

# AVIATION MAINTENANCE

Winter 2021/2022

  magazine.com  

# WHO WILL FIX IT?

## The Helicopter Mechanic Shortage

### Also Inside:

#### **WHEELS & BRAKES**

TRENDS, TECHNOLOGICAL  
ADVANCES AND TRADE OFFS

#### **AVIONICS REPAIR UPDATE**

AS AVIONICS BECOME  
MORE SOPHISTICATED,  
SO DO REPAIRS.

#### **ON GUARD**

SAFETY EXPERT JEFF  
GUZZETTI LOOKS AT TWO  
HELICOPTER ACCIDENTS  
WHERE HISTORY REPEATS

SEE  
YOU AT

**AEROSPACE**  
TechWeek.com

**AMERICAS**  
ATLANTA

NOV 22

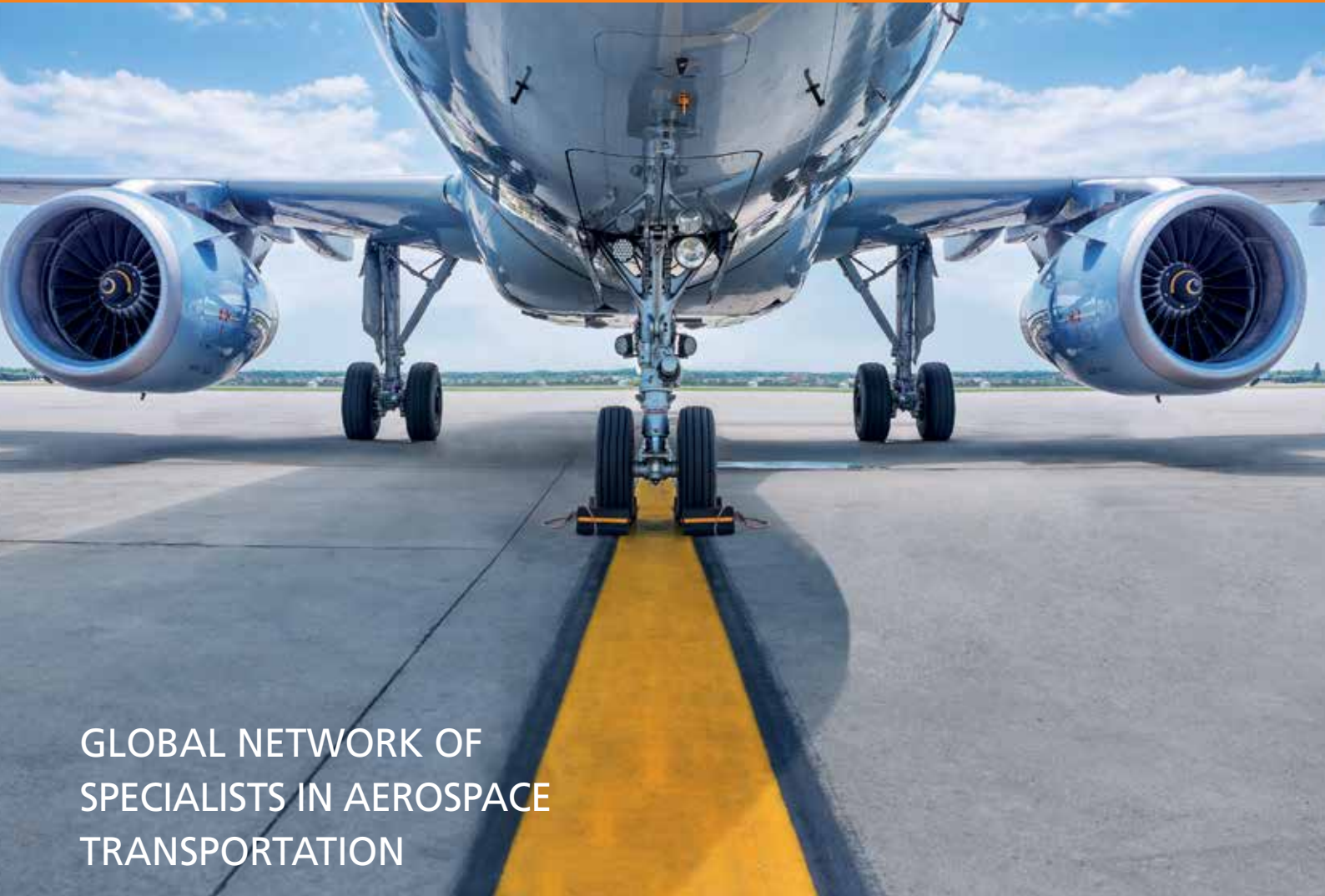
**GLOBAL**  
MUNICH

MAR 23

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



**Aviation Logistics Network**



**GLOBAL NETWORK OF  
SPECIALISTS IN AEROSPACE  
TRANSPORTATION**

**Do you have an urgent transportation challenge?**

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



**Contact us now on**

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

**[www.aln.aero](http://www.aln.aero)**



## DEPARTMENTS

- |                       |  |
|-----------------------|--|
| 04 Editor's Notebook  | 48 Q&A with LeAnn Ridgeway<br>VP Sustainability, Collins Aerospace |
| 06 Intelligence: News | 50 Legal Spin  |
| 34-35 Classified      |  |

# 26

## COVER STORY

### Who Will Fix It? The Helicopter Mechanic Shortage

The rotorcraft industry around the world is struggling to fill vacant positions for these highly specialized technicians. How bad is the shortage and what can be done to improve the situation? Learn more in our cover story by Mark Robins.



## 18 Wheels and Brakes

Aircraft are evolving and so are their wheels and brakes. The changes may not be glaringly obvious, but the structure of this technology is evolving.

## 36 Avionics Repair Update

Options for avionics upgrades abound. One key trend is the continued desire for better connectivity. We asked avionics makers about their newest products and spoke to avionics shops to learn more about the latest in avionics repairs and upgrades.

## 42 On Guard: A Tale of Two Helicopters

Two accidents involving two helicopters that were manufactured within a two-year period occurring two months apart. Check out safety expert Jeff Guzzetti's latest installment of On Guard to find out the cause.



**SEE OUR NEW MEDIA KIT**  
[avm-mag.com/advertise](http://avm-mag.com/advertise)

## CATEGORIES

- GENERAL AVIATION
- COMMERCIAL
- BUSINESS JET
- MILITARY
- ENGINES
- TECHNOLOGY
- PRODUCTS/ TOOLS
- SPECIAL REPORT
- AFTERMARKET

Aviation Maintenance (ISSN 1090-221X) is published bi-monthly by Aerospace & Security Media Ltd, 2139 Oakview Rd. SE Atlanta, GA 30317. Application to mail at Periodicals postage paid at Atlanta, GA and additional mailing offices. POSTMASTER send address changes to Aviation Maintenance 2139 Oakview Rd. SE Atlanta, GA 30317. The editor welcomes articles, engineering and technical reports, new product information and other industry news. All editorial inquiries should be directed to Aviation Maintenance; Email: [news@avmain-mag.com](mailto:news@avmain-mag.com). Subscriptions: Free to qualified individuals involved in the aircraft maintenance industry. All other prepaid subscriptions, see [www.avmain-mag.com](http://www.avmain-mag.com). Content may not be produced in any form without written permission.

# AVIATION MAINTENANCE



+44 (0)20 3892 3050  
+1 (920) 214 0140

## EDITORIAL

**Editor-in-Chief**  
Joy Finnegan  
[jfinnegan@avm-mag.com](mailto:jfinnegan@avm-mag.com)

## Contributing Editors

James Careless	Kathryn Creedy
Mark Robins	Ian Harbison
Jason Dickstein	Dale Smith
Jeff Guzzetti	James T. McKenna

## ADVERTISING/ BUSINESS

**Publisher/Owner**  
Adrian Broadbent  
[abroadbent@aerospace-media.com](mailto:abroadbent@aerospace-media.com)

**Group Publisher & Sales Director**  
Simon Barker  
[sbarker@aerospace-media.com](mailto:sbarker@aerospace-media.com)

**Key Account Sales Director**  
Jina Lawrence  
[jinalawrence@avm-mag.com](mailto:jinalawrence@avm-mag.com)

**Key Account Sales Director**  
Paula Calderon  
[pcalderon@aerospace-media.com](mailto:pcalderon@aerospace-media.com)

**DESIGN/PRODUCTION**  
Lisa Garrison  
[lgarrison@aerospace-media.com](mailto:lgarrison@aerospace-media.com)

## CLIENT SERVICES

**Administration**  
Maria Hernanz Reyes  
[maria@asi-mag.com](mailto:maria@asi-mag.com)

**LIST RENTAL**  
**Statistics**  
Jen Felling  
[felling@statistics.com](mailto:felling@statistics.com)

**REPRINT PARTNER**  
The YGS Group  
717 505 9701 x100



**AEROSPACE  
TechReview.com**



Aerospace & Security Media is a trading arm of ASI Publications Ltd

ASI Publications Ltd  
1 Coyners Avenue  
Southport  
PR8 4SZ  
UK

[abroadbent@aerospace-media.com](mailto:abroadbent@aerospace-media.com)

[www.avm-mag.com](http://www.avm-mag.com) or  
[www.aerospace-media.com](http://www.aerospace-media.com)

UK Company registration no 5999781  
UK VAT no GB227106044



# In the Midst of Chaos

BY JOY FINNEGAN  
EDITOR-IN-CHIEF

The last two years has been a roller-coaster ride for the industry. The pandemic has brought so many challenges, from mothballing aircraft to quickly bringing them back into service; from programs that encouraged early retirements to a heightened shortage of personnel; from the rude and unruly passenger struggle to continued supply chain problems. All this, plus the never-ending concern for family and loved ones during this unpredictable health scare, has left many burnt out.

Just as we are beginning to look ahead to better days coming out of one of the most unusual times our industry has ever experienced, we are faced with another crisis; a major conflict has begun as Russia invaded the sovereign nation of Ukraine, in late February. How this will impact the aviation maintenance industry remains to be seen. But one thing is for sure, these days will go down in history as one of the most unique and challenging times aviation has ever endured. If you didn't understand that the aviation industry was cyclical before, surely by now you get it.

We can hope the conflict that began by Russia invading Ukraine will be short lived and over quickly; for so many reasons, not the least of which is the possibility of many lives lost, or negatively impacted by war. Especially remembering that the U. S., just last year, left Afghanistan after 20 years.

Some things have occurred in just a few days, that many thought we'd never see. Severe economic sanctions have been imposed against Russia by multiple countries around the globe, including the expulsion of certain Russian banks from the SWIFT banking system. SWIFT stands for the Society for Worldwide Interbank Financial Telecommunication and is a global messaging system connecting thousands of financial institutions around the world. The move is intended to make the financial sanctions being imposed on Russia felt with immediate effect.

Then the European Union announced it will "finance the purchase and delivery of weapons and other equipment to a country that is under attack," for the first time ever. Other strong moves made by the EU include shutting down the EU airspace for Russians, proposing a prohibition on all Russian-owned, Russian registered or Russian-controlled aircraft. These aircraft will no more be able to land in, take off from or overfly the territory of the EU, a statement said. The restrictions apply to any plane "owned, chartered or otherwise controlled by a Russian legal or natural person." And according to news reports as I wrote this, EU countries were reportedly planning to send fighter jets to Ukraine. "We're going to provide even fighting jets. We're not talking about just ammunition," said Josep Borrell, the EU foreign policy chief.

What will happen obviously remains to be seen. Prayers and support for those caught in this mess and already Ukraine President Volodymyr Zelensky's rallying cry is part of history: "I need ammunition, not a ride!"

For those of us waiting to see how this will play out and how it will impact our industry, what is there to do but to continue doing what we know and love best — our work. With that in mind we present our latest issue full of updates and articles looking at the very latest in several areas.

On the cover we feature our story about the critical need for more mechanics to enter the workforce, especially in the rotorcraft area. More baby boomers are reaching their mid-60s and retiring. During the next decade, a record number of maintenance technicians will be eligible to retire and this trend will outpace the total of new mechanics entering the market, according to some predictions. The median age of aviation mechanics is 51, nine years older than the median age of the broader U.S. workforce as calculated by the U.S. Bureau of Labor Statistics.

As mentioned earlier, the pandemic worsened this situation by offering early buyout packages to encourage those near retirement to leave in the beginning of the crisis. Now, as things hopefully return to normal, the need for more mechanics is clear and urgent. See what the Aviation Technician Education Council, Helicopter Association Intl. and operators like Bristow are saying and doing about the situation in this story starting on page 26.

Next, we take a look at trends and developments in wheel and brake repair. While much remains the same, small, incremental changes are making a difference in this niche sector of aviation maintenance. Automation is one key area of change as are new technology materials that are more lightweight but still as strong. Learn more in this story beginning on page 16.

Another niche repair area is avionics repair and avionics upgrades. Options for upgrades abound, depending on the specific needs of clients. One trend in this area is the continued desire for better connectivity. Improving inflight connectivity will continue to be an important growth area of avionics businesses. We asked leading avionics systems makers like Honeywell and Universal about their latest products to solve all manner of challenges. We also spoke to MROs that provide repair and upgrade installations to learn more about the latest in avionics repairs and upgrades. That story starts on page 36.

Last, I'd like to urge you to read safety expert Jeff Guzzetti's latest installment of his "On Guard" series. In this story, two helicopters, built two years apart crash within two months of each other. Sadly, both accidents involved loss of life. As it turned out, both helicopters had the same maintenance-related problem. As Guzzetti puts it, "You can't make this stuff up." Please read this cautionary tale of two helicopter accidents – even if you aren't a helicopter operator or mechanic. There is much to be learned from these two tragic events across the board for anyone responsible for the care and feeding of aircraft. That piece starts on page 42. **AM**

CARING  
FOR  
A  
CLEANER  
WAY  
TO FLY



Like you, we understand just how important it is to look to the future. That's why Airbus Services ensure your aircraft performs as efficiently as possible, while also meeting your environmental goals. To do this, we offer the right services for your aircraft, allowing you to increase aircraft availability while lowering costs. And through sustainable practices that save fuel and minimise noise, together we'll keep the world a beautiful place.

**AIRBUS**



## CFM56 Maintenance for WestJet by Lufthansa Technik

WestJet has awarded its CFM56-7B engine maintenance program to Lufthansa Technik. This agreement provides WestJet with access to a wide range of services including overhaul capabilities and on-site maintenance support. Under a separate agreement, Lufthansa Technik has collaborated with FTAI Aviation to provide access to CFM56 modules and material to support this maintenance program. An important principle of this maintenance approach is the replacement of modules, which optimizes engine life and delivers a more environmentally sustainable program.

"WestJet is excited to move forward in this new agreement with Lufthansa Technik in a dynamic new program to support our fleet. We are looking forward to working with this expanded relationship with Lufthansa Technik to provide excellent support and engine life cycle management. Further, working with a support organization that understands the airline perspective and needs, serves to enhance the value of support brought to the table. This is the result of a very competitive process started in January 2021 that resulted in Lufthansa Technik's team being awarded a contract that provides leading value and support through a team approach offering creative solutions," said Gandeephan Ganeshalingam, vice president of Technical Operations, WestJet.

"Lufthansa Technik is excited to be partnering with WestJet on one of their largest maintenance programs. We look forward to continuing our strong relationship with them. Similarly, in subcontracting a third party supplier like FTAI, we are confident that we will be able to provide a high quality and reliable product



at a competitive cost. One major pillar in our collaboration is that we will be able to, where appropriate, further optimize an engine's life. This results in high engine reliability and stable operations for WestJet," said Georgios Ouzounidis, VP Corporate Sales North America at Lufthansa Technik.

"We are proud to support our partner Lufthansa Technik on this unique CFM56 maintenance program for WestJet," said Joe Adams, FTAI's chairman and CEO. "As the CFM56 engine matures, we believe this program serves as a new blueprint for providing the most creative and cost effective aftermarket maintenance solution to the largest engine fleet in the world."

## FAA Administrator Dickson Announces He is Leaving Agency

FAA Administrator Steve Dickson announced he will be leaving the agency at the end of March. A former Delta Air Lines captain and operations vice president of that airline, Dickson came to FAA after taking retirement from his position at the Atlanta-based airline. Although Dickson faced a tough couple of years coming in amidst the Boeing 737 Max tragedies, the COVID pandemic and the worst spate of unruly passengers in aviation history, he handled all with aplomb. He is only a little over two years into a five-year term. Dickson released the following statement:

"By now, most of you have heard that I will be stepping down as FAA Administrator as of March 31. As I expressed to FAA employees in an email sharing my decision, it's time for me to go back to Atlanta, where my wife, Janice, and my family have been keeping a light on for me. It started as a porch light, but it's become a search light, calling me home.

As I also told the nearly 45,000 FAA employees, I am tremendously proud of the work we've accomplished over a very short time. We put this agency on firm footing to excel and prosper in the 21st century and beyond. We made, and we continue to make, our global aviation system safer from the hard lessons learned from the 737 MAX; we kept the skies open and safe despite tremendous odds when COVID-19 shut down the global transportation network, and we continue to make sure

the safety of the aviation industry and the insatiable desire for connectivity can coexist.

And despite all of the crises, this dedicated workforce shared my vision for modernizing our approach to safety and revitalizing and reinvigorating our workforce, in part through our Flight Plan 21 initiative, which is now well underway. We're safely integrating exciting new forms of transportation—drones, flying taxis, automated aircraft and spacecraft, to name a few. I'm not exaggerating when I call this the most exciting time in aerospace since the advent of the jet engine, and maybe even the Wright Brothers.

I said hello to many intelligent and diverse new people in our workforce, and said goodbye to too many wonderful souls, taken from us much too early by COVID-19.

Please know that although I will leave the FAA at the end of next month, I will always be an advocate for the agency's work and our shared commitment to aviation safety."

The Biden Administration will begin a search for his replacement.



Steve Dickson

## AAR announces a 10-year extension of its component MRO agreement with IAMCO for support of the NATO E-3A Airborne Warning and Control (AWACS) Fleet

AAR has received a 10-year extension of its component maintenance, repair, and overhaul contract with International Aerospace Management Company (IAMCO), which is responsible for depot-level maintenance for the North Atlantic Treaty Organization's (NATO) E-3A AWACS aircraft fleet. The services will be performed at AAR's Component Repair facility in Amsterdam.

AAR's Amsterdam facility has served IAMCO for two decades. The company says it has been ranked an "Outstanding Source of Repair" on numerous occasions.

"AAR is honored to announce the extension of this long-term service contract," said Eric Bron, AAR general manager, Component Repair – Amsterdam. "We look forward to continuing a partnership with NATO and providing outstanding service."

"IAMCO is very pleased to confirm AAR as one of its sources of repair for component MRO in this extension of the E-3A program,"



said Bernard Masuy, IAMCO branch manager, Components. "AAR's Amsterdam facility proves to be a reliable partner and a strong pillar of the E3A DLM component maintenance program."

## Raytheon Appoints Calio as COO and Names Eddy as President of Pratt & Whitney

Raytheon Technologies Corporation announced the appointment of Christopher T. Calio as chief operating officer and named Shane G. Eddy to succeed Calio as president of its Pratt & Whitney business unit, effective March 1, 2022.

As COO, Calio will oversee the company's four business units as well as its technology and engineering; enterprise services and digital; and operations, quality, environmental, health and safety and supply chain functions. Calio will continue to report directly to chairman and CEO Greg Hayes.

"Chris is a tested leader who has successfully steered Pratt & Whitney through one of the most dynamic and challenging periods in aerospace history," said Hayes. "He has guided strategic investments and delivered industry-leading innovation across commercial and military programs. As we execute on our strategy, including our commitment to develop talent across the organization, Chris' experience and leadership will help advance the company's growth and transformation initiatives."

With more than 20 years of executive leadership experience, Calio has spent the past decade in aerospace and defense. In his most recent position as president of Pratt & Whitney, he oversaw the introduction of numerous product enhancements, including

the recent introduction of the GTF Advantage engine as well as the F135 program.

Shane Eddy, currently SVP and chief operations officer at Pratt & Whitney, replaces Calio as president of Pratt & Whitney.

"Shane's significant aerospace industry leadership experience and in-depth understanding of Pratt & Whitney's products and culture makes him the ideal leader to take the business through its next phase of growth," said Hayes. "Building on his proficiency running global operations, Shane's management and operational expertise will help drive continued optimization of the business."

Eddy joined Pratt & Whitney in 2016, with prior experience at GE Aviation, Sikorsky Aircraft Corporation and Bell Textron.



Chris Calio



Shane Eddy

## IAI Completes Conversion of 100th B767-300 Aircraft

Israel Aerospace Industries (IAI) is celebrating a major milestone – it has completed the freighter conversion of the 100th B767-300 aircraft. This achievement shows IAI's commitment to the cargo conversion industry for over four decades as well as their "advanced capabilities, robust pace and expanding capacity to provide customers worldwide with the most optimal freighter solution." The 100th B767-300 freighter was converted at IAI's cargo conversion facility in Tel Aviv, Israel, prior to being delivered to the customer.

IAI began operating the B767-300 conversion line in Israel in 2007 together with M&B Conversions, a joint venture with Mitsui, and received the STC (Supplementary Type Certificate) in 2009. In 2017, IAI opened an additional B767-300 conversion facility in Mexico, increasing operations to meet global demand for the



converted widebody aircraft. The converted B767-300 aircraft provides a competitive and cost-effective solution for customers seeking to increase their cargo fleet, and as air cargo traffic is predicted to double in the next two decades and e-commerce continues rising, IAI says it will continue providing this service to the market.

## Stark to Become New Chairman of the Executive Board of Lufthansa Technik

The chairman of the Executive Board of Lufthansa Technik, Dr. Johannes Bussmann, will leave the Lufthansa Group at his own request later this year. After more than seven years in his current role and 10 years on the Executive Board, he will hand over leadership of the company to COO Soeren Stark.

Stark has been a member of the Executive Board of Lufthansa Technik since 2019. He previously held a number of other executive functions at Lufthansa Cargo and Lufthansa Technik. Subject to the approval of the Supervisory Board, he will assume his new role on 1 July 2022. Johannes Bussmann assumed leadership of the world's leading provider of technical services in aviation in 2015 after overseeing human resources on the Executive Board for three years. After leaving Lufthansa Technik, he will become CEO of a major German technology company.

"I look back with great gratitude on my years as chairman of the Executive Board and my 23-year career at Lufthansa Technik," Johannes Bussmann said. "We have achieved great things during this time. I am really proud to have been a part of this success story and to have had the opportunity to lead this company over the past seven years. The time has come for me to take on new responsibilities outside the aviation industry. It is a challenge that I am looking forward to tackling."

"The chairman of Lufthansa Technik's Supervisory Board, Dr. Detlef Kayser, said: "I would like to thank Johannes Bussmann for his outstanding work at Lufthansa Technik. He and his team have led the company safely through the crisis. Above all, he played a special role in the success and growth story that Lufthansa Technik has written in recent years. I therefore wish him all the best for the future."

Bussmann, who holds a doctorate in engineering, began his career at Lufthansa Technik in Hamburg in 1999 as a development engineer. After serving in various marketing and sales positions, he became head of the Component Supply business unit in 2007 and then of the Engine Services business unit in 2011. He was appointed to Lufthansa Technik's Executive Board in 2012. Bussmann implemented the company's growth and investment strategy. He also decisively drove the digitalization of the company



Shown here are Dr. Johannes Bussmann, left, and Soeren Stark, right.

and the development of digital products, most notably the AVIATAR digital platform for optimizing flight operations.

His appointed successor, Stark, joined Lufthansa Technik's Executive Board as chief operations officer in January 2019. In this role, he is responsible for Technical Operations and Logistics. Previously, Stark headed the Executive Board department Operations at Lufthansa Cargo AG for three years. He began his career at Lufthansa Technik in 2004 as managing director of Lufthansa Technik Logistik in Hamburg. From 2011 to 2016, the industrial engineer headed the aircraft overhaul business at Lufthansa Technik AG.

"Soeren Stark has distinguished himself in various positions in our Group and achieved much. At Lufthansa Technik, he has demonstrated his abilities as an excellent manager as he developed our worldwide overhaul network and played a key role in the restructuring work performed during the corona crisis, among other areas," said Kayser. "With his high level of expertise, experience and leadership, he will lead Lufthansa Technik successfully into the future."

Kayser also said the early succession arrangement would ensure continuity at the top of Lufthansa Technik. It is a decision that will enable the company to defend and expand its position as the world's leading provider of technical services, he noted.

## L2 Aviation and Global Aerospace Design Join Forces

L2 Aviation announced a strategic agreement with Global Aerospace Design Corporation (Global). The two say together they will provide customers with L2 Aviation's exceptional history of achieving results combined with Global's ability to shorten design and certification cycles. Additionally, L2 Aviation has opened a Cincinnati, Ohio office that stages L2 Aviation and Global in a centralized area to better serve customers. "I am excited to announce this strategic relationship between Global and L2 Aviation," said Todd Hamblin, president and CEO of Global Aerospace Design Corporation. "L2 Aviation has an incredible team of dedicated professionals who provide exceptional results focused on minimizing aircraft down-time which blends perfectly with Global's focus on building lasting customer relationships."

"By adding Global combined with the opening of an office in Cincinnati, Ohio, we have expanded our ability to exceed

customer expectations and expand our capabilities," said Mark Lebovitz, president and CEO of L2 Aviation.

"We are driven to be a dedicated partner for our customers and provide unparalleled support and innovation they can count on. By adding Global to our family, we are able to further demonstrate our commitment to innovating a future our employees and customers can trust."





# Leading the way

From small aircraft to large jumbo jets,  
Druck's ADTS 500 Series is the world  
leader in Pitot Static Testers

---

Druck, a Baker Hughes business, has over 20 years' experience in the field of calibrating aircraft's airspeed and altitude systems. Whether low flying sightseeing aircraft, commercial aviation or combat jets, Druck has the products to meet your needs. Druck's product lines feature TERPS technology at their core, which delivers unprecedented accuracy and stability to produce the highest levels of performance.



[druck.com](http://druck.com)

Copyright 2021 Baker Hughes Company. All rights reserved.

 **Druck**  
a Baker Hughes business

## King Aerospace Names CONUS Deputy Program Manager

King Aerospace Inc. (KAI) has named William A. "Bill" Forbes to the position of deputy program manager for the contiguous United States (CONUS). In this role, Forbes provides management and oversight of aircraft maintenance and logistics operations in support of military aircraft around the world. He will oversee the day-to-day operations at seven CONUS locations operating 41 aircraft. His responsibilities in support of maintenance operations serve to ensure that King Aerospace's team members are properly resourced to sustain quality maintenance standards and to provide the customer with safe, mission-ready aircraft. He brings more than 30 years of military and civilian experience in the aviation industry from both the government and contractor sides of the business.

"Specialized contractor logistics support requires mission-driven focus and unwavering dedication, which Bill unequivocally demonstrates," said Jarid King, president of King Aerospace Companies. "He understands how the excellence of our services and the trusted performance we deliver support our troops' readiness, wherever they're deployed globally. He's an incredible, experienced leader with a passion for what we do."

His wide-ranging experience includes leading aviation maintenance departments in dynamic operational environments around the globe. His expert knowledge of Federal Aviation Administration (FAA) compliance issues, regulations and directives, as well as military aviation rules and documentation, helps ensure positive outcomes. Forbes

understands enterprise-level planning and decision-making, forming mutually beneficial partnerships, and aligning customer needs with mission requirements.

"Bill inspires teams to deliver the best, most innovative solutions," said Greg Mitchell, vice president of government services for King Aerospace Inc. "He's a proven leader with excellent judgment and decision-making skills."

Forbes' extensive work history includes leadership roles throughout his 23-year military career in the United States Navy. He achieved the highest enlisted rank of E-9 and retired as a Master Chief Petty Officer, representing the top 1% of enlisted personnel. In addition, he has served in key management roles with several defense contractors in his post-military career. Forbes has experience in a vast array of military aircraft, from fighter-attack to logistics support platforms. In these roles, he maintained a high-level security clearance in support of military operations.



Bill Forbes



Jarid King

## Ryanair Opens New Aircraft Maintenance Facility In Seville, Spain

Ryanair opened its newly expanded maintenance facility at Seville Airport in December, delivering further investment in the region and creating 250 high-skilled jobs, including licensed engineers, mechanics and support staff – bringing Ryanair's local headcount to 500 by 2023.

Ryanair has invested more than €30 million (\$33.6 million) in this state-of-art five-bay maintenance facility (20,000m<sup>2</sup>) since it first opened in 2019. The Seville Line Maintenance station is one of the most environmentally friendly facilities in the world and will maintain a large portion of Ryanair's fleet of aircraft, which will grow to 600 aircraft by 2026.

With over 2,500 engineers across Europe, Ryanair Line Maintenance Engineering is responsible for all aircraft maintenance activities. Ryanair has carried over 22 million customers to/from Seville since its operations began in 2003 and has played a vital role in Seville and Andalucía's traffic and tourism recovery post COVID-19.

Ryanair has also announced its full 2022 schedule from/to the Seville-San Pablo airport, delivering 53 routes, including seven new summer routes to/from Agadir, Billund, Frankfurt, Oujda, Tenerife, Tétouan, Turin, further supporting the recovery of the tourism industry and enhancing the region's connectivity.

"As the largest airline in Spain, Ryanair is delighted to open its expanded maintenance centre in Seville, which brings its



total investment to €30m and 500 jobs, underlining Ryanair's ongoing commitment to Spain and the Andalucía region," Ryanair's Eddie Wilson said. "This state-of-the-art facility is a world class environmentally friendly facility as Ryanair continue to lower CO<sub>2</sub> emissions as Europe's greenest airline Ryanair creates opportunities for highly skilled engineering jobs, with our industry leading rosters and the youngest fleet in Europe. Seville is an ideal location with endless opportunities to attract, train and employ local talent to support this facility. With this state-of-art facility and four based aircraft for S22 delivering 53 routes to 13 countries, Ryanair is supporting and positioning Seville for a strong recovery, and we look forward to further growing local tourism, traffic and jobs."





# Day in. Day out.

**CFM Services. Supporting your engine throughout its lifecycle.**

At any point in time – from entry into service to mid-life and through maturity – we have the capability, resources and experience to deliver all of your engine service requirements. From customized programs to tailored transactions, we ensure your CFM engine is maintained to meet your needs and cost of ownership objectives. Wherever you are in the world, whatever day in your engine's life.

**Expertise. Choice. Flexibility.**

**[cfmaeroengines.com/services](http://cfmaeroengines.com/services)**

CFM International is a 50/50 joint company between GE and Safran Aircraft Engines





## flydocs and SGI Aviation Team Up

flydocs announced a strategic alliance with SGI Aviation Services BV (SGI), to develop its financial asset management software solution. The enhanced offering will cater to a diverse range of aviation asset owners through flydocs' digitized asset management tools.

SGI Aviation will continue to benefit from the comprehensive solutions that flydocs provides out of aircraft maintenance data and its digital capabilities to ensure smooth integration with their systems and industry offerings.

"We're excited to be collaborating with SGI Aviation to disrupt the asset management sector with this new product," said André Fischer, CEO, flydocs. "In SGI Aviation, we have found a trusted and industry-wide respected partner supporting us in producing the best-in-class asset management software to meet the growing demands of the aviation sector. Digital asset management is an emerging way through which aviation assets can be financially, contractually, and operationally administered effectively and with our innovative approach, we will continue to generate significant efficiency gains with flawless delivery."

Commenting on the announcement, Paolo Lironi, CEO, SGI Aviation stated, "We, at SGI, have been actively involved in setting industry standards, on digital documentation for aircraft and engines, for many years. I am particularly proud to be an active member of the IATA



paperless initiative working group and I believe this cooperation with flydocs perfectly fits the SGI strategy to continuously ramp up its ESG contribution. This new software solution will surpass current offerings that lack the simplicity and ease of use that flydocs are known for. We consider it to be a major milestone, reinforcing SGI Aviation's position as one of the industry's leading independent asset management companies."

## China Airlines Extends Contract with Lufthansa Technik for Six Years

China Airlines, the flag carrier of Taiwan, extends the Total Component Support (TCS) contract with Lufthansa Technik for another six years minimum. The agreement covers component support for the Airbus A330 fleet of 23 aircraft. Lufthansa Technik also provides component services for their Airbus A350 fleet, including simulator components as well as Auxiliary Power Units.

Jason Tsai, VP Engineering Division of China Airlines, said: "The reliable and high-quality services we have experienced since 2010 had convinced us to extend the contract. A stable operation is crucial for us and Lufthansa Technik has proven to be a dependable partner."

"We are thankful for our long-term and trustful relationship with China Airlines and are committed to exceed their expectations," said Konstantin Stathopoulos, VP Corporate Sales for North Asia at Lufthansa Technik.



## ST Engineering Secures Extension Contract from Jeju Air

ST Engineering announced that its Commercial Aerospace business has secured the extension of component Maintenance-By-the-Hour (MBHTM) contracts from Jeju Air to support the airline's Boeing 737NG and Boeing 737Max aircraft. Under the extension contracts, which will take effect on 1 January 2025, ST Engineering will continue to provide integrated component support to Jeju Air's Boeing fleet till 2030 after the existing contracts expire.

Jeffrey Lam, Commercial Aerospace President at ST Engineering, said, "We thank Jeju Air for their confidence in our trademarked MBHTM program. The contract extension validates the value we help create for Jeju Air since we started working together in 2015. As the

aviation industry looks forward to leaving the worst of the pandemic behind, we stand ready to support longstanding customers such as Jeju Air with unwavering attention to performance and quality as they plan for their next leg of growth and recovery."

Louis Kim, Head of Purchasing at Jeju Air, said, "We are grateful to ST Engineering for providing stable MBHTM service for Jeju Air even in the difficult pandemic situation. The long-term MBHTM contract proves that Jeju Air and ST Engineering are strategic partners. We expect that the partnership between the two companies, which is strengthened in the current difficult situation, will shine even more after the pandemic situation is over."

## Astronautics Badger Pro+ Provides Glass Cockpit Upgrade for Huey II

Astronautics Corporation of America's Badger Pro+ Integrated Flight Display System is providing a forward-fit and retrofit glass cockpit upgrade solution for the Bell Huey II modernization program.

Astronautics is providing each Huey II with three 6x8-inch high-resolution displays, a control panel, and an engine data acquisition unit. Astronautics equipment, along with additional upgraded avionics, transforms the cockpit from analog instruments to a digital, full-glass cockpit, replacing primary flight displays and engine instruments with the same Badger Pro+ Integrated Flight Display System flying on new production Bell helicopters.

"Astronautics' Badger Pro+ provides the Huey II with new capabilities that extend its mission readiness, including reduced pilot workload and increased precision and situational awareness," said Brian Keery, Astronautics' senior manager of displays and cockpit integration.

Badger Pro+ is the latest generation of Astronautics' Badger display family, which has demonstrated reliability over one million flight hours in the harshest environments. The displays show primary flight, navigation, and engine data, and include high-definition video from multiple inputs, all with night vision compatibility. Badger



Pro+ integrates information from across all systems on the aircraft, providing an operationally advanced pilot interface and a path for adding safety features, such as terrain and traffic awareness and Wide Area Augmentation System compatibility. The readability of the displays is world-class with color, contrast, letter sizing, and fonts that provide exceptional viewability.

Astronautics' Badger Pro+ is the standard-fit, integrated flight display system on production Subaru Bell 412EPX and Bell 429 helicopters.

There are more than 300 Huey IIs operating in 14 countries with more than 1.2 million flight hours in military and para-public missions.

## CDB Aviation Completes Deliveries of Seven 737 MAX Aircraft to Brazil's GOL

CDB Aviation announced the delivery of the last of seven Boeing 737 MAX 8 aircraft to GOL Linhas Aéreas Inteligentes, Brazil's largest domestic airline.

The aircraft, configured with a 186-seat layout, incorporating both GOL+Conforto and GOL Premium class seats, were delivered from the lessor's orderbook with Boeing as part of the lease agreements originally signed with the carrier in 2020.

"Our teams worked side-by-side to execute leases and deliver all these aircraft in very adverse conditions throughout the pandemic. GOL is a great customer that has all our trust," pointed out Luís da Silva, CDB Aviation's Head of Commercial, Americas. "The 737 MAX is expected to transform GOL's fleet, providing significant efficiency gains,

while supporting deeper penetration into existing markets and new opportunities for expansion."

"The delivery of this last aircraft in a package of seven 737 MAX 8s from CDB Aviation marks a milestone in GOL history, our MAX fleet reaching twenty-four aircraft with this delivery. This accelerated fleet transformation plan ensures we can serve our customers better, with more comfort and environmental responsibility," said Celso Ferrer, GOL's COO. "The MAX being a key component in the company's goal to reach carbon neutrality by 2050, as this aircraft consumes 15% less fuel, produces 16% fewer carbon emissions, and 40% less noise, and has a greater flight range than the next generation aircraft."

# alufase Height solutions

ALUMINUM SCAFFOLDING

### HOUSTON

6060 Brookglen Dr Suite  
Houston, TX 77017  
T. +1 (713) 910 5600

### SPAIN

Ctra. M-114, Km. 1  
28864 Ajalvir, Madrid (Spain)  
T. +34 91 884 49 06



EUROPE • SOUTH AMERICA • USA

[www.alufase.com](http://www.alufase.com)

CONTACT: [export@alufase.com](mailto:export@alufase.com)





## Singapore Airlines and Scoot Sign 787 MRO Agreement with Collins Aerospace

Collins Aerospace has entered into a long-term MRO agreement with Singapore Airlines and Scoot, to support the Singapore Airlines Group fleet of 55 Boeing 787 aircraft. Through its FlightSense program, Collins will provide the airlines with full lifecycle support for high-performance pool access, maintenance services and reliability upgrades.

Products supported under the agreement include Collins' air management systems, electric power generator and start systems, emergency power systems, fire suppression, sensors and lighting systems. The new agreement also extends Scoot's current FlightSense program with Collins, which was signed in 2014, to include the airline's new 787 aircraft that will be delivered in 2023.

"This contract marks a significant milestone for Collins, Singapore Airlines and Scoot in strengthening the close relationship we've built over the years," said Henry Brooks, president, Power & Controls for Collins Aerospace. "We look forward to continuing to provide the airlines with comprehensive MRO services to keep their 787s flying and optimize fleet operations."

Lau Hwa Peng, senior vice president, Engineering, Singapore Airlines, said "Our longstanding partnership with Collins Aerospace has provided our airlines with high quality maintenance and support services, even as we navigated the challenges brought about by the pandemic over the last two



years. We look forward to an even closer relationship with Collins as the industry recovers in the coming years."

Ng Chee Keong, chief operating officer, Scoot, said, "This signing reinforces our well-established partnership with Collins Aerospace, which has remained robust amidst the COVID-19 pandemic. During the current dynamic landscape, the ability to collaborate with our partners and adapt quickly is especially crucial."

## KF Aerospace Now Using dentCHECK for its Commercial MRO Operations

KF Aerospace, a leading Canadian approved maintenance organization (AMO) has begun using 8tree's dentCHECK to enhance the efficiency and quality of its dent-mapping activities.

"KF performs hundreds of structural repairs annually on a wide



variety of commercial aircraft" says Gregg Evjen, chief operating officer. "Implementation of dentCHECK has allowed KF to improve accuracy, accelerate the damage mapping processes, and produce a digital record for our Engineers to utilize as they develop the

repairs."

"We are absolutely thrilled that KF Aero decided on dentCHECK, when they embraced the tool after a rigorous evaluation a couple years ago", said Arun Chhabra, CEO, 8tree.

"They joined the global community of dentCHECK users as the first Canadian firm to do so. Several other Canadian operators have since followed in their footsteps. KF Aero joins the ranks of more than three dozen MROs, airlines and OEMs that use dentCHECK daily to disposition dent-damage on aircraft across the cargo, commercial, business and defense aviation sectors. We look forward to continuing to support KF Aero's maintenance operations and having them experience 8tree's exceptional customer service."

dentCHECK is the world's only handheld-portable, completely wireless 3D scanner tool with integrated AR that is purpose-built for the aviation maintenance industry. It is now used by the commercial, cargo and defense MROs. Delivering real-time 'go/no-go' answers at the push of a single-button, the tool significantly reduces damage-mapping and reporting times, compared to traditional manual methods that use depth-gauges and straight-edges.

8tree says that when compared to traditional inspection methods, dentCHECK delivers a 90% gain in efficiency and 35x better measurement consistency.



# Want your business to take off in 2022/23?



Then we've got you covered with our leading events and publications.

**AEROSPACE  
TechWeek.com  
AMERICAS**

8-9 November '22 | Atlanta, USA

**AEROSPACE  
TechWeek.com  
GLOBAL**

29-30 March '23 | Munich, GERMANY

PUBLISHERS OF

**AEROSPACE  
TechReview.com**

**AVIATION  
MAINTENANCE**



## Falcon Aviation Services Goes Live on Rusada's ENVISION

Emirati Oil & Gas and business aviation services operator Falcon Aviation Services has gone live with Rusada's ENVISION software.

Falcon Aviation Services provides bespoke charter services to the Oil & Gas industry, as well as VIP and Helicopter Sightseeing Tours using a diverse ultra-modern fleet consisting of 29 helicopters including Bell, AgustaWestland and Airbus, and 6 fixed-wing aircraft including De Havilland, Gulfstream, and Embraer. It also offers a wide range of operational and aviation support services including, MRO, CAMO, FBO, Aircraft Management and Heliport Management, amongst others.

After a successful implementation project conducted by Rusada's Middle East division, Falcon Aviation Services are now live on the system. They will use ENVISION to manage their airworthiness, maintenance planning, maintenance execution, and inventory through its Fleet Management, Base Maintenance and Inventory Management modules.

"We selected ENVISION because we needed a system that could effectively link our airworthiness, maintenance and inventory activities. Previously, these functions were working in isolation and weren't benefiting from the shared knowledge that ENVISION provides," said Captain Ramandeep Oberoi, chief operating officer at Falcon Aviation Services "Migrating to a new software platform can always be challenging but the team at Rusada and our team



here have gone above and beyond to make the transition as smooth as possible and guarantee this project's success."

Julian Stourton, CEO at Rusada added, "I'd like to congratulate the teams at Falcon Aviation Services, and here at Rusada for an incredibly well-executed project. After the inevitable slowdown in implementations due to Covid, we are now seeing projects kick into gear again, with this being our third go-live in the last 3 months. We look forward to even more in the year ahead."

## Marshall Announces Apprenticeship Partnership with Bombardier

Marshall Skills Academy has announced plans to partner with business jet aviation specialist Bombardier to deliver its Level 3, Aircraft Maintenance Engineering Apprenticeship from September 2022.

This will be the first time that aviation training specialist Marshall Skills Academy, which rebranded at the start of 2022 to better reflect its core focus and expertise, has delivered an apprenticeship provision externally, building on a proud 100-year history of providing its own award-winning apprenticeship programs.

The new cohort of Bombardier Level 3 apprentices will complete their first year in Marshall's workshop in Cambridge before returning to the aircraft manufacturer's Biggin Hill site, where they will be given day release to continue with their studies.

Marshall Skills Academy will provide continuous on-site learning and assessment at Biggin Hill along with dedicated support to the wider Bombardier team to enable them to develop and grow the apprentices within their workplace.

Marshall Skills Academy's head of Aviation Excellence Matt Siggins, himself a former Marshall apprentice, explains: "The Marshall Apprenticeship program has long been acknowledged as setting the gold standard in the industry and I am incredibly proud and excited to working with the Bombardier team at Biggin Hill to help them grow the next generation of aviation engineers. The decision to extend our Aviation Apprenticeship offering beyond those that we need for our own aerospace businesses will enable us to partner with more like-minded organizations to develop a robust pipeline of talent for the future."

"We are very happy to be working with Marshall Skills Academy on this critical program to develop future generations of aircraft technicians," said Paul Thompson, general manager of

Bombardier's Biggin Hill Service Center.

"This world-class facility will provide a solid training ground for our apprentices in a technologically advanced workplace environment – with the possibility for full-time employment at the facility upon graduation."

Commenting on the partnership with Bombardier, Dan Edwards, general manager of Marshall Skills Academy said, "There is a growing concern across the aviation sector over the massive skills gap in competent aircraft maintenance professionals. Marshall Skills Academy is proud to be involved with doing its part to close that gap so that the world's fleet of aircraft can continue to fly safely."

Edwards continued, "It is also an exciting time for the business as we have started working more collaboratively with industry professionals to help them solve their biggest challenges by delivering the world-class training that puts Marshall apprentices above and beyond the competition. As we move towards blending traditional delivery methods with technical learning, we aim to build strong collaborative relationships with future customers rather than transactional ones. Therefore, Marshall Skills Academy's holistic approach to apprentice training, support and wellbeing is truly unique."

Marshall Skills Academy is working with Bombardier to support their recruitment efforts to onboard up to 20 new apprentices in 2022.



## Custom Electronics Introduces Portable Power System for Military and Defense Industry

Mica paper capacitors and tailored high-voltage assemblies manufacturer, Custom Electronics, Inc. (CEI), has released a portable battery system, the CMP2500.

At the heart of the CMP2500 battery system are LiFePO4 lithium-iron phosphate cells. Each battery has a 2.5kWh capacity while the system provides up to 10 kWh capacity at 24 VDC or up to 5 kWh at 12 VDC. The batteries are housed in a rugged military-spec case that can be moved by one person, making it ideal for military and defense field and training applications including charging of drones, running simulations, targetry and silent watch. Users can set up in a field or training space without having to run a cable to a generator or back to the military installation. In addition, the quietness of the system when running is a main benefit for these types of applications.

"From start to finish, the CMP2500 battery solution is designed to provide power when and where you need it," said Carol Brower, vice president of Operations, Custom Electronics, Inc. "Simplicity of design, ease of use and safety are top priorities we focused on when designing all system components. The design allows for continuous, uninterrupted power."

One of the unique features of the CMP2500 solution that distinguishes itself from many of its competitors is its proprietary battery management system (BMS). With a focus on taking a modular integrated systems design approach to generate, store,



distribute and utilize electric energy in order to power devices and equipment, the BMS delivers a safe, effective and cost-efficient energy storage solution. The BMS is custom designed to protect cells, equipment and the user. In addition, the system is fully scalable in voltage and capacity, and can replace or supplement generator operations by reducing operating time, fuel consumption and related noise.

The systems charger and inverter capabilities are sourced from high-quality manufacturers and included as system components. In addition, the inverters feature up to 4000W output and chargers up to 40 ADC.

## CTT Systems Receives Inflight Humidification VIP System Order for Airbus ACJ350 from AMAC Aerospace

CTT received an Inflight Humidification VIP system order from AMAC Aerospace for one Airbus ACJ350 aircraft. The IFH VIP system is designed to increase humidity in the entire widebody cabin, which requires support from four humidifiers in addition to three line-fitted humidifiers. The system is scheduled to be delivered to AMAC in Q2 2022.

This ACJ350 aircraft will also be line-fitted with humidifiers in flight deck and crew rests. The ACJ350 aircraft will be moisture protected with CTT's Anti-Fuselage-Condensation technology that will be line-fitted in the green aircraft. In total, this ACJ350 aircraft will be equipped with 10 humidifiers and two zonal drying units. This is CTT Systems' 101st Inflight Humidification award for VIP aircraft (from Airbus ACJ and Boeing BBJ).

"We look forward to work together with CTT in this widebody VIP completion project. Cabin humidification is a common request from our VIP clients that value good health, wellbeing and feeling



at ease during and after flight," comments Tracey Hawthorne-Kurz, director Logistics & Purchasing at AMAC Aerospace Switzerland.

"We are grateful to receive another order from AMAC and pleased to cooperate with AMAC in the fitting of our IFH system in this ACJ350 completion that also include line-fitted humidifiers," says Peter Landquist, vice president Sales & Marketing at CTT Systems.

## PWI Named Distributor for the KADEX LED Wing Tip Light for King Air 350

Canadian based aircraft parts distributor KADEX Aero Supply, has chosen PWI in Wichita, KS to be a world-wide, in-stock distributor for the KADEX LED Wing Tip Light Assembly. KADEX's LED Wing Tip Light Assembly is STC approved and designed for the Beechcraft King Air 350 aircraft.

"Being a distributor for the LED Wing Tip Light Assembly is another way PWI can provide King Air owners with additional lighting options," says Robi Lorik, president and CEO of PWI. "We want PWI to be a one stop lighting shop for King Air owners and

this is the next step in that process."

This LED Assembly provides a long life as well as increased durability and reliability. The LED Assembly also features reduced weight and power consumption compared to bulbs. The LEDs in the Assembly also reduce the chances of long-term lens deterioration.

"This LED upgrade provides trouble free operation for King Air 350 owners," says Lorik. "The Assembly improves the pilot's vision of his surroundings, while also improving his visibility to other aircraft."



# AS AIRCRAFT EVOLVE

# SO DO WHEELS AND BRAKES



Antavia image.

## James Careless

# W

hen people marvel at modern aircraft, they tend to focus on major technological advances like carbon fiber

airframes/wings and fuel-sipping turbojet engines. But progress is also occurring in less obvious but equally important areas of today's flying machines — namely wheels and brakes.

### A Long List of Improvements

The Wright Flyer (the earliest successful powered aircraft) had neither wheels or

brakes. It landed on skids, and the pilot just hoped for the best.

Wheels for takeoff and landing emerged a few years later. They soon became standard equipment on World War I biplanes and beyond, growing in size and weight-bearing capability over time.

So did brakes. They evolved from the small brake shoes used on bicycles to larger, more robust drum brakes, and then disk brakes.

The power to activate these brakes originally came from hand-levered control cables. But this approach was only

adequate for small aircraft, which is why hydraulic braking systems using pressurized fluid and master cylinders came into being. (Some aircraft also use pneumatic braking systems.)

In the 21st century, "one of the latest developments in brake actuation has been the electric brake," said Alex Lara, director of Wheels & Brakes Service at AAR Corp. "Recently electric brakes have been introduced in the B787. Electric brakes are powered by the aircraft's electric system and this force is transferred to the heat sink through electromechanical actuators.



This new design considerably reduces the possibility of hydraulic fluid leakage and facilitates brake installation and maintenance.”

Like most MROs, AAR offers Cost per Landing, All-Inclusive Flat Rate repair and overhaul, and tire management programs. The company also provides spare wheel and brake inventory for its customers, so they don't have to invest in spares themselves.

“The arrival of electrical brakes on recent aircraft is probably the main new trend in this area,” said Ismaël Fadili, sales

and marketing director at France's Antavia AMETEK MRO.

“When it comes to wheels, the technology has been rather the same in recent years.” Antavia has two different shops for wheels and brakes located in France, and about 30 people dedicated to these products.

The basic concept underlying aircraft



*Ismaël Fadili  
Sales and Marketing Director,  
Antavia*

wheels and their brakes — robust rolling surfaces that support safe takeoffs and landings — has not changed. But the structure of

this technology is evolving, said Phil Randell, CEO of UK wheel/brake specialist firm World Aero. World Aero is a privately owned, independent aircraft wheel and brake MRO based close to London Gatwick



*Phil Randell  
CEO, World Aero*



World Aero's Randell says a key trend his company is seeing is the weight reduction of wheel and brake components. New materials and stronger wheel structures ensure that they are still robust in service, he adds. World Aero image.

Airport. Frequently supported aircraft types range in size from Learjet 45 to Boeing 747-8, with a constantly varied list of wheels and brakes being processed at any one time.

"As with most other components that make up aircraft, a key trend we are seeing at World Aero is the weight reduction of wheel and brake components," Randell said. "Whereas wheels used to be really heavy and almost indestructible, they often now look like something you'd expect to see on a race car! Everything is being pared down so we are seeing ever leaner, more delicate-looking equipment

on aircraft. Of course, new materials and stronger wheel structures ensure that they are still robust in service."

But every technological advance comes with some form of tradeoff. In the case of modern aircraft wheels and brakes, making them lighter means that they may have shorter lifespans compared with the heavy items of the past. "The efficiencies and fuel savings delivered by lighter-weight wheels and brakes tend to outweigh the additional costs of potentially higher rejection rates at overhaul," said Randell.

Offering better performance than older technologies, modern carbon brakes and

radial tires are also becoming common on everything from small commuter planes to long-haul aircraft.

"There are also ongoing retrofit programs for types such as the 737NG to replace steel brakes with carbon equipment, a process that requires the replacement of the main wheels too," Randell told *Aviation Maintenance* magazine. "The cost of the new components is high and the resale value of the old equipment is negligible. Still vendors are offering huge incentives for aircraft operators to refit their equipment, such as free wheels and brakes for an entire fleet."

Again, every improvement comes with a price. In this case, the repair cost of carbon brakes is considerably higher than steel types, which could be a deal-breaker for many cash-strapped aircraft operators. On the other hand, the operational lifespan of a carbon brake is "often three times that of a steel brake," said Randell. This much-longer lifespan translates into significant time and money savings on brake changes, plus reducing "the logistics of routing units to and from overhaul, spares holding levels, and administration," he said. An added bonus: Carbon brakes weigh less than steel brakes, so carrying them aloft reduces fuel burn and saves even more money for operators.

A final technological advance in this category is the use of boltless wheels. A boltless wheel relies on a lockring device that marries the wheel flange to the wheel base. This change allows the boltless wheel to have fewer parts and less weight than its conventional bolted counterpart.

According to World Aero's Randell, boltless wheels have made serious inroads into corporate aircraft, but not their larger cousins. "The only aircraft type of note to have done so recently is the huge Hercules C-130 transport aircraft," he said. To be specific, the U.S. Air Force upgraded its entire C-130 fleet to boltless wheels and carbon brakes in 2013.

## Trends in Wheel and Brake Service

In response to advances in aircraft wheel and brake technology, the specialist MROs that service them are making changes to their operating procedures. However, "many of our practices have remained the same over the years as there has been no major disruption in this technology," said Fadili. "This is why we are focused on how to be more productive using the automation of tasks such as wheel scans and automatic blasting machines."



# ONE STOP SHOP

FOR WHEEL & BRAKE  
**PART** REPAIRS



C.M.M. Repairs

Wheel & Brake Shop  
Tooling Fabrication

Engineering Orders

WORLD'S  
LEADING  
PROVIDER

OVER 25 YEARS OF EXPERIENCE



Keeping Aircraft Rolling

FAA CERTIFICATED  
#M8YR750N & EASA APPROVED  
EASA.145.6457



[www.TTrepairs.net](http://www.TTrepairs.net)



[sales@ttrepairs.net](mailto:sales@ttrepairs.net)



(502) 368-3008



One challenge the wheels and brakes sector has been experiencing is the talent shortage. Just as we discuss in the story on the helicopter mechanic shortage (see page 26), this deficit in human resources is being felt in all MRO sectors, including wheels and brakes. Looking for ways to encourage new technicians to enter the sector is crucial and needs to happen immediately, many say. Antavia image.



Wheels and brakes MROs, like all businesses in the pandemic era, have been learning to handle supply chain issues around the world and many have experienced logistical delays across the board. World Aero image.

This is also the case at FerroCrtalic, a Slovenian firm with 55 years' experience in removing paint for aircraft wheels (among other things, paint removal is required to allow wheels to be inspected for cracks

and other signs of wear).

"The process for cleaning modern painted wheels is the same for older models," said

Aljaz Molek, FerroCrtalic's sales manager

for special equipment. Nevertheless, FerroCrtalic has stayed abreast of the times when it comes to paint removal methods. Instead of using chemical processes, the company says it is providing the most advanced "plastic air blasting" method to remove paint using small plastic particles, thus eliminating the toxic substances associated with the chemical processes. And reusing the plastic is much more environmentally friendly. On top of that, the company also provides high-pressure waterjet paint removal, which is basically removal of paint using pure water at high pressure. The water can be recycled and used numerous times.

"As well, we are now deploying 'laser cleaning,'" Molek said. In this process, a laser beam is pulsed at a target using a high frequency (50 kHz to 1500 kHz). The short pulses create just enough energy within the wheel's surface for rust and paint to evaporate into plasma and burn off.

"Being new, laser cleaning is quite an expensive technology," said Molek. "But its price will come down over time,



**atp** Aviation Hub® »»» Flightdocs®

The only tool you need to  
enhance operational efficiency.



Maintenance tracking, work orders, inventory, compliance, maintenance manuals, & technical publications. **Fully integrated.**

[www.atp.com/flightdocs](http://www.atp.com/flightdocs) | 1-800-747-4560







The MRO sector for wheels and brakes is very established and key components are straightforward, says World Aero's Randell. Strength, reliability and ultimately safety have always been at the core of wheel and brake repair, so it's more about refining and honing practices, rather than big step-changes. World Aero image.

allowing more aircraft operators to take advantage of it."

World Aero is also focused on improving its wheel and brake maintenance processes. Echoing Fadili, Randell observed that "the MRO sector for wheels and brakes is very established and the key components are actually quite straightforward, so we don't tend to see a lot of new practices and innovation. Strength, reliability and ultimately safety have always been at the core of what we do, so it's more about refining and honing practices, rather than big step-changes."

Also like Antavia, World Aero is "continually streamlining processes to achieve better efficiencies and faster turnaround times," he said. "We will do whatever is needed to meet customer deadlines, often at little to no notice. It's this flexible, premium level service that keeps our customers loyal and sets us apart from our competitors."

One area where wheel and brake MROs are seeing change is in their customers' management of this maintenance process. "More and more airlines are steering away from maintenance and concentrating on

flying," Lara said. "As a result, airlines are looking for a one-stop shop when it comes to their wheels and brakes. They are seeking companies that can manage all the repairs and logistics associated with these components, including tires."

### COVID's Impact

Two years of the pandemic have had a significant effect on the wheel and brake industry, going right back to early 2020 when the world went sideways. But the impact on business has varied from sector to sector.

"As far as the commercial and regional sectors are concerned, Antavia has seen a volume decrease in line with the percentage of aircraft flying," said Fadili. "For the military and business jet sectors — with the exception of the first two-three months of the pandemic — activity has remained at a pre-COVID level."

"AAR did see a drop in commercial business, but at the same time we witnessed an increase in the cargo sector," Lara said. "Some customers have been deferring major repairs, due to the advantage of having excess spares,

as a result of their partially parked fleet. More recently, due to supply chain issues around the world, we have experienced logistical delays across the board. OEMs have increased their lead times on orders from 30 days to 60 and even 90 days. Freight forwarders have also reduced their services and increased or have added surcharges."

Decreases in customer business and supply chain challenges have affected the cash flow of MROs across the aviation industry. Uncertain as to when COVID-19 will finally recede and allow the volume of aircraft usage to return to pre-pandemic levels, these MROs are husbanding their financial resources carefully, and keeping expansion plans on the back burner.

A case in point: "As with many other organizations, many of World Aero's business development plans have been placed on hold during the pandemic," said Randell. "Our focus has very much been about protecting our team, supporting our customers and weathering the storm. Flexibility, preparation and the right skill set are the crucial factors we've been focusing on to ensure World Aero is

in the best position to react accordingly to our customers' needs as we move forward."

"Some of our customers have not been able to weather the pandemic," said FerroCrtalic's Molek. "But we are getting the feeling that business is starting to pick up, and that the aviation industry's future is looking better for all of us."

## Looking Ahead

Whether or not COVID-19 is in the rearview mirror, the wheel and brake industry is looking ahead to the future and making plans to profit from it.

At Antavia AMETEK MRO, they see "staying the course" as their best business strategy.

"As there are no major new aircraft programs scheduled for the next few years, there are no major new technologies arising," Fadili said. "Nevertheless, we could see some improvements in line with addressing environmental concerns, such as new painting or surface treatments."

FerroCrtalic is pursuing a similar approach. "We have been working during COVID to be prepared when the industry picks up," said Molek. "We want to be ready to ramp up with what we have when this happens."

AAR and World Aero are taking a longer view of the future and what's coming.

"The wheel and brake industry will continue to grow as orders for new aircraft increase: Airlines are retiring their older wide-body aircraft and replacing them with newer more efficient narrow bodies," AAR's Lara predicted. "Electric brake technology will continue to be the trend, along with the introduction of lighter and stronger materials. Additionally, carbon will become more efficient and reliable as OEMs compete and continue to improve their products. On the wheel side, besides lighter and stronger materials, I believe the two-piece lock ring design wheels will continue to evolve and become the next generation of aircraft wheels. This design eliminates the need for tie bolts, thus reducing cost and maintenance."

World Aero's Randell agreed with Lara's upbeat assessment. He also expects to see "an increased focus on IT to streamline the processing of units through workshops, utilizing barcodes, scanners and other technologies."

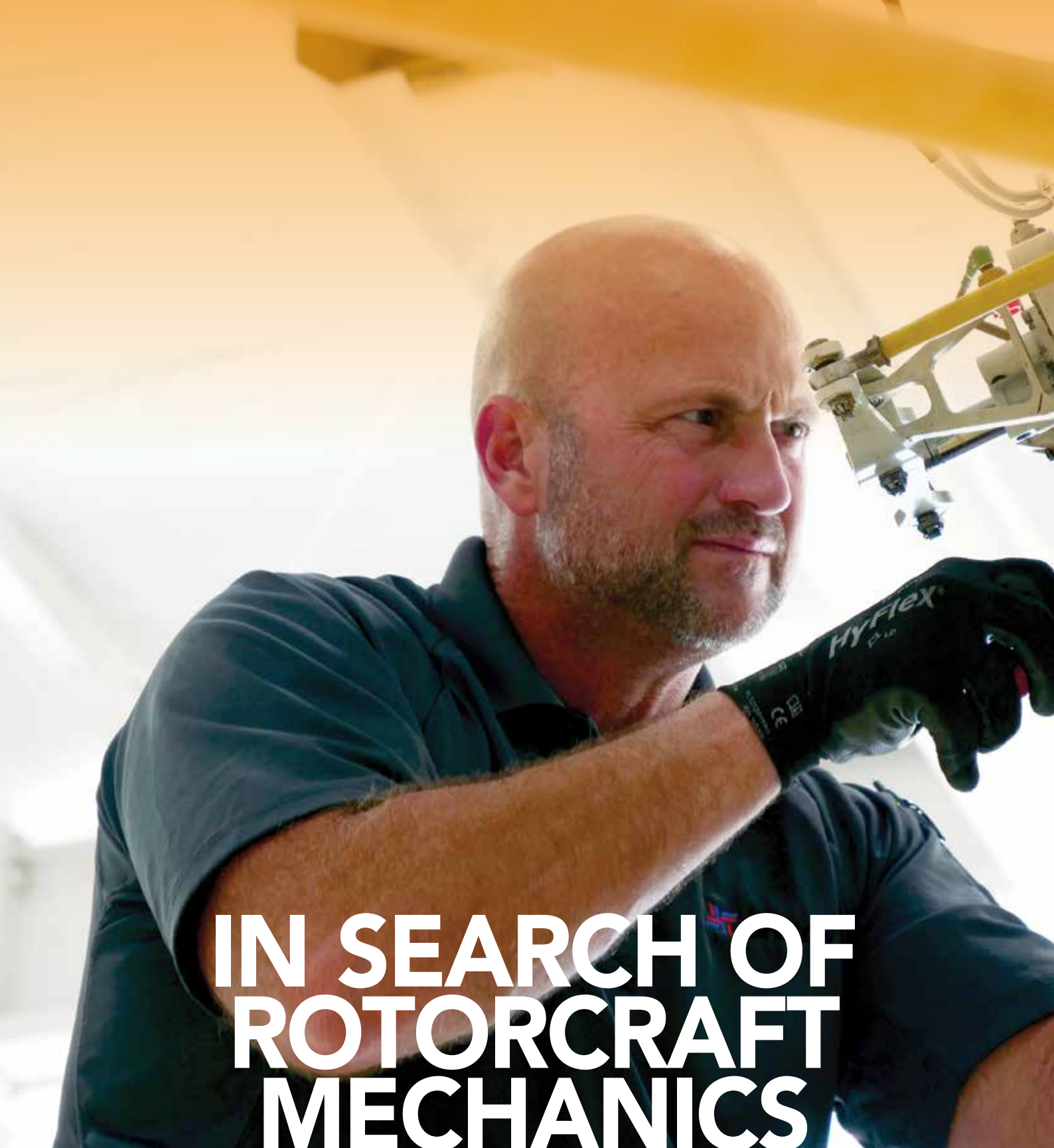
But there is a cloud on the wheel and brake industry horizon: "A challenge that is going to increase further for the



Shown here, A320 brakes at World Aero. World Aero image.

whole of the MRO sector is a lack of new talent entering the market," said Randell. "We are seeing fewer young people interested in joining the industry, which in turn will lead to a skills shortage as the established, older workforce retires," he explained. "At World Aero we work hard to promote opportunities, career progression and on-the-job training to attract the next generation of engineers. But it's still not easy to find candidates of the right caliber, a problem that has been made even harder by COVID. This is a real worry for the sector — and something we all need to be addressing now."

The bottom line: The aviation wheel and brake industry is evolving to keep up with new technologies, while maintaining tried-and-true processes that work as well in this century as they did in the last one. **AVM**



# IN SEARCH OF ROTORCRAFT MECHANICS

THE HELICOPTER MECHANIC  
SHORTAGE PROBLEM AND WHAT  
THE INDUSTRY IS DOING ABOUT IT

Mark Robins





Marcus Morgan works on the rotor section of an AW139 helicopter. Bristow Group image.

**A**

round the world, the rotorcraft industry — and to a larger extent the entire aviation industry — is struggling to fill vacant positions for maintenance

technicians. The negative impact of this manpower shortage is especially severe at a time when the global rotorcraft fleet is expanding and modernizing. In 2020, the FAA issued 30% fewer new mechanic certificates than it did in 2019, a drop-off that the Aviation Technician Education Council (ATEC) described as "devastating" in its 2021 Pipeline Report. Without engine repair technicians, many fear there could be fewer rotorcraft in operation.

According to a 2017 Oliver Wyman report, "When Growth Outpaces Capacity," executives from the MRO industry said they are indeed worried about an anticipated shortfall in the number of adequately trained aviation mechanics. A majority of survey respondents (78%) reported that it is getting harder to hire mechanics and the tightening labor market is pushing them to rely on overtime and other stop-gap efforts to keep up with market demand.

"One of the biggest impacts of the labor shortage is increased turn-around-times (TAT) for heavy maintenance checks and the limited availability of maintenance slots — the two are highly correlated," said Jonathan Berger, managing director of Alton Aviation Consultancy. "Maintenance shops have limited capacity because the shortage of mechanics means aircraft overhauls take longer, which reduces the number of slots available. This labor shortage is not unique to the helicopter industry. Worldwide there is a shortage of mechanics in virtually every industry — e.g. automotive, rail, energy, IT, agriculture, etc. — and aviation is not immune: fixed wing and helicopters. Everyone is coping as best they can."

Crystal Maguire, executive director of the Aviation Technician Education Council (ATEC), agreed that the rotorcraft industry is not going to have the maintenance personnel it needs. "Look at the entire workforce population and every sector has a problem. Its impact is there, and [the rotorcraft industry] is not going to have the workforce to support growth. But it's not going to make the [rotorcraft] industry go away. [The industry] is going to figure out other ways if it doesn't have the personnel to do it."



Helicopters require a level of specialized training that is not often taught in traditional classrooms. Bristow Group image.



Aviation Structural Mechanic 2nd Class Jocelyn Joseph performs maintenance on an SH-60F Sea Hawk helicopter aboard the amphibious command ship USS Blue Ridge. U.S. Navy photo by Mass Communication Specialist 3rd Class Matthew D. Jordan.

## Retirement, COVID and Vacancies

One of the most often cited reasons for this mechanic manpower shortage is retirement as more baby boomers reach their mid-60s and early retirement. This loss of experience compounds the overall

skills shortage dilemma. According to the Oliver Wyman 2017 MRO survey, over the next decade, the record number of maintenance technicians eligible to retire will outpace the total of new mechanics entering the market. The median age of aviation mechanics is 51, nine years older than the median age of the broader U.S. workforce as calculated by the U.S. Bureau of Labor Statistics.

Maguire said she has witnessed, industry-wide, "an exodus of folks who were nearing retirement. We are still trying to get a better sense of that statistically. We have fast-forwarded our manpower shortage projections." COVID-19 has exacerbated this problem; because of COVID, many senior rotorcraft mechanics were offered early-out buyout packages to retire early. "We knew we were going to have a problem if we didn't already; that's the biggest implication of COVID," Maguire said.

"Clearly the pandemic directly contributed to what many are calling the 'great resignation,'" Berger explained. "I prefer the term the 'great reflection.' The global pandemic and associated lockdowns provided the opportunity for thoughtful introspection and to reprioritize what's really important to them. The fact is that aviation is a very cyclical industry; for





TRAIN SMARTER.  
SERVICE FASTER.

**FlightSafety**  
INTERNATIONAL

Our training goes beyond the basics. It is the difference between “good enough” and “best of the best.” And training the best leads to a more efficient maintenance department so aircraft are serviced correctly the first time, faster, and as frequently as required. The result: more time in the sky.

**FSI. Nothing short of excellence.**

Call **+1.201.584.8262** today or visit **FlightSafety.com**





Aviation Structural Mechanic 2nd Class Jessica Neff replaces a radar altimeter on an SH-60F Sea Hawk helicopter. U. S. Navy photo by Mass Communication Specialist 3rd Class Britney Epps.

helicopters, oil and gas has experienced periods of tremendous boom and busts of the past several decades, and emergency air medical, and search and rescue (SAR) are quite stressful fields of work.”

“In an odd way the pandemic may have helped the industry, because it allowed operators to retool, restructure, economize and strategize for the future,” said Zac Noble, director of maintenance and technology at Helicopter Association International. “Most helicopter operators were forced to slow their flight pace or stop them altogether. It isn’t good for operators or industry when that happens, but it allowed for the reorganization of assets internally to operations, but also allowed academic institutions to push needed pilots and mechanics into the stream. We are still facing shortages of mechanics. Flight operations are beginning to ramp back up in most cases for those who were not forced to close their doors for good. But because flight volume hasn’t returned to pre-COVID levels, maintenance operations are able to keep up with the pace, although it might require additional workdays or time in some cases.”

Not all companies were adversely affected by the pandemic and the mechanic shortages it produced. “We never shut down or reduced our operations during COVID-19, and in some ways picked up more work as a result of increased search-and-rescue medevac missions, mostly to transport

COVID patients,” said Benjamin Hulshoff, director of maintenance at Bristow Group. “The biggest impact was with some staff workers who could work remotely, but for our aircraft maintenance technicians, that was not an option. We had more impacts to our operations from the hurricanes that hit the coast of Louisiana than we did from COVID-19.”

## Filling Manpower Shortages

For most operators, filling rotorcraft engine mechanic vacancies has become more competitive, but they have still found ways to do it. “It does take a little more active recruiting to fill positions in today’s more challenging environment, but to date, we have not had any issues in the United States in obtaining good quality candidates,” Hulshoff said. “The helicopter industry is a very niche industry. Bristow has a strong reputation and offers very competitive pay and benefits. In the United States, when we merged with Era Group Inc. in June 2020, we also had a surplus of positions from combining the two companies, so we have not faced as many of the issues as other helicopter companies have faced.”

Maguire said ATEC has been working a lot on building awareness of rotorcraft mechanic perks and trying to attract more professionals to it across all sectors. “We are trying to approach this at a national level — getting stakeholders and coalitions together to talk about what we can do as a whole. What are the talking points? How can we all pull together as one to increase the pipeline, which would raise all boats. If more people were aware of the opportunities, we wouldn’t have this shortage problem. That’s what we are working on. You see planes flying around more than you see helicopters flying around, so it’s awareness. It behooves us to illustrate the broad range of opportunities available. There’s a lot of things to do with an Aircraft Maintenance Technician (AMT) license.”

Hulshoff said the rotorcraft industry needs to reach out to more women and minorities, who he believes are underrepresented in the field. Also, “I think a strong pipeline of candidates can come from the military services, and there are many experienced candidates serving in the military. The military branches are now helping their aircraft maintenance technicians obtain FAA certifications, which makes them more employable in the civilian sector. I also think we can help early career AMTs get their FAA certifications quicker and to offer more support for

those who want to come into the field, whether they work in general aviation or a related field with similar skill sets. Making the process to obtain certification easier helps offer advancement routes for your aircraft maintenance technicians so they can have a long career with your company. We have a lot of workers who have been with our company 15 years or longer, which is unprecedented in other fields.”

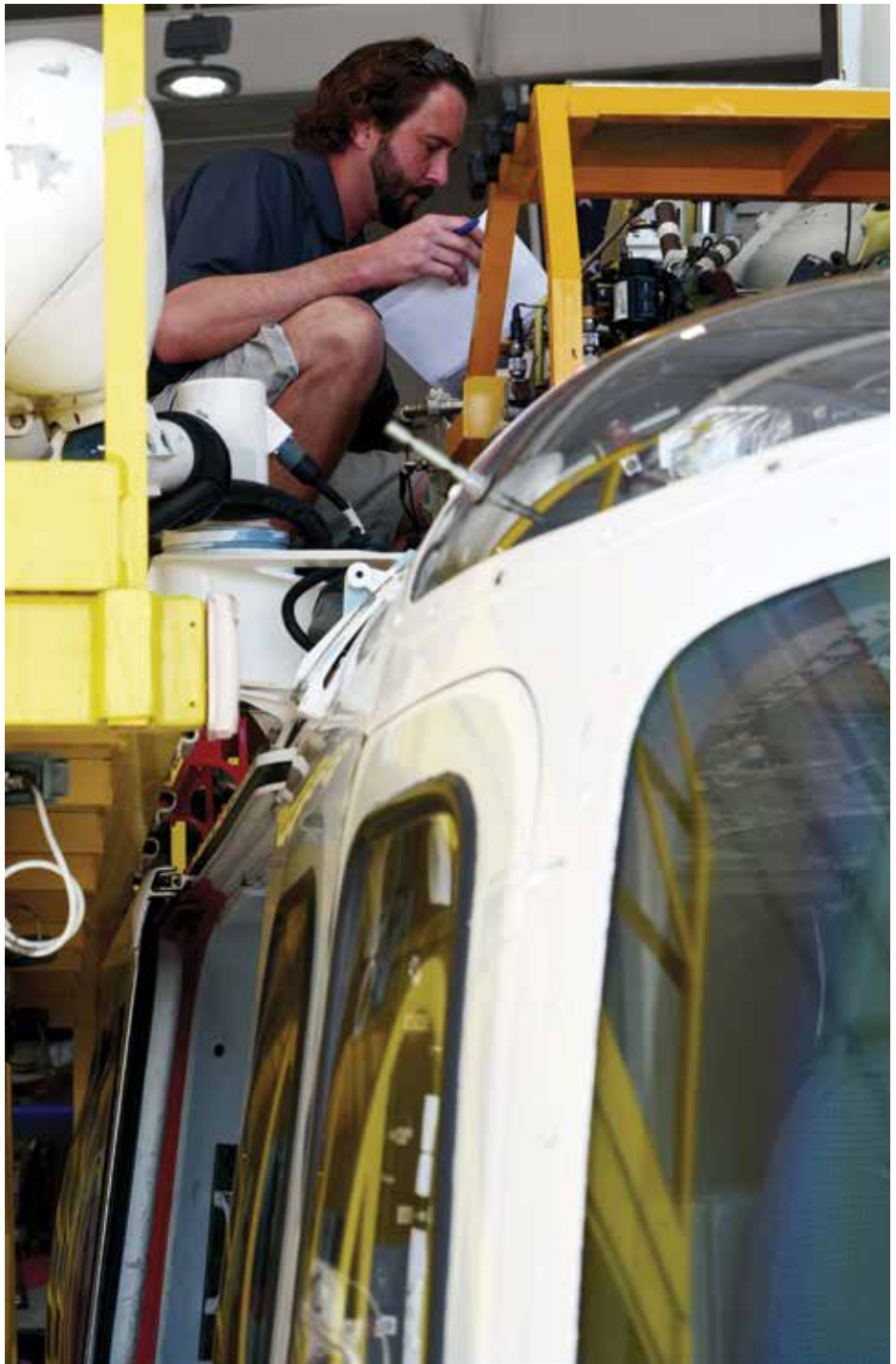
## Next Generation Rotorcraft Mechanics

To replace retiring rotorcraft mechanics and technicians, the rotorcraft industry is looking to attract, recruit and train a new generation of younger workers. And, as college tuition continues to rise, a career as rotorcraft technician could be viewed favorably by millennials because it doesn't require a four-year college degree.

To fill vacancies, companies are getting creative, offering generous sign-on bonuses and other incentives in addition to competitive wages. Some students have even arranged for companies to pay their tuition instead of taking out student loans. To recruit tomorrow's tech-savvy rotorcraft diagnosticians at a recent career fair in Ohio hosted by the Pittsburgh Institute of Aeronautics, companies were conducting on-site interviews and offering jobs to students on the spot.

Bristow has stepped up its recruiting efforts, including position marketing and participating in specific job fairs. “We also established maintenance scholarships at a local trade school in Louisiana to create a pipeline of AMTs,” Hulshoff said. “For our current workforce, our focus has been on the quality of life and to ensure we do our best to retain our AMTs.”

To help attract and train the next generation of rotorcraft mechanics, ATEC is working on a high school curriculum, planned for fall 2022, that includes rotorcraft maintenance to build awareness for young job seekers. “We are really trying desperately hard to get these programs in high school settings that would communicate these [rotorcraft mechanic career] pathways,” Maguire said. “They could do a lot of the training for free. Those are the programs that we encourage. It's not going to come around without the industry taking a lead in it. [Build awareness] locally in high schools, that's a great way to do it, and with mentors to get these programs in there. Building our own local pathway programs — that's what we've seen is making the biggest impact for companies — getting involved at that local level.”



Mechanic Matt Bavar consults technical data on repairs to a AW139 helicopter. Bristow Group image.

Helicopter Association International is a strong advocate for education accessibility. HAI and many other organizations offer scholarships to qualified applicants. “Additionally, the COVID pandemic created a pathway for remote learning from Part 147 certificated schools that can meet the published requirements,” Noble said. “Educational opportunities are available. I would encourage anyone interested in a career in aircraft maintenance, and particularly helicopter maintenance, to look into avenues for attaining an Airframe and Powerplant Mechanic Certificate.”

Since helicopter repair is so niche, is





Career fairs are being increasingly used to attract young talent to work as rotorcraft technicians. Photo by Ryan Johnson.

it more difficult to attract young talent to this profession? "There is no doubt that helicopters require a level of specialized training that is not often taught in traditional classrooms," Noble said. "Things like hands-on rotor track and balancing are rarely taught in Airframe and Powerplant courses because availability of a real helicopter to train on is difficult to get into schools. HAI has tried to work with our members to bring that capability to schools, but those resources are difficult to come by."

### **Emphasize an Attractive Occupation**


Yes, there are real challenges to attracting young talent to work as a rotorcraft technician; the work is often physically demanding in bad weather, and requires long and odd hours with unreliable schedules. Being an AMT means having a stressful job with pressure to resolve technical issues quickly and accurately. But building awareness of the many advantages of being a rotorcraft technician is a positive way to attract talent.

At HAI, Noble explained, through implementing collaborative strategy opportunities and because margins are normally so close in the helicopter

community, pride can be built in what helicopters do for our communities and nation. "[This is] key to recruiting and retaining qualified mechanics. Helicopters are different than airplanes. Helicopters provide the infrastructure necessary for citizens to enjoy a high quality of life. We erect power grids, fight fires, provide law enforcement, agricultural spraying, lift power and environmental units to the tops of tall buildings, perform logging operations, transport crews to and from offshore oil platforms, and carry our sickest citizens to appropriate medical facilities. There is an endless list of jobs that helicopters do, and for a pilot, mechanic, support team to take pride in the services they bring to our society is instrumental in filling required and very necessary positions."

Hulshoff agreed that one way the industry can promote a helicopter AMT career is to emphasize that rotorcraft operation ensures safe passage of passengers daily in the offshore energy industry and helps save lives with search-and-rescue services. "The United States depends on the energy industry to run and being a part of that industry can be very rewarding. [Also,] many AMTs prefer helicopters because the work is more





Our highly effective asset management programs are tailored to the needs of our customers. We offer innovative exchange, lease, and spares programs that are designed to provide differentiating cost and operational benefits to airlines.

Proud to be rated the top avionics supplier in the 2020 Air Transport Aftermarket Customer Satisfaction Survey.

Tailored to suit  
your needs

[baesystems-ps.com](http://baesystems-ps.com)

challenging and offers a rewarding career. Our locations are mostly in Louisiana in the United States and a lot of our mechanics love the region for what it offers compared to other areas of the country. We have a very modern fleet of aircraft and are the largest operator of the latest generation AW139, AW189 and S-92 aircraft. AMTs like to work on current generation aircraft instead of the older Bell and Airbus models in the offshore oil and gas industry. We have a good mix of helicopters from single engines, light, medium and heavy twins in the United States that can offer lots of variety to our AMTs and that can also be a very rewarding aspect of their job."

Money matters, and being a rotorcraft technician pays well. According to the U.S. Bureau of Labor Statistics, the median salary in 2020 for aircraft and avionics equipment mechanics and technicians was \$66,680 per year and \$32.06 per hour — a major selling point. And the job outlook (projected percent change in employment) from 2020 to 2030 for this career path is 11%; the average growth rate for all occupations is 8%.

Berger believes to make a helicopter mechanic a more attractive profession, "not unique to helicopter mechanics, but all professions, is quality of life and standard of living must improve—and not only salaries and benefits, but geographic locations as well. Mechanics often have to work night shifts and in remote locations far from family and friends. This is a tremendous challenge to attract new recruits."

Another selling point is that rotorcraft mechanics can easily relocate, since there are jobs available virtually everywhere. "It offers worldwide opportunities, and for someone who doesn't mind traveling, there are plenty of companies which have daily operations around the globe," Noble said. "The helicopter community is smaller than the airplane community, but the jobs and tasks to be completed by rotorcraft are plentiful and require continuous operations. Aircraft maintenance provides an overwhelming sense of accomplishment especially when coupled with a mission set that saves lives, fights fires, provides community security, or many of the other helicopter profiles. I am certified to fly just about anything — multiengine airplanes, single engine airplanes, and helicopters — but the certificate I am most proud to carry in my pocket is the FAA Certificate that says I am an aircraft mechanic." **AM**

## CLASSIFIED

**KARPET KING AERO** AIRCRAFT CARPET SEWING MACHINERY

**812 AERO - HEAVY DUTY BENCH MOUNTED MACHINE**

- Commercial and Private Aircraft Serging Machine
- Simple to Operate & Easy to Maintain
- Perfect Finish on Internal & External Corners
- Capable of Serging all Types of Carpets
- Stitch Width from 4mm - 15mm
- Full Wrap to Weight Saving Stitch Types



**812 PBL AERO PORTABLE AIRCRAFT SERGER**

- 812 PBL Aero Designed For Portability
- Sew Large Carpets in Situ with Ease
- Fitted With Our Heavy Duty Top Puller Making Easy Work of Even the Heaviest of Carpets



- Servicing and Repairs on all Brands of Sergers
- Spare Parts Available for Immediate Dispatch

**KARPET KING AERO** [W https://karpetking.aero/](https://karpetking.aero/)  
 Karpet King Unit 3 New Line Industrial Estate, Bacup, Lancashire, England OL13 9RW  
 T +44 (0)1706 871933 F +44 (0)1706 875980 E sales@karpetking.co.uk

**CONTINENTAL TESTING**

**YOUR AVIATION CALIBRATION SPECIALISTS**

Trusted Calibration Services

- Two laboratories in Dayton, OH and Denver, CO
- Two mobile calibration labs covering much of the contiguous 48 states
- Offering superior service and repair of your equipment



**CONTINENTAL TESTING**  
 104 S. Main St. Union, OH 45322-3358 937-632-3322  
 975 Platte River Blvd Unit M Brighton, CO 80601-4349 720-841-4357  
[www.continentaltesting.com](http://www.continentaltesting.com)

**EXPERIENCE THE BENEFITS** **ASI Aircraft Specialties, Inc.™**

- Wheel & Brake Services • Maintenance Products • Safety Equipment • GSE • Cabin Media • Repair Management Solutions

**ONE CALL DOES IT ALL 800.233.0831**

**SCHWEISS** THE DOOR LEADER

**DOORS**

HYDRAULIC — OR — BIFOLD  
 ONE-PIECE DOORS STRAP LIFT DOORS

**SCHWEISSDOORS.COM 507-426-8273**



**BORESCOPE Sales & Service** Relocating June 2021 to Valdosta, GA

**Pratt & Whitney Approved PWC34910-109 Kit**

**Now Featuring PVJ20 Joystick**

- 360° Rocking Joystick Articulation
- 180° Locking & Micro Articulation
- 3.9mm Dia. x 1.5m Length Standard
- 5" LCD Display w/Text Input
- 3x Visual Grid Measurement Overlay
- Color Conversion Defect Detection
- 5x Live Zoom, 5x Image Zoom
- 6x LED lighting, ~8hrs Battery Life



**Sale Price: \$8,995.00**

**(931) 362-4009 sales@borescopess.com**

**ALBERTH AVIATION**

**Tools and Equipment Designed by Mechanics for Mechanics**

**TIRE INFLATION CAGE**

now available for 42" tires



**Safety Equipment**

- Protect Employees from injuries
- Prevent costly hangar damage
- Exceeds OSHA & military standards
- Triple safety redundant features

**Online test videos**

**HYDRAULIC WHEEL DOLLY**



optional brake dolly attachment

- Helps prevent back injuries and aircraft damage
- Low profile design eliminates clearance issues
- For wheel diameters 25-40", up to 350 lbs
- Converts to brake dolly with optional attachment

**GSE | Tooling | Aircraft Parts**

★ Celebrating Our 25th Anniversary ★

[www.AlberthAviation.com](http://www.AlberthAviation.com)  
 832-934-0055



# FARSOUND

## BREATHING LIFE INTO YOUR SUPPLY CHAIN

**YOUR PROBLEM | OUR SOLUTION**

We care about your problems and don't believe in one size fits all solutions.



[www.farsound.com](http://www.farsound.com)

## Loop Resistance Tester

- ✓ Approved by Boeing
- ✓ Safe in fuelled zones
- ✓ Light & portable



**MK**  
TEST SYSTEMS

[www.mktest.com](http://www.mktest.com) [sales@mktest.com](mailto:sales@mktest.com)

## NEW USA1000J PLUS

### 4MM PORTABLE JOYSTICK ARTICULATING VIDEOSCOPE



**USA1000J PLUS INCLUDES:**

- HD 7 INCH SCREEN
- 4MM DIAMETER PROBE
- INTERCHANGEABLE 90 DEGREE TIP
- 1500MM OF WORKING LENGTH
- JOYSTICK ARTICULATION
- HEAVY DUTY STORAGE CASE



360 DEGREE ARTICULATION



SIDE VIEW TIP

TOUCH SCREEN OPERATION

## 4MM KIT STARTING AT \$8995!

**USA** BORESCOPES

931-362-3304  
[sales@usaborescopes.com](mailto:sales@usaborescopes.com)  
[www.USABorescopes.com](http://www.USABorescopes.com)

## FOD Protection Solutions

Lightening Holes & Penetrations – Avionics Racks  
E-Bays & Electronics, Wing & Fuselage Wireways

### 49% cost savings

**SPRING-FAST® GROMMET EDGING**

- No Adhesives
- Snap On
- FAA Approved

**EWIS Compliant**



**SEALS, SLEEVING, TRIMS AND GASKETS**

**SEAL-FAST™ EDGE SEALS & TRIM-FAST™ EDGE TRIMS**

- UV Resistant Silicone
- Clip On

**FAR 25 Compliant**

**PROTECT-FAST™ CABLE SLEEVING AND WRAP**

- Easy Wrap for Harnesses
- Multiple Diameters

CONTACT US FOR FREE SAMPLES

**DTI** North America +1.508.229.2000 x210 [www.devicech.com](http://www.devicech.com)  
EMEA +49 40 350 85 128 [www.dti-devicech.eu](http://www.dti-devicech.eu)

## Integrity Aero Service

### ADVANCED AIRCRAFT COMPONENT REPAIR

#### Above & Beneath the Surface



WINGLETS, FLAPS, SPOILERS, AIRBRAKES, INLETS, FAN COWL DOORS, THRUST REVERSERS, DOOR ASSEMBLIES, RADOMES, FLEVATORS, RUDDERS, WING TIPS, ACCESS PANELS, FAIRINGS

Bombardier/Learjet | King Air/Beechcraft/Hawker | Dassault Falcon  
Gulfstream | Cessna/Citation | Saab | Embraer

FerroECOBlast® EUROPE

MRO AMERICA

## SHOT PEENING DONE RIGHT

ferroecoblast.com

**MEET US**  
April 26-28, 2022  
Dallas, TX, USA  
Live at stand 5923

## MICROCRANES®

THE ORIGINAL

Battery Power, Portable Hoist

22 ft. tip height. Pick & Carry



Compacts to 30 inches

[www.smartrigranes.com](http://www.smartrigranes.com)



Challenger 300 / 350 Inlet Engine Mounting Ring Replacement

Technical Expertise and Quality Repairs

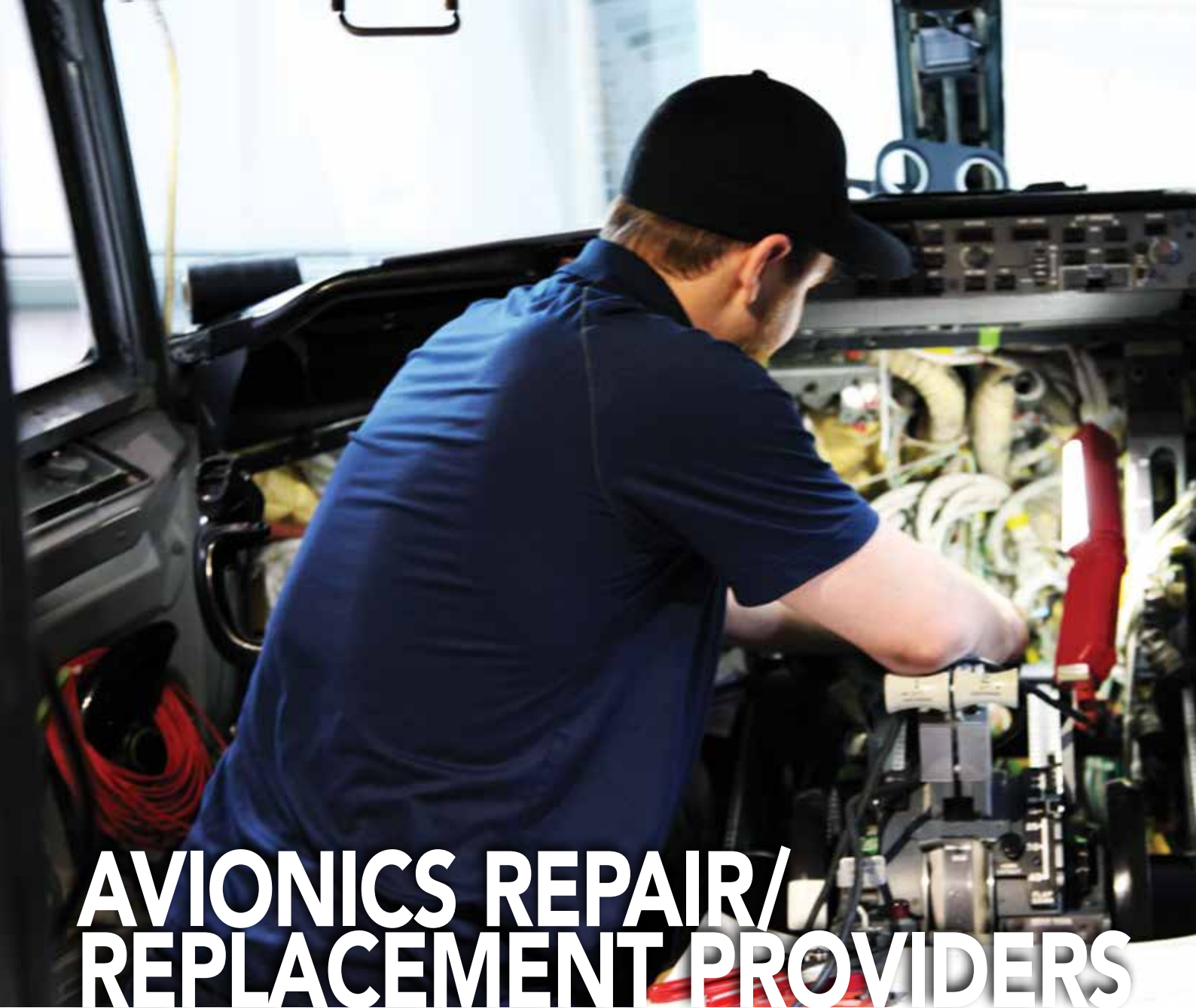
Aircraft Structural Repairs/ Custom Painting

**For A.O.G. Service - Your Schedule Is Our Schedule**

Quality delivered. Schedules met. Expectations exceeded.

1-855-749-2444 | [IntegrityAero.net](http://IntegrityAero.net)





# AVIONICS REPAIR/ REPLACEMENT PROVIDERS KEEP UP WITH TECH TRENDS

**A**s the world's aircraft become more sophisticated, so too do the avionics that control them. This is why avionics repair/replacement providers are keeping up with technology trends that are changing the fundamentals of flight.

## Change Abounds

To say the least, there are many technology trends that avionics repair providers are responding to. "They include increased remote diagnostics capabilities to service avionics in distant AOG (Aircraft on Ground) situations, methods to decrease turnaround times to return avionics to service sooner, and increased capabilities

to support expedited projects," said Don Milum. He is Director of North American Sales for Universal Avionics. "We are also fielding upgrades and replacements of older, less reliable avionics units as a means of reducing the overall requirement for repairs in total," Milum said. Overall, "our connectivity solutions can reduce nav database loading time by 75%."

Headquartered in Tucson, Arizona, Universal Avionics' product/serving portfolio includes Flight Management



Universal Avionics offers an intuitive head-up system called ClearVision. ClearVision is a complete Enhanced Flight Vision System (EFVS) solution providing head-up capability combined with enhanced vision (EVS) and synthetic 3D terrain display (SVS). Universal Avionics image.

Systems, Display Systems/Glass Cockpit [Insight], Enhanced Flight Vision Systems (ClearVision), Data Communications, Recorders [Kapture], Databases, and Flight



Honeywell says their Anthem flight deck is the first cockpit system to be built with an always-on, cloud-connected experience that improves flight efficiency, operations, safety and comfort. Honeywell image.



Mid-Canada Mod Center image.

## James Careless

### Deck Connectivity.

Universal Avionics is also applying breakthroughs in artificial intelligence, remote diagnostics and augmented reality to its avionics repair procedures and processes. These software tools are being combined with connectivity troubleshooting and maintenance data compilation that can be sent back to the avionics OEMs for advanced diagnostics. "The shop can pinpoint issues before a unit is actually sent back for repair, thus reducing the time for the overall repair/support process," Milum said.

Honeywell Aerospace is also keeping abreast of the latest avionics' technological trends, with the goal of leveraging whatever benefits they have to offer. A case in point: "At a subcomponent level,

we are continuously evaluating different applications of technology whether it is thermal imaging or JTAC technology," said Jason Bialek, Honeywell Anthem product line director, Honeywell Aerospace." Overall, Honeywell remains focused on robust testing capabilities that ensure the reliability and safety of our products," he said.

With its headquarters in Phoenix, Arizona, Honeywell Aerospace is the largest division of the Honeywell conglomerate. Honeywell Aerospace products and services are found on virtually every commercial, defense and space aircraft. The Aerospace business unit builds aircraft engines, cockpit and cabin electronics, wireless connectivity systems and mechanical components.

Because Honeywell Aerospace is also an avionics OEM, the company is addressing the aviation market's demand for more advanced inflight avionics directly. This is why it launched its new Honeywell Anthem flight deck system in October 2021.

"Honeywell Anthem is the first cockpit system in the industry to be built with an always-on, cloud-connected experience that improves flight efficiency, operations, safety and comfort," said Bialek. "The Honeywell Anthem flight deck offers unprecedented levels of connectivity, an exciting and intuitive interface modeled after everyday smart devices, and a highly scalable and

customizable design." This product is based on a flexible software platform that can be customized for virtually every type of aircraft and flying vehicle, he added. They include large passenger and cargo planes, business jets, helicopters, general aviation aircraft, and advanced air-mobility (AAM) vehicles.

At Flying Colours Corporation in Peterborough, Ontario, (Canada), improving inflight connectivity is an increasingly important part of their avionics business. (The company also provides MRO services, completions, refurbishments, special mission modifications, exterior paintwork, and aircraft transaction support for fixed wing and rotary business aircraft types.)

"Our work predominantly focuses on mid- to large-size jets: We find the Gogo AVANCE L3/5 inflight connectivity technology is proving very popular with a lot of owners who fly predominantly in North America," said Kevin Kliethermes, Flying Colours' sales director. "We've also recently completed installing Ka-band satellite connectivity technology on a Challenger aircraft type, which is a first for us. We've installed many on super mid-size aircraft, but this is the first time we've installed the powerful broadband offering on a super midsize aircraft. We anticipate this will become a more regular request as we find more and more customers do not want to fly without connectivity."





The Gogo AVANCE L3/5 inflight connectivity technology has proved very popular with North American clients, says Flying Colours. Gogo image. Top image shows the Collins Pro-Line Fusion solution that works well to upgrade and extend the life of older aircraft like the King Air shown. Collins Aerospace image.

IFlying Colours is modernizing other avionics systems on its clients' aircraft as well. "In terms of upgrading flight decks, the Collins Pro-Line Fusion solution is giving a new lease on life to older aircraft," Kliethermes said. "The Collins Venue Cabin Management System is proving popular with our customers too. We've been working closely with Alto Aviation to optimize its installation. Alto Aviation's controls are specifically designed to fit into previous switch panel location holes. This results in a CMS upgrade that maximizes client budget and reduces installation time significantly."

These kinds of avionics modernizations make good sense at a time when older, less sophisticated avionics systems are becoming harder to maintain. "Component

obsolescence appears to be the biggest challenge with avionics these days," said Bill Arsenault. He is president of Mid-Canada Mod Center in Mississauga, Ontario, which provides turnkey avionics installations and repairs to a wide variety of corporate and commercial customers. "Parts to repair older equipment are becoming more difficult to get," Arsenault explained. "This is driving more avionics upgrades. However, manufacturers do not have modern solutions available for every case."

Mid-Canada's core business is custom avionics upgrades. They offer avionics upgrades such as major cockpit retrofits, internet connectivity and navigation system enhancements to a wide variety of business and commercial customers.

One last tech trend being addressed

by the avionics repair/replacement sector is the shortage of up-to-date skilled technicians. Honeywell Aerospace is addressing this problem through various innovations. "We need technicians to be able to reach proficiency quickly, so it will be important to simplify the training and product diagnostic process," said Bialek. "To make this happen, Honeywell is exploring digital training and collaborative tools, as well as technologies that accelerate the troubleshooting process."

## The Pros and Cons of COVID

For the past two years, the work being done by avionics repair/replacement providers has been performed in the shadow of COVID-19. And for once, the news related to the pandemic's impact isn't all bad.

In the case of avionics repair and replacement, "the pandemic caused a surge in private aviation, driving demand for more aircraft than was/is available," Milum said. "This has meant that airframes that have fallen out of favor over the last several years due to avionic obsolescence and rising repair costs have found new life by owners upgrading their avionics in total. Legacy equipment is being replaced to improve dispatch rates and operational compliance in all areas of airspace around the globe, which is our wheelhouse."

This being said, avionics repair and replacement providers faced their own challenges for the past two years. According to Bialek, "the COVID-19 pandemic has affected companies in every



sector, and Honeywell is no exception. However, while the current pandemic deeply affected the aviation industry in 2020, we've seen a steady recovery since, and we are confident in the industry's long-term growth potential."

"COVID has created challenges on many fronts," said Mid-Canada's Arsenault. To cope with them, "keeping our staff and customers safe has been our core strategy from the start of the pandemic. This strategy has kept us from having infections spread in our workplaces. However, this has increased our costs, which for the most part we have not passed on to our customers. As well, the more recent supply chain issues caused by the pandemic are increasing lead times on parts and components, and causing work delays and disruptions."

Being an aircraft repair station, Flying Colours was deemed an essential service by the authorities in the USA, Canada and Singapore. As a result, it was exempted from lockdowns in its respective locations, and was able to keep providing a full range of services to its clients worldwide.

"Our work has continued, although some customers have delayed work — such as those owning aircraft in Europe who have been restricted on flying due to changing travel restrictions," Kliethermes said.

"Other customers have moved their maintenance schedules forward: As regular flying was restricted, they used that downtime to undertake maintenance work. This work regularly includes SATCOM/connectivity upgrades, as we always advise our customers to install systems that will remain current for years to come."

"We reworked our organization so that our shifts enabled us to keep working while sticking to the government guidelines," he added. "We produce many of the components that are installed ourselves, which means we were less reliant on the supply chain than many companies. This allowed us to keep finishing projects on time."

### Looking Ahead

When avionics repair/replacement providers are asked to look to the future, they



Flying Colours said the pandemic resulted in customers using downtime to undertake maintenance work. This work regularly includes SATCOM/connectivity upgrades. Image by Joy Finnegan.

respond by looking past COVID to a big picture issue — namely the evolving state of avionics repairs/replacements as modern aircraft become ever more complex and autonomous.

For Universal Avionics' Don Milum, the future is fraught with positive possibilities.

# T-RX™

Avionics Radio & Pulse Tester

## Built for Maintenance Engineers. Engineered for Safety.



Streamline your avionics radio testing process with the CCX Technologies T-RX Avionics Radio and Pulse Tester.

The T-RX is an all-in-one avionics tester that conducts 100+ tests on over 16 systems with only 1 device!

**CCX**  
TECHNOLOGIES

Call +1 (613) 703-6161 Email [info@ccxtechnologies.com](mailto:info@ccxtechnologies.com)  
[www.ccxtechnologies.com](http://www.ccxtechnologies.com)

European Enquiries:

**EVOLUTION**  
MEASUREMENT

call +44 (0)1264 316470 Email: [enquiries@evolutionmeasurement.com](mailto:enquiries@evolutionmeasurement.com)  
[www.EvolutionMeasurement.com](http://www.EvolutionMeasurement.com)



Mid-Canada's Bill Arsenault predicts more integrated, smarter avionics systems will become easier to troubleshoot and repair and that onboard diagnostic equipment that helps the technician zero in on faults and potential causes will also become better and more prevalent. Mid-Canada Mod Center image.

They include “the implementation of remote diagnostics and troubleshooting that requires connectivity, and better obsolescence management,” he said. Milum also expects to see analytics being used for avionics trend monitoring and reports “to help the DOM improve life cycle management, maintenance predictions, and repair activities.” He also predicts that “automated tested equipment (ATE) will arrive as well, allowing more effective management of part configuration changes while reducing avionics maintenance.”

Honeywell's Jason Bialek foresees “the potential of integrating serial number level maintenance history and reason-for-removal data as more feasible in an increasingly digital MRO environment.” He added that, “this will help technicians troubleshoot more efficiently to get products back to our customers. It will also be important to incorporate the right test points into products to streamline the troubleshooting process, and we will continue to refine automation and diagnostics in our test

procedures to gain accuracy.”

Mid-Canada's Bill Arsenault is looking forward to the possibilities outlined by Milum and Bialek. “More integrated and smarter avionics systems will only become easier to troubleshoot and repair, in my opinion,” he said. “Onboard diagnostic equipment helps the technician zero in on faults and potential causes.”

Meanwhile, Flying Colours' Kevin Kliethermes sees the increasing abilities of avionics equipment driving regulatory demand for their mandatory use in aircraft, which will drive technological progress in this area further still.

“As aircraft systems become more complex, and more mandates are introduced though the NEXT GEN mandates — and flight deck navigation, safety and situational requirements like FANS and CPDLC datalink communications come into play — aircraft will need to be equipped to provide these services to fly within regulatory requirements,” said Kliethermes. “Connectivity is already important, but looking to the future it will be an essential

part of the aircraft, with OEMs installing the relevant equipment during production. This affects all areas of avionics and our work will become more focused on repairing integral systems rather than retrofitting more up-to-date systems in the aftermarket sector.”

“Basically, there will be much more connectivity to and from the aircraft for the flight deck and passengers and this will be the prime focus going forward,” he observed. “Data management and how the avionics systems manage this will become more important, along with the need to protect this data through cyber security elements.”

Taken as a whole, avionics repair/replacement providers are dealing with a host of challenges as they weather the forces of technological change, COVID-19, and supply chain shortages. But based on the upbeat attitude of those providers who spoke with **Aviation Maintenance** for this story, they are embracing these challenges as opportunities for growth — and better service to their aviation customers. **AM**



# Join our 'Aerospace Tech' Group – [linkedin.com/groups/9054053](https://www.linkedin.com/groups/9054053)



**AEROSPACE  
TechWeek.com**

**AEROSPACE  
TechReview.com**



# A TALE OF TWO HELICOPTERS

Jeff Guzzetti

Former NTSB and FAA investigator Jeff Guzzetti explains how seemingly small maintenance errors can lead to tragic circumstances, especially in helicopters.



Graphic 1. Photo still from a ground witness video of the helicopter accident in Hawaii. Note the USS Arizona in the background above the tail rotor. The YouTube video showing the sequence of the helicopter crashing went viral. See the video here: <https://youtu.be/0sTTGlqZDx0>. MrMotofy image.

**S**ystem or component failures are among the most common defining events for fatal accidents in helicopters. Sadly, the circumstances of new

accidents are often similar to those of previous ones, suggesting that some mechanics are not taking advantage of the lessons learned from such tragedies.

Five years ago, while working in FAA's accident investigation division, I crossed paths with the investigations

of two fatal accidents, occurring two months apart, and involving two Bell helicopters that were manufactured within a two-year period. In the end, both crashed due to improper maintenance and a lack of grease on a drive shaft. You can't make this stuff up.



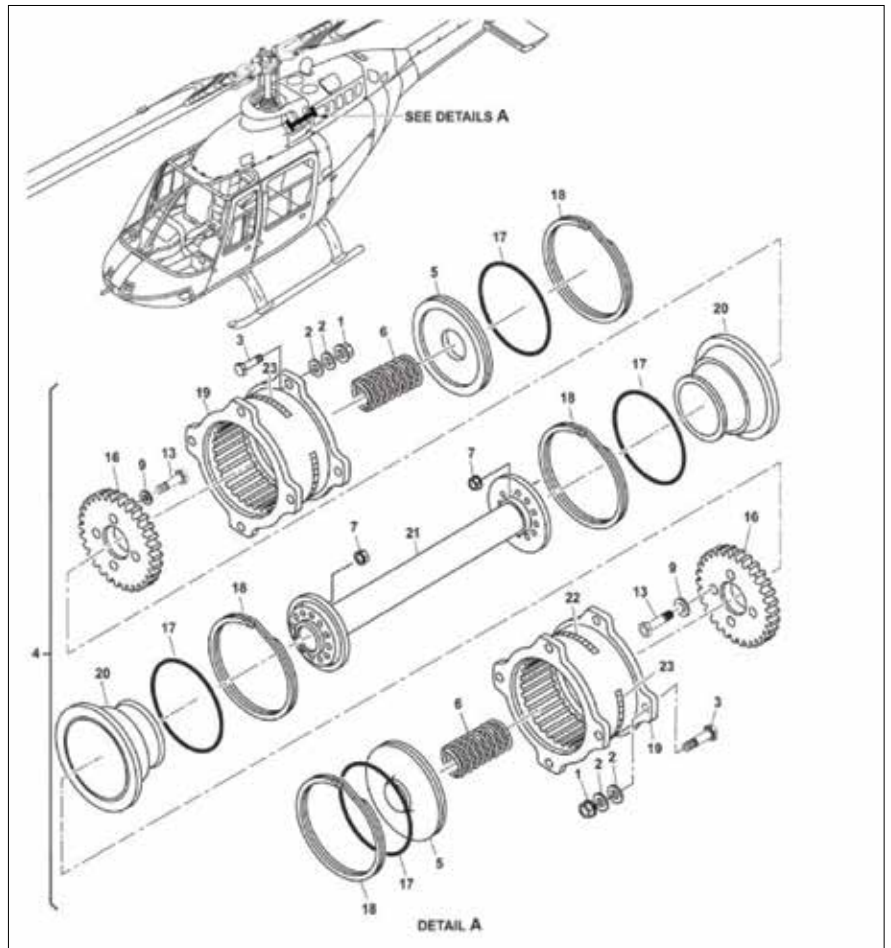
## Pearl Harbor

The first crash occurred in Hawaii on the morning of February 18, 2016, when a Bell 206B, operated by Genesis Helicopters, was in the middle of a Part 91 air tour flight around the island of Oahu with four passengers on board. The 35-year-old commercial pilot and former Army Black Hawk driver noticed a vibration throughout the cabin, so he cut the tour short and diverted toward the destination airport.

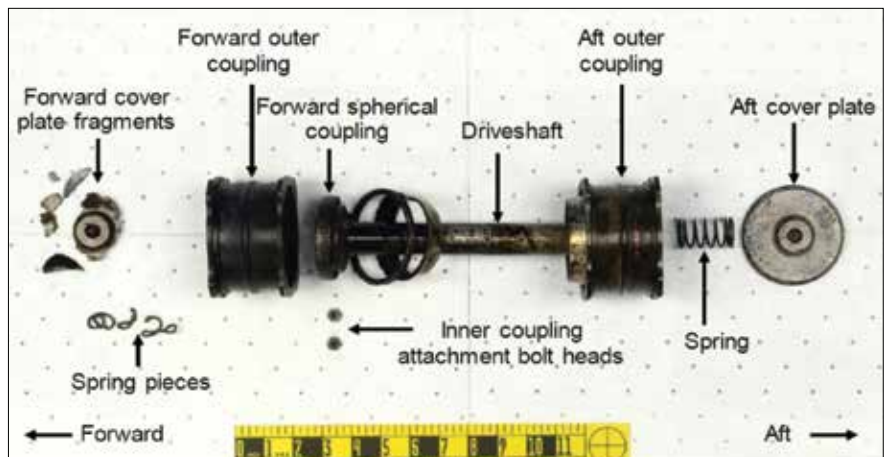
The vibration developed into a grinding noise and was followed by the main rotor low rpm warning light and an increase in engine rpm. The pilot initiated an approach to a grassy area near the shoreline next to the Pearl Harbor Visitor Center. He noticed people near his intended landing area, so he altered his course to land in the water close to the shore. The helicopter impacted the water, rolled over, and began to sink (see graphic 1). A few shocked bystanders jumped in to pull the pilot and three of the four passengers out of the water. Unfortunately, a 15-year-old boy was trapped inside and drowned.

Shortly after my office received the notification, a video of the accident surfaced on social media and went viral (<https://youtu.be/0sTTG1qZDx0>). I considered dispatching one of our senior FAA investigators to the accident, but Hawaii was a long way away, and the Honolulu FAA Flight Standards office had a very capable inspector who was already at the scene and working with the National Transportation Safety Board (NTSB) investigator in charge. We decided to support the investigation from afar.

Genesis Helicopters operated only one helicopter under a Part 91 Letter of Authorization (LOA) from the FAA to conduct air tours within 25 statute miles of the departure airport. It employed only four people: the owner, the pilot, a receptionist, and a maintenance "assistant." At the time, FAA policy stated that FAA should



Graphic 2. Engine-to-transmission-driveshaft diagram.

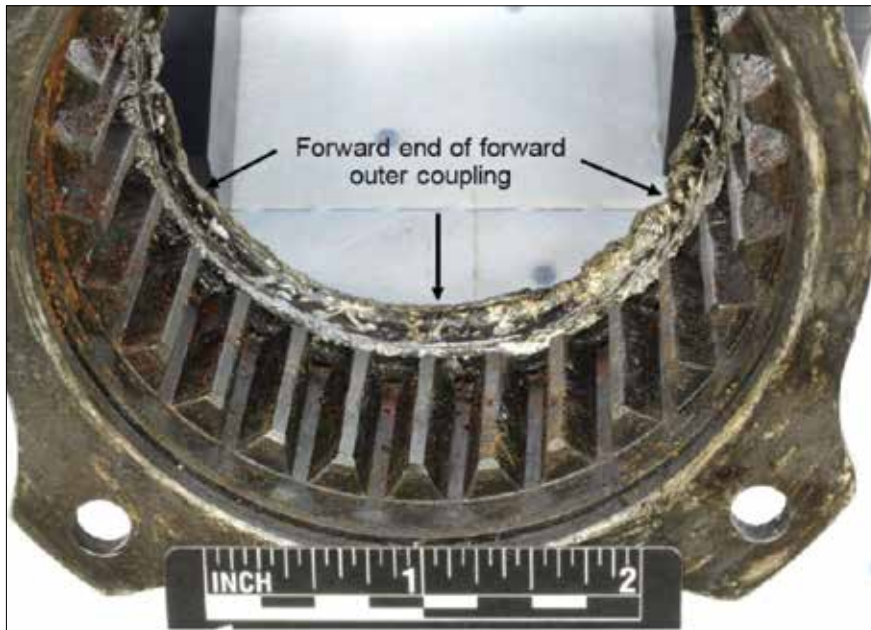


Graphic 3. The drive shaft from the accident helicopter.

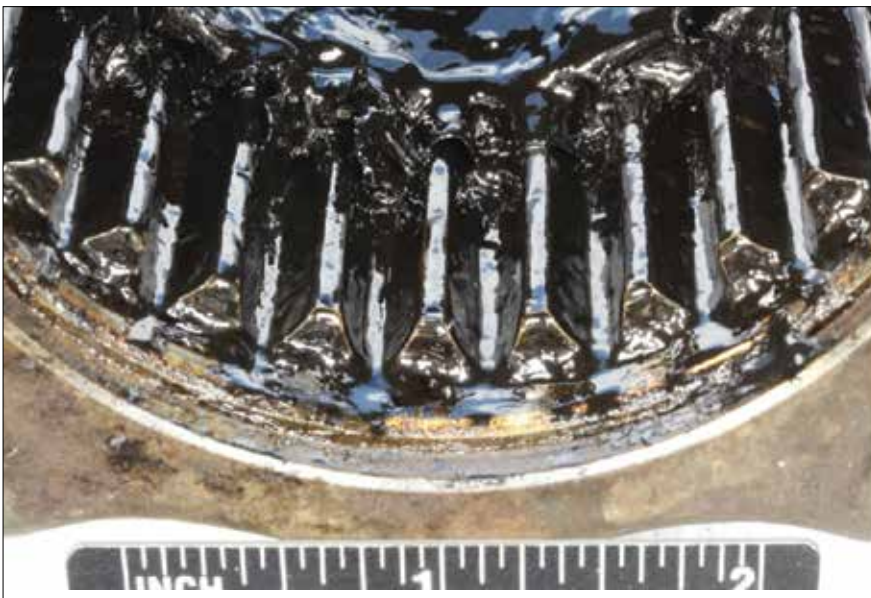
conduct inspections of 10% of all Part 91 air tour operators with an LOA, which could include ramp inspections, aircraft records review, or airworthiness directive compliance. The FAA inspector assigned to Genesis was interviewed

by NTSB and stated that he had not completed a ramp inspection of the company since being assigned to it three months prior, but was trying to schedule a visit. Ironically, on the morning of the accident, he called the owner to

# ON GUARD



Graphic 4. The external spline teeth on the forward inner coupling were worn down to the bottom landings.



Graphic 5. Compared to the damaged teeth of the inner coupling shown in the previous graphic, this photo shows the mating teeth of the forward outer coupling had only minor wear marks, leading investigators to determine how it failed.

Interviews with the accident pilot, the owner of the company, and the non-rated "maintenance assistant" revealed that maintenance had recently been conducted on the engine-to-transmission drive shaft, even though this work was not recorded in the helicopter's maintenance records. In addition, the owner, who was a rated mechanic, was not present the entire time of the removal, inspection, and reinstallation of the drive shaft. To make matters worse, the maintenance records revealed no entries for a current annual or 100-hour inspection, and several required component inspections were overdue.

The drive shaft was sent to the NTSB Materials Lab in Washington, one block away from my office. The metallurgical exam revealed that the forward coupling of the drive shaft did not appear to be lubricated and had been exposed to high temperatures. The external spline teeth on the inner portion of the coupling were worn down to the bottom landings, while comparatively minor wear marks were observed on the mating teeth of the forward outer coupling (see graphics 4 and 5). The asymmetry in the wear pattern, combined with the observations of elevated temperatures, indicated that the assembly likely failed by overheating from a lack of lubrication. This resulted in softening and subsequent failure of the spring that centers the coupling. When the spring failed, the coupling shifted forward, damaging the forward end of the outer coupling, fracturing the forward cover plate, and wearing the external spline teeth down to the bottom landings. Following the failure of the drive shaft, the engine continued to operate, but was not able to drive the main rotor.

The NTSB opined that when maintenance was last conducted on the drive shaft, grease was not applied to the forward coupling as specified in the manufacturer's maintenance manual. The NTSB probable cause was "the in-flight failure of the

schedule a records inspection but was unable to reach anyone.

## Drive Shaft Separation

The pilot stated that he was descending to land when it felt like the main rotor stalled and the helicopter "fell out of the sky" about 20 feet from touchdown. The Bell 206B was built in 1979 and was powered by a single Allison 250-

C20B turboshaft engine. It was removed from the water, rinsed with fresh water, and taken to a secure location for examination.

The wreckage exam showed no problems with the engine. However, the drive shaft section from the engine to the transmission was found separated at the transmission side (see graphics 2 and 3 previous page).



engine-to-transmission drive shaft due to improper maintenance, which resulted in low main rotor rpm and a subsequent hard landing to water." The NTSB also cited numerous findings in the investigation, such as the operator's failure to conduct scheduled and routine maintenance checks, and the lack of robust FAA requirements to oversee Part 91 air tour operations. That last finding troubled me, because the FAA would have likely caught the operator's maintenance failures if it were required to operate under more stringent Part 135 commercial rules.

## Great Smoky Mountains

Two months later, in April 2016, another Bell 206 helicopter was destroyed when it impacted terrain while maneuvering near Pigeon Forge, Tenn. Tragically, the 1,300-hour commercial pilot and all four passengers were killed. Just prior to the accident, a ground witness observed the helicopter at a low altitude in a descent and noted that it sounded unusual. He then heard the engine go silent, followed by the sound of the impact. The helicopter was operated by Great Smoky Mountain Helicopters, another small Part 91 air tour operator with a fleet of two ships (see graphic 6). The accident ship was built in 1977, two years before the birth of the Hawaii helicopter that had just crashed.

We now had two helicopters, built two years apart, and crashing two months apart, each during Part 91 air tours. My concern grew. Fortunately, the investigator in my office who was on call to launch on the next significant accident was Matt Rigsby, arguably the most knowledgeable helicopter safety expert in the FAA. As a former investigator for Bell Helicopters and aerospace engineer at the FAA's Rotorcraft Directorate, Matt is well-known in the helicopter community. He booked a flight to Knoxville, rented a car, drove about an hour to the crash site and met up with two senior NTSB investigators (see graphic 7).

The investigators identified the initial



Graphic 6. Pre-accident photo of the helicopter that later crashed near the Great Smoky Mountains.



Graphic 7. NTSB Investigators Chihoon Shin (left) and Luke Schiada survey the damage of a helicopter accident that occurred in Pigeon Forge, Tenn.

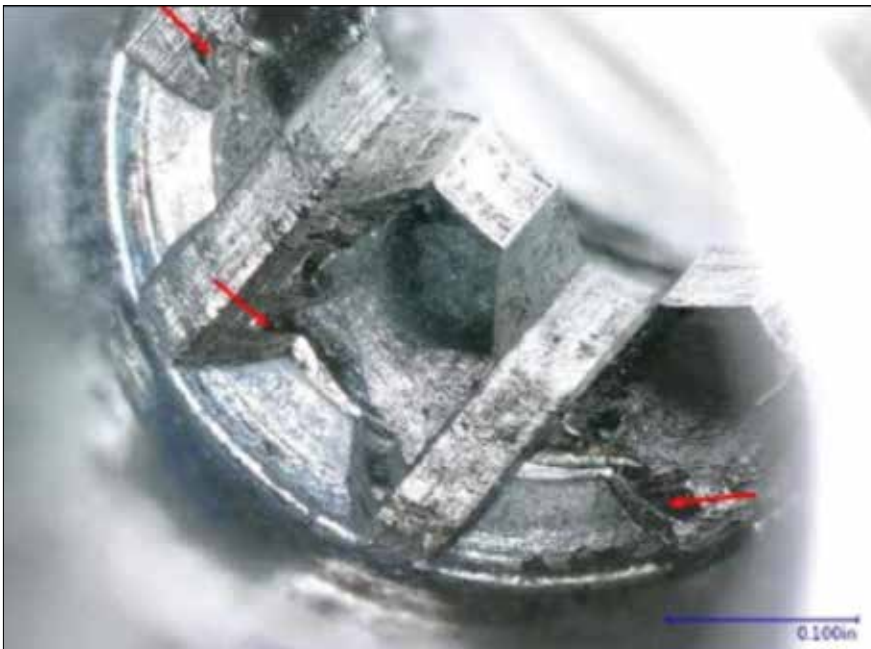


Graphic 8. The suspect fuel pump was removed from the engine by investigators and disassembled for clues.

# ON GUARD



Graphic 9. Digital microscope photo of the damage to the internal splines of the drive gear after cleaning. The splines exhibited evidence of severe damage, with significant portions of the spline teeth missing material.



Graphic 10. The drive shaft spacer installed on the drive shaft (red bracket) was measured to be about 0.240 inches thick. However, the original 1985 build record from the pump manufacturer indicated a spacer with only half that thickness was installed. The incorrectly sized spacer likely resulted in a gap between the spacer and drive gear that provided a path for grease on the splines to escape. The investigation could not determine when the incorrectly sized spacer was introduced into the fuel pump assembly.

tree strike about 400 feet south of the main wreckage on top of a 1,100-foot-high ridge. Pieces of Plexiglas and a section of the front-left skid tube were found near the tree strike. The debris

path continued from the top of the ridge to the bottom, where the main wreckage was found, mostly consumed by a post-crash fire. In his nightly update, Matt remarked that the damage to the

main and tail rotor blades indicated low rotational energy consistent with unpowered ground impact damage.

## Fuel Pump

The fuel pump was removed from the engine accessory gearbox and disassembled (see graphic 8 previous page). Removal of the drive shaft revealed that its small splines, which are normally mated to the internal splines of the fuel pump drive gear, exhibited evidence of severe damage and worn spline teeth. The drive shaft spacer exhibited thermal distress and indentations consistent with contact with the internal splines of the drive gear (see graphics 9 and 10). Disassembly of the engine fuel pump revealed anomalous and accelerated spline wear that was severe enough to prevent the fuel pump from delivering fuel to the engine, resulting in a total loss of engine power.

The illustrated parts list for the fuel pump's component maintenance manual (CMM) allowed for 11 different sizes of drive shaft spacers. According to the CMM, measurements taken during assembly of the pump's drive shaft are used to select the proper spacer thickness. The spacer installed on the accident pump drive shaft was about 0.240 inches thick (see graphic 10). However, the original 1985 build record from the pump manufacturer indicated a spacer with only half that thickness was installed.

Review of maintenance logs revealed that the helicopter and engine had accumulated 22,562 hours and 8,550 hours respectively at the time of the accident. The helicopter had been operated for about 40 hours since its most recent and concurrent 100-hour and annual inspections. The engine fuel pump was installed seven years prior to the accident and had accumulated 1,078 flight hours since its last overhaul at that time, which was performed at a facility in Colorado in accordance with the CMM. No anomalous findings were



recorded. The overhaul interval was 4,000 hours, so, in theory, the pump should have been in good condition. What happened?

In its final report, the NTSB stated that the wear on the splines of the fuel pump drive shaft was likely accelerated due to a lack of grease. Remnant material on the splines was consistent with grease being present on the shaft at one time, but it could not be determined if it was from the last overhaul or an earlier one. Additionally, drive gear spline impressions on the drive shaft spacer were consistent with an erroneously selected spacer. The incorrectly sized spacer likely resulted in a gap between the spacer and drive gear that provided a path for grease on the splines to escape. The investigation could not determine when the incorrectly sized spacer was

introduced into the fuel pump assembly.

The NTSB determined the probable cause was "an inflight loss of engine power due to a failure of the engine fuel pump, which ... resulted from the absence of adequate grease..." As with the Hawaii accident that occurred two months prior, the absence of grease on a spline shaft led to a fatal accident.

## Lessons Learned

As stated in a recent safety alert and video produced by the NTSB and HAI, "helicopter safety starts in the hangar." Proper maintenance procedures and inspections are particularly critical for helicopters because of their mechanical and operational complexity. A lack of vigilance in performing maintenance tasks, or in verifying that the work was done correctly, can lead to accidents. So, what can maintenance technicians

do? Here are a few suggestions:

- Carefully follow the manufacturer's instructions and manuals when performing a task to ensure that the work is completed as specified.
- Have a qualified person, other than the person who performed the maintenance, inspect critical items that have received maintenance. Ask questions if something is unfamiliar.
- Use work cards to document maintenance steps. If none are available, consider developing them from available maintenance manuals.
- Be thorough when performing routine inspections.
- Keep yourself and your maintenance staff educated and trained. Read up on the many resources from the FAA, such as Advisory Circular AC 43-13-1B, and keep abreast of the findings from helicopter accidents. **AM**



## The premier publication for the Aerospace Technology industry

Great solutions to reach your target audience of Aerospace, OEM, MRO & Airline Technology Professionals

- Advertising
- Spotlights
- Digital Media
- Emails
- **Webinars**
- Social Media
- Events



### GET THE MOST OUT OF AEROSPACE TECH REVIEW WEBINARS

- Raise brand awareness and increase your Online Traffic
- Generate new leads and create business relationships
- Speed up your sales process and get a faster ROI
- Position your brand as an expert in the aerospace tech field
- Helping you reach your audience whilst travel is restricted

**Unparalleled Multi-Media Reach Across All Platforms**

For further details contact Simon Barker, Publisher & Sales Director, at [sbarker@aerospace-media.com](mailto:sbarker@aerospace-media.com)



## Leann Ridgeway

VICE PRESIDENT, SUSTAINABILITY, COLLINS AEROSPACE

### Tell us about your background and how your previous roles at Collins inform your work in sustainability.

Prior to becoming vice president of sustainability for Collins in October 2021, I served as vice president of our Information Management Services business (formerly ARINC) for three years. This business is integral to Collins' sustainability efforts because it enables us to use real-time data and predictive technologies to optimize flight routes and use less fuel. Our recent acquisition of FlightAware, which we combined with the IMS business to form our new Connected Aviation Solutions business unit, has enhanced our ability to improve route efficiency and reduce the carbon footprint of air travel even further.

Previously, I also led the integration of B/E Aerospace, which is now part of Collins' Interiors business. Here too, sustainability has been a key factor as we worked to produce lighter components across the Interiors portfolio. For example, use of advanced materials has enabled us to manufacture seats and monuments that offer up to 38% weight reduction compared to the previous generation.

### Why is sustainability important to Collins Aerospace?

At Collins Aerospace, we believe that sustainability isn't a choice — it's an imperative. Quite simply, we must all do our part to reduce our environmental impact. And it's not just a priority for us, but for all our stakeholders as well — including our customers, our employees, our shareholders, our regulators and the flying public.

As a leader in technologically advanced and intelligent solutions for the global aerospace and defense industry, we are in a unique position to make a positive impact on the future. Our resources, knowledge and experience give us a greater grasp of the challenges ahead — and above. This is a once-in-lifetime opportunity to transform air travel as we've known it.

### With the coronavirus situation dragging on with the omicron variant, why is sustainability still important right now?

Collins has committed to support the aviation industry's goal of net-zero carbon emissions by 2050 as part of the declaration released by the Air Transport Action Group (ATAG). While that goal is still roughly 30 years away, the plans to achieve it are predicated on taking action now. The more we do in the near term, the easier it will be. Conversely, the longer we delay, the more the problem will be compounded and, ultimately, the harder it will be to solve as the curve only gets steeper over time. It's inevitable that other, significant industry challenges like COVID-19 will arise and demand our attention as well, but we must keep our focus on sustainability at the same time. This is a huge challenge and a great opportunity. With aviation being a "hard to abate sector," we must get started now.

### What are some of the goals and timelines Collins Aerospace has set in relation to sustainability?

To support the aviation industry's goal of net-zero carbon emissions by 2050, we have several initiatives under way to advance enabling technologies as part of our sustainability technology roadmap, including:

- **Connected Ecosystem** - Creating more connected solutions for aircraft that use real-time data and predictive technologies to optimize flight routes and use less fuel, and developing artificial intelligence-based flight optimization and aircraft routing tools that leverage airspace information, atmospheric data, aircraft state and performance databases for dynamic route optimization.

- **Alternative power sources** - Working together with our sister Raytheon business, Pratt & Whitney and the Raytheon Technologies Research Center, we are supporting the development of hybrid-electric and all-electric propulsion systems. At the same time, we are designing More Electric aircraft systems to replace traditional hydraulic and pneumatic systems, thus reducing greenhouse gas emissions. And we're bringing new systems onboard aircraft that can accommodate sustainable

aviation fuel.

- **Advanced structures** - Creating lighter, streamlined and more fuel-efficient architectures for aerostructures by using technologies that include thin acoustic structures, low-drag liners and environmentally friendly coatings to reduce drag.

- **Integrated solutions** - Our breadth of tip-to-tail solutions provides us with unique opportunities to combine systems across our portfolio. For example:

- **Integrated aircraft doors** - Smaller and lighter one-piece door structures for a more efficient use of space on the aircraft.

- **Power thermal management solutions** - In collaboration with Pratt & Whitney and the Raytheon Technologies Research Center, we paired advanced systems architectures with digital engine controls in new ways to increase vehicle thermal capabilities, reduce fuel burn, and lighten overall aircraft weight, all while optimizing engine performance.

### Recently Collins acquired Dutch Thermoplastic Components (DTC). How does this acquisition help meet your sustainability goals?

DTC is a leader in the development and fabrication of structural thermoplastic composite parts. By acquiring them, we expanded our ability to use advanced thermoplastics to make lighter aircraft components for our customers, ultimately helping support lighter aircraft that are more fuel-efficient. With thermoplastic composites, we can potentially reduce the weight of aircraft structures by 20 to 50% compared to thermoset solutions and metallic solutions respectively.

In addition to improved product performance, thermoplastics are also more sustainable to manufacture. By using traditional materials like thermosets, aircraft parts are cured in large autoclave ovens that consume a massive amount of energy. With thermoplastic composites, we are using more efficient out-of-autoclave processes that greatly reduce energy usage. Switching from thermosets to thermoplastic composites also adds to energy efficiency as cold storage of thermoset materials is eliminated. Thermoplastic composites have higher resistance to impact and fatigue compared to thermosets. This means that parts will last longer, a key to future circular economies. Finally, thermoplastic composite products are fully recyclable at the end of their lifecycle, meaning that they can be melted, reshaped, and reused.



## Do you anticipate more acquisitions to help meet your sustainability goals? If so, what will you be looking for in terms of a potential acquisition?

---

We're always open to strategic acquisitions that make sense and augment our sustainability technologies. FlightAware and DTC are both good examples of this.

## Talk about Collins Aerospace's commitment to research and development in sustainability. Give examples of programs the company has implemented as a result of R&D in this area.

---

Collins' annual research and development exceeds \$3 billion, the vast majority of which supports technologies that drive improved sustainability. For example, as part of our Electrified Aircraft initiative, we're developing electric motors for hybrid-electric propulsion systems. These systems, which combine fuel-burning engines with electric motors and batteries, can significantly improve aircraft fuel efficiency and lower carbon dioxide emissions, while also reducing noise and operating costs. It is estimated that large commercial and regional aircraft can reduce fuel burn by approximately 5% and 30%, respectively, when implementing hybrid-electric propulsion architectures.

Last summer, Pratt & Whitney Canada announced plans to integrate new hybrid-electric propulsion technology into a De Havilland Canada Dash 8-100 flight demonstrator. Pratt's fuel-burning engine will be combined with 1 megawatt electric motor from Collins in a hybrid configuration that will optimize engine performance throughout the different phases of flight and demonstrate potential fuel savings of around 30%.

Collins has also teamed up with U.K.-based Hybrid Air Vehicles and researchers at the University of Nottingham on the world's first zero-emission aircraft, Airlander 10. To achieve zero-emission operation, Airlander 10's four fuel-burning engines will be replaced by 500 kilowatt electric motors provided by Collins. This will happen in a phased approach, beginning with the two forward engines in 2025 to achieve hybrid-electric operation, and the two rear engines in 2030 for zero emissions.

With the support of the French government and local communities, and in collaboration with local industry, we've

also made a significant investment in Collins Propeller Systems in Figeac, France. The center's mission is to find innovative ways to design and manufacture more sustainable, next-generation propeller systems for turboprop, engine-powered aircraft. Whether propeller-enabled engines are burning sustainable fuel or hydrogen in the future or are replaced with electric motors or hybrid-electric systems, propeller aircraft can play a large role in reaching fleet sustainability goals.

## How are you incorporating your clients' input into your sustainability goals?

---

We have conducted a Materiality Assessment to understand the sustainability priorities of our stakeholders, including not only customers, but investors and the communities we serve. In 2019, we joined 23 other leaders in aerospace, research organizations and associations across Europe to sign the Clean Sky 2 Joint Declaration of European Aviation Research Stakeholders to lead the way toward the decarbonization of aviation by 2050. In 2021, we signed the Letter of Intent (LoI) to join as a Founding Member of the currently forming Clean Aviation Joint Undertaking. As part of a unique, long-term collaboration with Airbus, Emirates Airlines, GE Aviation and Thales, and in partnership with the Dubai Future Foundation, we co-created Aviation X Lab to focus on technological innovations in aviation, including those enabling the next era of sustainable air travel.

## There are many layers to sustainability. Can you talk about how you are addressing sustainability within your own facilities?

---

While we are working to develop more sustainable products, we are also focused on increasing the sustainability of our manufacturing operations. To that end, we are actively exploring and implementing solutions to reduce energy usage at our facilities, including:

- Solar energy is being utilized by seven sites worldwide to replace more than 3,898 MT CO<sub>2</sub> and 4.3 million pounds of coal burned per year — equivalent to removing 855 passenger vehicles from the road annually.
- At our propeller facilities, in 10 years we have reduced our CO<sub>2</sub> emissions by

45% while growing our business by 50% and our workforce by 20%.

- Improving our water management processes through rigorous oversight and conservation efforts. Depending on the geographic location of our sites and their natural environment, we optimize our production processes and reduce virgin water usage by recycling water and reusing reclaimed water and rainwater.
- Eliminating waste, championing reuse and recycling across our value chain to accelerate a more circular system. Recycling 94% of all waste generated.

- Since 2017, Collins has invested more than \$35 million in the development of chemical alternatives. For example, we use Hexavalent Chrome processes on many of our products for wear and corrosion resistance. In response to maturing Global Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) regulations, we have qualified and placed into production Hexavalent Chrome-free alternative processes in our facilities in the EU and UK. These greener alternatives meet and/or exceed material performance of the Hexavalent Chrome processes being replaced.

## What about sustainability in the air? How are you helping aircraft operators meet their sustainability goals? Does this include working on alternative power sources?

---

Alternative power sources are a key piece of our sustainability technology roadmap. In addition to electric propulsion, we're also collaborating with Pratt & Whitney, our customers and industry partners to develop systems and solutions to enable 100% SAF-ready engines and aircraft. The breadth of Collins' systems and technology across the aircraft also puts us in a unique position to collaborate with customers on hydrogen solutions.

In addition to our aforementioned technologies to help aircraft operators reduce weight and optimize fuel efficiency, Collins is also working to help reduce aircraft noise. By improving the acoustic-dampening performance of our nacelles, we can reduce the acoustic signature of aircraft engines. Creating higher-performing acoustic liners can extensively reduce the noise signature of the aircraft, which allows more efficient routing and opens more local airports to commercial flights. **AM**



## Export Basics: Doing Business Across Borders

This is part one of a three-part series on U.S. export compliance for aviation businesses.

Diversification is often important to a growing business, and geographic diversification is a classic way to expand your reach and help protect your business from domestic downturns. Being able to provide maintenance services and parts support to customers outside of your home country is often an important step to growth in an aviation business.

There is a complex web of regulations and relationships that affect these international transactions — and many of you have read my articles about bilateral agreements, airworthiness tags, maintenance release tags, and other features of the internal civil aviation system. But this month's article will deal with the specific issues of export compliance that are faced by the aviation community.

Export compliance can seem complicated because there are so many different agencies that affect it. Many of us in aviation are used to dealing with just one regulatory scheme for aviation safety (the FAA's regulations, in the United States). For export compliance, though, you typically need to be concerned about three different regulatory compliance agencies:

- Office of Foreign Asset Control, Treasury Department
- Bureau of Industry and Security, Commerce Department
- Directorate of Defense Trade Controls, State Department

There are also special situations where other agencies may get involved, but we will remain focused on these three for this article. Please note that the importing authority in your destination country will also have jurisdiction and you should work with your business partner to ensure compliance with the partner's import laws.

One of the most important rules that I can impart to you is that navigating the export rules can be worthwhile. Many companies refuse to export because they are concerned about the penalties from non-compliance. The concern is justified, but the value that you can obtain from a healthy export trade is worth the investment that you will make in compliance. There are several strategies for compliance. We find that our clients will often rely heavily on our law firm when they first start to export, but that they eventually work with our firm to build a compliance system as they become more comfortable with compliance. The goal, of course, is to have a system that helps to guide transactions in a way that ensures full compliance.

I typically like to start my export analysis by examining the Treasury Department restrictions. The Treasury Department frequently does not restrict the export of aircraft parts but when it does it can be a serious situation. There are two areas that need to be examined for aircraft parts exports:

- Specially Designated Nationals
- Country-Based Sanctions
- Transactional Sanctions

Specially Designated Nationals are people and entities who are sanctioned by the Treasury Department. You can apply for a license to export to them, but unless there is a reason for the government to grant you a license, you might not get one. Often, once a potential business partner has been added to an SDN list, the best approach is to work to get them off of the list (assuming that they were wrongly added to the list in the first place). You can find these "SDNs" listed in the consolidated export screening list at <https://www.trade.gov/data-visualization/csl-search>.


The consolidated export screening list is published by the International Trade Administration and it (as the name implies), it consolidates lists of people and entities that are subject to various export restrictions. Once you've found someone on that list, you need to identify why the person/entity is on the list and what sort of restrictions this imposes before you can consider exporting to that person/entity.

Country-Based Sanctions — the United States issues sanctions against locations. These sanctions programs frequently include intermediate destinations (not just final destinations). You can find a list of these destinations online at the OFAC website: <https://home.treasury.gov/policy-issues/financial-sanctions/sanctions-programs-and-country-information>. There can be more than one program that affects a country. At present, Russia is affected by both the Magnitsky sanctions and Ukraine-related sanctions (which were imposed in response to the annexation of the Crimean peninsula). But the United States is threatening to add additional sanctions.

Read the rules carefully, as they may not impact your specific transaction. Some of the sanctions programs might forbid almost all transactions, while others might not apply to aviation transactions at all!

While most of the Treasury Department's sanctions programs are aimed at specific countries, some of them are aimed at classes of perpetrators and classes of transactions. An example of the sort of sanctions program that the United States publishes is the program against narcotics traffickers. These programs typically result in people being added to the consolidated screening list, mentioned above, so that makes scrutiny of that list particularly important. There are also sanctions programs that target specific types of transactions, like trade in diamonds (which is not a common way to pay for aircraft parts, so I won't say anything more about that program).

The important thing for Treasury Department compliance is to check compliance for every transaction. The rules can change fast, and a transaction that was legal one week might be illegal the next. There is a tendency for exporters to sometimes become complacent because they are used to seeing the same results every transaction. They assume that the business partner will always be unsanctioned. But in this fast-moving world, an export partner can be added to a sanctions program with relatively little public warning. In my law practice, I have represented companies whose long-time business partners were added to a sanctions list — but my client did not notice and continued to do business with the partner. Companies who come to my firm after failing to perform transactional due diligence find that the experience can be more expensive than simply installing an effective compliance program that checks the appropriate lists for every transaction.

Next issue, we will examine how to distinguish Commerce Department jurisdiction from State Department jurisdiction (an important step in your export analysis) and we will discuss compliance for aircraft parts deemed to be defense articles, under the International Traffic in Arms Regulations (ITARs). If you are looking for more guidance on how to comply with U.S. export laws, then please be sure to join us at the ASA/AFRA Conference. I will be teaching a workshop on export compliance at the ASA/AFRA Annual Conference in June. Check out [aviationsuppliers.org](http://aviationsuppliers.org) for more information! 



*TPAerospace*

# **SIMPLICITY FOR THE WIN**



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

[TPAEROSPACE.COM](http://TPAEROSPACE.COM)

# Keeping our customers a step ahead

Our innovative exchange, lease, and overhaul programs are tailored to the needs of our customers. Our global repair centers deliver unmatched service and support to keep you a step ahead.

Proud to be rated the top avionics supplier in the 2020 Air Transport Aftermarket Customer Satisfaction Survey.

[baesystems-ps.com](http://baesystems-ps.com)

