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NOVEMBER/DECEMBER 2022 • VOLUME 24 • ISSUE 8

Keeping the world's fleets flying

MRO Management

GET SMART
How intelligent spare parts inventory management makes a big difference

INDUSTRY VOICES
A timely launch, a painting partnership and a well-kept secret

THE POWER OF DATA
In review: The Predictive Aircraft Maintenance 2022 conference


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Editor's Letter

The year ahead looks set to be an intriguing one for the global MRO industry. With travel bouncing back so strongly in 2022, MRO activities have been gaining momentum, and companies will be looking to build on that – across all segments of MRO – in 2023.

It will not be plain sailing though, as significant challenges remain. Geopolitical, economic and societal issues present a difficult background to business next year. Supply chain disruptions remain, while labour shortages – both in the short and long term – still need to be addressed.

Beyond the day-to-day, other topics on the agenda for 2023 include digitalisation and sustainability. The former provides an opportunity to achieve efficiency improvements, while the latter has become something companies can no longer just talk about it, but need to deliver on.

Our annual global industry outlook – and cover story (p22) – combines the perspectives of a range of companies from across the industry, as we seek to look into the crystal ball to determine what 2023 will hold in store.

The results are fascinating. A general mood of positivity and optimism can be discerned, while we can look forward to new innovations and partnerships, increased collaboration and further digitalisation.

With these things in mind, the Predictive Aircraft Maintenance 2022 conference took place in London in November, in partnership with *MRO Management*. More than 100 delegates were in attendance at the Pan Pacific London hotel for what was a very positive, informative and forward-thinking event. Experts in the field of predictive maintenance were able to share knowledge and network with those who were curious about the benefits of the solutions they are offering.

In the near future, the MRO industry as a whole will be able to unlock even more of the power of data, and the potential savings are extraordinary. You can read a review of the event on p32.

This issue also includes some fascinating 'Industry voices' contributions. Panasonic Technical Services' Tom Eskola describes how the company has become the largest in-flight entertainment and connectivity MRO in the world. MAAS Aviation's Richard Marston shows how the aircraft painting and exterior coatings company has formed a successful long-term partnership with Ryanair. And DBK Aero's Delphine Kennedy tells the incredible story behind the creation of her own business.

I hope you enjoy reading the issue.

Jason Holland
EDITOR
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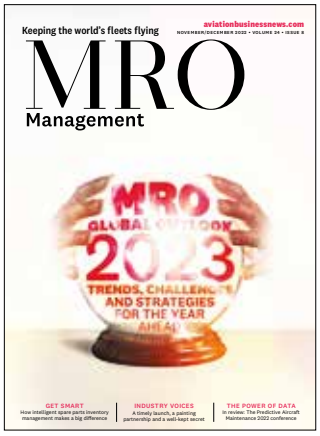

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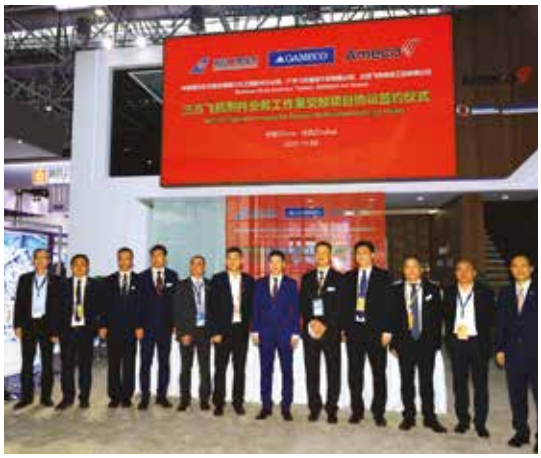
REGULARS

FEATURES

TREND WATCH

New capabilities, collaborations and techniques are driving innovation in the MRO industry



01

Closer collaboration

● China Southern Technic, Ameco and Gameco have signed an agreement covering the sharing and exchange of aircraft component maintenance support workloads. Through the complementary exchange and cooperation of Ameco and Gameco's maintenance capabilities, mutual promotion and common development, the companies will provide "more comprehensive and high-quality component maintenance support services".

05

Strategic partnership

● AJW Group and Fokker Services Group have signed a five-year component maintenance agreement covering various aircraft platforms and associated engine types such as Airbus A320ceo and A320neo as well as Boeing 737NG and MAX aircraft. Parts under the agreement will be repaired in-house at Fokker Services Group's three facilities across the Netherlands and the United States. This covers a variety of parts including air starters, starter valves, starter generators, avionic panels and captain seats. Fokker Service Group's newest capabilities, CFM LEAP engine accessories, are also part of the agreement.

"After 90 years, AJW Group's vision continues to be on efficiency to satisfy customer demand"

02

Expanded features

● Airbus is further extending the capabilities of its digital platform Skywise for airline customers. The new 'Skywise Core [X]' supplements the existing 'Skywise Core' offer with optional packages. Airbus said this would accelerate customers' digital transformation journey. The offer brings additional tools and features that empower users to perform more advanced actions on their data, operational applications, and make data driven decisions. One key element is the ability to simulate 'What-If'-scenarios, and to push data from Skywise into external systems.

03

Connect and coordinate

● Aero-Masters has signed an agreement with Embraer-X for the use of maintenance coordination platform Beacon. The platform is intended to connect resources and professionals for faster return-to-service aircraft. Aero-Masters said it intended to use Beacon to enhance its maintenance coordination and "help more airlines keep passengers flying, simplifying communication around maintenance events of all types of aircraft models and boosting team collaboration, improving knowledge exchange and streamlining workflows around maintenance events".

04

Support network

● AFI KLM E&M has joined Pratt & Whitney's global support network for GTF engines, positioning it as a "key player" in the PW1500G aftermarket. The MRO company will begin receiving and working on PW1500G engines in the second quarter of 2023 in Paris. Air France has ordered 60 A220s – to be powered by the PW1500G – with options for 60 more.

06

Great expectations

● Lufthansa Technik began carrying out what it says is the world's first performance restoration shop visit (PRSV) of a LEAP-1A engine in November. The PRSV serves to restore the performance of the engine, the MRO company said. The shop visit means Lufthansa Technik is able to analyse the new engine type under real operating conditions, helping to identify further design requirements for component repair. The LEAP-1A engine is owned by the Swedish charter company Nova Airlines.

07

Pathway to success

● American Airlines and the Aviation Institute of Maintenance (AIM) have partnered to create a pathway for the next generation of aviation maintenance professionals. An MoU signed by the pair guarantees that top candidates from AIM's Chicago campus will get interviews at American, while providing ongoing engagement with American's team of aviation maintenance professionals and offering access to American's maintenance facilities. Eligible students will also be offered financial assistance for certification exams and toolboxes.

08

Moving on up

● ExecuJet MRO Services Malaysia has started construction of a new purpose-built MRO centre at Malaysia's Subang Airport. The Dassault Aviation subsidiary will relocate from its current facility at the airport to the larger, purpose-built facility once construction is completed in Q4 2023. The new facility will have a gross floor area of approximately 149,500sq ft, including corporate offices, customer areas and back shops. The aircraft hangar will be able to accommodate 10 to 15 business jets of various sizes simultaneously; there will also be a dedicated apron area for use.

TRENDING STATS

87

Fokker Services Group is building an 87m long, 86m wide and 27m high widebody aircraft maintenance hangar at its existing site in Woensdrecht Airport in the Netherlands

10

Virgin Australia has signed a 10-year 'TrueChoice' overhaul agreement with GE Aerospace covering the airline's fleet of CFM56-7Bs

5

ADSE and Fokker Services Group have signed a five-year agreement formalising their existing partnership for current and future projects

40

Hainan Airlines has contracted Collins Aerospace to provide its fleet of 40 Boeing 787s with customisable support solutions to reduce repair time and costs

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THE BEST KEPT SECRET IN MRO

Panasonic Technical Services says it is now the largest in-flight entertainment and connectivity MRO in the world, and significantly increased its MRO footprint in Europe recently. Despite the company largely flying under the radar, VP and GM **Tom Eskola** now has an ambitious growth strategy in place

"Our intention is to leverage our global footprint to provide innovative and directed maintenance and material management solutions"

Tom Eskola is VP and GM at Panasonic Technical Services

Visit panasonic.aero for more information on the company's customised maintenance solutions

In-flight entertainment has undergone significant evolution since its inception in 1921, when the first in-flight movie was shown. As commercial flight gained trust and popularity, from the 1960s onwards, the need to provide entertainment for passengers, especially on long-haul routes, became evident.

Today, in-flight entertainment (IFE) is a far cry from the communal screen showing the same film to all passengers and now offers passengers a fully personalised at-seat experience, in-flight connectivity and many other bespoke entertainment services.

As an OEM, Panasonic Avionics has been at the forefront of IFE development since the launch of our first system in 1980 on the Boeing 767-200. Over the past 40 years, we have focused on developing IFE and connectivity solutions that enable our airline customers to continually enhance the passenger experience – a mission which has necessitated a bespoke MRO offering.

Panasonic Technical Services (PTS) is a division of Panasonic Avionics. We have flown under the radar to become the world's largest IFEC (in-flight entertainment and connectivity) MRO, with 45 line stations and eight repair stations globally. Providing customised maintenance solutions that guarantee performance, we help drive strategic outcomes for our airline customers. We currently support in excess of 3,000 aircraft in service with 55 airlines, creating optimal flight experiences for passengers and supporting efficient operations. Our IFEC systems are at peak performance when coupled with Panasonic Technical Services maintenance.

In Europe, we have recently significantly increased our MRO footprint with the expansion of our facility in Dundalk, Ireland. Here we provide repairs, line maintenance, spares parts supply, technical services and training to customers in the EMEA region, and hold Part 145, TCAA, FAA and UK CAA approvals.

As the aviation industry recovers to pre-pandemic passenger levels, the demand for MRO workscopes remains at a premium. Panasonic Technical Services' primary objective is to offer customised maintenance solutions, delivering greater peace of mind to our airline customers by ensuring guaranteed performance and cost.

Our expanded Dundalk facility is one of ten PTS locations within Europe and

3K

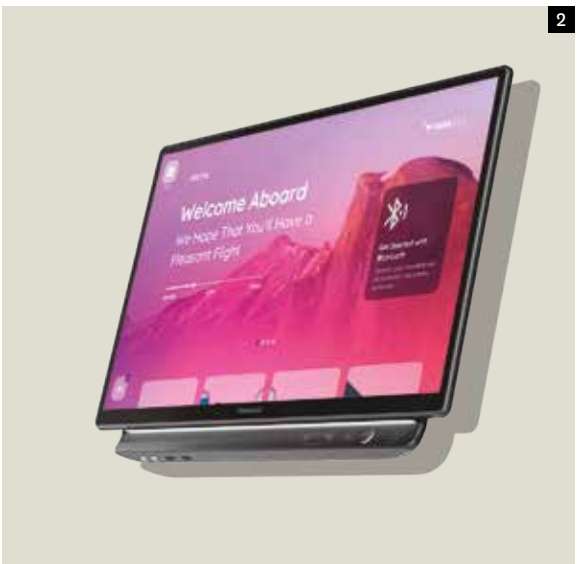
PTS currently supports in excess of 3,000 aircraft in service with 55 airlines, creating optimal flight experiences for their passengers and supporting efficient operations

1

"In many cases, airlines will choose not to sell a seat if the in-flight entertainment is not functional"

will give our customers in the EMEA region even greater flexibility for their IFE MRO requirements. In addition to our Ireland-based repair shop, we also have airport line maintenance stations in Amsterdam, Frankfurt, Lisbon, London Gatwick, London Heathrow, Madrid, Paris Charles de Gaulle, Paris Orly and Rome Fiumicino. Supporting our European MRO capabilities, we're also able to provide access to a global supply chain of IFEC hardware, software, LRUs and cabin components.

The universality of our services allows us to ensure airlines have access to the right parts with minimal turnaround times.



2

We expect to induct 1,500-2,000 units per month at our Dundalk facility, where our technicians will repair Panasonic Avionics' X series and Next IFE systems and Boeing CSS equipment, as well as being our European distribution centre.

Reliability of equipment and reduced turnaround times for IFE maintenance, whether scheduled or unscheduled, is of vital importance for airlines as faulty equipment impacts financially on the passenger payload.

Downtime of IFE equipment causes significant disruption for airlines. In many cases, airlines will choose not to sell a seat if the IFE is not functional. This is particularly an issue for long-haul flights. The availability and level of IFE can not only drive passengers to an airline, but can also help to retain them as they will be encouraged to fly with a carrier that has provided a good IFE experience.

At the Aircraft Interiors International show in Hamburg, Panasonic Avionics launched a pioneering new IFE solution. Astrova by Panasonic Avionics is our next generation IFE seat-end system, leveraging the latest, cutting-edge consumer electronics and avionics technology to redefine the entertainment experience passengers will have when flying for business and pleasure.

It provides airlines with a unique customer engagement channel where they can foster higher levels of passenger loyalty and improve their NPS scores by tailoring their in-flight entertainment experience based on passenger preferences, opt-in personalisation services, e-commerce and retail therapy, a 4K moving map platform, and much more.

Customer loyalty for Panasonic Avionics, as well as for own customers, is paramount to our ethos. While PTS is a strong choice for maintenance, our intention is to leverage our global footprint to provide innovative and directed maintenance, repair and material management solutions to airlines and third-party suppliers looking to enhance their capabilities.

In doing this, we aim to make Panasonic Technical Services the preferred MRO for IFE and connectivity maintenance for commercial airlines worldwide.

Tom Eskola was appointed as vice president and general manager of Panasonic Technical Services earlier this year. A US Army colonel with 22 years of service, Eskola has worked in the in-flight entertainment and connectivity business for the past 17 years, and first joined Panasonic Avionics in 2011.

1. Panasonic Technical Services has a global network of strategically placed repair stations
2. Astrova is Panasonic Avionics' next generation in-flight entertainment seat-end system

INTO THE BLUE

Aircraft painting and exterior coatings company MAAS Aviation is celebrating its long-term partnership with Ryanair – and with the mutual trust and benefits that come with such a working relationship, there could be many more years to come, says MAAS' chief commercial officer **Richard Marston**

"There is now great value assigned by customers to being able to source a top-quality aircraft paint finish applied in the shortest possible down time"

Richard Marston is MAAS' chief commercial officer

Visit maasaviation.com to learn more about the aircraft painting and exterior coatings specialists

As with many other business sectors, working relationships between aviation companies change on a regular basis. New providers enter the market promising better and faster services, different technology or pricing structures are offered, or maybe it's down to more suitable locations becoming available. Whatever the reason for changing, it's a competitive marketplace with few business relationships really standing the test of time.

At MAAS Aviation – recognised experts in aircraft painting and exterior coatings – we are very proud of our enduring partnership with Ryanair, which spans more than four decades, dating back to when the airline was founded in the 1980s. Our business has changed during this time, and Ryanair has grown to become Europe's largest airline group – operating over 3,000 flights per day this summer. I believe it is our shared focus on quality, attention to detail and the highest delivery standards that has led to our continuing positive partnership throughout that time.

Forty years on, and MAAS is still painting Ryanair's aircraft today and is responsible for ensuring the high-quality appearance of the carrier's fleet of over 500 Boeing aircraft. Ryanair maintains very high standards, investing in every element of its fleet to ensure it operates, and looks, first-class all of the time.

1

It is this quality driven ethos that the company seeks in its supply partners too, so the OEM operating standards we work to at MAAS are a perfect fit.

In 2021, following a multi-million Euro investment, MAAS Aviation opened a purpose-built twin bay paint shop at Kaunas Airport, Lithuania, growing our global footprint to 11 state-of-the-art facilities and increasing our overall MRO capacity in Europe by 40 per cent. The ultra-modern paint shop features the very latest technologies, including systems to ensure safe and secure operations and to manage the environmental impact of the company's activities.

Demonstrating trust and confidence in its long-term supplier, Ryanair partnered with MAAS in launching the new facility, and re-located its established winter

2

3

repainting programme to the new Kaunas 24/7 coating lines.

Airlines like Ryanair continue to place huge emphasis on differentiating themselves through the use of innovative cabin interior products and by having an equally innovative high-quality external livery applied to their aircraft.

Consequently, there is now, more than ever, great value assigned by OEM, airline and lessor customers to being able to source a top-quality aircraft paint finish applied in the shortest possible down time.

According to Adam Hale, head of base maintenance at Ryanair, the airline's "relationship with MAAS is built on consistently delivering an outstanding quality product, on time, every time".

He adds: "With the Ryanair Group fleet now standing at over 500 aircraft, it is essential to have suppliers like MAAS that have grown up alongside us that can meet and exceed our exacting standards. We look forward to many more years working together as the fleet grows to over 600 aircraft by 2025."

4

Environmental sustainability

Environmental responsibility is an important factor that is at the forefront of MAAS' business strategy and it is another area where the two businesses share values.

It is very important to us at MAAS, and to Ryanair, that we constantly seek new ways to be sustainable and minimise our impact on the environment. Having developed a decarbonisation strategy in 2021 – Pathway to Net Zero – Ryanair has set an ambitious goal to be a carbon neutral airline by 2050. This will be achieved via a number of strategies set out by the airline, including working with its partners – like ourselves at MAAS Aviation – to make aviation more sustainable.

At MAAS, all our facilities are designed to manage waste from our processes responsibly, with waste materials recycled wherever possible. In fact, our unique recycling technologies allow us to recover 80 per cent of the solvents we use.

We work continuously with paint manufacturers to ensure the high-performance aerospace coatings we use not only look superb but also reduce aircraft weight to improve fuel efficiency, thereby reducing emissions.

OEM-approved aviation paint supplier AkzoNobel is another long-term partner for us at MAAS and is the preferred coatings provider to the Ryanair programme. AkzoNobel's systems include a number of chrome-free products, further supporting us in our environmental goals.

The company's performance means that we require less paint to achieve the same result (the Basecoat/Clearcoat system requires just a single coat as opposed to two or three), not only reducing the amount of material we use, but also reducing the overall weight of the aircraft. Both of these advantages – along with the proven durability of the coatings – contribute to more sustainable operations by lowering aircraft fuel consumption and thereby reducing CO_2 emissions which makes the overall solution as lean as it can possibly be.

The collaborative relationship between MAAS, Ryanair and AkzoNobel makes for an enviable partnership, which delivers a fleet appearance that is second to none, and that really stands out at the airport.

Ryanair is very proud of its fleet and demands the highest of standards in terms of gloss-retention and colour stability, as well as overall longevity of the coating's performance. Our experience in aircraft painting and first-class, modern facilities are directly supported by the coatings selected, which are fast drying and assist ease of application. meaning we can limit an aircraft's time on the ground and deliver the highest quality finish in the fastest turnaround time possible.

It is a mutually beneficial partnership between MAAS Aviation, Ryanair and AkzoNobel and one that we look forward to continuing for many years yet.

1. MAAS has been painting Ryanair's aircraft for four decades
2. The painting company employs the latest technologies
3. Ryanair's suppliers must meet its "exacting standards"
4. A focus on sustainability is shared by both companies

All photos courtesy of **AkzoNobel**

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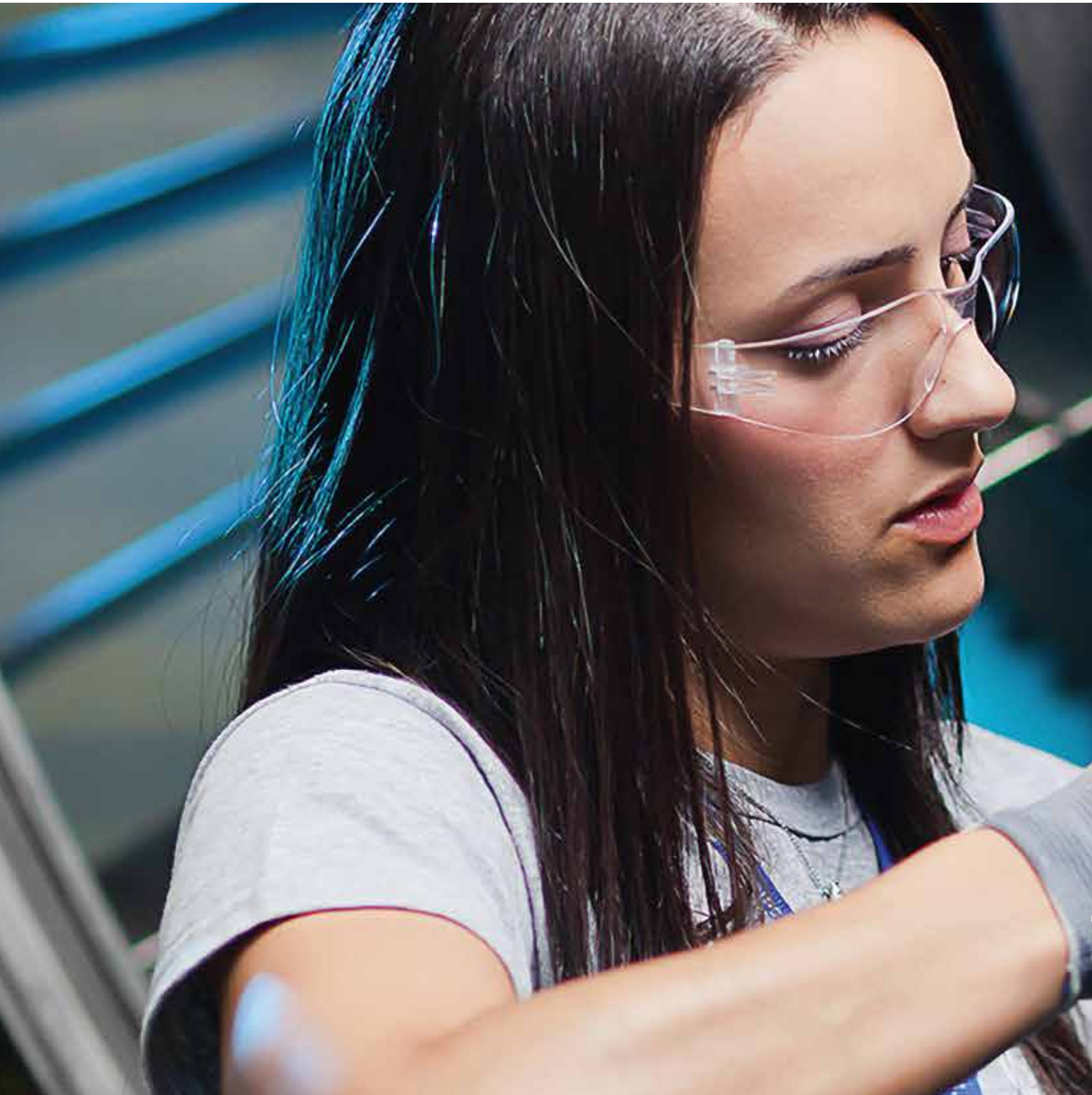

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THE SKY IS NOT THE LIMIT

When **Delphine Kennedy** launched her own business during Covid it was all about timing – perhaps strange at first glance, but not when you take a deeper look. Now DBK Aero is delivering timely aftermarket solutions to airlines and aerospace traders worldwide

"Aviation is still a very patriarchal industry, but it is changing. We need, as women, to stick together, and push each other forward and upwards"

Delphine Kennedy is the CEO of DBK Aero

Visit dbkaero.com for more on how the company delivers aftermarket solutions

Are you crazy? Why would you do that? Are you sure you are capable? You have a perfect life with a good salary, why now? How will you do it? What if you don't succeed?

These were some of the questions I got once I told a few friends and family about launching my own trading business.

Yes, go girl! You can do it! You are going to be so successful! You have all the connections and willpower to make it happen! Can't wait to see you succeed! You are amazing! It can only work!

These were the affirmations I got once I told a few peers, colleagues and friends in the aviation business. It perfectly summarises our industry. Resilience, persistence and manifestation that, despite everything, we are going to make it to the other side and be better and prouder than ever.

So why am I launching my own business now? Some asked why I didn't do it sooner, while some wondered why I would do it during Covid. Timing is everything. Two decades of working in this industry and in different areas of aviation made me the complete package I am today. Five years ago, I was not ready. I would have never thought I would be running my own business and moving into my own DBK warehouse just one year after my first deal.

It is tough starting from scratch, though, I won't lie. It can feel pretty lonely too, but I am surrounded by amazing people that are helping me whenever I need it.

Running your own business is more than just making deals. It is thinking about insurance, banking, racking, wrapping, tooling, MRO... and finally trading. Multitasking has never been so necessary. Haemorrhaging money left and right is something to add to the stress too.

I believe that one of my strongest assets is my network. I started going to trade shows right at the start of my career, at a time when customers assumed I was the 'coffee lady', only for me to prove them wrong five minutes into a conversation. There were not many women in the industry at the time, 16+ years ago, which in hindsight was a blessing in disguise. It meant people would remember me, and they have grown with me.

Some of my biggest champions are my customers; suppliers I have met and worked with for nearly 20 years.

16

Delphine has over 16 years of experience in the aviation industry, including spells at Avtrade, UAM and Aviation Concepts

1

“Surround yourself with like-minded people that will push you, criticise you, but mostly support you”

They have seen me through all stages of my life, including going to a trade show while eight months pregnant.

Aviation is still a very patriarchal industry, but it is changing. We need, as women, to stick together, and push each other forward and upwards, and squash this imposter syndrome.

My core values such as my integrity, loyalty, and efficiency make me someone you want to work with. And with DBK Aero I can do it on my own terms.

The UK aviation community is very strong, from Brighton to Scotland, and Cardiff to Southend. From that was born the Aviation Network Group (ANG), which is now live with its own WhatsApp group and website.

I know I can quickly ask the community for anything and there will always be someone who can help in some way, and vice versa. That is the strength of aviation and something I can rely on while debating which bank to do business with, which FX site is best, or where to buy anti-static bubble wrap.

One year in and I can say that I never imagined the rollercoaster of emotions that I would feel. The highs are super high, and the lows pretty low. There is always something new to learn and that is powerful. There have been plenty of ‘pinch me’ moments, including my first PO from a dear customer, or increasing my customer base with high end names, which I never thought would happen so quickly, or getting the key to my warehouse and moving into my own space with my own colours. It suddenly feels real.

So would I do it again? Yes! I don’t think I could go back. Everything I have done in my life led me to being my own boss. The recent nominations and articles, as well as new customers brought on board every day, make me so happy. I want to work on my own terms, be an inspiration for women and show that it can be done. If I can do it, then YOU can do it too.

I’m always flattered when being asked privately by peers – whether women or men – how they can change their career, how they can be the next best company. Believe in yourself. Surround yourself with like-minded people that will push you, criticise you, but mostly support you. Manifest everything you want to happen in your life. Give yourself a pat on the back and last but not least... celebrate. Celebrate every win, however little or big they are. Learn from your mistakes, which are part of an entrepreneur’s life, and stop making excuses. Today is a new day. The sky is NOT the limit.

1. DBK Aero has just moved into its new warehouse – and a bright future lies ahead

Ryan Aggergaard
is an attorney-at-law at Washington Aviation Group

Records expungement – striking a balance

The FAA has revived its enforcement records expungement policy, so what does this mean for airmen, asks Washington Aviation Group attorney-at-law **Ryan Aggergaard**

Visit washingtonaviation.com for more information on the law firm, which supports the aviation community

One of the unfortunate realities of working in a highly regulated industry like civil aviation is that violations of those regulations can often result in significant penalties.

While each of us in the industry keeps safety in the foreground of everything we do, sometimes systems break down or oversights occur. When this happens, enforcement actions may be unavoidable, and findings of violations and civil penalties may result. Regrettably, these findings might follow the person or entity that committed the violation for a long, long time – in some cases, until death!

On the one hand, this may make intuitive sense, as violations of aviation safety regulations can cause grievous harm to the flying public and terrible financial harm. On the other hand, it doesn't seem fair that a relatively minor mistake with no adverse safety consequence should follow a person for the rest of their life, making it difficult to continue in their chosen profession.

Records of enforcement against holders of airman certificates (including mechanics and repairmen) can make future or continuing employment difficult (or at least more difficult or costly than is necessary). Fortunately, the Federal Aviation Administration (FAA) has recently issued a new policy permitting the expungement of certain enforcement records against individuals.

The winding history of this policy goes back over 30 years. In 1991, the FAA adopted a policy allowing it to expunge certain individual enforcement records. Prior to the implementation of this policy, the FAA would maintain records of enforcement against individuals indefinitely. The purpose of this open-ended retention was to allow the FAA to determine whether an individual exhibited a pattern of non-compliance based on violation histories.

A review of the retention process by the FAA and industry groups determined that this violation history could decrease an airman's chances of employment and lead to unreasonably high insurance rates, among other challenges. The groups concluded that certain violation histories were probably not useful to the FAA over time and that the interest of safety was not necessarily served by indefinite retention of every type of violation history.

Based on this analysis, the group advised the FAA that an expungement policy be developed.

↑ The FAA has issued a new policy permitting the expungement of certain enforcement records against individuals

Under the policy that arose, suspension cases would be expunged after five years and cases involving no enforcement action would be expunged after 90 days. Revocation cases would not be expunged under the 1991 policy. The policy was applicable to individuals, but not entities (like air carriers and repair stations).

Almost 20 years later, the *Airline Safety and Federal Aviation Administration Extension Act of 2010* was signed into law. The act required, among other things, the FAA to create a pilot records database for air carriers to use for pilot background checks. The act also required that the database include 'summaries of legal enforcement actions resulting in a finding... of a violation of [federal aviation statutes or regulations] that was not subsequently overturned'. These records are required to be kept until the individuals dies.

In 2011, the FAA (reasonably) interpreted its expungement policy to be inconsistent with this 'til death do us part' requirement and suspended the policy. However, it also decided that it would review its expungement policy once the pilot records database rule was finalised.

"It doesn't seem fair a relatively minor mistake with no adverse safety consequence should follow a person the rest of their life"

Ten years later, in 2021, the FAA published the final rule for the pilot records database. (If you require immediate results and feedback, don't get into federal rulemaking!) The final rule noted that the act 'requires the FAA to maintain records in the [pilot records database] for the life of the pilot and does not provide the FAA with discretion to expunge records outside of that timeframe'.

At first blush, this might appear like a fatal blow to the prospects of enforcement record expungement. However, the FAA has examined the issue and has concluded it is now ready and able to resume expungement of certain records. The FAA has determined that records *without a finding of violation* are not included in the pilot records database and as such, certain types of legal enforcement actions the FAA issues are eligible for expungement consistent with the act and the pilot records database.

Under the FAA's reinstated expungement ('expunction' in FAA parlance) policy, civil penalty actions settled with no finding of violation in the enforcement information system (EIS) may be expunged after five years after the civil penalty has been paid (assuming no further action against the individual in the intervening five years). In addition, military referrals and foreign referrals without findings of violation are likewise subject to expungement two years after being closed in the EIS.

While the pilots record database was at the heart of this expungement debate, the policy applies to all individuals, including certificate holders like mechanics and repairmen, and non-certificate holders like passengers. This makes the revised expungement policy particularly

"Ensuring that skilled workers are able to continue maintaining the global aircraft fleet is an important goal"

noteworthy to A&Ps running their own business as well as mechanics and repairmen working for other certificate holders (like a part 121 operator or a part 145 repair station).

Our law firm has represented many clients who faced civil penalty actions from the FAA and the reinstatement of this policy could have a significant effect on an individual's decision-making process when confronted with such an action.

Although not always the case, in our experience individuals faced with a civil penalty action are often able to negotiate a settlement for *either* a finding of violation or a civil penalty, rather than accept both. When expungement was not an option (meaning the violation would be maintained indefinitely) clients weighed the cost of having a violation on their record – including reputational harm, insurance considerations, employment prospects and certificate renewal questions – against the black and white bottom line number of a monetary civil penalty.

Each client weighed this differently. For certain clients, the concern was a straightforward monetary one: 'I don't care about the violation; everyone has one of those – we need to get the penalty as low as we can'. In other cases, the violation was the concern: 'I'll pay the penalty, but I really don't want a finding against me'. Every airman had to make that decision for himself or herself. But the prospect of expungement after five years drastically alters that cost analysis.

Knowing that a finding of violation will be maintained indefinitely in the pilot records database may cause many airmen to angle for a civil penalty settlement rather than risk a finding of violation, even if the case against them is weak. Remember, a civil penalty settlement with no finding from EIS is not included in the pilot records database and is therefore eligible for expungement.

Conversely, the FAA, understanding this calculus, may be able to leverage the prospect of expungement into larger civil penalties, knowing that an individual is willing to pay a greater penalty to ensure a clean record five years down the road.

Ultimately, a policy that allows for the expungement of enforcement records should benefit individual certificate holders and the industry as a whole. It is no secret that aviation faces an imminent shortage of qualified mechanics and repairmen, so ensuring that skilled workers are able to continue maintaining the global fleet is an important goal and not one that should be sacrificed due to minor violations from which an airman can learn and move on.

↑ The revised policy is noteworthy to A&Ps running their own business as well as mechanics and repairmen working for other certificate holders

At the same time, the policy of maintaining records of enforcement actions severe enough to warrant a finding of violation (and no willingness by the FAA to settle without such a finding) will allow the industry to keep a record of those persons who demonstrate a pattern of non-compliance.

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GLOBAL MARKET OUTLOOK 2023

MAXIMISING MOMENTUM

Labour shortages, supply chain disruptions and economic headwinds will continue to present the MRO industry with significant challenges in 2023, but there are nevertheless plenty of reasons to be optimistic. **Jason Holland** spoke to a range of companies to see how they are planning to build on the positive momentum the industry generated in 2022

I think 2023 will be an outstanding year for our industry, despite the persisting global challenges," says Lufthansa Technik's David Doyle. Across all MRO segments, many of the company's shops "are almost fully booked so that we even had to turn down first customer requests", reports the vice president of corporate strategy, innovation management & product development at the Hamburg, Germany-headquartered MRO.

This positivity is echoed at ST Engineering. "Thanks to widespread dissemination of vaccines, re-opened borders and pent-up demand for travel, flying and MRO activities have been steadily recovering, and I believe we will continue to enjoy that momentum across all segments of MRO in 2023," comments Jeffrey Lam, president of commercial aerospace at the Singapore-headquartered company.

"However, it remains to be seen how quickly we can get back to the 2019 pre-pandemic level of activity given all the uncertainty that is in the current global economic climate, and how soon major markets such as China relax their Covid measures and fully re-open their borders."

Richard Kendall, chief commercial officer at Hong Kong-headquartered HAECO Group, says factors such as these have led to regional variations in MRO recovery, which will persist into 2023. "While every country was affected by Covid to a great extent in the first 12-18 months [of the crisis], in the past six months we have seen more regional variation in terms of impact on air travel and hence in terms of MRO demand from the airlines in those particular regions," he reports.

"While narrowbody traffic in, say, Europe and domestically in the US, and at times domestically in Mainland China, came back relatively early, from there regional differences emerged. Chinese lockdowns have disrupted regional air travel within China, for example."

The overall picture is promising, according to Lewis Prebble, president of the airlines and fleets division at Arizona, US-headquartered StandardAero. "I believe there remains a lot of opportunity in the industry, despite the headwinds faced on a number of fronts," he says.

"2022 saw a continued recovery in passenger traffic, aircraft orders and MRO demand and, while some observers are now projecting a one-year slip in the date for a full recovery to pre-Covid levels of traffic, there is at this stage no indication that a full recovery won't be attained."

Louis Philippe Mallette, senior vice president operations at Montreal, Canada-headquartered AJW Technique, the maintenance hub for the AJW Group's component MRO service, notes that the aviation industry continues to face immense challenges. "Even though the effects of the pandemic are essentially now in the background, they can still be felt in terms of labour shortages, supply chain fracture, spare part availability and lead times, and the ongoing conflict in Russia and Ukraine. Even though these and a downturn in travel due to a falling economy appear to be a melting pot for the deterioration of the MRO and aftermarket sectors, there is still strength in commercial aircraft maintenance, and we are confident of further recovery in MRO services going into 2023," he says.

Mallette cites a recent quarterly MRO survey which indicated that MRO sales were up across the industry, and are, in fact, the strongest they have been over the past year. "These results are led by MRO sales and strength in Europe and Asia, which is interesting considering the political unrest

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"I believe there remains a lot of opportunity in the industry, despite the headwinds faced on a number of fronts"

in the region and the looming economic crisis," he comments.

Availability of spare parts, lack of raw materials, and lead times due to a reduced workforce remain a significant risk to MRO recovery, Mallette adds, but he thinks "things look set to improve in the coming year as ageing fleets, spare part inventory levels and a delay in new aircraft deliveries have airlines turning to MRO services. Increases in material pricing are also a key factor affecting growth as the continued rise in pricing creates a favourable environment for investors as the industry gains strength."

Many MROs are reporting strong health, largely due to the recovery coming back much quicker than many analysts predicted, says Fraser Currie, CEO of Jordan-headquartered MRO company Joramco. His company posted record revenues and net profit in 2021, and 2022 will surpass even these marks, he reports.

The MRO landscape has been affected, with there now being a "huge demand from airlines for long-term contracts", he notes. "There's a huge capacity shortage in the market, especially in the US, which doesn't have the seasonality that we have." Joramco's seasonality has reduced in recent times though, and it is now almost as busy in the summer as it is in the winter.

"A lesson from that is we're going to have to evolve staffing policies in terms of training and leave, because we traditionally would have leave in the summer, train in the summer and get ready for winter. We're currently able to do that, but forecasting into 2023 and 2024 it's no longer the case and we're going to have to adopt similar models to the US."

David Doherty, head of commercial at Abu Dhabi-headquartered Etihad Engineering, also sees contract demand shifting. "We are seeing many airlines looking to undertake fleet refurbishment projects which had previously been put on hold, with slot availability becoming a challenge, which means that many operators are looking to secure long term maintenance deals with their preferred providers over three or four years," he says.

Lufthansa Technik's Doyle was pleasantly surprised by the faster-than-expected rate of recovery. "After we quickly returned to the black in 2021, we now even see us on track for a record result for 2022, having just reported the best ever quarter in our company's financial history. I expect this positive development to stay that strong across all MRO products," he says.

Sector trends

As well as regional variations, there are also differences in the outlook for 2023 by MRO segment. "A couple of patterns have emerged," explains HAECO's Kendall. "Narrowbody MRO rebounded much earlier than the widebody sector, and that's a culmination of bringing aircraft out of storage, and those aircraft that were continuing to operate throughout the pandemic coming up to their regular cyclical maintenance checks. Our sizeable airframe services business in the US rebounded much earlier in terms of volume than our Asian facilities, for example."

2

A lot of HAECO's "bread and butter" is widebody aircraft maintenance at its airframe facilities in Hong Kong and Mainland China, says Kendall, but despite the slow rebound in this sector the company has "actually had quite strong demand for maintenance in 2022". He adds: "Many of our customers are internationally based, and we generate more than half of our business from the US, and about a quarter from Europe."

Edwin Poldermans, director of operations at Netherlands-headquartered independent aviation aftermarket company Fokker Services Group, reports that the demand for widebody maintenance in the EMEA market has increased substantially. Due to lockdowns, a lot of capacity in Asia Pacific is no longer available, while there has also been some uncertainty on future border closings.

"This is the reason we forecasted growth opportunities in this widebody segment and this year, we invested in our widebody capabilities by building a new widebody hangar at our location in Woensdrecht in the south of the Netherlands," he says. "In this new hanger we will be able to provide full Airbus A330 base maintenance, while looking at Boeing 777s in the near future."

3

While there is usually a lag between the airframe and engine markets, the global engine MRO market has also rebounded in 2022. Lufthansa Technik's Doyle says that "green time reserves have largely dried up so that even costly overhauls are really gaining momentum again".

CFM International is still expecting engine MRO activity to grow as the Covid recovery continues. "We see spare parts volume continuing to increase based on the higher MRO demand year-over-year, and internal shop visits continuing to grow as well," states a spokesperson for the Ohio, US-headquartered 50/50 joint venture between GE Aviation and Safran Aircraft Engines.

Pratt & Whitney, the Connecticut, US-headquartered engine manufacturer, has positioned itself to "power the segments recovering most quickly", according to Kevin Kirkpatrick, its vice president, aftermarket global operations. "These include GTF and V2500 engines on single-aisle aircraft and PW4000-powered freighters," he says.

"GTF-powered aircraft are especially well positioned for growth – not only for domestic operation, but also for the longer routes made possible by A321neo, A321LR and soon A321XLR aircraft. In certain cases, these aircraft are replacing widebodies. We are seeing an increase in demand for both our Pratt & Whitney GTF engines and mature commercial engines. We are ramping our shop visit volumes to accommodate this demand and working with customers to align shop visit planning with availability."

Jan Kotka, chief operating officer at Tallinn, Estonia-headquartered Magnetic MRO, thinks engine repairs of CFM56-5B/7B engines will continue as they are in 2023 "or become even bigger". He believes engine leasing will recover as well "as more and more engines go for scheduled repairs that will last longer than pre-Covid due to problems with longer material repair turnaround times".

Iberia Maintenance expects that engine MRO volumes will be strong in 2023, based on its already committed workload. The Madrid, Spain-headquartered MRO company's commercial & business development director Marc Wittingen says there is "a continuous trend on multiple engine models to tailor workscopes".

1. HAECO is seeing the engine MRO segment rebound after a drop in volumes in 2021
2. Lufthansa Technik's David Doyle sees a bright future for predictive analytics
3. There has been an upturn in productivity at AJW Technique Europe in 2022

1

1. MRO providers will need to become increasingly specialised and digitally efficient to maximise available resources and capture maximum market share, says Magnetic MRO's COO Jan Kotka (**2**)

Labour shortages

There will be a variety of factors challenging MROs around the world in 2023. "While recovery of the aviation industry continues to gain traction, uncertainties due to geopolitical tensions, availability of skilled manpower, supply chain disruptions, and heightened risk of global recession from rising interest rates will pose challenges," points out Singapore-headquartered SIA Engineering Company.

For its part, the company "will maintain vigilance and nimbleness in managing costs" while pursuing "sustainable growth". A spokesperson states: "We will continue to seek opportunities to expand our capabilities and geographical presence through acquisitions and partnerships, as well as invest in our staff to build a future-ready workforce capable of supporting new-generation aircraft and engine platforms."

"By far the biggest challenge our industry needs to overcome is producing sufficient personnel to meet growing demand"

He adds: "Shop visits are looked upon as investments these days and this results in more and more partial or modular workscopes. Additionally, supply chain performance will to a certain extent limit the amount of volume that shops worldwide can handle. Repair capacity is still not back to pre-Covid levels and the expectation is that 2023 will be another challenging year. The supply of new parts will also continue to be constrained due to limited availability of certain raw materials and limited production capacity."

Turning to component maintenance, Wittingen says demand is "usually aligned with utilisation of aircraft. As utilisation is increasing, the demand for component maintenance will be strong as well."

Component repair is a growing business area for Fokker Services Group. "For our component repair supply chain, we have requested a higher volume of parts as a response to this growth," comments Poldermans.

"We have been recruiting base maintenance and component maintenance colleagues with strong problem-solving skills. We find the right colleagues to join our organisation, and promote those who are starting their career in our apprenticeship programmes to various other business areas like sheet metal work and component repairs."

HAECO's Kendall says that teardowns of older aircraft have created a supply of used serviceable material for the aftermarket. "That also adds to the availability of green time for components," he says. "There have also been concessions or suspensions on component agreements between airlines and service providers, which are now starting to be reactivated as those aircraft come back into service."

The outlook for line maintenance remains positive, too, according to Magnetic MRO, "albeit slower than expected due to slower long-haul recovery into late 2022 and spring 2023". MROs are being challenged by an increased operating cost burden which will potentially grow next year.

Airlines may also see slower recovery because of cost-of-living increases, which in turn results in limited schedules. This directly impacts line maintenance services. "Next year will require even greater cooperation and partnerships both internally and externally, in order to be successful and competitive," the company says.

2

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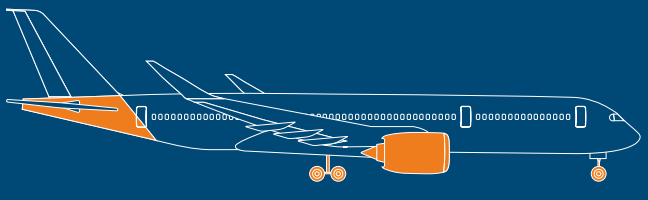

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"Manufacturers still face the challenge of sourcing raw materials such as aluminium and electric components"

For Lufthansa Technik's Doyle, "by far the biggest challenge our industry needs to overcome is producing sufficient qualified personnel to meet growing demand". He says: "Attraction and retention of qualified personnel will become a source of competitive advantage in the short to medium term, so we all need to change our approach and invest heavily in people."

HAECO's Kendall agrees with this sentiment. "There has been a migration of the workforce from our industry into other industries," he says. "Recruitment drives are needed to not only try and bring back people who may have left during the pandemic, but also bring youngsters into the industry.

"There is a challenge of supply and capacity, not of hangar space but of labour availability. This will be a real challenge for the industry, particularly in the first half of 2023, but also for the rest of the year and into 2024. Even if you recruit someone, you can't put them into productive work immediately, you have to train them."

Etihad Engineering's Doherty says it "is imperative that companies begin to address the training issues and invest in development programmes to ensure that new talent is introduced to the industry. While the forecast for the sector is positive, the challenges facing the industry need immediate attention to avoid a self-made crisis."

Joramco is among the companies to have recognised and addressed the longer-term issues. "We're putting a lot of new investment into our training academy, and are currently spending more than US $1million per year on it," reports Currie. "Academies are not profit centres. That is why very few companies will invest significantly in them, which I think is an absolute travesty in this industry. A few of us are investing, but governments are also not contributing and stepping in.

"That said, the Jordanian government has recently made pledges to us to invest in 100 new students to enter into our academy. They see technical degrees, qualifications and career paths as still a very popular way to go within Jordan, whereas in other parts of the world this is not the way people are going."

Pratt & Whitney is also committed to finding solutions, and Kirkpatrick says the company "will continue to focus on attracting top talent" next year. "This year, Pratt & Whitney Aftermarket Operations has already hired hundreds of employees and we are continuing to establish partnerships with A&P and trade schools, attend on-site career fairs, and build more robust on-boarding and training programmes," he adds.

Supply chain issues

Moving onto supply chain disruptions, Fokker Services Group's Poldermans sees this as "one of the biggest ongoing challenges facing the MRO sector". He explains: "Issues on this topic began a few years ago right at the start of the pandemic, and we predict it will continue for a couple more years to come.

$1M

Joramco is investing over US $1million per year on its training academy, Joramco Academy. Graduates get employment priority with the company

2

"From maintenance staff shortages, disruptions with logistics suppliers, and delays with the production and delivery of new parts, there are many areas to address. To tackle this, we have been stocking up our Netherlands warehouse with big orders of OEM materials. Additionally, at Fokker Services Group, we have EASA design and production approvals in place to invent and implement new solutions. With these approvals, we can counter specific supply chain disruptions."

StandardAero's Prebble says that supply chain issues have contributed to extended turnaround times during 2022. "Simply hoping that this situation recovers in 2023 is not a convincing strategy, so we are instead committed to working with our supply base and customers to ensure as much transparency as possible of demand and supply, keeping communication channels open while problems persist," he says.

"Overhaul shop visit slot capacity constraints have been one of the factors behind the recent increase in demand for modular workscopes and hospital shop visits, and we expect these MRO offerings to remain popular during 2023."

3

The challenge of logistic lead times is driving greater regionality in MRO sourcing, according to AJW Technique's Mallette. "As such, OEM centres are sharing services across the globe to mitigate capacity constraints and are working with customers and logistic partners to understand the supply chain vulnerabilities that exist, and how to overcome them," he says. "This includes the possible increase by operators in the need to embrace increasing levels of used serviceable material or Parts Manufacturer Approval (PMA) based solutions.

"Further affecting the already struggling supply chain is the introduction of additional tariffs and increased border checks brought about by Brexit, the effects of which will be felt going into the new year. The immense strain on administrators, and the aviation infrastructure in general, is not easing, and will be here for the near future.

"The deterioration in the OEM and supplier performance environment concerning processing time, and the rising cost of raw materials and labour are influencing their underperformance, which, despite recruitment efforts, can also be attributed to skills and staff shortages across the aviation industry.

"Manufacturers still face the challenge of sourcing raw materials such as aluminium and electric components going into 2023 as global shortages persist."

Magnetic MRO's Kotka says MROs are having "to cope with constantly increasing spare parts prices" on the one hand, and on the other "we are in a difficult situation when negotiating with customers to increase service costs".

He says that the shortage of skilled workers and the continued supply chain challenges are driving a lack of MRO capacity in Europe. "Inevitably the cost increase for MROs will be absorbed by needed radical efficiency improvements but also increased service rates to customers," he warns.

Digital and sustainable

Embracing digitalisation can help companies achieve efficiency improvements. "I think a key focus for 2023 will be for companies to recover in profitability. To help that happen, airlines and MRO providers have to

1. Joramco will start building the first of two new hangars in Q1 2023
2. Fokker Services Group is focusing on digitisation of aircraft maintenance data
3. Lufthansa Technik will continue to invest in the ramp-up of capability for the LEAP-1A & -1B motors next year

1

1. Pratt & Whitney is making a dedicated effort to modernise and transform its global operations, supporting its overall Industry 4.0 strategy
2. A drilling robot employed by ST Engineering for floor grid drilling during freighter conversion work

3,020

Greenhouse gas emissions at Pratt & Whitney's Arkansas site have been reduced by 3,020 metric tonnes per year since 2010

"Digitalisation will be one of the persistent trends that pushes the industry forward and into the future"

be more cost efficient, productive and sustainable," says ST Engineering's Lam. "One way is to transform the hangars and workshops into a smart environment that makes greater use of robotics and digital technologies. In this regard, digitalisation will be one of the persistent trends that pushes the industry forward and into the future. This will not only improve productivity, but also alleviate some of the challenges arising from the manpower crunch, which is expected to continue into 2023."

Augmented reality, high-resolution cameras and drones are alternative technologies that can be used for the inspection of aircraft.

2

HAECO is among the companies putting such technologies in place, with some success. "Ultimately our business, particularly on airframes, is very labour intensive so it's very difficult to move the needle significantly with technology to replace the labour input," notes Kendall. "We are also in a very highly regulated industry, so these things take time and sometimes quite a bit of persuasion to get regulators to accept the new technologies and ways of doing things."

Kendall thinks that while there are a lot of good new technological tools out there "that can and will be put to good use, we'll get frustrated as an industry in the implementation of them because there are limitations to adoption. As an industry we are behind the curve, so there are a lot of opportunities to use digital tools and the data we have as an industry."

Rising costs will bring the topic of digitalisation back onto the agenda of most airlines who are searching for operational optimisation, predicts Lufthansa Technik's Doyle. "The sharing of data between airline and MRO offers us a chance to optimise together, to bring predictive analytics into the operational workflows and generate measurable savings," he says.

Sustainability is another issue at the forefront of many MRO companies' minds, especially with skyrocketing fuel prices. "Sustainability has become the 'new normal'. It is no longer acceptable to just talk about it, we need to deliver on it and ensure we are providing MRO services as sustainably as possible and offering airlines more sustainable alternatives," says Doyle.

"Sustainability products are getting a lot of traction in the market and I am pleased to see airlines creating a lot of 'pull' for these products."

It may be the case that anything the MRO industry can do to become more sustainable will pale in terms of impact compared to engine and aircraft emissions, but that does not mean there aren't worthwhile initiatives out there. For example, Pratt & Whitney's MRO sites have been "re-imagining operations and pursuing greener practices", according to Kirkpatrick. "Since 2010, water consumption at our Arkansas site has improved by 46 per cent and greenhouse gas emissions have reduced by 3,020 metric tonnes per year," he reports.

"Employees at our Dallas site developed an environmentally friendly laser for cleaning engine parts that vaporises grit, dust and rust from components, reducing material consumption, emissions and industrial waste." There are other initiatives too, he says.

There are also some good examples at Fokker Services Group. "Investments have been made in our building and utility infrastructure in order to improve our carbon footprint drastically, for instance by introducing alternate energy sources such as solar," says Poldermans.

"More efforts are being considered such as electric vehicles for handling and transport in our facilities, while the reduction of waste and its environmentally friendly handling is another topic that has caught our attention."

There is plenty for MRO companies to do in 2023 – whether it is getting through a high workload, continuing their digital journeys, attracting new talent or implementing sustainability initiatives – but there are enough reasons to believe that it can indeed be the "outstanding year" many are hoping for.

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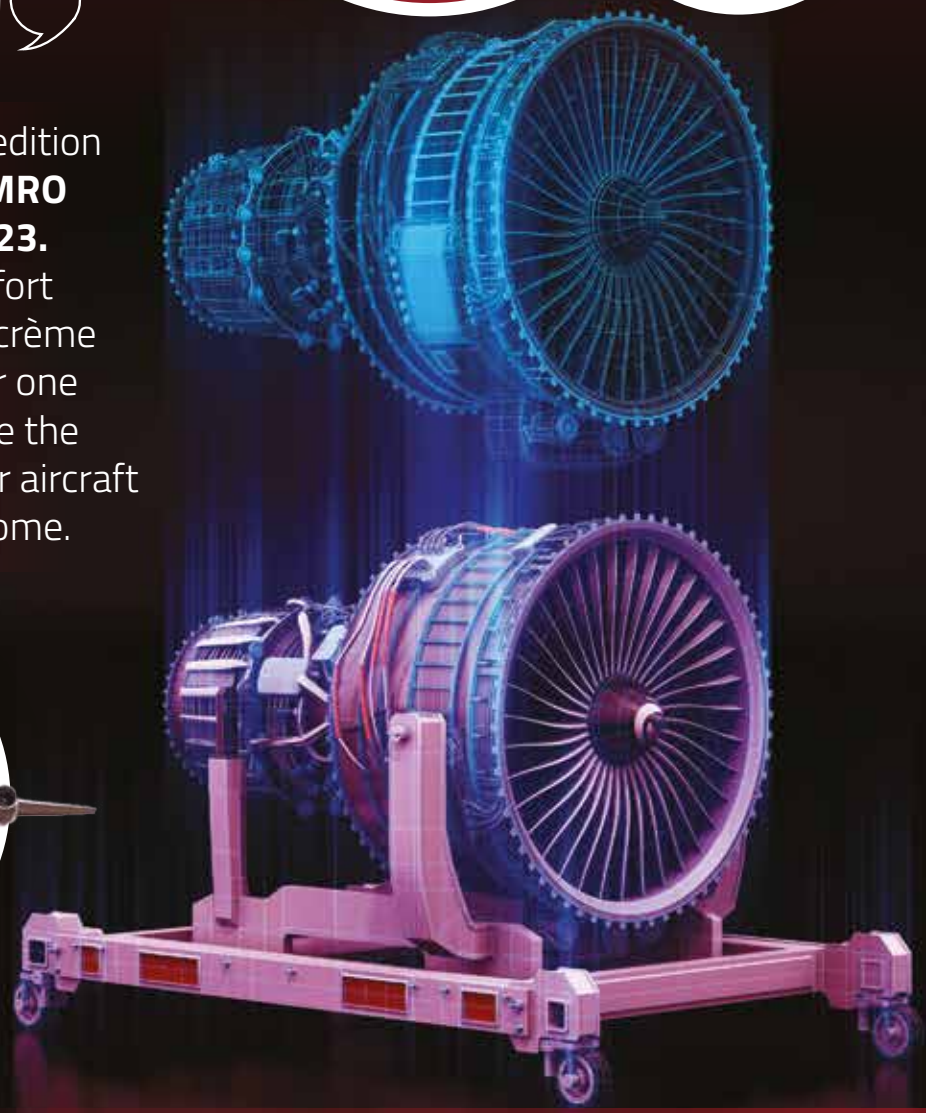

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PREDICTIVE AIRCRAFT MAINTENANCE 2022

UNLOCKING THE POWER OF INFORMATION

The Predictive Aircraft Maintenance 2022 conference took place in London in November. ***Jason Holland*** reviews an event which featured insightful speakers, lively discussion panels and excellent networking opportunities

Accelerating development, making the most of the masses of data, industry collaboration and data standardisation were among the key themes of the Predictive Aircraft Maintenance 2022 conference. More than 100 delegates were in attendance at the Pan Pacific London hotel in the UK's capital city for what was a very positive, informative and forward-thinking event.

Richard Brown, managing director of NAVEO Consultancy, chaired the Predictive Aircraft Maintenance conference.

He opened the event with an exploration of the importance of data. "There has been exponential growth in data due to increasing digitisation across the aviation industry," he said. "This data is being leveraged – or could be – to improve numerous aspects of airline operations, including maintenance, repair and overhaul. The challenge now is leveraging this data, accessing it, analysing it, and avoiding drowning in it!

"By leveraging the latest aircraft health management technology, it's possible to reduce unscheduled maintenance and turn unplanned and costly into predictable, planned and manageable."

Two excellent and insightful presentations followed, exploring how some current predictive maintenance solutions are doing just that, how they work, and where these solutions are heading. Lufthansa Technik's head of digital fleet solutions Mia Witzig began with an analysis of the company's AVIATAR platform, which she described as "digital, open, neutral and modular" web-based solutions for airlines and tech-ops.

Witzig presented one case study of an A320 EBASS system for an airline customer. AVIATAR predicted upcoming component failures resulting in a reduced

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1. Richard Brown of NAVEO Consultancy opened – and chaired – the conference
2. AFI KLM E&M's Rob Stolk discussed some real-world results of using PROGNOS
3. Lufthansa Technik's Mia Witzig revealed potential savings from using AVIATAR
4. Speakers from the session on software, analytics and digital offerings
5. Cranfield University's Dr Ip-Shing Fan provided an academic perspective on predictive maintenance

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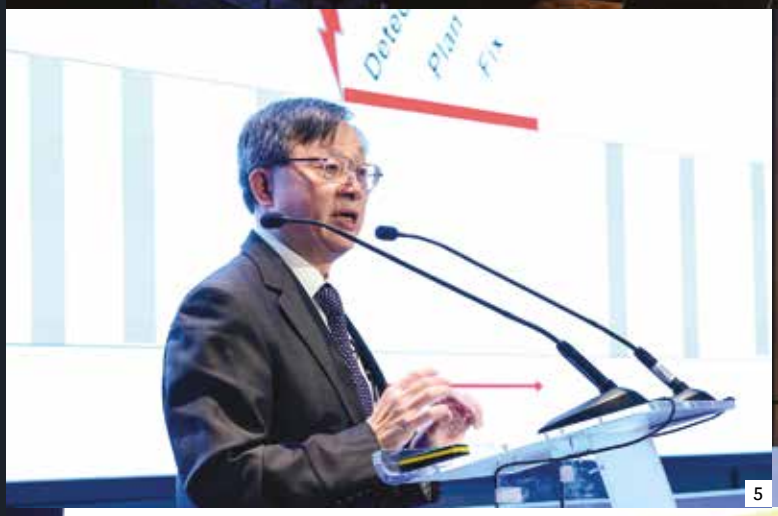

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"THE BENEFITS OF PREDICTIVE MAINTENANCE KEEP ON RISING"

number of operational incidents and response time.

After looking at other areas and components in which predictive maintenance has been useful, Witzig concluded her presentation with a startling statistic. Operating an A320 fleet of 50 aircraft costs US$25 million of operational interruptions and unscheduled maintenance per year, but at least US1.5 million can currently be saved with predictive maintenance per year.

This presentation was followed by Air France Industries KLM Engineering & Maintenance's predictive maintenance lead Rob Stolk's overview of his company's PROGNOS solution. He began by noting that there are 100,000,000 data points on a modern aircraft – more than the number of people in the UK.

He then explained how PROGNOS for Aircraft – which uses full flight data and covers 26 aircraft systems on eight aircraft types – had helped customers, citing the example of an air conditioning system. "We have prevented a lot of operational disruption and saved a lot of money," he said. "Now we want to cooperate with more of the industry and make our predictions even better."

Stolk noted that there were two ways to join PROGNOS – either by sharing full flight data or by uploading algorithms onboard. The latter option addresses concerns over the sharing of data, as only outgoing data is shared. However Stolk also noted that "more data equals better models, more models and more benefits".

A session on a range of software, analytics and digital offerings followed, with the aim of showing how data can be assessed to create actionable solutions. Aerogility's head of AI Simon Miles discussed the advantages of model-based artificial intelligence, while Rusada's global pre-sales director David Purfurst explained the benefits of his company's 'ENVISION' software platform and explored the ways in which a fractured ecosystem in predictive maintenance can come together like pieces in a puzzle.

Nadeem Muhiddin, Gamit's managing director, concluded the session by noting the importance of getting all aspects of digitalisation right and the need for standardisation of data sets – otherwise any benefits of predictive maintenance solutions might just be lost elsewhere. Gamit's 'ROAM' online enterprise solution, for example, uses advanced technologies to deliver an innovation document management platform. "We are still in the midst of standardisation, and it is hard to share data without this," he said. "Everyone in this room has a part to play in achieving this."

Dr Ip-Shing Fan, senior lecturer in enterprise solutions at Cranfield University, then provided an academic perspective on predictive maintenance as he outlined the work of the Cranfield Digital Aviation Research and

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1. Speakers from two MROs and two OEMs sat on a panel discussing "the good, the bad and the future" of predictive maintenance
2. Two networking receptions offered excellent opportunities to make connections
3. A second discussion panel featured representatives from easyJet, Engine Lease Finance Corporation and Rusada

Technology Centre's Digital MRO Lab, which supports automation of activities as well as data analytics leading to predictive maintenance. "We need a holistic view of a whole operation, and not just technology; we need to factor in business intention," he said. "Aircraft becoming intelligent and conscious is where we are heading to." Dr Fan also noted that there weren't currently "enough people in the industry who understand the power of information".

StandardAero's regional sales and service manager Airlines & Fleets Guillaume Limouzy concluded the morning sessions with a presentation on how his company is optimising engine health monitoring – making sure everything is "at the right time, in the right place and with the right person".

Following lunch, the stage was set for two high-level panel discussions exploring "the good, the bad and the future" of predictive maintenance. The first panel featured two MRO companies and two OEMS, with Lufthansa Technik's senior manager customer development Nils Westermann; Air France Industries KLM Engineering & Maintenance's Rik van Lieshout; Airbus' head of digital sales and marketing David Marty; and GE Aviation's fleet support director, customer and product support operations David Harper participating.

"AIRCRAFT ARE BECOMING INTELLIGENT AND CONSCIOUS"

Marty said that it must become an industry objective to accelerate the digital transformation. He said: "Digital transformation is not an option: the only question is, when do you want to start?"

Van Lieshout said the development of predictive maintenance solutions must go faster, and noted the importance of collaboration. "No one company will solve it all, and all issues will not be fixed in six months – but steps are being made."

The second panel got the views of an airline, a leasing company and a software company. It featured easyJet's predictive maintenance specialist Craig Lynch; Engine Lease Finance Corporation's Rory O'Donnell; and Rusada's Purfurst. Lynch offered insights into easyJet's use of Airbus' Skywise platform, noting that 35 cancellations had been avoided in August due to predictive maintenance. This is the tip of the iceberg. "We've only recently been able to accurately measure the benefits," he said, but explained that such solutions were yielding excellent results across the industry and promised much more.

O'Donnell's main questions about predictive maintenance involved data ownership, sharing, and transparency – there are many commercial implications and much needs to be done in the field of predictive maintenance to push past these concerns. However, O'Donnell added that from all he heard throughout the day, he was convinced of the potential of predictive maintenance solutions.

The Predictive Aircraft Maintenance 2022 conference concluded with a session involving aircraft manufacturer Airbus and engine OEM GE Aviation. Airbus' digital solutions marketing manager Stéphane Colombier and Skywise predictive maintenance customer representative Petros Manaras gave more details on the Skywise platform and looked at what the future might hold. Manaras said there had to be a culture of collaboration within the industry in order to unlock the massive gains that predictive maintenance can achieve – including fuel savings, a hot topic as sustainability becomes ever more important. "The benefits of predictive maintenance keep on rising," he said. "Users continue to ask us to work on different pain points."

GE Aviation's Harper explored the past, present and future of aircraft engine analytics-based maintenance, noting that three key things were needed: domain expertise, a strong portfolio of analytics, and a large data set.

"Feedback drives continuous improvement, and we recognise that every situation is unique," he said. "We are excited by new analytics technologies. Ultimately, it is all about helping the people at the front line make the best decisions possible, and so move closer to optimised maintenance."

3

1

TURNING DATA INTO INTELLIGENCE

As airlines seek to grow and prosper post-pandemic, predictive maintenance solutions and all that they promise are more appealing than ever before, as **Emma Kelly** reports

Predictive maintenance solutions are increasingly being taken up by airlines as they seek cost and time savings, particularly in the post-pandemic recovery period.

Ongoing developments in machine learning and artificial intelligence are making more sense of the wealth of data that comes off a modern airliner. The commercial aviation industry is recognising, however, that in order to truly unlock the predictive maintenance potential, more collaboration and data sharing is needed for the benefit of all.

Lufthansa Technik was a pioneer in predictive maintenance, developing solutions more than seven years ago as soon as the necessary computing power became available, says Mia Witzig, head of digital fleet solutions. "We are building on the know-how of our operational engineers, supply chain and MRO experts who used statistical data for many decades to provide spare parts, maintenance and engineering services to airlines."

The company's 'AVIATAR' digital platform combines fleet management solutions, data science and engineering expertise to provide a comprehensive range of integrated digital services for airlines, MRO companies, OEMs and lessors. "When we launched AVIATAR in 2017, it was the only platform available and we enjoyed the first-to-market advantage. Initially, some airlines hesitated to embrace the new technology, but we are seeing strong growing market demand now, as the financial benefits become more and more obvious," Witzig says.

Today, more than 3,400 aircraft from 50-plus operators are connected to AVIATAR, with the majority using 'Predictive Health Analytics' (PHA). PHA makes sense of the wealth of operational data coming from modern aircraft, with data analysed in real-time and enriched

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with MRO shop reports and climatic/environmental data, for example. "Our PHA solution's unique algorithms create tasks and visualise them in a very user-friendly design, which enables operators to minimise unscheduled maintenance," explains Witzig.

Collins Aerospace is also seeing increasing demand for its predictive maintenance platform, 'Ascentia'. Some 60 airlines around the world, operating approximately 2,500 aircraft, are using it, according to Brian McHugh, product owner, Ascentia, Connected Aviation Solutions. The Ascentia all-in-one solution provides health monitoring and predictive maintenance analytics. Customers can select an off-the-shelf product, whereby Collins provides the analytics, or they can develop their own analytics using a custom alerts feature, McHugh explains. Analytics are currently available for the A320, 737 NG, Boeing 787 and Embraer 170/190, with plans to expand the catalogue in 2023 with key reliability drivers for the 737 MAX, 777, A330, A350 and A220, he adds.

Ascentia has a competitive edge in a number of areas, McHugh believes, pointing to the systems expertise of Collins engineers on components even when Collins is not the OEM. "Our nose-to-tail approach means that airlines can view all their reliability information on a single platform," he says. Furthermore, Collins has a 24/7 monitoring team that reviews each alert, ensuring "accurate, reliable and targeted" predictions. McHugh says the team can also help

EVEN MORE COLLABORATION AND DATA SHARING IS NECESSARY

smaller airlines that want cutting-edge analytics without investing in a dedicated predictive maintenance team.

Another benefit is its custom alerts, with Collins recognising that airlines often have a support structure of expert mechanics and engineers that understand the technical aspects, but lack expert data scientists to translate insights into code. "Ascentia can provide a low code/no code environment where creating a complex predictive analytic is as simple as writing an Excel formula," he says. "We believe that each airline owns their own data and we want our users to have unrestricted access to it. Rather than stand in an airline's way, we want to enable users to do more with predictive maintenance."

As a result, there has been strong interest from airlines, keen to benefit from its prognostics and health management (PHM) to improve operations. McHugh points, for example, to a retroactive case study for the flow control valve from an A320 operator when Collins applied Ascentia analytics to historical flight data. If the airline had been an Ascentia customer at the time, an Ascentia alert would have highlighted a valve issue months before the first MEL, allowing the airline to schedule targeted and proactive troubleshooting and part replacement in advance of the failure.

Without Ascentia, the airline engaged in multiple, ineffective troubleshooting efforts, says McHugh. Ascentia's targeted analytics would have turned an unscheduled event into a scheduled one, reducing overtime, AOG shipping fees and increasing aircraft availability.

Aviation maintenance software from IFS is a core part of Rolls-Royce's 'Blue Data Thread' initiative, which supports predictive maintenance for every life-limited component in Rolls-Royce Trent engines throughout their lifecycle. Using AI, the IFS aviation maintenance solution enables the automated provision of field data to ensure the engine manufacturer receives timely and accurate information on its Trent 1000, XWB and 7000 engines, says Rob Mather, vice president of aerospace and defense industries at IFS.

"IFS aviation maintenance software then acts as a gateway to automatically push maintenance programme changes from Rolls-Royce back to the airline operators. As a result, life-limited engine part maintenance deadlines are updated based on actual operating conditions and life consumed by each engine in use," Mather explains.

The solution uses a multivariable predictive maintenance forecasting algorithm, based on an amalgamation of data from Rolls-Royce and the airline, to provide the most accurate information. "This is a perfect example of how, using this multitude of data points, value can be added to a collaborative predictive maintenance strategy," he says. Mather adds that IFS is looking for additional predictive maintenance opportunities with other industry players.

Functionality of predictive maintenance solutions is increasing. The scope of Collins' Ascentia, for example, has expanded and will continue. "Our approach is to be agnostic and provide solutions nose-to-tail," says McHugh.

1. The AVIATAR platform combines multiple apps in one place. Photo: Lufthansa Technik
2. Collins can take data from multiple aviation sources through the Ascentia platform to predict future maintenance needs

"WE ARE ALWAYS LOOKING TO PUSH OUT NEW FEATURES"

"We are always looking to push out features that will provide the greatest benefits to our customers by focusing on what they need and those we wished other tools had, and by leveraging over 20 years of experience specialising in PHM, reliability and engineering."

Ascentia's development is focused on features that drive value for customers, says McHugh.

Lufthansa Technik's Witzig says it is part of the company's DNA to develop new features, which are directly in response to customer requests which drive its product roadmaps. "They are asking for all sorts of new solutions to digitise their operation," she says. Witzig points, for example, to the electronic technical logbook recently developed by AVIATAR and approved by EASA for use by Wizz Air. "It offers so many new opportunities for data analytics," she adds.

Lufthansa Technik works with operators to develop user cases "which turns pains into gains". One example is condition monitoring and prediction offerings which were added earlier this year to AVIATAR for Boeing 737 NG operators worldwide as a result of co-creation with United Airlines.

Developments at IFS include its 'IFS Cloud', which features IoT connector, machine learning and AI services that the software specialist plans to apply to multiple innovations to support airlines and MROs, particularly in predictive maintenance and asset in-service optimisation. One such innovation, 'IoT and Machine Learning for Predictive Maintenance', has completed its proof of concept. "The solution allows for the aggregation of real-time sensor data, business and operations data, logs and more, into a data lake infrastructure – with an ability to transform all this into valuable data assets," explains Mather.

"These assets, along with machine learning models, can then be used to produce advanced statistics and KPIs to provide a holistic view of the aircraft in question, combining historical and forecasted values to achieve true predictive maintenance down to the individual serial number level."

Going forward, more collaboration and data sharing is necessary. "Data sharing and access is key to enabling predictive maintenance to reach its full potential," says Mather. "It's good to see some of the leading players in the industry are already starting to work on their own data platforms to get the benefits of sharing engineering data."

He points to GE's cloud-based 'Predix' platform which allows third-party MRO operators to download predictive analytical data via the internet, store it in their own systems, and share it with customers. In addition, Mather highlights Airbus' 'Skywise' cloud-based data platform, which collects data including work orders, spares consumption and flight schedules from multiple sources for MRO operators to perform predictive and preventative maintenance.

30%

IFS data shows a machine learning approach to aircraft analytics can lead to a 30 per cent increase in uptime

"In the maintenance arena right now, the conversation seems to be focused on who owns the information and not enough on sharing data for the benefit of customers," he says. "This is a fundamental hurdle. Airbus, like many airlines and MROs, will have several different customers, partners, locations and, in most cases, they will use different programmes for each one. This leads to data being siloed and sharing programmes being more internally focused."

McHugh says Ascentia makes it easy for airlines to share and collaborate on predictive maintenance alerts, while Witzig says Lufthansa Technik respects data ownership. "AVIATAR is the only independent digital platform focused on tech operations which allows all the players in the market to share and use data. On AVIATAR, operators of aircraft from different OEMs can manage all types on one screen," she affirms. AVIATAR provides customers with full control of their data stored on the platform, with the platform being "open, neutral and modular".

As cost pressures increase, the use of predictive maintenance solutions is expected to continue to grow. "What the industry needs is more intelligent predictions for maintenance on AOG faults, remaining operating life and repetitive defects," says Mather. "It's essential that the use of predictive maintenance continues to grow over the coming years. IFS data shows a machine learning approach to aircraft analytics can lead to a 30 per cent increase in uptime – key data when, as the aviation industry moves through its recovery phase, airlines want to keep costly AOG repairs to a minimum."

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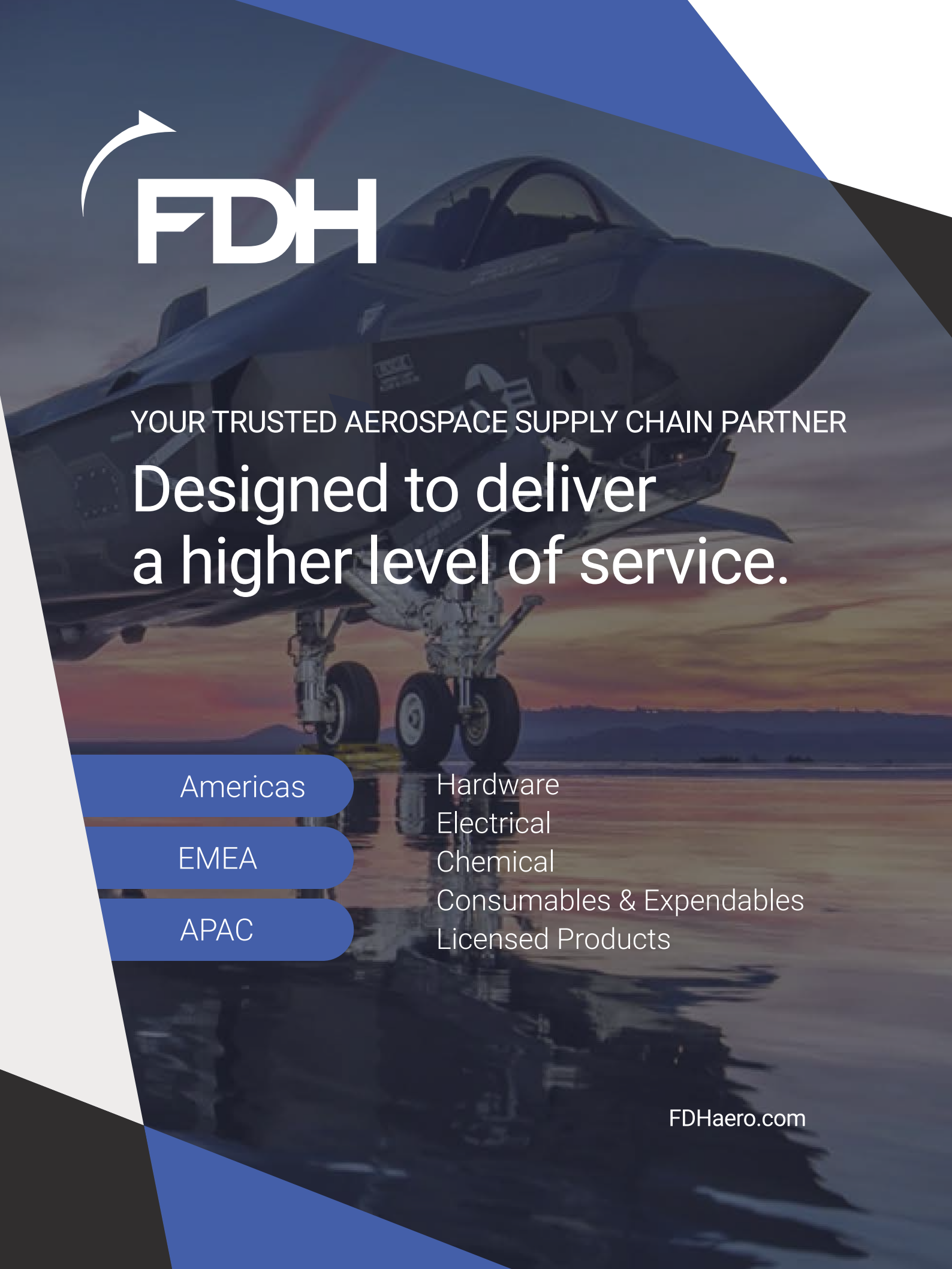
1. Mia Witzig's key objective at Lufthansa Technik is developing predictive maintenance applications



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Q&A

Mark Bechtel is the aviation field services representative at Shield Technologies

SHIELD TECHNOLOGIES

Proud to protect

Shield Technologies' **Mark Bechtel** reveals the strategy for the company's engine protective covers in commercial aviation in 2023

***MRO Management:* How has 2022 been for Shield Technologies and your corrosion inhibiting covers?**
Mark Bechtel: We are very pleased with the successes we've achieved and the groundwork we have established in both the military and commercial aviation sectors at Shield Technologies in 2022. These two markets really pair nicely for us for two reasons. Firstly, much of the equipment we are protecting is the same or similar in both arenas which aides us in telling our story. Secondly, we can use documented cover applications and evaluations that have triumphed on the military side as an example to a customer on the commercial aviation side.

Would you say a good foothold has been established in the aviation industry now?
Yes, without a doubt – for several reasons. First and foremost, we wanted to get Shield Technologies' name out in this market: and since early 2021 *MRO Management* has been one of the vehicles to achieve that.

"We have devoted significant resources to expanding this market and expect continued growth over the next years"

We know this through our review of advertising analytics from the publication as well as product inquiries from potential new customers. Additionally, the feedback we get from OEM and MRO customers has been extremely positive. They immediately see two things – how much easier it is to use our covers over other products, and the superior levels of environmental protection that only our covers can provide their engines.

What has the reaction been among potential customers in your discussions you have had?
I would say initially sceptical and curious when describing the attributes of Shield's covers, because they had no idea that a cover could do so many positive things and last often twice as long as products they were currently using. The scepticism quickly turns to hopeful excitement when we lay out the potential return on investment.

Has there been clear understanding of what differentiates Shield's covers?
Explaining the differences between Shield's covers and other cover products is usually an eye-opening experience when discussing our ability to significantly mitigate corrosion. That fact is a game changer when coupled with the long-lasting levels of multi-faceted environmental protection that are only seen when using Shield's covers. There really is no other cover on the market like it.

Have there been any barriers to selection?
I think the only real barrier is changing the paradigm between what covers have always been in the past and the transformation of what a cover can be. Shield Technologies realised those differences and set out to make a cover system that focuses on actively inhibiting corrosion and at the same time mitigates damage from moisture intrusion, UV, heat, FOD and other factors.

What's the strategy for 2023, regarding commercial aviation?
We want to continue to get our word out and build on the successes we have achieved over the past several years.

Is the commercial aviation sector now a priority for Shield Technologies?
Most definitely. We have devoted significant resources to expanding this market and expect continued growth in it over the next several years. We are proud to protect the engines that propel us around the world and will continue to provide our customers with the world's most effective, longest-lasting, corrosion inhibiting cover system.

Shield Technologies is now focused on commercial aviation engine covers as a priority

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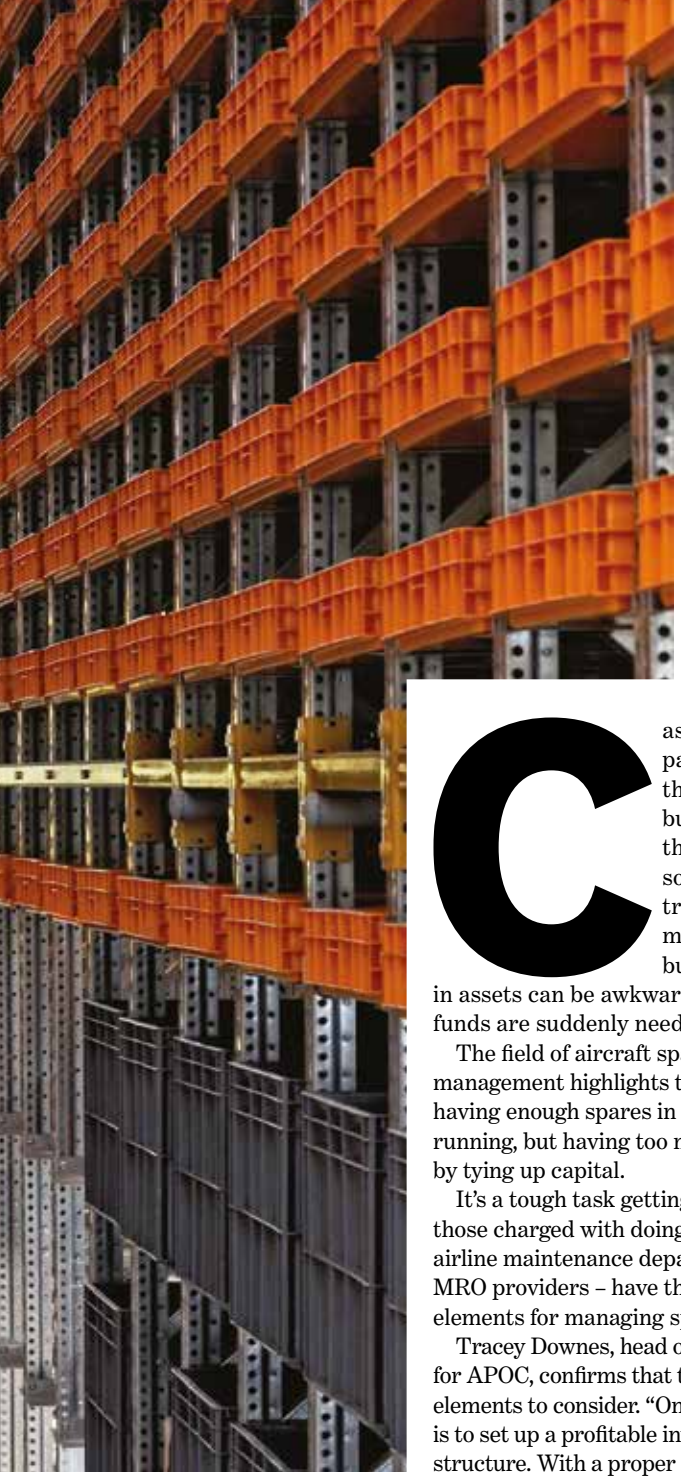

Intelligent inventory management of spare aircraft parts can make a huge difference to an airline's overall operation, as ***Bernie Baldwin*** discovers

Cash is king. Yes, most payment transactions these days are electronic, but having money in the bank ready for – sometimes emergency – transactions can certainly make life easier for a business. Tying up money in assets can be awkward when contingency funds are suddenly needed.

The field of aircraft spare parts inventory management highlights the occasions when having enough spares in house keeps the business running, but having too many can make life tricky by tying up capital.

It's a tough task getting the right balance, and those charged with doing so – be they in-house airline maintenance departments or third-party MRO providers – have their views on the key elements for managing spare parts inventory.

Tracey Downes, head of component sales for APOC, confirms that there are a number of elements to consider. "One of the most important is to set up a profitable inventory management structure. With a proper system in place, airlines can reduce the capital burden of holding inventory and so free up cash flow," she emphasises. "By working with a third-party parts supplier, airlines can consolidate their purchases while still ensuring access to aircraft parts as and when required."

Downes continues: "Another essential aspect is to forecast the customer's parts consumption and needs. The best way for an airline to overcome supply chain shortages is not with short-term fixes, but by taking a long-term perspective and accurately identifying their present and future needs for parts. Plan ahead by mapping out consumption requirements and forecast the parts needed to tie in with their longer-term company objectives. By identifying their parts procurement cycles in advance, while ensuring precise budget and capital flow planning, both airlines and manufacturers can optimise operations and free up their cash flow for other investments."

Downes says it's also important to consider how valuable the use of a good maintenance software programme can be to assist with managing spare parts inventory. "Although it is crucial to have a supply chain and inventory plan to avoid costly parts shortages, not many airlines can get it down just right, as it is tricky to formulate a strategy on their own in this unpredictable economic climate," she says.

"At APOC, we are continually evolving our software and real-time stock data and we have positioned ourselves to exceed market predictions and expectations. We have a continual investment in software, which positions APOC as a frontrunner in the sector ready to support the renewed growth in the USM (used serviceable material) market."

Likely to agree wholeheartedly with Downes' suggestion to use a "good maintenance software programme" is Adam Frost, product manager for OASES. For him, a key element is for the organisation to know what materials are required for maintenance activities.

"In OASES [the application], each task can have the required material listed and specified as required or contingency against likely findings from the task," Frost remarks. "In preparation of a maintenance input, the maintenance organisation can provision the required items and ensure they have access to the contingency material within their network of warehouses or at suppliers. Various material reports and the materials preload – where stock is provisioned for specific maintenance tasks – allow the airline to plan material in advance."

During maintenance, the technicians might request further spare parts. Frost notes these requests may be made using OASES Mobile or OASES Desktop and are linked to the supply chain and logistics for sourcing and positioning, and follow the items until they are issued from stores to the aircraft. "Supplier performance

↑ A balance must be struck between having enough spare parts in the warehouse – and having too many

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"Pool agreements are a popular way to increase part availability and to access material quickly"

statistics help the airline to ensure lead times are met and the quality of spare parts is maintained," he comments.

"It is important to have a robust process for sourcing materials for deferred defects. Our 'Carried Forward' defect report lists all current defects and for each shows the materials requested along with their current disposition, including associated orders, expected delivery times and air waybill tracking. OASES' 'Shipping Workbench' ensures material moving between warehouses and suppliers are controlled through preparation to receipt at their required destination.

"Also important is the need to maintain the traceability of spare parts to the source and provide easy access to certification documents. This can be attached to OASES stock records and helps maintenance technicians and auditors ensure compliance with regulations."

As can be observed, both companies advocate assessment of the amount of stock customers should hold. "This is usually a decision for the airline, but OASES provides data to model usage and lead times to inform this," Frost reports. "Holding stock of spare parts ties up capital and is effectively an insurance against delays, cancellations and providing serviceable aircraft on time from maintenance to facilitate the flying schedule."

He adds: "There is a lot of variability between airlines and it can depend upon the aircraft types being operated, the age of their fleet, the nature of the operation, the operational network configuration and the local climate. For example, new aircraft are generally less hungry for spare parts and OASES' 'Warranty Workbench' plays a significant role in the decision making. Older aircraft need more attention and require an efficient repair loop, although a proactive reliability programme can mitigate some unscheduled component changes."

Minimum stock levels, both across the organisation and at specific warehouses with good visibility of shortages across the network, help the airline ensure there are sufficient spare parts available to support the flying programme, Frost notes. OASES users can assess minimum stock levels based on usage history.

All of this is done with a 'green' element, which ensures as little waste as possible while benefitting the owner of spare parts. "OASES Web has an 'Unused Parts' feature which allows materials managers to identify spare parts with no recent usage for redistribution or disposal. This helps make sure that the best value is extracted from the stockholding and allows capital tied up in unwanted inventory to be released back to the business," Frost explains.

Downes says when it comes to assessing stock levels a customer should keep, the nature of the business and the continued need for maintenance visits, APOC works directly with airline customers' maintenance planning departments to forecast inventory requirements.

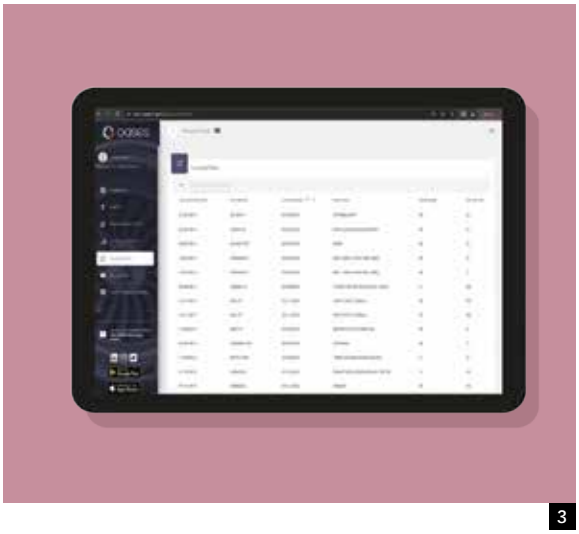
2

"Understanding airline shop visit requirements each quarter is crucial as a reference and having supplies on hand to support these shop visits ensures smooth execution when supporting our customers," she stresses.

The pandemic, Russia's attack on Ukraine and other external factors have all played a role in the current state of supply chains. Airlines and MRO providers need to know that when inventory is removed from stocks, it can be replenished as rapidly as possible – thus preventing a potential AOG situation.

"Aircraft parts have the distinctive feature of being expensive and need to be handled within short cycle/turnaround times (TAT) in order to reduce inventory costs," states Downes. "Aircraft inventory control is therefore a critical activity to ensure both effective maintenance and profitable use of multiple aircraft assets.

"If you know what, where and when a part is needed you can increase availability of the parts and reduce the stock in a 'just in time' manner. At APOC, our IT system shows real-time stock levels – actual live requirements backed up with minimum/maximum stock level control.



3

"As we continue to invest in narrowbody airframes, we use historic data to predict future requirements and ensure the typical units are in stock and ready to go, in line with our customers' requirements."

According to Frost, OASES provides a status of inventory versus minimum stock levels across the operational network. The application's minimum stock level report takes into account what's on order and any alternate part numbers along with their stock levels, thus being prepared for any quirks in the external supply chain. "We have a feature that can import and recommend re-order levels based on usage and turnaround times," he confirms.

"Essential codes can be defined for each part number, so parts that will prevent the aircraft from being dispatched can be assessed more rigorously than those that don't. Email notifications are provided on any event – issue of stock, picking, transfers – which causes a warehouse to sink below minimum levels.

"OASES has the concept of a central distribution warehouse, where stock can be easily transferred to outstation warehouses. OASES Web has a 'Customs Tracking' feature that ensures that all customs border-crossing shipments are identified and the customs details are recorded to ensure compliance with deferment account rules."

External factors are not overlooked though. "Material controllers take a view of whether items currently on order – be it on repair, exchange or purchase – will sufficiently replenish stock to minimum, or whether further purchasing or perhaps loans are required to meet potential demand," Frost comments.

"Pool agreements are a popular way to increase part availability and to access material quickly, although they are generally limited to one-for-one exchanges. Stock can also be taken on consignment from suppliers such that the stock is located near to where it may be needed. This reduces the lag caused by physically shipping the items from suppliers' warehouses."

While the challenges of the global aircraft parts supply chain are likely to continue to loom over the industry, planning in the manner described will help deliver smart inventory management – with some cash to spare.

1. Smart inventory management is vital as challenges in the global supply chain mount
2. When inventory is removed from stocks, it must be replenished as rapidly as possible to prevent a potential AOG situation
3. OASES software enables full visibility of inventories and other management options

PROTECTING THE PROTECTION

There are some peculiarities in the maintenance of nacelles and thrust reversers, as well as some specific requirements. ***Mario Pierobon*** reached out to industry experts to define them, the frequency of maintenance, and the special skills and training needed for maintaining these important aircraft units

When it comes to an engine nacelle, protection is the name of the game. But they also contribute to an engine's performance, efficiency and flight safety by directing and optimising high-speed airflow through the powerplant.

Nacelles operate in severe environments and are subjected to significant loads, including engine thrust and the fluctuations caused by forces and pressures, both external and internal. The nacelle systems also play a key role in reducing engine noise, including the integration of complex acoustic treatment that has been micro-drilled with millions of small holes on the inner composite surfaces, acting as sound traps.

The engine nacelle generally consists of several airframe units that include inlet cowls, fan cowls, thrust reversers, exhaust nozzles and engine mounts, explains Petr Doberský, director of Czech Airlines Technics. "These airframe units are usually manufactured by a different company than the manufacturer of the entire aircraft. In the case of Airbus and Boeing narrowbodies, the supplier of these units is usually Collins Aerospace (formerly Goodrich)," he says.

Peculiarities and requirements

In case of damage and necessary repairs, it is necessary to refer to the manufacturer's documentation, or contact the manufacturer directly and consult with the manufacturer about repair options, affirms Doberský. "For third-party MROs, this support is usually paid. At the same time, this is probably the biggest peculiarity, because the aircraft original equipment manufacturers (OEMs) usually do not provide technical support for these units," he says.

Lufthansa Technik's Airframe Related Components (ARC) services unit offers maintenance, repair and overhaul (MRO) services to all commercial aircraft nacelle types. "General requirements are to hold approvals as a maintenance organisation (EASA Part 145), access to manuals, availability of skilled workers, organisational set-up, access to materials and processes to handle these components correctly," says Henrik Schmutzler, head of MRO nacelles at Lufthansa Technik. "The type of damage influences the work scope's variation. Often, it is decided only after the inspection whether the work package is for 80 or 800 hours. Customers also require different levels of maintenance. Both thrust reversers and other nacelle parts require specific tooling for disassembly and assembly."

As the size of engines increases, the nacelles also become larger. "As a result, logistics to transport nacelle parts becomes increasingly challenging," reports Schmutzler. "Our ARC services unit has local repair stations in Hamburg, Shenzhen, and Dubai. For some work scopes we offer on-site repair teams that come to the location where the customer/parts are located.

↑ Lufthansa Technik's ARC unit offers MRO services for all commercial aircraft nacelle types

1

"Nacelles contribute to an engine's performance and flight safety by directing and optimising high-speed airflow"

"Major repairs require complex equipment for curing of composite repairs with heat blankets. In addition, some repairs have to be conducted in an autoclave. This in turn requires part specific tooling. Our ARC services unit has one of the industry's largest autoclaves."

Frequency of maintenance and customer requests

Damage usually occurs because of one of two main reasons. The first is by accident (for example a bird strike, lightning strike, foreign object damage, ground vehicles or runway debris); the other is over time (such as wear, corrosion or water ingress), affirms Schmutzler. "Accidental damage repair is always on condition. Other inspections/repairs can be conducted on frequent events which depend on type specific requirements, experiences and in some cases regulations. In addition, customers have varying requirements as well," he says.

20K

Inspection of static parts such as seals or thermal protection panels is due every 20,000 flight hours

According to Doberský, it is important to highlight that nacelles and thrust reversers are mostly inspected during higher levels of maintenance. "Their damage occurs due to the impact/absorption of foreign object debris (FOD), bird in flight or due to corrosion. A common reason for corrosion, such as on Airbus reversers or pylons, is de-icing liquid in combination with long-term parking of the aircraft (as seen during Covid)," he says.

"Customers often demand the best possible anti-corrosion protection of these units if they plan to park the aircraft for a long time and not operate it.

"In these cases, it is necessary to follow the manufacturer's standard aircraft maintenance documentation, such as the aircraft maintenance manual (AMM), structural repairs manuals (SRM) or service bulletins (SB), or to contact the manufacturer directly to discuss the issue with them."

Thrust reversers consist of various parts with different requirements. They are also specific to each aircraft type, and Czech Airlines Technics has thrust reverser inspection experience with the 737 MAX, the 737NG and the A320F, explains Doberský.

"For the 737 MAX, in accordance with the maintenance planning document (MPD), visual inspection of blocker door mechanisms is due every 6,600 flight cycles (FC), and inspection of static parts such as seals or thermal protection panels every 20,000 flight hours (FH).

"Most operational checks are to be performed every 15,000 FH," he says. "For the 737NG, in accordance with the MPD, the most common

12K

For the 737NG, in accordance with the MPD, the most common interval between inspections is 15,000 FH or 12,000 FH

2

interval between inspections is 15,000 FH or 12,000 FH. The interval between operational checks is 3,600 FH, 5,000 FH, 7,500 FH or 15,000 FH. In addition, the Federal Aviation Administration (FAA) has issued Airworthiness Directive no. 2019-18-03 ordering the performance of a thrust reverser upper locking actuator integrity test every 750 FH."

The MPD of the A320F foresees diverse inspection intervals of individual parts, according to Doberský. "The most common interval between inspections is six years/7,500 FC/15,000 FH. The shortest interval is 3,000 FC for general visual inspection of 'C' duct hinge fittings; the longest interval is 12 years for tasks such as detailed inspection of forward frame to beam connections, primary sliders and tracks," he comments.

3

"Nacelles operate in severe environments and are subjected to significant loads, both external and internal"

Special skills and training

Lufthansa Technik's ARC services unit employs sheet metal workers, composite workers and adhesive bonding workers. "Each work needs intensive training and experience. Also specific tasks such as grinding (such as for scarfing for composite repairs or corrosion removal) is a skill trained intensively. In addition, all workers need training in applying manuals correctly, aviation regulation, type training and training on all used tool and equipment," says Schmutzler.

Experienced personnel and special equipment are indeed required for the maintenance of nacelles and thrust reversers, says Doberský. "Replacing damaged parts requires extensive disassembly and assembly, and it tends to be time consuming. Some bigger parts can only be replaced in the manufacturer's shop, as they sometimes require very special tools and procedures not available to MROs," he says. "Usually they are composite parts (such as acoustic panels) that need special procedures to be repaired (in case the damage location and dimensions are within repairable limits), but sometimes special preparations and an autoclave are also needed.

"Composite repair procedures tend to be sensitive to compliance with technological conditions (cleanliness, temperature and pressure) and the quality of the materials used (such as prepregs). Aircraft manufacturers offer both theoretical and practical training for mechanics and engineers for special composite repairs."

15K

The most common interval between inspections is six years/7,500 FC/15,000 FH. The shortest interval is 3,000 FC for general visual inspection of 'C' duct hinge fittings

1. Special equipment is required to maintain nacelles and thrust reversers
2. Middle River Aerostructure Systems specialises in the production of engine nacelle systems and their thrust reversers
3. Czech Airlines Technics employs more than 600 qualified personnel

CLEANER COMBUSTION

Rolls-Royce's innovative lean-burn combustion system ALECSys has entered the final flight test phase – and is a key part of the manufacturer's drive to improve all aspects of environmental performance

1

UltraFan is a demonstrator aero engine from Rolls-Royce. It is the largest in the world, developed to prove certain technologies for narrowbody or widebody aircraft that may be built from the 2030s will work.

As part of the UltraFan engine demonstrator programme, the engine manufacturer is also developing 'ALECSys' – Advanced Low Emissions Combustion System – to help deliver the 25 per cent fuel saving over the first generation of Trent engines that the UltraFan engine is intended to achieve.

ALECSys is an innovative lean-burn combustion system that improves the pre-mixing of fuel and air prior to ignition. This results in cleaner combustion of the fuel and lowers NOX and particulate emissions. Now, the low-emission combustion system has taken off into the flight test phase.

2

140"

UltraFan has a 140-inch fan diameter. The large fan and relatively small core is key to its efficiency

The ALECSys demonstrator took to the skies attached to the Rolls-Royce Boeing 747 Flying Test Bed in Tucson, Arizona, US in November.

The test programme has included flights up to 40,000ft as well as a number of engine relights at different conditions, all of which have been successful, according to Rolls-Royce.

The ALECSys engine demonstrator has previously completed a comprehensive set of ground tests, including icing, water ingestion, ground operability, emissions and running on 100 per cent sustainable aviation fuel (SAF).

Everything is progressing well, according to Rolls-Royce's director of product development and technology, civil aerospace Simon Burr, and the future remains promising for ALECSys.

"We are very pleased to see the ALECSys engine now flying. This flight testing is a key part of our drive to not only improve engine efficiency but all aspects of environmental performance," he explains.

"It is part of the wider Rolls-Royce sustainability strategy, which also includes support for the increased use of sustainable aviation fuels and intensive research into alternative propulsion architectures and technologies."

"This flight testing phase is a key part of our drive to improve engine efficiency"

The ability to test ALECSys low-emissions technology in flight will allow the verification of altitude operability performance and provides experience of operating a lean-burn system to maximise maturity ahead of a future entry into service.

The ALECSys programme is supported by the EU's Clean Sky programme, and in the UK by the Aerospace Technology Institute and Innovate UK.

1. ALECSys is an innovative lean-burn combustion system that improves the pre-mixing of fuel and air prior to ignition
2. The ALECSys engine demonstrator has completed a comprehensive set of ground tests and is now in the flight test phase

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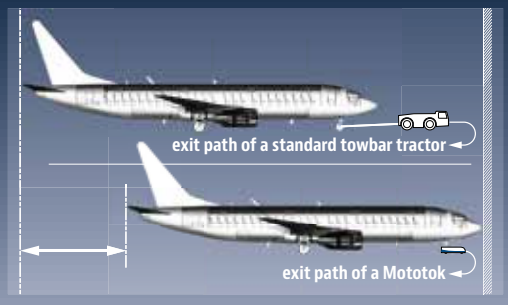

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