq ft facility in Caerphilly in Wales, UK.

The service will focus on optimising engine residual value to provide efficient and sustainable solutions, AerFin said, providing "a fantastic opportunity to further strengthen our relationships with airlines, lessors and MROs".

05 Customers first

Liebherr-Aerospace has launched a new customer service platform. The company has transformed its traditional customer portal into a platform that not only gives access to technical publications, but also provides automated functions that facilitate business interactions and make the search for information faster.

The platform features several new functionalities, as well as an enhanced range of training services for airlines and MROs with a new set of dedicated digital solutions. Customers can also exchange direct messages with experts in "just a few clicks".

06 MRO know-how

BAA Training has established a new MRO organisation in Spain called Avia Repair Co. It will operate at Lleida-Alguaire International Airport.

Following a certification process, the new MRO will initially provide services to BAA Training as a dedicated local MRO, but will carry out work for other corporate clients at a later date.

Avia Repair Co will initially service Tecnam P2002, Tecnam P2006, Cessna 172 and Cessna 150 aircraft, with more types to added. There are plans to recruit at least 10 engineers and mechanics in 2021 alone.

07 New horizons

S7 Technics is to construct a new aircraft maintenance centre at Pulkovo Airport in St Petersburg. Work to be performed at the centre will include base maintenance (D check inclusive), line maintenance, structural repairs, engineering support, EASA Part-21 J modifications and production of aircraft interior elements in accordance with the requirements of EASA Part-21 G.

The centre will be able to serve A320 family and 737 aircraft of all generations, as well as Sukhoi Superjet 100s and MC-21s. Construction will begin in 2023, with full completion by 2025.

Managing an engine pool during a pandemic

Customer communication and flexibility were among the factors which helped SES flourish during the pandemic. Chief technical officer **Ivan Graydon** reflects on lessons learned and strategies for preparing for the recovery in aviation

One of the main impacts of the pandemic for Shannon Engine Support (SES), like other companies, has been the increased number of engines on the ground. As aircraft were grounded in the early stages of the pandemic, short-term lease engines were the first to be removed and returned to lessors.

This initially led to an increased number of redeliveries and associated maintenance activities which we had to manage along with our regular workload.

Our customers were keen to get confirmation that leases were closed, so our strategy was and will continue to be to communicate with them regularly so they know they have our full support. We are committed to working with our customers to make arrangements that work for them and their operations.

The Covid-19 crisis also created a number of technical challenges, especially during its initial stages, that SES has had to rise to meet. Fortunately, SES has very strong relationships with our MRO suppliers, several of which we have been working with for over 20 years. We see our MRO suppliers as

key partners and this allows us to deliver the highest level of service and quality to our customers.

We engaged with our MROs from the get-go so they could provide us with the capacity we needed as the engines were returned. We worked with them to essentially 'triage' the maintenance workload. This approach enabled us to meet customers' timing expectations with regards to the termination of their leases while at the same time continuing with the routine maintenance on our own pool of engines.

The SES team is used to working in a high utilisation environment so the challenges of dealing with multiple engine projects within tight time frames

is something that the team were already very proficient at.

SES also has several key resources to draw from, giving us the flexibility and support to manage our portfolio throughout the Covid-19 crisis.

We have very strong key supplier relationships which are essential for the business, particularly when adapting to changing environments.

Additionally, we have seen that our global spread of engines and suppliers has been an advantage managing our customers' needs during the early stages of the pandemic. We have 11 pool locations across the globe which allowed us to ensure engines were easily accessible and available considering the travel and logistical restrictions in place.

Finally, as one of our key attributes, we have a dedicated team of highly skilled committed professionals willing to do whatever is necessary to support our customers and each other. The SES team excelled in supporting our customers and each other during the pandemic.

Preparing for recovery

As the worst of the Covid-19 crisis appears to be behind us, given the continuing global rollout of vaccines,



30

SES has over 30 years' experience in the leasing industry, building a wealth of expertise and knowledge in the CFM56 and LEAP product lines



Clockwise from left: SES has built a large portfolio of LEAP spare engines; chief technical officer Ivan Graydon says strong relationships have helped companies get through the Covid crisis



We will continue to communicate with our customers

the aviation industry and all companies in it can begin to prepare for the post-pandemic world. From a portfolio management perspective, SES is putting measures in place in anticipation of an expected increase in demand for lease engines.

We are actively managing our portfolio of engines to ensure they are 'lease ready' so we can react quickly as demand increases. We have over 30 years' experience in the leasing industry and have built a wealth of expertise and knowledge in the CFM56 and LEAP product lines. Our portfolio has grown year on year, and we have maintained our fleet to the highest technical standards.

In addition to our own expertise, SES has contracted with two continuing

airworthiness management organisations (CAMOs) – which are also airline affiliated – to ensure all our engines are managed and maintained within a regulated environment.

With an increased number of engines on the ground and some MRO organisations operating at reduced capacity levels, we have had to manage our engine re-preservation programme as well as any service bulletins and airworthiness directives that were issued to ensure continuing regulatory compliance and to meet and exceed our customers' quality expectations.

In terms of engine technical management, the key focus will continue to be to provide the highest level of service to our customers and to meet all their spare engine requirements.

As a professional engine lessor, we invest in and manage our portfolio for the long term. As a result, we maintain our engines to the highest possible standards to ensure our customers receive the highest quality product and service.

We are dedicated to building relationships with both our customers and suppliers. Having suppliers we can rely on to provide a high level of service will always be of the highest priority for us. We believe this will be the key to maintaining and growing our business as the aviation sector recovers and grows. **M**

What's on the horizon for MROs and their aircraft paint operations?

Sherwin-Williams Aerospace Coatings global marketing manager **Julie Voisin** reveals recent MRO market findings as sustainability, speed of application and weight savings drive future aerospace coatings product development

The global aerospace coating market was valued at US\$1,807.81 million in 2019 and is projected to reach US\$2,924.50 million by 2027, according to a recent analysis conducted by *Research and Markets*.

The market is expected to grow at a compound annual growth rate of 6.19 per cent from 2019 to 2027.

A Sherwin-Williams Aerospace-commissioned survey of the pandemic's effect on the North American MRO marketplace, conducted in the first quarter of 2021 with input from more than 200 North American MRO decision-makers, concluded that from the Covid-19 impact:

44%

experienced little or no effect on operations;

29%

experienced a negative effect; and,

15%

experienced a dramatic negative effect.

Interestingly, the survey revealed that 11 per cent of respondents saw a positive effect on their business during the pandemic, and another two per cent indicated it had a dramatically positive effect.

The same survey on Covid-19's lasting effects asked North American-based MRO facility owners/operators and managers when they felt the aerospace market would return to pre-pandemic levels:

12%

indicated it would be this year (2021);

42%

indicated it would be next year (2022);

26%

indicated it would be back in 2023; and,

20%

indicated it would be back after 2023.

When asked what their key obstacles to growth 'besides Covid-19 issues' were, particularly in paint operations, respondents noted four major points:

30.49%

said 'operating space';

28.05%

said 'workforce/skill level';

10.98%

said 'business competition'; and,

6.10%

said 'regulatory concerns'.

To best support those MRO operations returning to work, Sherwin-Williams Aerospace Coatings is focusing on three areas for aircraft paints: more environmentally friendly products in the form of coatings free of chromates and VOCs; the application of thinner films to save weight; and faster processing times. Meeting these three criteria is our 'SKYscapes' basecoat/clearcoat exterior coating system.

Designed to enhance productivity, SKYscapes exterior coatings paint processing times have been reduced by 30 per cent. This is because the paint cures or reaches its optimum hardness at ambient temperatures in half the time of other single-stage systems, which often take as much as 6-10 hours. That means less time – and cost – in the shop, meeting customer demand for faster turn times.

The SKYscapes system incorporates reduced film thickness, resulting in lower





Clockwise from left: A range of obstacles to growth in paint operations have been reported; Sherwin-Williams Aerospace Coatings global marketing manager Julie Voisin; the company has introduced a new maintenance product called JetPen for touching up chips, dings and scratches



JetPen users can touch up their aircraft with ease

weight and fuel costs. The entire system is finished with a clearcoat layer that provides improved system durability. It is also ideal for aircraft paint schemes with multiple colours, stripes or elaborate designs, which can be time-consuming.

This is important because aircraft are often being repainted and/or change their livery for a variety of reasons – the plane may be sold, leased to someone new, have reached its required maintenance checks, or the owner just wants something different. In the business jet world, it would not be unusual for the plane to be

repainted every five to seven years. As far as commercial aircraft repaints, it is more related to the required maintenance checks and amount the aircraft is flown.

Besides offering durable and productive topcoats and interior coatings, Sherwin-Williams was excited to have recently introduced a new maintenance product called 'JetPen'. This product allows users to touch up chips, dings and scratches quickly and easily in a one-time use on aircraft.

This two-component touch-up pen contains actual Sherwin-Williams aerospace coatings that can be used on aircraft exteriors and cabins at any point during the paint process.

JetPen can be used at the maintenance facility when doing some quick touch-ups and used at the customer site later. It provides a perfect match with previous primers, clearcoats and a variety of topcoat colours for systems such as Jet Glo Express, SKYscapes and Jet Flex.

At Sherwin-Williams Aerospace Coatings, we have already made colour selection and coating application simple. Now users can touch up aircraft with the same ease. 

Non-US repair of US sourced parts: US export and import compliance

Washington Aviation Group president **Jason Dickstein** presents the second in a series of two articles addressing import and export treatment of aircraft parts shipped internationally for repair

In this second article, we are going to examine transactions where the article starts in the United States and is exported for repair to a non-US location, with the intent that the article be returned to the US location after repair. This article is limited to US export and import law – but don't forget that the jurisdiction where the repair happens will have its own regulations.

In this scenario, we examine an aircraft component that is sent from the United States, for repair or alteration, to a location outside of the US. This may be sent by an air carrier, a distributor of used aircraft parts, a repair station, or any other person inside the US who is shipping the part to a non-US location for repair.

It is important for MROs located outside the US to understand these requirements when they are receiving parts from their US customers. When



An article can be subject to a licensing obligation because of where it is going, who is involved, or the intended purpose

components are shipped from the US to a non-US location for repair, the initial transaction is considered to be an export, and the return to the US is considered to be an import.

Shipping for repair outside of the US

The first step in the export analysis of a civil aircraft part will be to identify the Export Commodity Classification Number (ECCN). Many aircraft parts fall under the general default ECCN 9A991 – but not all of them! Where there

is a more specific ECCN that applies to your article, you will need to use that ECCN to identify the specific export limitations that may apply, including licensing provisions.

An important consideration when exporting such articles for repair is to examine whether the article is subject to an export licensing obligation. An article can be subject to a licensing obligation because of where it is going, who is involved in the transaction, or the intended purpose abroad.

For example, components that rely on inertial technology or gyro technology may be controlled for export purposes under the missile technology ('MT') restrictions. This can include avionics units and related sensors. Such units are typically required to be exported under a licence to most jurisdictions (except Canada).

If the article is subject to licensing requirements upon the initial export, then it is possible that a common licensing exception may apply, such as the 'TMP' licensing exception for temporary exports (15 C.F.R. § 740.9). Exporters can use TMP as their licensing exception when shipping parts for inspection, testing, calibration or repair abroad, but there are certain destinations that cannot use this exception, and the article must be returned to the US within a year.

Returning the repaired component to the US after repair

When an article is exported for repair and then returned to the US, it must be classified for import tariff purposes upon return. Most such aircraft components



HAZMAT SHIPPING CLASS

LIVE ONLINE - 6-7 OCT, 2021

Can you afford to be out of compliance?

- ▶ Maintenance providers who ship or accept hazmat must be regularly trained and certified - shippers, supervisors, and support personnel
- ▶ Penalty for "failure to train" can be costly (\$75,000+ in the US)
- ▶ Regulatory Inspectors are looking at your training records
- ▶ Our training is affordable and tailored to the aviation industry
- ▶ Scheduled over two days so you can get back to the job
- ▶ Meets all FAA, DOT and IATA training requirements

To learn more and register online, visit us at
WWW.DANGEROUSGOODSTRaining.NET



WASHINGTON AVIATION GROUP, PC
and the Law Offices of Jason A. Dickstein

Registration discounts available for ASA, ARSA, AEA & MARPA members!

TARIFF CODE

DESCRIPTION

9802.00.40.20

Internal combustion engine parts previously exported for warranty repair or alteration, upon their return following such repair or alteration

9802.00.40.60

Parts other than internal combustion engine parts, when previously exported for warranty repair or alteration, upon their return following such repair or alteration

9802.00.50.30

Internal combustion engine parts previously exported for non-warranty repair or alteration, upon their return following such repair or alteration

9802.00.50.60

Parts other than internal combustion engine parts, when previously exported for non-warranty repair or alteration, upon their return following such repair or alteration

will fit into one of these US tariff codes, when returned to the US, following repair abroad [see table above].

Note that for articles that are exported for repair or alteration, and then subsequently returned to the US, there may be a duty owed for the value of the repair or alteration. This is typically assessed at the cost to the importer of the repair/alteration times the duty rate of the underlying article.

So, if the aircraft part is subject to zero per cent duty then the repair will also be subject to a zero per cent duty (but the importer still needs to make sure the article is properly declared upon import).

If there is a special additional duty, like the duty applied to large-aircraft horizontal stabilizers from France or Germany, then that additional duty may apply to the value of the repair or alteration, as well.

There are also special rules for articles that are returned to the US after repair or alteration in Canada or Mexico.

When the goods are returned to the US, there is a specific declaration required from the person who performed such repairs or alterations about the cost of the work; and there is another declaration expected from the importer. The language of these declarations can be found at 19 C.F.R. § 10.8 (see 19 C.F.R. § 181.64 for the declaration for components repaired or altered in Mexico or Canada).

Each of these discussions is based upon a generic set of facts. There are a lot of special situations that have their own different standards. Real-life fact patterns can introduce additional facts that might change the analysis, so we always recommend that you seek professional assistance for both export and import compliance. ☺

Jason Dickstein is a Washington DC based attorney who has represented the aviation community on compliance issues, in transactions and in litigation for 30 years.



MRO

IN

MOTION

Features editor **Melissa Moody** explores the dynamic world of aircraft wheels and brakes and the work that goes into keeping them turning

Essential for both getting aircraft into the air and setting down safely, it is imperative that the wheels and brakes on aircraft are maintained to the highest standard. Usually considered as relatively simple, high-volume work, based on overhaul rather than repair, they can be seen as some of the most predictable of an airline's maintenance items.

Ironically, brakes tend not to break, but they do wear with use. The majority of brake maintenance is overhaul and the associated replacement of components that wear naturally every time braking is employed.

And despite what people may think, it's not just about take-offs and landings when discussing wheels and brakes.



Left: Lufthansa Technik uses a charge per cycle rate to cover the cost of operation per flight

Despite what people may think, it's not just about take-offs and landings when discussing wheels and brakes

The bigger picture

Wheels are likely to suffer corrosion or damage and they should not be confused with tyres, although because of the nature of the component there is a necessary degree of overlap.

Like brakes, tyres wear naturally in use and a wheel may be removed and its tyre replaced a few times – typically between four and six, depending on aircraft type – before the wheel requires overhaul, assuming no issues are identified during the basic inspection that accompanies an intermediate tyre change.

World Aero CEO Phil Randell explains that it is “critical” to fully understand the maintenance cycle of minor and major inspections. This is “to ensure that airworthiness is maintained at all times and also to protect against costly mistakes, such as unnoticed corrosion, which can result in a high number of irreparable units,” he says – a factor which many airlines will look to avoid, particularly in the current climate.

Seasonal changes also have a “huge” impact on shop inputs, Randell adds. “A typical northern hemisphere summer, for example, will see increased holiday traffic boosting flights and thus wheel and brake removals. Also hot runways, heavier aircraft or tighter turnarounds reduce the life of the tyres and, to a lesser extent, the brakes.”

He also notes that different routes can have a “heavy impact” on removals; runway conditions and manoeuvring area dimensions can make one route’s tyre consumption “vastly different” from another. “An aircraft that operates tight schedules into inner city airports with very compact ramp areas will see far less tread life than those operating into larger airports,” Randell says.

Chicago-headquartered MRO company AAR agrees that the maintenance landscape is about more than just the components themselves. The company’s director of wheel & brakes, German ‘Alex’ Lara, says that following the CMM and manufacturer’s recommendation is best practice

when looking at maintenance and will ensure a safe and long life of the product, but the MRO should also work with the airline and its schedules to allow both sides to work effectively. “It is important that the repair facility is in sync with the airline’s maintenance and quality procedures to ensure a reliable programme,” Lara says. “Understanding the day-to-day operation of the airline and their requirements is essential in maintaining sufficient stock levels to accommodate their operation.”

One of aftermarket supplier TP Aerospace’s strengths when it comes to wheels and brakes is its levels of backstock. Owning more than 20,000 of the component, in addition to structural parts and tyres, it claims to have “by far the largest aftermarket inventory for commercial aircraft in the world”, according to global programs director Philip Broskov Hansen. For its MRO services, TP Aerospace’s aim is to keep everything as simple as possible for both sides. “We want to make it as transparent and as predictable in terms of managing the cost of wheels and brakes as possible,” he explains – which is where cost planning programmes come in.

According to Hansen, airlines are looking into their costs in a specific way to see if any processes or operations can be done smarter or simpler. TP Aerospace’s programmes respond to this trend and have enabled the company to manage through the pandemic. Now, as flights are restarting, Hansen says the company stands ready to help, particularly if wheels haven’t been maintained during storage.

Similarly to TP, looking at the wider impact of the component and its effect on the airline, Lufthansa Technik uses a charge per cycle rate to cover the cost of operation per flight. “The Covid-19 crisis has not changed this approach in the market much for our customers,” says senior manager key accounts, wheels and brakes David Kahl. He points out that smaller customers may look to have more flexibility when ramping up, thus



From left to right: Lufthansa Technik has found that airlines are trying to find storage solutions; World Aero notes that conditions can have an impact on component life

The continued roll-out of carbon brakes is perhaps the most significant innovation in recent times

opting for single event pricing; however, there comes a point when the flight cycle pricing becomes more attractive to customers.

The MRO giant has also specialised in pooling for customers, providing leasable stock for airlines to use. It allows them to lower their initial asset investment, a choice that has “become more attractive since airlines have been managing their bottom line. We can provide stock from regional to large commercial airliners within a week,” Kahl adds.

Moving ahead

As with every other aspect of aviation, the wheels and brakes market has been impacted by the Covid-19 pandemic.

Hansen explains that if airlines “haven’t taken care of the aircraft in the proper way by rotating them and instead keeping them parked you would need to change out a lot of wheels and potentially brakes ready for the aircraft to fly again, which is something we see happening.”

Meanwhile, Lufthansa Technik has found that airlines have been looking to find solutions on how to deal with storage

and de-storage requirements, which typically include protection against the elements with subsequent removal of wheels after several months of parking. “The cost of removal is the pain point which airlines are looking to manage with rotation of their fleet or stringent long-term parking,” Kahl notes. “In essence: avoid removal and cost generation wherever possible.”

In terms of brakes, the MRO has seen an increase on oxidation on parts – from structural housings to partial oxidation on carbon heatsinks. Kahl says MRO shops have seen a “significant reduction” on the removals.

The aftermarket for parts has changed too. Parts which once were rare or expensive can now be procured in abundance at low rates with even OEMs offering significant, double-digit discounts on the parts, Kahl says – a state of affairs which isn’t expected to change until markets operate above pre-pandemic levels.

Prior to the Covid-19 crisis, AAR’s Lara felt that the primary driving force behind wheels and brakes was the increase in the

2,000

A Boeing 737 steel brake used to last around 1,100 landings before removal, but this has now jumped to 2,000 landings with carbon brakes



number of aircraft in recent years. That demand is still expected as the market picks back up as economies grow, and there will be an increase in demand among the middle-class emerging markets.

For some wheel and brake MROs, demand has remained consistent as schedules remain largely unchanged. Some customers have understandably had volumes decrease as aircraft were grounded, but others, such as cargo carriers, have seen an rise in volume as global cargo demand increased.

But some wheel and brake shops haven’t been so lucky, points out Lara. “As commercial flights came to a near halt, so did the repairs of wheels and brakes. Many small wheel and brake shops had to close their doors. Those shops with a diversified customer base did better due to the increase in the cargo sector.”

Ultimately, “it all comes down to the dollars and cents”, according to Hansen, “particularly in such a competitive market”. Where some companies used to be able to charge more because of their level of service, he points out that’s not so much the case anymore.

TPAerospace

**WE'RE NOW IN
DISTRIBUTION**

We're now also offering factory new
OEM wheel and brake piece parts
and assemblies!

All at good prices, minimal lead time and
superior customer support.

WHAT'S YOUR EXCUSE

FOR CHOOSING COMPLEX?

**WHEELS AND BRAKES.
IT'S THAT SIMPLE.**

TPAEROSPACE.COM

WHEELS & BRAKES



Left: AAR says that MROs must sync with airline's schedules for effective work on both sides

“Many small wheel and brake shops had to close their doors – those shops with a diversified customer base did better”

“We are really being challenged on processes and operators are going more thoroughly out in the market,” he says. “But sometimes it’s down to the facts. For example, one part might be 50 per cent cheaper than this other part, so we kind of have to keep a keen eye on the pricing.”

Steel vs carbon

The two main types of brakes, steel and carbon, both have their benefits and drawbacks, but carbon appears to be becoming the most favoured type among airlines.

The continued roll-out of carbon brakes is, in Randell’s opinion, the most significant innovation in recent times. “Not so long ago these items were exclusive to long-haul aircraft; now even the smallest commuter aircraft have them as options, or as standard,” he points out.

Kahl explains that a Boeing 737 steel brake used to last around 1,100 landings before removal, but this has now jumped to 2,000 landings with carbon brakes. Some aircraft types see this number move closer to 3,000 landings, resulting in lower maintenance costs and associated labour.

With ongoing retrofit programmes for common types, such as the 737NG, to replace steel brakes with carbon equipment (which also requires the

replacement of main wheels), there is a rise in demand across the board. “The cost of the new components is high, and the value of the old equipment negligible, but OEMs are offering huge incentives to fit their equipment, such as free wheels and brakes for an entire fleet,” reports Randell.

According to World Aero, while the repair cost of carbon brakes is considerably higher than steel types, the longer on-wing time brings “significant savings” in operator manpower for brake changes, the logistics of routing units to and from overhaul, spares holding levels and administration.

There is also the reduced fuel burn due to lower brake weight, although this is less of a factor for short-haul high-cycle operators. Randell says it is the long-term operating cost benefits that need to be understood, not the initial costs of retrofitting.

But it’s not necessarily up to the MRO to have the final opinion, according to Hansen. “As the MRO provider we have everything in stock, so we’ll leave it up to operators to decide what’s best for their operation and give pointers,” he says.

Lara adds that the idea of more electric components is also becoming popular, as seen by the carbon electric

brakes introduced in the 787 and now the A220. “Most brakes are powered by the aircraft’s hydraulic system in conjunction with pistons and cylinders. Electric brakes are powered by the aircraft electric system and this force is transferred to the heat sink through electromechanical actuators, which are housed in the piston housing.”

Kahl agrees. “[Electric brakes] will allow for further cost saving on the operator side as certain line items may exchange on ship which previously necessitated the removal of the complete brake for repair,” he says. “However, this is very much in its infancy and will only breakthrough in the next generation of aircraft due in the 2030s.”

Keeping positive

One of the biggest issues for the industry, and the resulting market, is the uncertainty surrounding travel.

“There is no doubt there’s significant demand for leisure travel, but this is very much controlled by changing restrictions on where and when people can travel and if there is a need for quarantine,” comments Randell. “This leaves airlines in the unenviable position of having to try and predict potential traffic volumes without much insight.”

He believes a slower market will be the case for the foreseeable future. “We aren’t expecting to return to pre-pandemic levels of servicing requirements for a further year, possibly even two,” he admits.

Hansen considers TP Aerospace lucky due to its mix of customers. The company hasn’t depended on passenger operators, and has been able to use freight operators to keep services up. Although it did have to implement some cost-cutting measures – something that was a “big wake-up call” – TP is starting to see positive trends in the market with customers who are preparing for wheels to start turning again.

AAR’s Lara notes that as aircraft are removed from storage and activated, flights have been slowly coming back to pre-Covid levels. “There has been a steady increase in the wheel and brake market, and this increase should continue as people feel confident about travelling and as countries begin to open their borders,” he concludes.

This feeds back into the MROs in the market, who for the first time in a year, can take a breath of fresh air. **M**

MRO

Management

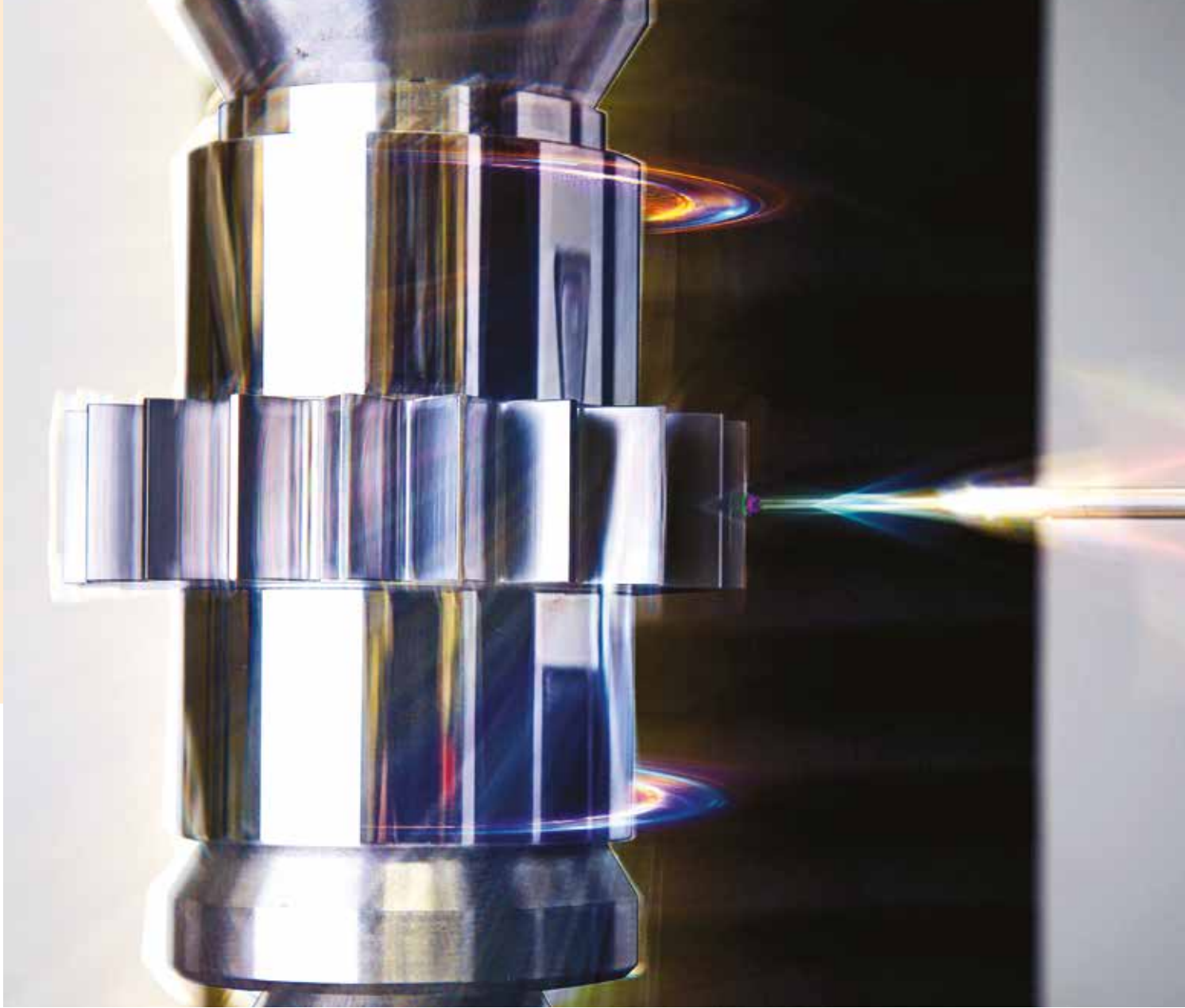
SUBSCRIBE
NOW



MRO Management is the magazine that delivers insight into current business thinking and strategies driving maintenance, repair and overhaul in the commercial aircraft sector.

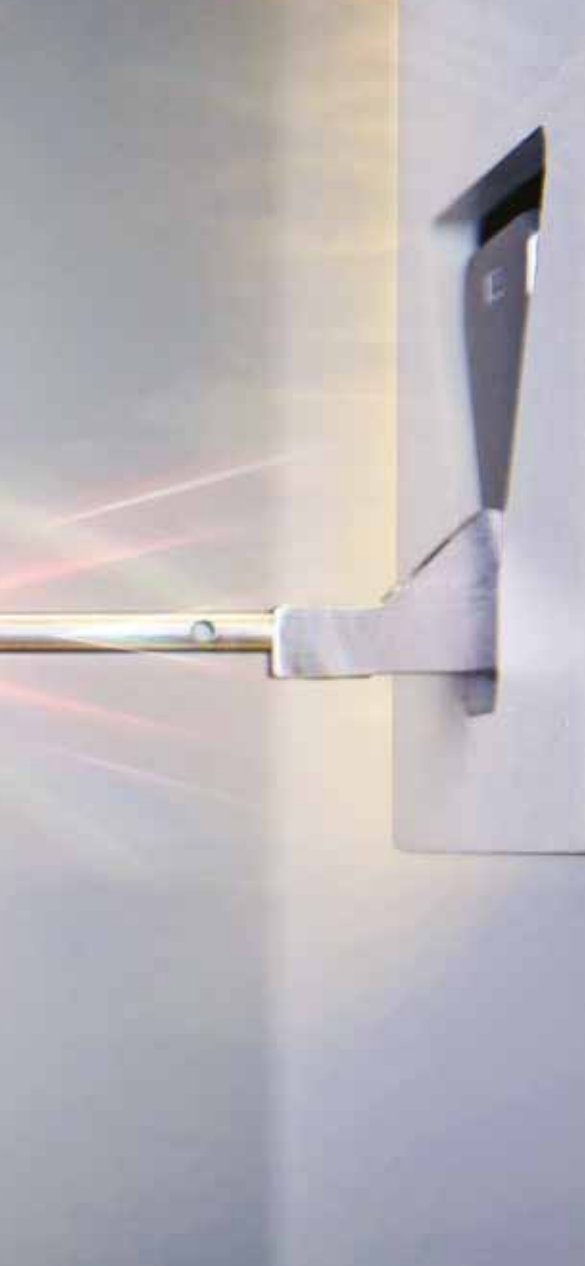
Reaching an audience of over 39,000 key decision-makers, we aim to keep you fully informed of the latest news and developments from the sector.

 aviationbusinessnews.com/subscribe



Getting more than the sum from the PMA parts proposition

PMA parts once had a chequered reputation, but their quality levels are now on par with – or better than – original parts, their manufacturers claim. **Bernie Baldwin** reports



Left: HEICO says a renewed customer focus on sustaining high quality standards and reducing maintenance costs has generated more interest in PMA parts

500

PMA manufacturer HEICO develops around 500 new PMA parts each year “with a rigorous proprietary process that is followed for each part”

a daily basis with parts from the original equipment manufacturers (OEMs).

While the FAA definition may be simple and concise, there is obviously a great deal more to getting PMA parts to market, as John Benschmidt, vice-president, sales and marketing for Jet Parts Engineering, explains. “Jet Parts Engineering (JPE) has developed an extensive PMA development process which we’ve refined and improved upon for almost 30 years. FAA Order 8110.42 is the foundation of our process, but we have added analysis and controls to ensure our products meet the highest standards,” he begins.

“One of the benefits of PMA is the ability to review all of the operational history of the OEM. Reviewing items like service bulletins, service difficulty reports and maintenance records allows JPE to identify the deficiencies of OEM products. From there, JPE can make adjustments in the design to help improve quality and reliability.

“As an example, JPE has 737NG pressure switches (PN 21C1-3-21 and -22) that monitor fuel tank pressure. These switches use ruggedised sensing mechanisms and improved sealing to eliminate the contamination that causes the OEM’s part to fail. We get to use hindsight to our advantage when looking at areas for improving on the OEM part.”

PMA manufacturer HEICO develops around 500 new PMA parts each year “with a rigorous proprietary process that is followed for each part”, according to Kim Barmoha, the company’s senior director of marketing. “Included in the process is a complete understanding of the form, fit and function of the part

with dedicated in-house metrological and materials analysis,” she says. “The FAA requires that PMA parts meet the same quality requirements as the OEM parts. HEICO, however, has internal requirements that go above and beyond the FAA requirements.”

Josh Abelson, president, PMA and chief commercial officer, PMA & distribution at Wencor Group says that his company has a different approach to PMA than many other providers, which is linked to its connections with airlines and MROs. “While historically, companies have primarily PMA’d parts with the highest price x volume values, Wencor seeks to partner with MROs to find comprehensive alternative material solutions (USM [Used Serviceable Material], DER [Designated Engineering Representatives], Wencor or reliable third-party PMA or OEM part-lifetime buy) for each part within the bill of material (BOM),” he elaborates.

“This approach provides our MRO and airline partners with maximum flexibility when making critical decisions about what to insource vs outsource and what to work on with the OEM vs independent repair providers,” Abelson continues.

“Our data and, more importantly, our customers’ experience, indicates when we PMA many or most parts in a next higher assembly (NHA), the PMAs generally have tighter tolerances and in some instances are made with more modern technology than OEM parts, resulting in more reliable, longer lasting parts.”

PMA products are not all components and widgets. Texas, USA-based NSL Aerospace has produced PMA sealants for aircraft for well over a decade, for use

You really know when some kind of technical entity has become part of everyday vocabulary when the adjective becomes a noun and then moves to a verb.

According to the US Federal Aviation Administration (FAA), ‘Parts Manufacturer Approval (PMA) is a combined design and production approval for modification and replacement articles. It allows a manufacturer to produce and sell these articles for installation on type certificated products.’

In keeping with the opening sentence, articles manufactured according to that approval – PMA parts – have simply become known as PMAs and the process is regularly described as ‘to PMA a part’. Such is the depth of use of these parts in the aviation industry as they compete on



“We’re seeing lessors accept PMA parts, especially when tied to the operational cost of their property”

on aircraft fuel tanks, access doors and the fuselage. “We can’t speak to the PMA potential for all sealants, but we can say that the FAA has a rigorous approval process for any sealant to be offered as a PMA. In 2008, our NSL PMA sealant was the first one ever approved through this standardised process,” declares Jim Carney, NSL’s president and co-owner.

As with other products, when developing its PMA sealants, NSL has a process to go through to equal or improve upon OEM sealants. “The FAA prescribes a standard procedure for any part seeking PMA approval. This guides applicants in the approval process,” Carney confirms. “We went through the same process with the FAA as any other PMA part. We developed our sealants through this testing process, matching the quality of the product to the OEM and also creating rapid cure versions for three of the products.”

Returning to engineered parts, the constant challenge for PMA manufacturers is to persuade potential customers that it is worth their while to use PMA parts. “Pre-Covid-19, HEICO’s most effective technique was to invite potential customers to tour the various facilities and see, first-hand,

the development, manufacturing and inspection of HEICO parts,” Barmoha reports. “Some of our most effective ‘salespeople’ are HEICO team members, who take pride in showing our customers what it is that we do.

“During the Covid-19 pandemic, the renewed customer focus on maintaining high quality standards and reducing maintenance costs, has brought more customers to us for our HEICO FAA-PMA parts.”

Wencor also has its own way to fight the OEM challenge. “We focus on a key message in the Wencor value proposition; the Wencor ‘ARC’ – availability, reliability and cost,” Abelson says. “Historically, many customers have purchased PMAs primarily for cost reduction. However, we have found the global pandemic has magnified a trend where PMAs have become equally important as a safeguard for continuity of supply.

“With many leading OEM supply chains suffering significantly, resulting in stock outs or lengthy lead-times, Wencor took proactive steps to protect our top selling PMAs and stands ready to support the market’s immediate requirements.”

80

Jet Parts Engineering releases about 80 new PMA parts per year and has been able to find high value parts for its customers, says vice-president, sales and marketing John Benscheidt

Significant factors when trying to sell in the face of OEM competition include the latter’s support packages to dissuade PMA usage. One example is CFM’s ‘TRUEngine’ programme, which designates qualified engines as those maintained ‘in accordance with CFM manuals and recommendations’ and which use ‘TRUEngine LLP (life-limited parts)’.

Jet Parts Engineering’s Benscheidt counters this approach, claiming that acceptance of PMA parts is not about safety or reliability, but economics. “In the past, major OEMs would use fear, uncertainty and doubt as tactics to dissuade airlines from using PMA parts. Since it has been proven many times that PMA parts are just as safe and reliable as OEM parts, airlines aren’t being persuaded by such tactics anymore,” he argues.

“OEMs therefore shifted their strategies to threats of voided warranty if PMA parts are installed; the settlement a few years back between the International Air Transport Association (IATA) and CFM was a step in the right direction to eliminate these anticompetitive measures, but there is still a long way to go.

“Education within the industry on the value that PMA parts bring – not only in direct cost savings but providing a competitive marketplace – will ensure that innovation and service levels don’t stagnate. We focus a lot of our attention on this type of education.”

Lessors play a big part with airline operators as well, but not all are fully supporting their airline customers, Benscheidt argues. “They want to free airlines from the burden of purchasing an aircraft or engine, but then resist providing additional benefits by allowing

Clockwise from left: HEICO's internal requirements "go above and beyond" FAA requirements; Wencor Group's messaging focuses on 'availability, reliability and cost'; Wencor's newly opened innovation centre in Provo, Utah

the use of PMA parts," he says. "This is driven by the fear that residual values could be affected in a market split on PMA acceptance. In these cases, the airlines have to push back when negotiating lease terms to protect their longer term operating costs. We're now starting to see lessors willingly accept PMA parts, especially when they're tied to the operational cost of their property."

As lessors and other customers increasingly accept PMA parts, their manufacturers continue to add new products to the market and are looking for increased uptake. "Jet Parts Engineering releases about 80 new PMA parts per year and we've been successful in finding high value parts for our airline and MRO customers," says Benscheidt. "Recent examples of these have been the CFM56-7B fan blade spacers (PN 340-001-262-0) which get damaged when technicians remove the adjacent fan blades for regular inspection.

"JPE now has a 100 per cent solution providing new PMA parts and a DER repair of OEM parts with exchanges. Many customers have found this to be a perfect answer to their high costs and part availability needs, associated with repetitive inspections. Another group of parts recently developed are JPE's 737NG landing gear PMAs (PN 161A1158-1, 162A1527-1, 162A1526-1 and 161A1163-1). When combined, these will greatly reduce the overall cost of an overhaul."

As noted above, HEICO develops around 500 new PMA parts each year. "From engine parts to window shades, from avionics to thrust reversers, HEICO

parts can be found in almost every ATA chapter," Barmoha says. "Typically, each part we bring to market has one or more partner customer committed to buying the part. During the Covid pandemic, we have seen our existing customers approve more HEICO parts, and have helped new customers develop their PMA strategies in preparation for the expected post-Covid recovery."

Preparations for a post-pandemic market have also been the subject of forethought at Wencor. "During the pandemic, while many in the industry conservatively retrenched, we opened our new innovation centre in Provo, Utah on 1 May 2020," Abelson recounts.

"This facility – covering approximately 70,000sq ft – combined with our other US offices, allowed us to produce the highest number of new PMA parts in several years. These approvals, from our ACO (Aircraft Certification Office) partners and/or our ODA (Organization Designation Authorization), covered

numerous products types on all major platforms.

"While we generally focused on our sweet spots of pneumatics, power and hydraulics, we are developing parts across the aircraft, engines and interiors and our recent approvals included parts or NHAs in ATA 21, 24, 25, 27, 29, 32, 36, 38, 49, 71, 72, 73, 75, 78 and 80 as we continued to expand Wencor's 10,000+ strong component solution portfolio."

At NSL Aerospace, while there have been significant recent developments, these have not been in new PMA sealants. "We have continued to expand the list of eligible aircraft that they can be used on – Airbus, Boeing and other major aircraft," reports Carney, while explaining that the company originally selected which sealant types 'to PMA' based on what was most commonly used.

"Our PMAs have been a steady product line since conception in 2008. But since the beginning of the pandemic, we have brought on board many airlines and major MROs because our PMAs offer shorter lead times, the opportunity for significant cost-savings and [the chance] to replace major sealant manufacturers," Carney says.

"Because our PMA sealants can be used on the majority of aircraft, we have been able to step up and help customers who are experiencing significant delays in lead times. This is a competitive advantage for us."

Whatever language is used to describe the processes and products in this sector, PMA manufacturers are now in a position to impress upon potential customers that any one of their parts is the definite article. **W**





RECONFIGURING FOR A NEW REALITY

Having already gone through a cultural shift in the six years since it was formed, 2Excel Engineering found itself needing to reconfigure the business again as a result of the Covid-19 crisis. The company is now in a position to prosper, as **Jason Holland** discovered during a visit to its facilities in the south of England

Clockwise from main image: 2Excel's hangars are now a hive of activity and efficiency; a SkyUp Airlines aircraft arrives; a 'Get Well' plan has transformed the business



“Since 2015 there has been a constant progression of operational, procedural, legal and commercial changes”

as a drum. This is not a place to make money, but a place to deliver a service so that other people can make money on the back of it. That's an interesting conundrum. It's a fickle, capricious global market and to compete in it from Hampshire is quite difficult.”

Competing, though, is exactly what 2Excel Engineering is doing – despite the recent triple shocks of the 737 MAX grounding, Brexit and especially the Covid-19 crisis. But to get to a position where the company could survive and compete during the pandemic required a complete cultural shift – a six-year (and still ongoing) process which boils down to it becoming efficient, reliable and respected, while getting full employee buy-in.

A big statement internally was required, which Norton describes as: “This is not a cottage industry anymore, we are going

Walking around 2Excel Engineering's headquarters in Hampshire, UK, the stark contrast between the old ways of working and maintaining aircraft and the new, more efficient methods implemented by CEO Chris Norton and his leadership team is clear.

There has been a dramatic turnaround at the site in the six years since ATC Lasham went into administration in 2015 and 2Excel Engineering was formed out of the ashes by Norton and a group of shareholders.

MRO Management was recently given a tour of 2Excel Engineering's hangars and offices, on a site whose aviation and MRO history goes back 70 years. At once you get a sense of the experience and expertise that such a long history would suggest. The recent touches of modernity brought about by investment into the site and the company's people, processes and equipment is also obvious. Production planners and check managers' offices

have been brought into the hangar to be close to the maintenance work going on; all tools and parts are now comprehensively labelled amid a digital, trackable system that is made possible by the extensive use of MRO software; and highly skilled technicians go about their business, happy to explain the role they are playing in the efficient and impressive operations.

Yet in some areas you can tell the site is 70 years old, and in darker corridors and hidden spaces, remnants of an older approach to business remain – now unused, deteriorating rooms that previously served as work silos or break areas, betraying a lack of communication and organisation, are ripe for development and reintegration into the wider 2Excel Engineering business [which operates as an independent organisation despite its links to aviation services business 2Excel Aviation].

“The engineering skills here are amazing, and that is what we can't lose,” says Norton. “How we harness those skills and make them relevant commercially to the market as it changes is vital.

“Providing a vision that employees believe in is absolutely necessary to make this place function: the market is tight





Above: Employee morale is sky high following a tricky period of reconfiguring as a result of the Covid-19 crisis



Above: Clear workflows have improved productivity

to become a factory, and you are going to become a production line, and we are going to run and control things.”

Many processes were largely recorded using “post-it notes and scraps of paper”, he explains. The years since 2015 have been a constant progression of operational, procedural, people, legal and commercial changes under an umbrella ‘Get Well’ plan.

This plan involved strengthening the company structure, improving procedures and infrastructure, giving people training and “making them leaders”, while recruiting people to fill critical posts. “We unloaded the overtasks – there were massive responsibilities sitting on a very small number of shoulders and they just couldn’t cope,” explains Norton.

2Excel Engineering also implemented a safety management system, and improved information accuracy so it was clear to everyone what was going on in the business and its workflows. “The bottom line is making sure everybody cared,” says Norton. “That’s the culture change – making everyone realise ‘this is your life’.”

2Excel Engineering has also transitioned from an initial over-reliance on a few clients to having a wider spread of customers. “Breadth is resilience, you do not want to be beholden to a single customer, or they can take you down,” notes Norton.

All these changes led to the creation of an operationally efficient business

that was winning trust and respect both externally and internally, had expanded Airbus approvals, and had gathered in all third-party risks. “We could go to customers and say, ‘This is why we are charging you this price. This is the work we did and we can justify every part of it,’” explains Norton. “It’s about creating partnerships so that airlines respect us and we respect them – they know they get a really good service, and we know that we are treated properly.”

But then the Covid-19 pandemic hit. 2Excel Engineering reacted quickly, matching capacity to demand, and increasing its focus on lessors. A long-term contract with Easyjet was even secured in October 2020. The UK government’s furlough scheme helped: about half of the company’s employees were furloughed in the initial stages of the crisis, with a rotation system in place to ensure everyone remained engaged.

By August, a reconfiguration plan was set, which would turn 2Excel Engineering into a functionally driven organisation with different lines of reporting introduced to create internal efficiency improvements. “The person telling you what to do every day might not be the same person who has the skills to line-

manage you,” explains Norton. “The new system has really worked, delivering increased control and productivity.”

Through the pandemic year, the company managed to run flat – turning a £6,000 profit – a result which Norton describes as “exceptional”. “This year will be the same but we can’t rely on furlough, so we will sell our way out of it, and we are actively doing that,” he adds. “We want to increase turnover by 15 per cent and get back into growth, give jobs to apprenticeships, but control costs to within an inch of their life. Morale is now good, after a rocky period of making redundancies. And customers are happy and impressed with our delivery.”

In short, 2Excel Engineering is no longer just surviving and competing – Norton now believes it is in a position to flourish. That’s why he is taking a step back from the business later this year, handing over the reins of the company to current chief operating officer Matt Caswell, whose business knowledge and practical experience makes him a respected figure among both shareholders and shop floor employees.

“We’ve reacted, survived, reconfigured and recovered – and next year we will prosper,” states Norton. “The business is now stable, and that’s why I’m handing over to Matt. I’ve still got personal money invested here though, so I would not go if I didn’t trust him to run it and not lose my money!”

“The business is now stable. We’ve reacted, survived, reconfigured and recovered – and next year we will prosper”

TOP TABLE

2Excel Engineering CEO **Chris Norton** discusses the outlook for the MRO market and why the Covid-19 crisis might lead to permanent changes, as well as the strategies that will be needed to ensure future success

How do you evaluate 2Excel Engineering's reconfiguration in light of the pandemic?

The sun hasn't been shining over this past year, but we've used the time well. Where we've needed to look introspectively and make ourselves better, we have. Where we've looked to recruit people from the labour market, that has much fewer jobs, we've recruited the best people. We've got good people and processes; we're ready for a bounce – whatever that bounce is.

We have the ability to scale up very quickly. We would employ more people if we could guarantee there was more work to be done, so we would grow back into what we were before the Covid-19 crisis.

At the moment, we sit at 60 per cent of the capacity we had last year. We were forecasting that to rise somewhere between 10 and 15 per cent for us – but that's us fighting for our bit of the market, not the market increasing by 15 per cent.

How do you see the wider MRO market?

People are coping with the crisis in lots of different ways. We refocused very quickly to the lessor market and we've got good relationships where we're respected and liked and trusted by customers. That puts us in a good place. Other people have cut costs in order to get through the crisis and locked down to minimise costs.

Some countries are providing great state aid but perhaps there is no activity going on. It does take time to re-accelerate to a post-furlough speed. Different countries and companies are affected in different ways according to the way their governments have acted, the way their CEOs and the board have acted, and to the market they serve.

Do you see there being permanent changes as a result of the Covid-19 crisis?

A lot of aeroplanes have been parked up, and a lot of them won't go back: at least 10 per cent of the fleet that was flying 16 months ago won't fly again. That's going to affect the spares market, the



The 2Excel Engineering ship is a good ship and it's on a steady course. We've got the momentum and we're capitalising on that

CHRIS NORTON

availability of the aeroplanes market and the value of that market. That directly affects business models, so there's a lot of knock-on effects of taking 10 per cent of capacity out of the market. That trickles down to MROs as they are serving the capacity. An independent MRO is serving the under-capacity in the market, so when suddenly there is enough capacity it means fighting for your piece of the cake is really interesting, and necessary.

How important is the company's apprenticeship programme?

It is one of our beacons of modern life. There are not enough people in the

STEM subjects at school, and that was resulting in not enough engineers, not enough diversity – we don't get enough females or enough ethnic minorities. Many of our ethnic minority employees have been recruited from abroad.

So being more diverse, inclusive and appealing to our local and wider area as an aerospace environment and a sector people want to work in for a job for life – one of the things we can do is have an apprenticeship programme. It's really worked in many respects, but hasn't improved diversity; it's mostly white males. We're still not appealing to a wider recruitment pool. But we've been able to give jobs to all of our apprentices – that's the purpose of it. We want to train our own people with our culture, who want to stay here and make a success here in the long term. So far it's working.

As you hand over the leadership of 2Excel Engineering to Matt Caswell, what do you see as the main challenges and opportunities for him?

We've had three strategic shocks in the sector – Brexit, the grounding of the 737 MAX and Covid-19 – in the last three years. So what's the next shock going to be and how are you going to deal with it?

The 2Excel Engineering ship is a good ship and it's on a steady course. We've got the momentum now and we're capitalising on that to consolidate the change we've been trying to make over a longer period of time – nearly six years. Matt will have to be alive to the changing context, the changing sector, the changing requirements, looking up and out and not getting dragged into the day to day of just running the ship.

What is the one main lesson you have learned from the pandemic?

Relevance is key. You have to earn respect and trust, so it is a long road. You can destroy a relationship in seconds by doing something wrong or bad. ☹



ROOM *for* GROWTH

The Covid-19 crisis might have forced the suspension of some projects, but the outlook for hangar design and construction looks bright as the aviation industry rebounds and opportunities emerge. **Jason Holland** reports

Aircraft maintenance hangars are long-term investments for their owners and operators. Designing and building them requires detailed analysis of an operator's MRO requirements and careful planning of a site's layout and features.

"When planning and building an MRO hangar, the primary considerations are the business case and the location," says Ted Oberlies, senior vice-president of the Aviation Group at Ghafari Associates, an engineering, architecture, process design, consulting and construction services firm.

"The schedule of operational requirements is the first criteria for planning, including the fleet size and composition, the customer base – such as whether it is airline-dedicated, third-party or mixed – and the depth and variability of service to be performed."

Listening carefully to the client's brief and ensuring that their expectations are met is vital, according to Richard Hanson, project director at steel building design specialists REIDsteel. However,

Left: Jewers Doors has built a strong reputation in the Middle East
Below: Rubb structures are modular designed, which helps to reduce the overall structure weight



designers and engineers must also ensure compliance with any planning and safeguarding restrictions which may apply.

“The customer is the one who knows most about how they want to operate their facility and it is our responsibility as a hangar designer to accommodate the very large spans, hangar door and crane requirements needed to fulfil those requirements,” says Hanson.

“When building a facility, one has to work within crane jib heights mandated by the airport, detail the building materials to eliminate the risk of foreign object damage hazards from wrappings and packings, and have work available on numerous fronts to ensure the impact of downtime due to inclement weather is minimised.”

Given the length of time hangars will be in use – often in excess of 40 years – forecasts must also be made about business and MRO growth, as well as fleet diversity, expansion and next generation aircraft specifications.

“Flexibility should be a driving factor when and where practical,” notes Oberlies. “The location and site parameters are also fundamental factors for facility siting, design and construction. These factors define the opportunities and constraints for development, such as airfield interfacing, airside/landside connection, aircraft ground travel, staging, as well as facility orientation, phasing and expansion potential.”

Despite being long-term investments, hangar construction projects will not have escaped the impact of the Covid-19 crisis. Oberlies says that while projects with government or public-private financing have seen limited impact, the same cannot necessarily be said of privately, often airline-funded, projects. “We’ve seen suspensions or postponements of projects, in some cases with construction alone and in others with design as well,” he says. “It was dependent on funding control and near-term uncertainty.

“When airlines cut schedules and fleets were substantially parked, airline/third-party MRO real estate groups largely adopted a ‘wait-and-see’ approach. We did not witness a stray from original facility plans, just a pause.”

Despite this, Ghafari proceeded with designs on two major MRO projects, one in Europe and one in the US, Oberlies says. “While last year’s dramatic reduction in active fleets curbed project urgency, we’ve further witnessed an encouraging rebound in project activation and schedule recovery.”

There was also a suspension or slowing of ongoing improvement projects in 2020, both in design and construction. “In such cases where there was a strategic advantage to complete construction (while operational demand was muted), those projects continued or were completed,” says Oberlies. “In some markets where construction costs have recently escalated, this proved additionally beneficial.”

Hanson says REIDsteel has been involved in many adaptations of existing facilities such as replacing doors, increasing door sizes, extending building lengths and increasing building heights. “Each project requiring an upgrade is unique and will have its own challenges which we can discuss with the client,” he explains.

Despite the Covid-19 impact, Oberlies says the outlook for hangar design and construction looks bright. “Developments and opportunities that we recognised pre-pandemic are gaining traction as the air transportation rebound accelerates,” he says. “In North America, for example, new construction or expansion of heavy and dedicated MRO centres has increased significantly in the past several years, with masterplans for more.

“In terms of base and line maintenance centres, we anticipate new hangars emerging as the result of renewal, expansion, and relocation needs at larger gateway and hub airports. Meanwhile, as point-to-point traffic grows, we may see more

91.5

In 2016, Rubb designed, engineered and installed a twin span hangar for Easyjet at Gatwick Airport, measuring 91.5m wide by 60m long

4.0

Digitalisation and the evolution of ‘Industry 4.0’ will continue to drive design considerations for new MRO facilities



ABOVE: As companies invest again, Butzbach's project pipeline is full

12

Butzbach has been looking after AMAC Aerospace hangar projects in Basel for 12 years

hangars developed to service new return over night aircraft scheduling.”

Digitalisation and the evolution of ‘Industry 4.0’ also continue to drive design considerations for new MRO facilities. “While we still support conventional and legacy systems and equipment, we’re planning for more automation, visuals and collaborative robotics in aircraft maintenance work environments,” says Oberlies.

“We’re also planning for the transition to digital task processing, remote supervision and inspection, as well as smart tooling that will inevitably improve flexibility, safety and cycle-time in the hangars and shops. The big data and predictive maintenance advancement will afford dynamic task scheduling and work balancing that should yield better turnover, quality and reliability.

“From engineering and supply chain to the hangar floor, these technologies will present opportunities and refined processes to reduce waste and cost. Consequently, we should see operators getting more return out of hangar facility investment in the years ahead.”

Fabric solutions

Companies offering temporary or semi-permanent solutions such as inflatable or engineered fabric structures note that the Covid-19 crisis might also have accelerated interest in their solutions – mainly on a cost and timeframe basis, according to Ryan Clarke, sales executive at Rubb Buildings, a company which offers relocatable and permanent engineered fabric tensioned buildings.

“Traditional hangars take longer to design and construct, and also cost more,” he explains. “Airlines don’t have as many funds as they did pre-pandemic, so they need something quick and affordable to meet their requirements.”

Compared to traditional hangars, Clarke says Rubb structures are “modular designed, which helps to reduce the overall structure weight. The fabric has a manufacturer’s warranty of 10 years, but Rubb hangars have been in use around the world and have proven to last more than 40 years with the original PVC sheets. Rubb hangars can also be insulated using ‘Thermohall’ PVC cladding technology.”

In 2016, Rubb designed, engineered and installed a twin span hangar for Easyjet at Gatwick Airport, measuring 91.5m wide by 60m long. To meet increasing demand, Easyjet approached Rubb in 2020 to expand the MRO facility with a third hangar, measuring 47m wide by 50m long, which brought the total width of the hangar to 139.1m.

Rubb also recently supplied a large MRO hangar for Turkish Airlines and maintenance support arm Turkish Technic. The 82.3m x 87.5m x 9.8m AVC type structure provides maintenance and repair facilities for Turkish Airlines’ fleet. The hangar is equipped with 50mm Rubb ‘Thermohall’ insulated cladding. The specialised architectural PVC deflects light and heat and is ideal for the climate in Turkey, according to Clarke.

Opening new doors

One of the key parts of a hangar construction project is the installation of specialist doors. “The size of the hangar door is important,” according to Katharina Ortner, head of marketing & communication at Butzbach. “As

Hangar Doors



Weathertight and insulated. The most reliable hangar door choice from Arctic areas to scorching hot climates.

CHAMPIONDOOR®

www.championdoor.com

HEAD OFFICE / FACTORY
Tel. +358 445 8800
info@championdoor.com

FRANCE
Tél +33 147 202 314
france@championdoor.com

USA
Tel. (713)-352-0403
us@championdoor.com

UAE
Tel. +971 488 103 31
uae@championdoor.com

BUTZBACH - THE DOOR COMPANY.®



Butzbach Hangar Doors Europe's leading manufacturer

With more than 900 hangar doors installed world wide, we are THE experts in our field. On the basis of this amount of experience, we have now developed a new modular design for our hangar doors. What's in it for you?

Here is how you benefit from this new system:

- Significantly reduced installation time on your construction site
- Less working space required on the construction site during installation
- Lifetime facility service and maintenance
- The highest quality standards due to an experience of hundreds of installed doors
- Better thermal insulation



Butzbach GmbH Industrietore
Weiherstraße 16
89293 Kellmünz

Tel. +49 8337 901-0
info@butzbach.com
www.butzbach.com

BUTZBACH
THE DOOR COMPANY.



Left: Rubb supplied a large MRO hangar for Turkish Airlines
Below: Jewers Doors completed a project for Gulfstream Aerospace at Farnborough Airport

“LISTENING CAREFULLY TO THE CLIENT’S BRIEF AND ENSURING THEIR EXPECTATIONS ARE MET IS VITAL”

space on airports is very limited, we offer different opening alternatives: for maximum flexibility we provide a system of sliding doors where all door leaves can be moved individually. Other possibilities are the telescopic sliding door system, the around-the-corner-door system (where the door can be installed inside or outside the hangar) or sliding doors with a tail door above the sliding door for very tall planes. Butzbach can also provide individually designed solutions.”

Germany-headquartered Butzbach offers a complete service for hangar doors, including sales, engineering, production, project management, installation and maintenance. It builds doors in all sizes, up to 32 meters in height and over 200 meters in width.

“In addition to our major customer Airbus, we also count Lufthansa Technik among our clients,” says Ortner. “Butzbach has looked after AMAC Aerospace hangar projects in Basel for 12 years. After the initial order in 2009, further doors were ordered from us.”

Looking ahead, Butzbach believes space at airports will become even more limited. “This mostly affects the installation of the door,” explains Ortner. “The optimisation of space and the reduction of the installation time will be a challenge for the industry.

“Additionally, radar radiation reflection, higher wind loads, better insulation, more safety and security and high availability will be in focus in the future. Another challenge in the near future will be the replacement of old doors, because it is easier to design a door for a new hangar than designing a door for an existing hangar.”

There are many variables which dictate which specialist hangar door best suits a particular hangar design, according to Jewers Doors director Jonathan Jewers. “This includes – but is not limited to – location, orientation, climate, space, height restrictions, ILS interference, operational requirements, single bay/multi-bay hangars, architecture and security,” he says.

renable hangar doors are pivotal to ensure that an aircraft can enter and exit a hangar without costly delay. “Doors can also be designed to accommodate any architectural design by the use of any type of cladding system,” says Jewers.

“This allow architects to highlight by design these exceptionally large and highly visible buildings which are often one of the first buildings to be seen as a passenger arrives at their destination. Airports are the primary international gateway to any country and these first impressions prove invaluable to new passengers arriving in that country.”

He believes the ‘Jewers Type 126 Horizontal Sliding Hangar Door’ is the “safest and most reliable hangar door system available”. The door is suitable for all climates and operating conditions, which Jewers says is invaluable to an end user “especially when carrying out quick turnaround overnight safety checks”.

Huge lifecycle cost savings can be achieved by using the best quality, highly insulated sliding hangar doors, Jewers notes. He points to his company’s ‘Esavian’ steel sliding hangar doors, which can be clad with any material, “meaning that the door can be architecturally designed and clad with any modern cladding system to set the hangar apart from other hangars”. Such sliding hangar doors also feature weather seal systems and are designed to withstand any wind pressure.

Ben Pritchard, regional sales manager at Jewers Doors’ Dubai office, notes a recent project in which the company designed, manufactured and installed its doors for DC Aviation Al-Futtaim, whose hangars were the first to be built and become operational from Dubai South (DWC). Pritchard says Jewers was selected based on a recommendation



Right: Champion Door says its solutions do not freeze or jam in cold conditions, and keep heat, sand and dust away in hot conditions

from Emirates Engineering. “Qatar Airways, Emiri Flight and General Aviation Hangars at Hamad International Airport, Doha, Qatar are all built with Jewers hangar doors,” notes Pritchard. “These are currently all of the hangars at [the airport] and were chosen due to our quality, reputation and service in Qatar over the last 20 years.”

Another hangar door option comes from Champion Door. The company’s technical director Baptiste de la Bouvrie says vertical lifting fabric fold-up doors offer an excellent alternative for large door openings and applications where good thermal insulation and resistance to varying conditions are required.

“Metal-surfaced and aluminium-framed doors cannot be built as large and are not as practical for all purposes,” he argues. “Champion Door offers a full support service to assist with designs, making choosing the right door solution as easy as possible. We put a lot of time into making sure the door meets the customer’s real needs. We make strength calculations for each door to ensure

that the door meets the requirements of the conditions for the specific site. The calculations are then verified by an outside party on behalf of our customer.”

Many traditional door solutions, as well as some fabric door types, are so heavy in construction that the architect must consider their weight in the design of the entire building. “If the doors open sideways, you must remember to reserve plenty of space for them on the sides of the door as well, as the door takes up a lot of space when opened,” de la Bouvrie says. The lightweight fabric fold-up door alleviates this problem, as the building does not have to be designed on the door’s terms.

“The door folds up when it opens, so there is no need to reserve any floor space for opening, and the space can be used for other purposes. A lightweight door doesn’t need heavy support structures to support it, so a fabric door can even save on construction costs,” de la Bouvrie explains.

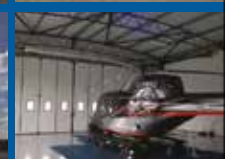
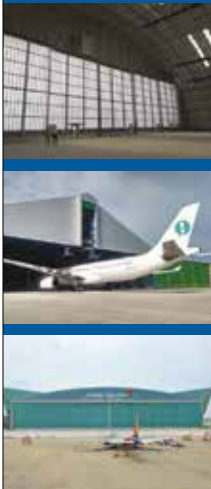
Unlike sliding doors, the fabric lift door also does not need rails to the floor, when moving sideways along the rails. “The door can be made with a company logo or any design,” de la Bouvrie says. “We have made a lot of very different types of doors. Of course, we also have our limitations, but we always do our best to make the building designer happy.”



[@Jewers_Doors](https://twitter.com/Jewers_Doors) [jewersdoors.co.uk](https://www.jewersdoors.co.uk)
 +44 (0)1767 317090 jjewers@jewersdoors.co.uk

World renowned door solutions for all your airside requirements.

MRO # FBO # GSE # Emergency Services



QATAR AIRWAYS

BRITISH AIRWAYS

easyJet

ROYAL AIR FORCE

RYANAIR

Emirates



MAINTAINING THE GEnx

The higher-selling of the two engine choices available for the Boeing 787 and the sole-source powerplant for the 747-8, GE Aviation's GEnx is one of the most important large-turbofan engine families in service today.

Chris Kjelgaard surveys the MRO landscape for the GEnx



Left: There are more than 2,700 GEnx engines in-service and on order, powering the 787 and the 747-8

The peak of the GEnx MRO market in terms of the number of annual shop visits could still be at least two decades away

GE Aviation has succeeded in achieving that fuel-burn target, according to Flip Martens, GEnx programme manager for Air France Industries KLM Engineering & Maintenance (AFI KLM E&M), one of GE's key partner organisations in the GEnx global MRO network. Both KLM and its sister company Air France operate GEnx-1B-powered 787s (KLM has 13 787-9s and five 787-10s in service, while Air France has 10 787-9s in operation). AFI KLM E&M handles the MRO for the GEnx engines of all of those aircraft, and those of a range of other airline customers, at KLM Engineering and Maintenance's Schiphol East MRO facility near Amsterdam. "The fuel consumption [of the GEnx-1B] is part of the reason that the 787 is the operators' aircraft of choice even in times of crisis," says Martens.

However, as GE Aviation itself concedes, the GEnx didn't manage to achieve its admirable fuel-burn reputation without several in-service technical hiccups along the way. The GEnx design issues which arose as a result of GE's efforts to develop an industry-leading engine in terms of performance and weight weren't altogether minor.

Two icing issues – one involving ice-crystal ingestion into the propulsor and, several years later, the other involving ice accumulation on fan blades breaking off in a PIP II-standard GEnx-1B – affected early GEnx-1B and GEnx-2B operations, causing diversions and engine shutdowns and leading to FAA airworthiness directives which required design changes from 2012 onwards. Another issue, abrasion of the engine inlet lining material by GEnx-1B fan blades, led to GE slightly reducing the thickness of the lining.

Hardware upgrades

As far back as 2011, GE Aviation certificated the first of two (so far) Performance Improvement Package (PIP) hardware upgrades for the GEnx-1B engine. GE's PIP I upgrade included a redesign of the engine's low-pressure turbine blade and stator aerofoils. Like the PIP I package, GE's subsequent PIP II hardware upgrade, which included changes to the high-pressure compressor stages, was designed to improve the GEnx's overall fuel-consumption performance.

To date, GE has also developed two hardware-upgrade packages designed to increase GEnx durability. Both were designed to improve time on wing (TOW), particularly for the GEnx-1B, which is not yet fully mature in terms of its TOW performance, according to Martens. That is true even for KLM, which Martens says boasts the industry's highest average daily utilisation rate for the Boeing 787, at nearly 16 hours.

"We expect an engine to be on-wing for 4,000 cycles before it is due for a performance-restoration shop visit. In the current phase of the programme, we need an extra [shop visit], with a small work-scope, before we get to 4,000 cycles," says Martens. "So time on wing is less than expected, but with the successive hardware upgrades we should get to the 4,000 mark."

Martens adds: "We believe the engine is slowly getting to be a mature engine. The OEM is putting in a significant effort to improve it." He estimates that the GEnx-1B will reach full maturity in terms of durability and average time on wing within the next three years. "I think the phased upgrades to an improved standard will help us increase time on



Due to reach its tenth anniversary of commercial service in October, the GE Aviation GEnx family of engines has established a firm following among operators of the Boeing 787 – for which the GEnx-1B is the much higher-selling of the two engine choices available – and the Boeing 747-8, for which the slightly lower-thrust GEnx-2B is the sole engine choice.

While some 787 operators (such as Air New Zealand) have opted to switch their engine selections for follow-on aircraft buys to GEnx-1Bs because of the highly publicised manufacturing defects that plagued operators of Rolls-Royce Trent 1000-powered 787s for several years, all GEnx operators are keen on the GE engine family's fuel-burn performance. In designing and developing the GEnx, GE Aviation set a goal of reducing the engine's fuel burn by 15 per cent compared with the CF6-80 family, its immediate in-house predecessor and one of the most dominant large-turbopfan powerplants of its generation.



4K

GE expects an engine to be on-wing for 4,000 cycles before it is due for a performance-restoration shop visit

70%

Estimates have put 787 flying throughout the pandemic at about 70 per cent of what it was before the pandemic began, according to AFI KLM E&M

Today the GENx MRO network consists of 14 facilities worldwide, 13 of which are active and the fourteenth of which soon will be

wing and lower cost for the operators,” he says. “Before that we are absorbing substantial additional cost for repairing and upgrading the engine.”

GE Aviation says today the GENx-2B is achieving an average time on wing 33 per cent greater than the GENx-1B because of the -2B’s lower maximum thrust and the different conditions under which it operates. (For instance, there are four GENx-2Bs on each 747-8 but only two GENx-1Bs on each 787, and far fewer 747-8s than 787s are based in or operate regularly to the desert environments of the Middle East.)

The GENx durability upgrades – the second of which GE introduced in 2018 for both the GENx-1B and the GENx-2B and retrofits of which are still ongoing as a result of the engine shop-visit slowdown caused by the Covid pandemic – were designed to solve a number of issues. They included cracking of high-pressure turbine blades and failures of the outlet guide vanes between the last HPC stage and the combustor.

The second durability upgrade – known as the Phase II durability upgrade and

particularly important for improving GENx-1B and GENx-2B durability in “hot and sandy” operating conditions, GE revealed in 2018 – includes design changes in the compressor-bleed cooling air holes in the combustor lining and combustor fuel nozzles. It also includes changes in the cooling-air flows to the HPT first-stage nozzle and the HPT first-stage blades.

Global MRO network

As with other turbofan engine types manufactured by GE Aviation and the CFM International joint venture in which GE is a 50-50 partner with Safran Aircraft Engines, GE’s philosophy in establishing a global network to perform MRO on GENx engines has been to make the network as open-source as possible.

The company has applied that philosophy in order to provide GENx customers with MRO price competition and at the same time ensure that the GENx MRO network for both the GENx-1B and the GENx-2B is highly global, so that customers don’t have to ship engines round the world every time

a GENx needs a shop visit, according to Brian Pfeiffer, GE Aviation’s director of customer services.

Today the GENx MRO network consists of 14 facilities worldwide, 13 of which are active and the fourteenth of which soon will be. Six of the existing facilities are shops and support facilities owned by GE Aviation: Celma in Petropolis in Brazil, GE Caledonian at Prestwick in Scotland, and GE facilities in Ohio, London, South Korea and Doha in Qatar. A seventh facility is GE’s GE Evergreen Engine Services joint venture with Evergreen Aviation Technologies in Taiwan.

Together these seven shops are handling from 60 to 70 per cent of GENx shop visits at present, Pfeiffer estimates. The remaining 30 to 40 per cent of GENx shop visits are being handled by the six partner facilities in the current GENx MRO network, though Pfeiffer expects these facilities to handle a greater proportion of the total GENx work over time.

Today the GENx MRO partners are AFI KLM E&M (which Martens estimates is handling “close to 10 per cent” of all GENx shop visits at present); Lufthansa Technik (including its Xeos JV facility with GE in Poland, which handles GENx-2B MRO); Sanad Aerotech in Abu Dhabi; Air India; Japan Airlines; and Ethiopian Airlines, which in February successfully ran its first GENx-1B

Left: AFI KLM E&M has eight GEnx customers at present
Below: The number of shop visits to be handled by the global GEnx network in 2021 will be lower than in 2019

post-MRO correlation test in its large test cell at Addis Ababa, after the engine had been through a shop visit in Ethiopian's facility.

Today the latter three carriers' shops are largely handling shop visits for engines powering the carriers' own aircraft fleets, but the others – particularly AFI KLM E&M and Sanad Aerotech – are handling shop visits for a variety of operators. Sanad's GEnx customers include Etihad Airways, Royal Jordanian and at least one other Middle East-based carrier. Martens says AFI KLM E&M has eight GEnx MRO customers at present and expects to maintain and grow its existing market share going forward as the numbers of operators of GEnx-powered 787s continue to increase.

New 787 operators will arise both in the ranks of carriers which have ordered new 787s, but haven't yet taken delivery of them, and also among carriers which agree new leases on 787s returned to lessors by operators after the ends of primary lease terms. AFI KLM E&M is particularly interested in the potential opportunities that the latter market may offer, according to Martens.

GEnx MRO capacity

Although GE Aviation declines to divulge the number of GEnx shop visits the global network will handle this year, Pfeiffer confirms the number of shop visits the network will perform

GEnx MRO business is “comparatively good considering the situation in the market, but could do a bit more” in terms of throughput

in 2021 is lower than the number it handled in 2019, as a result of the overall effect the Covid pandemic has had on long-distance passenger air travel over the past 20 months. However, the number of shop visits this year will be significantly higher than in 2020, he says, as the pandemic begins to wane in many developed nations.

However, the GEnx MRO market has probably fared rather better than the MRO markets for some other large-turboprop engine types throughout the Covid-19 pandemic, for two reasons. One is that while Boeing 747-8I passenger operations have been greatly reduced, the consequently greater need for freighter-aircraft capacity has kept the Boeing 747-8F freighter fleet fully occupied.

Second is that many airlines have preferentially kept their 787s in service and grounded other passenger-widebody types, because of the 787's excellent fuel-efficiency and its suitability as a mid-sized widebody for many passenger markets which have seen substantial capacity reductions. Estimates have put 787 flying throughout the pandemic at about 70 per cent of what it was before the pandemic began, according to Martens.

Pfeiffer says the global GEnx MRO network has enough capacity to handle total expected annual shop visits “probably out beyond 2023”, adding that “as we get past 2023 we will invest to raise capacity” if needed.

“Our goal is always to be about 10 per cent above actual annual shop visits,” he says. This ensures “we have capacity available to handle a little bit of lumpiness” in the market, for instance if operators were suddenly to restore all of their 787 flying en masse as the pandemic subsides, creating a consequent need for large numbers of shop visits a year or two later.

“One of the things that has been fortuitous for us is the hard capacity we put into the network early,” says Pfeiffer. That allows GE to re-evaluate the GEnx MRO capacity situation when the Covid pandemic has receded globally, when airlines reactivate all their 787s and as GE finds out just how much “green time” each currently stored GEnx engine has in terms of remaining cycle life before it next requires a shop visit for replacement of life-limited parts or for repairs or hardware upgrades.

“It buys us time to make those big decisions” on how best to grow the GEnx MRO network's overall capacity for future shop-visit requirements, says Pfeiffer. GE has three basic choices in how it may be able to do so: add more partner facilities to the network; invest in increasing the capacity in its shops; or invest in growing the capacity of its partners' shops. A fourth option to grow the network might be a combination of the first three options, adding partners where desirable and making strategic investments where necessary.

Pfeiffer thinks the peak of the GEnx MRO market in terms of the number of annual shop visits is still at least two decades away, because of the fact that sales of new 787s are continuing at fairly high volume and that, while 747-8 production is finishing soon, no end to 787 production is remotely in sight. “The shop-visit peak will probably be beyond 2040,” he says.





Left: AFI KLM E&M handles GENx MRO at KLM Engineering and Maintenance's Schiphol East MRO facility near Amsterdam for its parent airlines and third-party clients

GE Aviation set a goal of reducing the engine's fuel burn by 15 per cent compared with the CF6-80 family

GENx shop visits today

As probably the leading third-party partner in the GENx MRO network in terms of current market share, AFI KLM E&M's MRO experience of the GENx-1B engine (it doesn't handle the GENx-2B) is likely to be typical of that of most operators of GENx-1B-powered 787s. Martens says that, as of early June, AFI KLM E&M had seen a total 165 GENx-1B inductions since beginning MRO on the engine.

The majority of AFI KLM E&M's GENx-1B inductions to date have been for minor work-scopes such as repairs or hardware upgrades, but performance restoration shop visits involving extensive work-scopes have started recently, according to Martens. He expects the numbers of GENx shop visits handled by AFI KLM E&M annually to grow as the Covid pandemic recedes and also because the GENx-1B's market share on the 787 has grown over the past few years.

"We see [shop visits] peaking a little in two or three years," he says. While AFI KLM E&M has only "done a handful" of GENx-1B performance-restoration inductions to date, Martens also sees the numbers of performance-restoration shop visits handled annually by the company growing as in-service GENx-1Bs accumulate more cycle life and as average time on wing increases.

Much of the repair work AFI KLM E&M has performed to date has involved "a number of hot-section fixes", the company having treated several combustor and HPT technical issues in

particular. Those areas have largely been those where fixes have been required in order to get the GENx-1B to its intended 4,000-cycle time on wing between scheduled shop visits.

During the pandemic, "people are trying to delay shop visits to the maximum", says Martens, because airlines' scheduled passenger flying and revenues are substantially down. GENx MRO business is "comparatively good considering the situation in the market, but we could do a little bit more" in terms of throughput. "More flying could generate some catch-up," he notes.

GENx MRO lessons for GE

"We spent a lot of time studying the CF6 and the GE90, in designing the GENx," says Pfeiffer. One important lesson the company learned in making GENx MRO easier was "how to really transport the engine round the world" to make moving engines for MRO as easy as possible.

In that sense GE learned a lot from its experience with the GE90, like the GENx an engine with a very large fan. "So we developed the split-engine philosophy: we take the fan off" – in fact it is often left on-wing on the aircraft, according to Martens – "and we just ship the propulsor" for repair or a hardware upgrade.

GE also learned a variety of other lessons from its experience in designing, testing and performing MRO on the GE90, which until the advent of the new GE9X and the forthcoming Rolls-

Royce Ultrafan was the largest turbofan engine ever developed. For instance, GE learned how better to design the airflow in its large-engine test cells, according to Pfeiffer. "And we used some GE90 learning from shop visits to develop new inspection technologies, cleaning technologies and repair technologies."

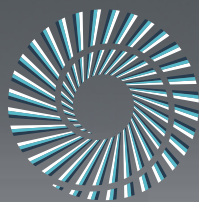
Because of the fact that in-service GENx engines were found to require shop visits earlier in their cycle lives than GE had expected, "we spent a lot of time studying the failure modes" of the engines, says Pfeiffer. This led to GE "adjusting on-wing and shop technologies to handle the distressed hardware [better]. Now we're starting to see benefits from that: the [additional] shop visits aren't proportional" to the extra time on wing the engines are now beginning to achieve.

165

As of early June, AFI KLM E&M has seen a total of 165 GENx-1B inductions since beginning maintenance work on the engine

"We're constantly looking at new inspection and repair technologies," says Pfeiffer. "We're constantly trying to use artificial intelligence and imaging technologies, including robots that can move into very tight spaces and do almost-arthroscopic surgery [on GE9X engine parts]. Our goal is to keep the engine together as much as possible."

Where GE has learned from its MRO experience with the CF6-80 and GE90, it can also use what it is learning from designing the GENx for ease of maintenance to apply to the MRO technologies and techniques for those earlier engines and for future engines such as the GE9X, says Pfeiffer. Its experience with the GENx "is highly leverageable, both backward and forward".



**AERO
NORWAY**
Quality Engines

unequivocal precision assured engine performance

Aero Norway is an independent engine MRO delivering globally recognised flexible worksopes for CFM56-3C/5B/7B series engines.

Skilled and experienced technicians combine a fresh Norwegian spirit, with a long and proud international heritage to provide fast turnaround, quick slot inductions and a range of highly competitive and reliable engine services that are multi-release FAA, EASA, CAAC amongst many others.

It's precisely why operators choose Aero Norway.

aeronorway.no



AVIATION *Business News*

Exclusive features, industry interviews, expert opinion and all the latest news from the cabin, cargo, MRO and low cost & regional airline industry

 aviationbusinessnews.com



ECO-CENTRIC

Liebherr-Aerospace is working on a performance plan which will enable MRO customers to benefit from an overarching environmentally responsible approach

Eco-responsibility in the MRO industry means performance. That's the key tenet of Liebherr-Aerospace's new sustainability plan.

The company, which develops, manufactures and services aircraft flight control and actuation systems, landing gear, air management systems, on-board electronics as well as gears and gearboxes, says its entire customer service network is taking a long-term sustainability approach covering the entire product lifecycle.

As an OEM that is heavily involved in the maintenance of its products through a global network, Liebherr-Aerospace designs its products to be repairable and recyclable. Indeed, these criteria are taken into account from the first phases of development.

In order to minimise a 'scrap and replace' approach to parts, all equipment is provided with associated documentation to perform OEM-approved maintenance and repairs. Liebherr's teams regularly develop salvage repair solutions for piece parts through the company's 'Design

"The next challenge will be to deal with intensive maintenance or high fuel consumption of aircraft near their end-of-life"

Organization Approval' (DOA) agreement. Solutions such as upgrades and modifications enable operators to extend on-wing life, to manage obsolescence, to optimise repairs and to reduce noise emissions and consumption while enhancing flight performance.

"The next major challenge for air transport will be to deal with intensive maintenance or high fuel consumption of aircraft coming to their end-of-life," states Liebherr-Aerospace. "To meet that challenge, the aircraft will be dismantled and still useable products will be induced into recycling: various Liebherr equipment will be extracted and repaired as needed to feed inventories and pools."

Additionally, Liebherr-Aerospace has committed to reducing its environment impact, and to managing closely its environmental risks – whether related to pollution, emissions or to dangerous products handling.

A dedicated project team will deploy and implement sustainable processes for the repair and maintenance of Liebherr products in its network worldwide.

The ongoing digital transformation of Liebherr's MRO activities is also contributing to the company's environmental performance.

Documentation is now paperless – in order to avoid printing and shipping, 450,000 pages from 3,000 documents have been made available digitally for customers within the Liebherr network.

The company is also deploying health management services "that help our customers to optimise the localisation and to adjust the dimensioning of inventories", according to Liebherr-Aerospace & Transportation VP MRO Operation & Strategic Investment Sven Dicke. He adds: "In parallel, our teams are working on digital smart MRO solutions enabling the generation of more value while consuming fewer resources due to leaner direct processes."

These initiatives combine performance with eco-responsibility as they shorten turnaround time and lead to longer on-wing life; equipment is also being reused. That's the power of performance. ©

AIRCRAFT LIVERY TRANSITION MADE EASY

COMPETITIVE - CERTIFIED - SHORT TURNAROUND



picture credits: Andre Maute



picture credits: Howard Chaloner

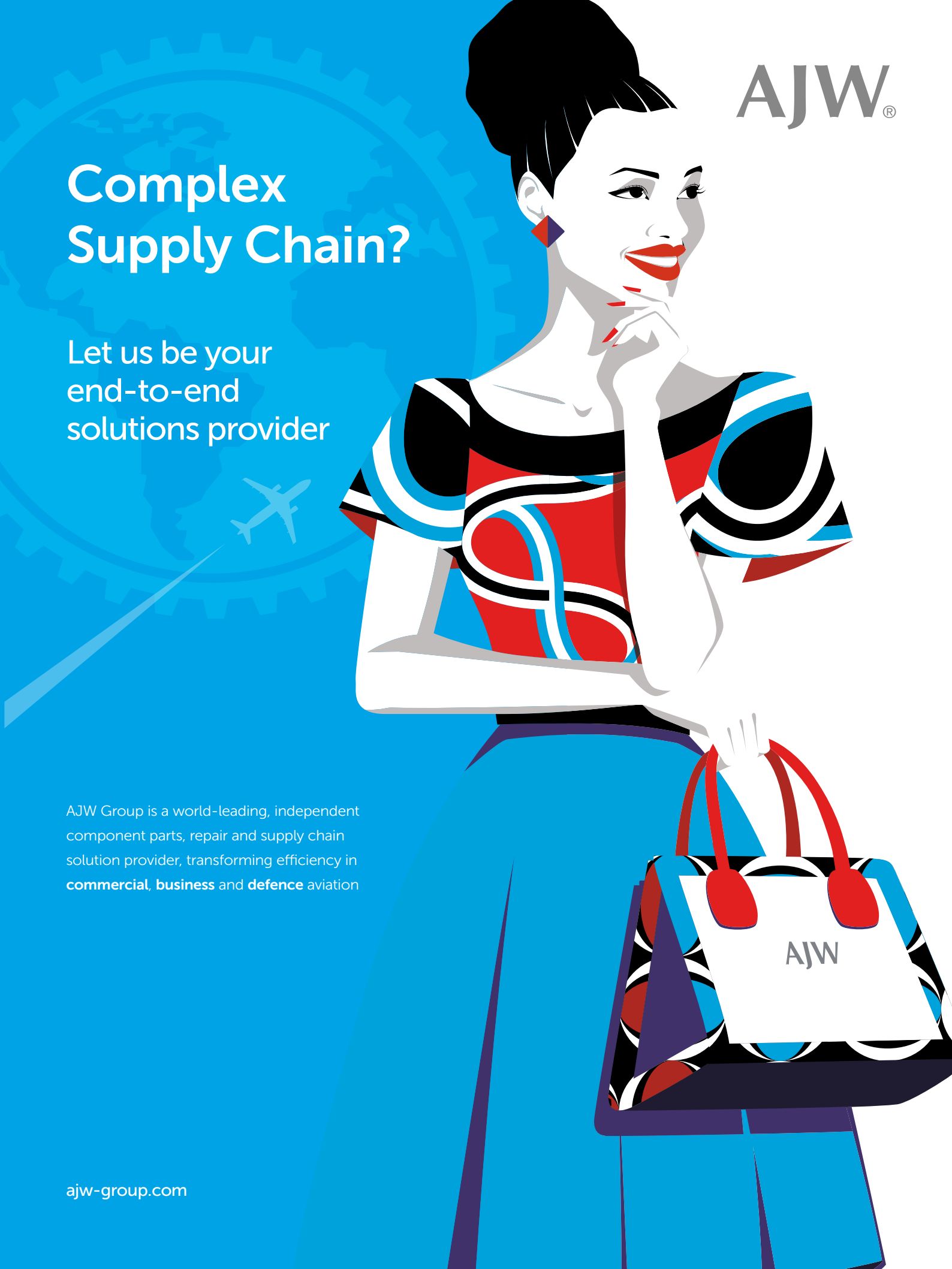
OEM QUALIFIED TO OFFER SIMILAR DURABILITY THAN PAINT



AIRBUS

ATR





AJW®

Complex Supply Chain?

Let us be your
end-to-end
solutions provider

AJW Group is a world-leading, independent component parts, repair and supply chain solution provider, transforming efficiency in **commercial**, **business** and **defence** aviation

ajw-group.com