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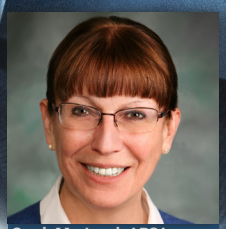
Russell Ford, StandardAero


Leo Koppers, MTU


Sarah MacLeod, ARSA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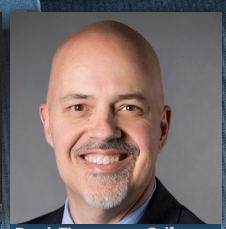
Derek Zimmerman, Gulfstream

April / May 2018

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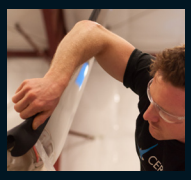

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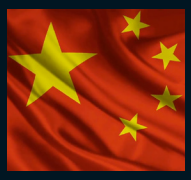

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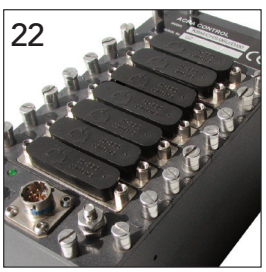

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What the Fortune Tellers Say

BY JOY FINNEGAN
EDITOR-IN-CHIEF

Every year experts release their thoughts on what the aviation industry, and our segment of it, will do during the coming years. As we have seen time and time again, sometimes they are right. And sometimes they are not.

There is always a chance for an unpredictable event such as a terrorist attack, a worldwide health scare or an economic downturn. Given that these things can occur and cannot be predicted, let's take a look at what a couple of these reports say will happen in the coming years. Let's start with the annual FAA Forecast released in March. Then let's put it together with a couple of other prescient outlooks.

The 2018 FAA forecast calls for slightly slower U.S. carrier passenger growth over the next 20 years to average 1.9 percent per year. But passenger growth will continue into 2018, as the FAA report says, "spurred on by favorable economic conditions in the U.S. and the world." They are predicting oil prices to rise to $51/barrel in 2018. Furthermore, the forecast assumes they will increase thereafter to exceed $100/barrel by 2030. "Over the long term, we see a competitive and profitable aviation industry," the report says (see more on airline service and support from Rich Hopf, Director of Airlines, BAE Systems on page 20).

As for the GA market space, FAA predicts the active general aviation fleet will remain stable through 2038. "The long-term outlook for general aviation is stable to optimistic," the report says, but outlines that growth at the high-end will "offset continuing retirements at the traditional low end of the segment." (See more from Derek Zimmerman, President Gulfstream Aerospace Services on page 44, Jim Swehla, Co-founder/EVP Sales and Marketing, West Star Aviation on page 50 and Todd Duncan, Chairman of Duncan Aviation on page 45). A final key figure from the report is that the U. S. civil aviation maintenance industry employs about 279,000 workers with most of those working in the MRO segment.

FAA's forecast calls for growth. Couple that growth with record airline profits last year and things look rosy.

Consultancy firm CAVOK and the Aeronautical Repair Station Association (ARSA) made a collaborative forecast which says there are some risks on the horizon. Strained capacity, higher costs and pent-up demand may lead to higher supplier rates and to workers seeking higher wages.

This report predicts a shortfall of maintenance workers by 2022 as a result of the retirement of baby boomers and the lack of interest in the job among millennials. This will be particularly evident in mature economies like North America. "This shortage could produce problems for the aviation industry," the CAVOK/ARSA report says.

The commercial air transport MRO market is growing. The CAVOK/ARSA report forecasts 3.8 percent growth for five years and then 4.5 percent yearly growth between 2023 and 2028 (see more of ARSA's Executive Director, Sarah MacLeod's thoughts on page 21). We used to talk about consolidation in our industry saying there was too much capacity. But this report is now looking at mergers and acquisitions as more likely and a way to handle the growth. We have already seen some of this taking place. For example, the StandardAero purchase of Vector Aerospace (see more comments from StandardAero's CEO Russell Ford on page 16), AAR's purchase of Premier (see more from AAR's Brian Sartain, SVP of Repair & Engineering on page 18) and Chinese firm HNA's purchase of SR Technics, leaving fewer but larger companies.

Also called out in their forecast is the larger role the OEMs are playing. Boeing, Airbus and the engine manufacturers are all zeroing in on the aftermarket as a way to hold on to the values of their products (see more from Pratt & Whitney's VP, Aftermarket Operations, Joe Sylvestro on page 17 and Leo Koppers, SVP MRO, MTU Maintenance also on page 17).

This is happening right now with Boeing Global Services recently announcing orders valued at more than $900 million in February (see more of what BGS CEO Stan Deal has to say on page 15). OEM involvement in the aftermarket and competition with the MROs of the world has never been tame. Watch this space for even more cutthroat competition.

One of my favorite forecasts comes from VZM Management Services led by industry veteran and expert, Marcel Versteeg. "The global Mainliner MRO market will grow around three percent in coming years – Middle East and Asia-Pacific will continue to show the highest growth rates," the report says. VZM says the growing cargo market and need to replace aging fleets will increase demand for P2F conversions.

They also predict labor shortages becoming evident worldwide. But, Versteeg says, efficiency improvements and technology can help to reduce labor shortages. "Independent engine MRO service providers are strengthening their position in the market by offering comprehensive service packages," VZM says (see more of what Neil Book, President/CEO of JSSI has to say on page 46).

Lastly, the Boeing Technician Outlook says, "global fleet growth will continue to drive a strong demand for technicians to repair and maintain the airplanes. Technology will drive the need for those who can work with advanced avionics, composites and digital troubleshooting, (see more from Gavin Gallogly, President Mitchell Aircraft on page 43). The report says 648,000 mechanics will be needed worldwide through the period ending in 2036. Hold on. It's going to be an interesting ride. AVM

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Lufthansa Technik Sets New Sales Record

Focusing on Digitization and Internationalization

Lufthansa Technik Chairman Dr. Johannes Bussmann gives remarks at the annual rmedia day in Hamburg, Germany in March.

Lufthansa Technik recorded its best sales result in the company's history, with new orders totaling more than €13 billion ($15.9 billion). The results were announced in March at their annual media day event held at their product innovation center in Hamburg. Sales revenue grew €5.4 billion ($6.62 billion) up five percent over the previous year. The company achieved an adjusted Earnings Before Interest and Taxes (EBIT) of €415 million. These figures include Lufthansa Technik and their 22 fully consolidated companies.

"Lufthansa Technik is and remains the leading provider in our industry," said the chairman of the Executive Board of Lufthansa Technik AG, Dr. Johannes Bussmann. "Last year was the year of sales. Our team delivered a fantastic performance, demonstrating the importance of the internationalization approach adopted by Lufthansa Technik." He called competition in the MRO market "lively."

According to the company, the number of aircraft under exclusive support contracts with Lufthansa Technik grew by a further ten percent in 2017 to more than 4,550. This is approximately 20 percent of all commercial aircraft worldwide. They plan to continue robust investments into the company. "Since 2014, we have almost doubled our annual investments to €233 million and we plan to pursue this approach further," said Constanze Hufenbecher, CFO of Lufthansa Technik.

One dark spot on the year was the closing of the Hamburg base maintenance site which resulted in the elimination of 400 jobs. But Dr. Bussmann was optimistic saying, "There is a future for Hamburg – as an engine site. We will move forward with confidence."

Last year, Lufthansa Technik established a digital fleet solution product division and introduced AVIATAR, a platform the company says offers numerous apps that can deliver a diverse, extensive range of digital maintenance, repair and overhaul (MRO) products and services. Bussmann said it will be like the iTunes or Amazon of the MRO industry, "keeping us competitive. WizzAir is the inaugural customer. They say AVIATAR will support customers "real-time and OEM-independent" in the management of fleet operations. Information is bundled and summarized at a single central point.

"We have made a very ambitious entry into digitalization with AVIATAR…we want to shape the digitalization of our industry with our modern fleet management solutions. With Wizz Air, we have already won an important AVIATAR partner with a large fleet from outside the Lufthansa Group," said Dr. Bussmann.

Internationalization was also a key component to the company's success last year Dr. Bussmann said, particularly in the engines division. The XEOS joint venture with GE Aviation, currently being established, has laid the foundation stone for the construction of a state-of-the-art maintenance facility for GEnx-2B and GE9X engines in Sroda Slaska, Poland. A contract has been signed with MTU Aero Engines to establish a new joint venture, EME Aero, also to be based in Poland. This company will have a future workforce of around 800 personnel to provide maintenance services for the PW1000G series of turbofans. The site for the Poland facility was announced a few days later as Jasionka (province of Subcarpathia) in the south-east of Poland. Lufthansa Technik and MTU Aero Engines, the two parties to the joint venture, say they will invest about €150 million ($184.3 million) in the region by 2020.

In Asia, the Component Services Division and the Lufthansa Technik Component Services Asia Pacific subsidiary have further extended the company's presence in this important growth market. In Dubai, Lufthansa Technik Middle East is providing services for airframe-related components, AOG support, landing gear and engines.

The company remains committed to its growth in Germany, too. At the end of September, they opened a new wheel and brakes shop at the Frankfurt Osthafen site. They modernized the Hamburg corporate headquarters and added a new Center of Excellence for Engine Casings and a new x-ray center. Dr. Bussmann said they are making ready for LEAP engine overhaul and to expand component repair services with these steps.

The company believes it is well-prepared for the future. "Never before have we generated so much revenue, supported so many aircraft, or employed so many people. With this foundation, we will stick to our course: growing throughout the world and driving the entire industry forward," said Dr. Bussmann.

— By Joy Finnegan

Spirit Tackling Mechanic Shortage Head On

Preemptively dealing with potential worker shortages, Wichita, Kan.-based Spirit AeroSystems, has developed a program designed to introduce high-school students to stimulate interest in manufacturing.

Much of the aviation industry faces the growing dilemma of an aging workforce and shortage of qualified replacement personnel. An Aeronautical Repair Station Association (ARSA) report predicts that "by the end of 2028, there will be a 10 percent shortage of mechanics." But one company is tackling this problem with a unique intern program.

Spirit AeroSystems, based in Wichita, Kan., has developed a program designed to introduce high-school students to the factory environment and stimulate their interest in manufacturing. The Wichita, Kan.-based company designs and builds wing, fuselage and other aircraft structures for Boeing and Airbus, as well as for manufacturers of business jets, helicopters and military aircraft. It employs about 15,000 people, but is expanding and needs 1,000 new employees.

To help fill its need, Spirit established in 2017 a program in which high-school students who like to work with their hands spend part of their summer break in the company's manufacturing facilities. The program comprises two levels. Students 16 to 17 years old learn "what it's like to be in manufacturing," explains Ryan Karasek, Intern Program Coordinator and Talent Acquisition Lead at Spirit, while the older students, who have graduated from high school, "actually go on the shop floor and use hand tools and pneumatic tools." Working with mentors, the over-18 interns are assigned to the assembly line producing Boeing 737 components and to Spirit's fabrication shops. They learn about machining and sheet-metal work and perform tasks such as de-burring and painting.

The interns work from 7 to 11 a.m. five days a week. The under-18 interns are in Spirit facilities during three weeks in June and paid $9 per hour, while those over 18 years old work six weeks during the months of June and July and are paid $10 per hour. Applications for the program are accepted in April.

After just one year in existence, the program has already bore fruit; four interns are now full-time employees. The company is expanding the program dramatically. This year, the number of participants doubled in Spirit's Wichita facility, from 20 to 40, and in its Tulsa, Okla., facility, from five to 10. In addition, the component manufacturer is forming a pilot program in its Kinston, N.C., plant to include five interns.

Spirit AeroSystems also repairs the components it builds. So far, interns haven't been exposed to that activity; however, Karasek says the program is flexible and can adapt to the company's various employment demands.

The manufacturer currently needs more factory workers primarily because Boeing is stepping up its 737 production. (In March Spirit delivered its 10,000th 737 shipset.) Last year, Boeing produced 47 737s monthly, according to Karasek. "In March this year, that number went up to 52, and next March they plan to produce 57 737s per month," he adds. Additional workforce also may be needed because Spirit is growing its fabrication business. "We previously fabricated parts only for ourselves," says Karasek. "Now we take in orders from third parties."
— By David Jensen

about people

Walschot CEO of SR Technics

Walschot

Frank Walschot is now Chief Executive Officer of SR Technics, replacing Jeremy Remacha, who is leaving the company at the end of the scheduled transition period. Walschot joined SR Technics in 2008 as VP Engine Maintenance and was appointed shortly thereafter head of Engine Services where he played a key role in developing the engine business further. In January 2015, Frank Walschot was promoted to COO, focusing on safety and quality standards at all locations based on the principles of Lean and Continuous Improvement. Walschot now returns to SR Technics after a one-year assignment in Haikou, China as CIO of HNA Technic.

Schwab President of JSSI Advisory Services

Schwab

Jet Support Services, Inc. (JSSI), announced Jason Schwab has been named president of JSSI Advisory Services. JSSI says Schwab will lead the company's growing range of aircraft consulting services and subscription products.

"Jason joins us with an outstanding mix of management, operations and aviation experience. He is a dynamic leader and will be a valued addition to the JSSI leadership team," said Neil W. Book, president and CEO of JSSI. "The appointment of Jason reflects our long-term commitment to delivering a diverse and exceptional portfolio of aircraft ownership and maintenance advisory services to new and existing clients around the world."

Emond Joins Esterline Avionics

Emond

Marie-Hélène Emond has been named Esterline Avionics Systems' marketing communications and public relations manager, taking over the role held by Janka Dvornik, who is retiring at the end of March after 35 years with the company.

Emond has many years of experience in marketing communications

about people

management in a wide range of industries, on an international scale. She has worked for ABB, Fordia, BDC, and the Canadian Institute of Mining, Metallurgy and Petroleum.

In addition to her extensive experience in business communications, Émond holds a Bachelor in Translation degree from l'université Laval and a M.B.A. from l'université Laval and York University. She is fluent in English, French, Spanish and German.

Moreland Jumps to Dallas Airmotive

Dallas Airmotive announced Keith Moreland has joined the company as a Rotorcraft Regional Engine manager. He will provide technical and sales support for helicopter operators in the Eastern United States region.

Moreland brings more than 18 years of rotorcraft industry experience to the role, including time spent as DOM at both Rotorcraft Services Group (RSG) and Uniflight. He also spent five years with Airbus Helicopters as Completions lead technician.

"Keith has a history of hands-on experience with helicopters and he knows the business from the Customer's perspective," says Mark Stubbs, COO of Global Engine Services.

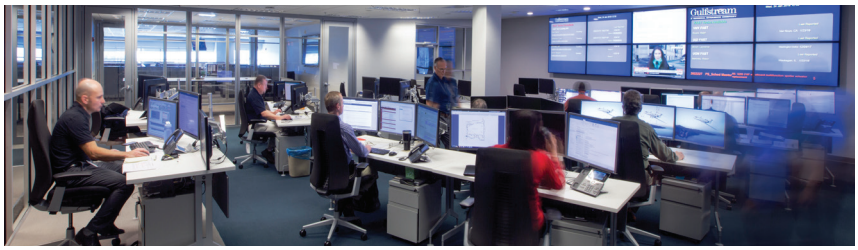
Moreland is a licensed Airframe and Powerplant (A&P) mechanic with inspection authorization. He is a military Veteran with four years in the U.S. Air Force and six years as a Combat Medic for the USAF Guard, 117th Air Refueling Wing, in Birmingham, Alabama.

C&L Aviation Adds Robertson

Ryan Robertson has joined C&L Aviation Group as sales manager for Component Repair. Robertson has more than 15 years of experience with regional aircraft and component repairs. Before joining C&L in 2018, he was director of Regional Sales for Worthington Aviation, with a focus on Dash-8, ATR, ERJ and CRJ aircraft. From 2002-2015, Ryan worked with INAir Aviation Services, where he helped several airlines, manufacturers and service providers. "Ryan will work with existing customers so that they are aware of our cost-saving capabilities, and he will also help expand our offerings for new and future clients as our component shop grows," said Calvin Tuitt, SVP of BD MRO.

Robertson

Gulfstream Launches AOG Resolution Center



Gulfstream Aerospace has created an opened a center dedicated to the resolution of aircraft-on-ground (AOG) issues, providing Gulfstream operators with integrated support and ensuring faster return to service of their grounded aircraft.

Almost 2,400 square-foot/223 square-meter, the center is located in the 679,199-sf/63,100-sm Gulfstream Savannah Service Center and is staffed by an enterprise-wide team dedicated to predicting, preventing and resolving maintenance or logistics issues that would prevent an aircraft from making its next flight, the company says.

"This is the first time we've concentrated such a broad team of multidisciplinary personnel together in a space solely dedicated to AOG situations," said Derek Zimmerman, president, Gulfstream Product Support. "Co-locating technical experts with cross-enterprise resources, including logistics, materials and purchasing support, will lead to more coordinated responses to customers, expedite resolution of issues and get aircraft back in the air faster than ever."

Calls or messages that come into the Technical Operations Contact Center, if designated an "AOG" condition, are routed to the center, where experienced team members have mulitple resources available. These include, multiple Field and Airborne Support Teams (FAST) aircraft to deliver parts, tools or technicians; more than 150 field service representatives, 12 mobile repair teams with specially equipped vehicles; and more than $1.6 billion in spares.

The center is also equipped with monitors that provide an up-to-date visual dashboard of Gulfstream aircraft in-work and the company's maintenance facilities and personnel, along with health updates from aircraft during flight.

"Our AOG center is the next evolution of what our Technical Operations department has had in place for years," Zimmerman said. "Continuously improving our services is part of our effort to meet and exceed the expectations of our growing worldwide fleet."

Hong Kong Airlines Selects Airbus' Flight Hour Services – Tailored Support Package Solution for A350

Hong Kong Airlines has selected Airbus to provide Flight Hour Services – Tailored Support Package (FHS-TSP) for its fleet of 21 A350 XWBs. This raises the number of aircraft covered by an Airbus FHS-TSP solution in the Asia-Pacific to more than 300 and 13 customers.

The FHS-TSP contract provides integrated and guaranteed services ranging from the supply and repair of components to the manufacturer's unique Fleet Technical Management service ("Part-M" Engineering services). An on-site Airbus team will manage daily maintenance activities including spares, warehousing, and engineering, ensuring Hong Kong Airlines' highest aircraft technical dispatch and operations.

Among the three FHS pools of spare parts which Airbus has in Asia, Hong Kong Airlines will benefit from the Hong Kong-based pool which opened in 2016. The other pools are located in Singapore and Kuala Lumpur, Malaysia.

"We are delighted to welcome Hong Kong Airlines as our newest FHS-TSP customer in the region," Laurent Martinez, Head of Airbus Services says. "This is the type of partnership we want to continue building in the future, so that any airline can continue to focus on its passengers while we focus on adding value to their operations."

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Mobil Jet Oil 387 Now Approved for P&W GTF

ExxonMobil's Mobil Jet Oil 387, a synthetic turbine engine oil, has been approved by Pratt & Whitney for use in its PurePower Geared Turbofan 1900G engines. These engines include the PW1918G, PW1919G, PW1920G, PW1921G, PW1922G and PW1923G variants.

The PW1900G engines were designed to power Embraer's E-Jet E2 E190 and E195 narrow body twin-engine jet airliners, which are scheduled to enter service in 2018.

"Known for its low propensity for coking, high load-carrying capability, and excellent compatibility with all elastomer seal materials, Mobil Jet Oil 387 is an ideal engine oil solution for operators of PW1900G engines," said Vipin Rana, global aviation lubricants sales manager at ExxonMobil. "As we continue to garner approvals by Pratt & Whitney for its newest engine models, we're confident that more airlines will adopt Mobil Jet Oil 387 due to its ability to provide optimal protection."

Along with its load-carrying capabilities, ExxonMobil says Mobil Jet Oil 387 has custom-made esters and unique additives that help to providing exceptional deposit control and elastomer compatibility. Mobil Jet Oil 387 also offers excellent thermal and oxidation stability, wear protection and low temperature fluidity, according to the company.

MTU Maintenance Starts Virtual Reality Mx Project

MTU Maintenance has started an augmented reality project at its facility in Berlin-Brandenburg. The project goes by the name "Inspection 4.0" and aims to improve knowledge management in the shop.

MTU says Inspection 4.0 has two main goals. The first is to centralize all data regarding a specific part into one system. This has the benefit of reducing the amount of time mechanics spent switching between documents and enabling them to focus on inspecting the part in question. Secondly, the real and virtual world of maintenance will merge – data will be transferred to tablets or smart glasses so that the mechanic has a complete overview at all times.

MTU Maintenance is collaborating with the Brandenburg University of Technology Cottbus-Senftenberg on the project, with key development taking place in Berlin. The project is support by Brandenburg Invest (WFBB) and the Investitionsbank des Landes Brandenburg (business promotion bank of the federal state of Brandenburg). Development of the project will continue until July 2019, after which results will be analyzed and once applicable, presented to the Federal Aviation Office of Germany for the relevant approvals.

StandardAero Components Announces Planned Expansion

StandardAero Component Services has announced investment and expansion at three of the company's U.S. sites during 2018 and will increase shop capacity by a total of 260,000 square feet (24,155 square meters), with expansion of facilities in Cincinnati & Hillsboro, Ohio, and Miami, Florida locations. The company says it will spend more than $16 million in construction and capital equipment.

The Cincinnati location expansion will include the build-out of an additional 200,000 sq. ft. (18,580 sq. m.) of work space to accommodate component repair growth on new platforms, military and commercial engine component repair, as well as larger components. Miami will add 30,000 sq. ft. (2,787 sq. m.) of working space and capital improvements including the installation of a state-of-the-art clean line, an additional vacuum furnace as well as water jet cleaning capabilities. As a result, the facility will be able to repair large engine cases. Hillsboro will be completing a 30,000 sq. ft. (2,787 sq. m.) expansion to support new OEM manufacturing production, bringing the facility's total manufacturing footprint to 115,000 sq. ft. (10,684 sq. m.) of space.

"These expanded capabilities also include dedicated processes for the repair, overhaul and manufacturing of various component types to support our customers' engine needs," says Rick Stine, president of StandardAero Components, Helicopters & Accessories.


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UTC Aerospace Brings Commercial Innovations To Falcon 6X With Quieter, Fuel Efficient Nacelle

UTC Aerospace Systems has been selected by Dassault Aviation to provide an advanced nacelle system for its new Falcon 6X. Under terms of the agreement, UTC Aerospace Systems will design an integrated power plant solution including an inlet, fan cowls, thrust reverser and an engine build-up (EBU) system. Dassault Aviation has chosen the Pratt&Whitney PurePower PW812D engine to power the new airplane.

This contract marks the company's return to the business and corporate jet nacelle market. UTC Aerospace says the integrated system will employ lightweight composites that take advantage of the company's design and proprietary manufacturing technologies.

The design will include an advanced inlet configuration aimed at reducing community noise and increasing fuel efficiency. It will have an improved compact thrust reverser.

"This program will enable us to bring the many new nacelle system technology advancements we've developed and matured for large commercial aircraft over the last 15 years to the business and corporate jet market," says Marc Duvall, president, Aerostructures.

Chuck Hagen Receives the HAI Excellence in Helicopter Maintenance Award 2018

The Helicopter Association International (HAI) has handed Chuck Hagen, field service representative, salesman and trainer of Aeromaritime America, ITP Aero's subsidiary located in Mesa, Ariz., the Excellence in Maintenance of Helicopters Award.

The prize was awarded during the Helicopter Trade Show & Exhibition HAI HELI-EXPO held in Las Vegas in February. This award acknowledges distinguished helicopter maintenance service professionals out of HAI's 18,000 members.

Hagen has dedicated all of his 23-year professional career to the maintenance of helicopter engines. In 1996, he joined ITP Aero's Aeromaritime America, a Rolls-Royce Authorized Maintenance Repair and Overhaul Center (AMROC), specialized in the Rolls-Royce 250 engine helicopter.

"This award is a great honor for ITP Aero. Chuck represents, and this recognition certifies, the excellence standards we support our clients with, which at the same time represent the core of our company's foundation," Ramon Fonoll, Aeromaritime America GM commented. "Chuck is a prime example of the effort of many that work to make excellence in maintenance and service our reason for being."

AeroBearings Faces Emergency Revocation by FAA

The Federal Aviation Administration (FAA) has issued an Emergency Order of Revocation against Kornitzky Group, doing business as AeroBearings, of Arlington, Texas, for improperly overhauling and repairing turbine engine bearings.

The FAA alleges that AeroBearings routinely disassembles, inspects and overhauls turbine engine bearings without possessing the data necessary to perform key aspects of this safety critical work. The FAA further alleges that the repair station intentionally falsified documents certifying that these repairs were accomplished in accordance with appropriate data and federal safety regulations.

The FAA began its investigation of AeroBearings in 2016 after receiving two Administrator's Hotline complaints from customers who reported quality problems with bearings overhauled by the company. During its investigation, the FAA found that AeroBearings conducted work that exceeded their available data on bearings for a variety of aircraft engines, including those manufactured by General Electric Co., Pratt & Whitney, and CFM International.

The allegations also include that AeroBearings disassembled engine bearings for overhaul, even though some manufacturers specifically prohibited disassembly and during these overhauls, AeroBearings removed material from critical internal bearing surfaces without having the requisite design data to verify the overhauled parts would fit and function together as designed.

The FAA says that because AeroBearings did not possess the necessary approved data to determine that the overhauled engine bearings met original manufacturers' design specifications, they could not determine they were airworthy.

The FAA says enough evidence exists to immediately revoke AeroBearings' Air Agency Certificate.

AeroBearings had 10 days from the issuance of the FAA's Emergency Order of Revocation to file an appeal.

Diehl Launches On-Site-Support in Charleston, Near Boeing Plant

Diehl Aerosystems has opened "On-Site-Support Service" (OSS) in Charleston, South Carolina at a recent ceremony.

The Diehl OSS is located in a newly refurbished facility covering 5,000 sq.ft./550 sq.m., includes a local commercial representative and supporting staff who will oversee the flow of Diehl parts for Boeing airplanes assembled in Charleston. The company says this local presence will enable Diehl to deliver just-in-time support to the growing demands of the Boeing production system. The facility also has the potential for expansion to support additional activities such as warehousing and kitting.

In Charleston, Diehl is providing cabin lining packages and supporting sub-structures for the 787-10 Dreamliner.

The new site joins several other facilities of Diehl's in the U. S. - a Customer Support Center (CSC) in Sterrett, Ala.; a facility in Everett, Wash., near the Boeing factory there; and in Mobile, Ala., and Montreal, Canada, in addition to others around the world.

STATE OF THE INDUSTRY

by Joy Finnegan

Industry Leaders Discuss Key Issues Facing Aviation MRO

The annual *Aviation Maintenance magazine* State of the Industry Leadership Insights has always attracted great interest from the MRO industry. We contacted a wide range of industry leaders, from airline MROs to independents, industry associations, airplane manufacturers and engine OEMs.

We received replies from chairmen and chief executives, vice presidents and directors. All have been candid with their answers.

Many of the responders answered all of the questions, while some answered those that they felt were most relevant to their own business.

We hope that you find this survey enlightening and useful to your own business activities. Huge thanks to all of these busy executives who took the time to answer our questions. We greatly appreciate your participation and sharing your insights with our readers.

Stan Deal, Boeing Global Services

1. WHAT TECHNOLOGY ADVANCEMENTS ARE NEEDED IN THE AVIATION MAINTENANCE INDUSTRY?

We are experiencing revelations in technology today that will change the formula and timeline for innovation within and beyond the aerospace industry, including maintenance. Ultimately, these advancements should do two things for our customers: increase the efficiency and capability of their platforms, and decrease operational costs. At a granular level, this could look like a new digital tool that uses data analytics to predict a maintenance issue and then prescribe a comprehensive plan to address it. More broadly, technology advancements like virtual reality and artificial intelligence will augment human decision-making to transform the way maintenance is predicted and performed. Our responsibility is to two-fold: Invest in the technologies that address our customers' greatest needs, and enable the talent that will discover, create and support future aerospace technology innovation.

2. WHAT INNOVATION THAT YOUR COMPANY HAS MADE IN THE LAST YEAR ARE YOU MOST PROUD?

Boeing has been pioneering aerospace innovation for more than 100 years – I feel an incredible sense of pride and responsibility to be a part of its legacy and innovative path forward.

On July 1, 2017, Boeing Global Services was launched as a third Boeing business unit alongside Defense, Space & Security and Commercial Airplanes. It was a big, bold businesses model transformation that has significantly expanded capabilities and offerings for the aerospace services industry. The new business model has redefined the interdependencies of Boeing, including our suppliers and industry partners, to introduce services that drive faster flow times, lower operational costs, and enhanced end-to-end reliability and efficiency. I'm proud to say that we're learning faster than ever before – our business is growing faster than the average aerospace services market growth of 3.5 percent, and we're showing customers around the globe that Boeing is a long-term, complete lifecycle innovator.

3. NAME AND EXPLAIN THE HARDEST CHALLENGES YOU WILL FACE THIS YEAR AS A LEADER.

The most important challenge that I face – and it's shared by leaders across aerospace and many other industries – is the global competition for talent. Technology is innovated and advanced by talented people; challenges are overcome by tenacious teams; and change is best navigated through the minds of our employees. As industry-leading MRO technology evolves, so must the dynamics of how we approach and apply it. This requires a great deal of forethought – how do we re-skill talent? How do we preserve knowledge? How do we focus our community investment and presence to inspire future talent? Our hardest MRO-related challenges will be solved by Global Services employees. I believe we have the right people and structure in place to tackle them, and I think we're focused on the right services capabilities.

4. THERE IS A SAYING, "THE ONLY CONSTANT IS CHANGE." HOW DOES YOUR COMPANY ADDRESS CHANGE IN OUR INDUSTRY?

Boeing wants to lead and embrace change when it's in the best interest of our customers. In the MRO realm, this means working alongside our suppliers, operators and customer maintenance personnel to fully understand and co-own the challenges they face. For example, when an existing process to get parts in the hands of maintainers is not complying with their schedule, we've identified flexibility in the system to give them an immediate, tailored solution. We're also being conscious to address change holistically. Rather than changing a maintenance process to resolve a specific issue, we evaluate whether or not that process can be evolved to optimize maintenance for an entire airline. Boeing is at the forefront of providing digital solutions that help customers drive operational efficiencies and asset utilization to reduce costs. We'll continue to evolve and grow our digital offerings to help customers improve readiness rates and productivity.

5. WHAT ARE THE BIGGEST BARRIERS YOUR COMPANY FACES IN YOUR QUEST FOR SUCCESS (GOVERNMENT, REGULATIONS, OEMS, PERSONNEL)?

Global Services was established to break down barriers and provide Commercial and Government customers with unprecedented value and the best experience in the industry. We're taking a hard look at things like government and FAA regulations, data sharing and personnel demand in the context of how we can bring the breadth and depth of Boeing's resources to the industry in the form of comprehensive solutions. We're making organic investments to unlock the potential of the entire enterprise and to understand our customers' needs from multiple perspectives. This is allowing us to get creative and bring the best of Boeing to any obstacle.

The flow of data is a complexity facing our industry, and one that Global Services is addressing with the recent launch of Boeing AnalytX – Self-Service Analytics. We've been sharing data for the benefit of the industry for more than 20 years. The launch of Self-Service Analytics is a step toward bringing our customers a systemic way to share and use data for the benefit of the industry. Subscribing customers can access to their own data across their subscribed applications. They will be able to use the Self-Service Analytics tools to explore data within an application data set or across applications they currently use.

6. IS THE SHORTAGE OF MAINTENANCE PERSONNEL TRULY HERE? IF SO, HOW IS IT IMPACTING YOUR COMPANY AND HOW ARE YOU ADDRESSING THE PROBLEM?

Boeing's Pilot & Technician Outlook (PTO) represents the global demand forecast for pilots, technicians and cabin crew based on future fleet growth projections over the next 20 years. Total technician demand is based on the amount of maintenance required over the life of various aircraft types. Global Services looks at demand holistically to determine how we can leverage the strength and possibility within each of our capability focus areas (Supply Chain; Digital Aviation & Analytics; Engineering, Modifications and Maintenance; and Training and Professional Services) to unlock efficiencies that support and mitigate potential issues related to demand. For example, our Airplane Health Management (AHM) tool, powered by Boeing AnalytX, provides real-time situational awareness and maintenance status of an operator's entire fleet to avoid unplanned maintenance, thus preserving personnel resources.

7. WHAT SHOULD WE BE WARY ABOUT IN OUR INDUSTRY DURING THE NEXT FIVE YEARS?

There is a lot of work being done in the name of innovation, but we must have the courage to step away from anything that does not create value for our customer and drive positive momentum for our

industry. For Global Services, this means approaching every idea with unconstrained perspective and really listening to customers, whether concerns center on reams of data or a single part. Embracing the idea that innovation can happen at every level unlocks incredible potential.

Russell Ford, StandardAero

1. WHAT TECHNOLOGY ADVANCEMENTS ARE NEEDED IN THE AVIATION MAINTENANCE INDUSTRY?

The biggest technology opportunities lie in the new generation aircraft engines that are more fuel efficient, smarter, have longer maintenance intervals and allow for more on-condition and on-wing maintenance and field services versus traditional shop visits and heavy off-wing overhauls. Data analytics, including predictive engine health monitoring and analysis that make use of on-condition sensors and information, will also be extremely important for the industry. Finally, advanced materials and additive manufacturing capabilities are continuing to develop in our industry. Certifying repairs and services for these types of engine components will require new thinking and new technologies.

2. WHAT INNOVATION THAT YOUR COMPANY HAS MADE IN THE LAST YEAR ARE YOU MOST PROUD?

During 2017, we are most proud of our innovative efforts to complete four acquisitions to meet the growing demand and capacity requirements for our services. The first acquisition was Jet Aviation Specialists, a component repair shop in Miami, in February. Second was PAS Technologies, another component repair and manufacturing company with shops in the U.S., Asia and Europe, in May. The third was the acquisition of the Lockheed Martin business at Kelly Air Center, in San Antonio, during August, which expanded our overall capacity and test cell capabilities. Finally, the fourth was the acquisition of Vector Aerospace, a large, diversified MRO company that greatly increases the scale of our global capabilities, from Airbus Industries. These additions to the StandardAero portfolio align with our long-term growth strategy and give us new customers, new platforms and new services to offer to customers. As a result of our actions in 2017, we grew the employee base from 3,800 employees to more than 6,000 employees across 40 sites in 12 countries on 5 continents.

3. NAME AND EXPLAIN THE HARDEST CHALLENGES YOU WILL FACE THIS YEAR AS A LEADER.

The hardest challenge I expect to face in 2018 as a leader is to ensure the successful integration of these acquisitions into our company, most importantly the seamless continuation and expansion of our strong company culture across a substantially larger enterprise.

4. THERE IS A SAYING, "THE ONLY CONSTANT IS CHANGE." HOW DOES YOUR COMPANY ADDRESS CHANGE IN OUR INDUSTRY?

At StandardAero, we embrace change through a continuous improvement (CI) culture and commitment throughout the entire organization. At any given time, there are more than 400 employee-led CI projects underway in our company. In the past few years, these efforts have produced tens of millions of dollars in process improvements. But, more importantly, these efforts challenge our employees to find new ways to look at things and new ways to solve problems.

5. WHAT ARE THE BIGGEST BARRIERS YOUR COMPANY FACES IN YOUR QUEST FOR SUCCESS (GOVERNMENT, REGULATIONS, OEMS, PERSONNEL)?

The biggest barriers for us include challenges in receiving government delivery orders or government furnished materials and issues in the OEM supply chain – particularly around key parts availability and reliability.

6. IS THE SHORTAGE OF MAINTENANCE PERSONNEL TRULY HERE? IF SO, HOW IS IT IMPACTING YOUR COMPANY AND HOW ARE YOU ADDRESSING THE PROBLEM?

Developing, finding, hiring skilled technicians is one of the biggest challenges we collectively face in the MRO industry. While currently sufficient, the pipeline for our future technical workforce development is a concern and we are going to need additional people. We have sufficient tools, machines and facilities but the constraining issue in the future is going to be qualified technicians, along with OEM parts supply and availability.

Our efforts to develop technicians range from apprenticeship programs with local colleges, to mentoring students at various trade schools, to internships in our repair shops and helping local community colleges develop programs and occupational standards to establish certification programs for A&P mechanics and other technicians.

At StandardAero, we also actively recruit veterans and find them to be very well-suited for many of our maintenance and technical roles. In fact, 21.5% of our U.S. workforce today is either retired or active/reserve military veterans. In addition, we are expanding operations in places like San Antonio, where there is an embedded pool of military and government trained people who are qualified and available in those locations.

In addition, we are bringing in people from ancillary industry sectors, like automotive and industrial manufacturing companies, and training people to cross over, learn quickly and get trained as A&Ps. We have also donated tooling, engines and equipment to help schools provide hands-on training. Finally, we partner with trade associations, like GAMA and NBAA to promote STEM education and participate in programs to attract young people to careers in aviation.

7. WHAT SHOULD WE BE WARY ABOUT IN OUR INDUSTRY DURING THE NEXT FIVE YEARS?

What keeps me up at night is our ability to attract talented young people into our industry and create the draw for the next generation of professionals. Can we recreate the excitement of the 1960's-1970's "Space Race" in the 21st Century? That is the challenge. Together, we need to find ways to fuel new focus, fresh ideas and new dreams to spark and capture the interest of the next generation of aerospace engineers and technicians.

Leo Koppers, MTU Maintenance

1. WHAT TECHNOLOGY ADVANCEMENTS ARE NEEDED IN THE AVIATION MAINTENANCE INDUSTRY?

Unsurprisingly, we believe the next technology advancements in the MRO business will be driven by digitalization and this is where the greatest development will take place across the industry. At MTU, we're working towards full data integration throughout the entire product lifecycle and as a result, improving the predictability of engines. We expect this to benefit both the MRO and OEM aspects of MTU's business. Data availability and automated analysis will be key here.

2. WHAT INNOVATION THAT YOUR COMPANY HAS MADE IN THE LAST YEAR ARE YOU MOST PROUD?

Recently, we started integrating MTU's MRO data – such as engine monitoring data and inspection data – within a common MTU group-wide platform. This can be used on either side of MTU's business units. The OEM side will be able to use the data to further improve our engine design. And on the MRO side, we can use the data to further improve maintenance costs for our customers.

3. NAME AND EXPLAIN THE HARDEST CHALLENGES YOU WILL FACE THIS YEAR AS A LEADER

We need to cope with the growth in the MRO industry, while the OEM side of the business is delivering more new engines than ever before. In particular, the availability of spare parts is a concern and puts high pressure on the total supply chain. Delays could lead to engine turn time increases; we need to manage this process in cooperation with our leasing arm, MTU Maintenance Lease Services B.V.

4. THERE IS A SAYING, "THE ONLY CONSTANT IS CHANGE." HOW DOES YOUR COMPANY ADDRESS CHANGE IN OUR INDUSTRY?

That is very true. Our approach to change is to have a broad basis for growth. For instance, one challenge for us as an independent service provider is the increasing OEM coverage for next generation engines. MTU Maintenance has adapted its strategy to this market situation and cooperates with OEMs in their aftermarket networks, for instance on the PW1100G-JM, as well as airlines such as Lufthansa Technik and China Southern. But our greatest focus is on our broad independent portfolio and continually developing and improving our highly-customized and integrated solutions for customers.

5. WHAT ARE THE BIGGEST BARRIERS YOUR COMPANY FACES IN YOUR QUEST FOR SUCCESS (GOVERNMENT, REGULATIONS, OEMS, PERSONNEL)?

We are incredibly fortunate that the global engine MRO market is very healthy and that strong growth is expected well into the next decade. As such, one of the bigger challenges will be serving this growth. We are increasing capacity levels at all our existing facilities in 2018. For instance, we will further invest in our Chinese facility: its capacity of 300 shop visits per year is to be expanded capacity by another 50% again within the coming years so as to keep up with local market growth as well as to accommodate any new programs in due course.

Furthermore, we created a new facility, Engine Maintenance Europe, or EME Aero for short, a joint venture Lufthansa Technik last year. According to current plans, the facility will be operational in 2020 and have an annual capacity of over 400 shops visits. It will service the new PW1000G-series geared turbofan engines as part of the OEM network.

6. IS THE SHORTAGE OF MAINTENANCE PERSONNEL TRULY HERE? IF SO, HOW IS IT IMPACTING YOUR COMPANY AND HOW ARE YOU ADDRESSING THE PROBLEM?

We would not necessarily speak of a shortage, however, there is definitely a need for qualified personnel within the industry. Over the past year, we have been looking to hire more maintenance technicians at our locations in Berlin and Hannover in particular. However, due to our expanding engine and product portfolio, we also regularly look for engineers, sales people and customer account managers, among others, from all countries and backgrounds – also from outside aviation.

Furthermore, we run a global company. At our location in Zhuhai, China, for instance, we are not noticing any particular shortage in qualified applicants.

7. WHAT SHOULD WE BE WARY ABOUT IN OUR INDUSTRY DURING THE NEXT FIVE YEARS?

One challenge in coming years is likely to be parts and supply chain related. With the OEM ramp up on new generation engines and current generation engines maturing and going through shop visits, there will be enormous parts demand and significant pressure on the parts supply chain.

Joe Sylvestro, Pratt & Whitney

1. WHAT TECHNOLOGY ADVANCEMENTS ARE NEEDED IN THE AVIATION MAINTENANCE INDUSTRY?

Across the industry, big data continues to be a hot topic. Data is critical to improving the MRO business decision making process. Better data means more accurate analysis – better decisions, operational efficiencies, cost reductions, and reduced risk

Big data has been a large focus for Pratt & Whitney for many years. As part of EngineWise, we're using state-of-the art data analytics and real-time intelligence to proactively monitor the health of our engines in order to predict and prevent engine disruptions before they occur. We understand that no two operators are the same and have different engines, aircraft, geographic routes, operational needs and environmental conditions. Analytics technologies allow us to use global fleet data while monitoring the unique environments in which individual aircraft fly.

New data acquisition and predictive analytics tools enable both operators and Pratt & Whitney to make recommendations that reduce operational disruptions and increase aircraft utilization.

2. WHAT INNOVATION THAT YOUR COMPANY HAS MADE IN THE LAST YEAR ARE YOU MOST PROUD?

One area where we are growing and innovating is with our EngineWise services portfolio, which we announced in April 2017. The advantage of EngineWise comes in our commitment to advance and integrate our engine expertise and fleet intelligence into service offerings for our customers that allow them to optimize engine performance to keep their businesses running smoothly and efficiently. Essentially, EngineWise better represents what we offer, and how we're evolving to improve the predictability, reliability and health of our customers' fleets.

3. NAME AND EXPLAIN THE HARDEST CHALLENGES YOU WILL FACE THIS YEAR AS A LEADER.

There are many tough leadership challenges we will face this year and high on the list is how to keep a large and distributed organization aligned and efficiently working on its priorities. Between existing customer commitments, pursuit of advancing customer service, and introduction of new product lines, maintaining efficient alignment is a challenge for any company. A couple of areas we have implemented changes to help with these challenges are in the area of clear leadership communication of the mission - what needs to be done and why is it important. The commander's intent will help leadership across and down the organization to align and work together to accomplish the priorities. Additionally, a process called Policy Deployment helps to flow the company's top priorities down and identify every organization's role and responsibility to support and ultimately achieve these objectives. This process helps define the owner for leading a particular initiative but also clearly identifies the key cross-functional stakeholders and their deliverables. Ultimately, these challenges and techniques are about communication and clearly setting priorities to enable the organization to address them.

4. THERE IS A SAYING, "THE ONLY CONSTANT IS CHANGE." HOW DOES YOUR COMPANY ADDRESS CHANGE IN OUR INDUSTRY?

Pratt & Whitney is constantly innovating and adapting to change due to the nature of the aerospace industry. For example, one of the biggest challenges in the industry today is the skills gap. The threat of automation isn't that it will replace all jobs, but that people will need to have the right skills to fill the jobs that will be created as business needs evolve. With the increasing rate of change, companies and their employees must be willing to embrace change and continue to learn to stay competitive.

5. WHAT ARE THE BIGGEST BARRIERS YOUR COMPANY FACES IN YOUR QUEST FOR SUCCESS (GOVERNMENT, REGULATIONS, OEMS, PERSONNEL)?

Our biggest challenge at Pratt & Whitney is two-fold: Hiring skilled employees for the jobs of the 21st Century, ranging from engineers to mechanics to inspectors, but also managing our unprecedented engine ramp. We will produce and overhaul engines at a rate we haven't seen since the early 1980s, and we have invested $1.3B in our facilities to handle the market dominance we fully expect to achieve in our new products, including the F-35 and GTF engines, while also continuing to support our operational commercial engines.

6. IS THE SHORTAGE OF MAINTENANCE PERSONNEL TRULY HERE? IF SO, HOW IS IT IMPACTING YOUR COMPANY AND HOW ARE YOU ADDRESSING THE PROBLEM?

Pratt & Whitney is in an age of tremendous growth. We are recruiting to fill 25,000 positions across all functions globally by 2025. And we are well on our way.

We view work in the aerospace field as a higher calling, because what we do really matters to the world. Getting top talent that really identifies and believes in that higher calling, and in the opportunities that exist in aerospace, is really the challenge. That's why it's so important for us to work closely at the grassroots level – in the high schools and college level – where students really start to see the potential and fulfillment that comes from working in the STEM fields, and with a global aerospace manufacturer like Pratt & Whitney.

Our dedicated talent acquisition team utilizes new digital tools to find active and passive candidates. We have many sourcing and outreach strategies such as a robust campus recruitment program, a strong presence at key diversity conferences, participation with Paradigm for Parity Coalition, USBLN and more. Additionally, we value working with veterans groups, whose skills are very transferable to the type of work we do. We also have a strong employee referral program. Our employees are great brand ambassadors for us. Social media has also become a very important component of our process and we utilize our @PWCareers Twitter account every day to highlight job opportunities.

7. WHAT SHOULD WE BE WARY ABOUT IN OUR INDUSTRY DURING THE NEXT FIVE YEARS?

As we look out five years from now, there is unprecedented projected growth in shop visits. At Pratt & Whitney, we are laser focused on supplier capacity and performance. We need to ensure that we have a strong supply base in place that is performing at gold standard levels so we can make our commitments and deliver to customers. The GTF engine has complex parts and repair processes - we are looking to ensure we have strategic companies in our supply base that can help us take on this monumental task of capitalizing and investing in the GTF MRO network.

Brian Sartain, AAR

1. WHAT TECHNOLOGY ADVANCEMENTS ARE NEEDED IN THE AVIATION MAINTENANCE INDUSTRY?

AAR doesn't think there's a lack of technology advancements available in the industry, but the lack of practical application that the aviation maintenance industry struggles with. There are various technologies such as advanced diagnostic algorithms, IoT, wearables, mobile devices, chatbots that have been available for some time. Each one of these technologies can significantly improve operational efficiencies under the right implementation circumstances, but the substantial investment required per implementation have slowed adoption.

2. WHAT INNOVATION THAT YOUR COMPANY HAS MADE IN THE LAST YEAR ARE YOU MOST PROUD?

AAR has been working on modernizing our custom MRO ERP for the last couple of years. Since last year, we rolled out the "1MRO mobile


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www.mtu.de/maintenance

app" on both iOS and Android platforms. This application allows our Project Managers to access real-time information using their mobile devices. In addition to this, our mechanics and inspectors can view their training records, authorizations with just a few clicks. They can also register for upcoming training classes. We are very excited about the next level of integration with our customer portals, to enhance the customer experience.

3. NAME AND EXPLAIN THE HARDEST CHALLENGES YOU WILL FACE THIS YEAR AS A LEADER.

The shortage of qualified aviation mechanics is the biggest challenge I will face this year as we expect the shortage to intensify as demand for services increase and the work force ages. Major employment actions by airlines have already had a significant impact on our workforce and the supply of contractors is limited. AAR is developing an even more robust approach to address the situation in addition to what we have done already - listed below.

4. THERE IS A SAYING, "THE ONLY CONSTANT IS CHANGE." HOW DOES YOUR COMPANY ADDRESS CHANGE IN OUR INDUSTRY?

By staying on top of industry trends, staying close to our customers and developing strategies that take advantage of opportunities as they present themselves. Anticipating and reacting to industry trends is how AAR has stayed in business for more than 60 years and remains financially stable. For example, we built our state-of-the-art Rockford MRO to accommodate wide-body and new-generation aircraft like the 787, A350 and A380 in anticipation of future demand, but are currently utilizing that space for current generation aircraft.

5. WHAT ARE THE BIGGEST BARRIERS YOUR COMPANY FACES IN YOUR QUEST FOR SUCCESS (GOVERNMENT, REGULATIONS, OEMS, PERSONNEL)?

For us, addressing the personnel shortage is key. Since government education policy and funding moved away from technical schools/training and to four-year colleges, we've seen a shortfall of high-quality technical training for jobs like AMTs. The current FAA requirements for AMT certification makes it challenging to attract new candidates to the occupation.

Global expansion of MRO facilities into emerging markets is also a challenge. While independent MROs like AAR can bring and share our expertise, we need to find local partners with strong workforce and cultural knowledge of the region to be successful. Luckily, AAR has found that partner in our JV with Indamer to develop a new MRO facility in central India that will be operational by early next year.

6. IS THE SHORTAGE OF MAINTENANCE PERSONNEL TRULY HERE? IF SO, HOW IS IT IMPACTING YOUR COMPANY AND HOW ARE YOU ADDRESSING THE PROBLEM?

Aerospace has dealt with a shortage of experienced aircraft maintenance workers for over a decade. Data from ARSA suggests that the impact is already being felt: More than 80 percent of respondents to ARSA's 2018 member survey report difficulty finding qualified technicians and more than two thirds of responding companies have unfilled positions.

AAR has also done our best to partner with technical schools and community colleges near our MROs, advise on their training curriculum, and provide apprenticeships to their students and graduates.

In fact, one of the reasons we chose to build a new MRO facility in Rockford was the local promise to establish an enhanced AMT training program at nearby Rock Valley Community College, which is now underway and producing graduates. In this way, everyone wins as jobs are created and AAR can hire locally but we also need more experienced workers.

AAR also is bringing the labor issue to the attention of elected officials, and we're supporting any legislation such as the recent bill introduced by Senator Inhofe and others called the Aviation Workforce Development Pilot Program Bill as well as supporting efforts of ATEC (Aviation Technician Education Council) in the areas of modernizing AMT curriculums.

The Aviation Workforce Development Pilot Program Bill would establish a pilot program to train maintenance professionals, help veterans transition to civilian careers and recruit new technicians. Grants of up to $500,000 per year would be available to business or unions, schools and governmental entities that partner to pursue creative solutions to one of the aviation community's most pressing strategic challenges. ARSA is now working with its members and allied organizations to build support for the legislation and get it enacted this year, likely as part of the Federal Aviation Administration reauthorization.

7.WHAT SHOULD WE BE WARY ABOUT IN OUR INDUSTRY DURING THE NEXT FIVE YEARS?

Again, the shortage of qualified aviation maintenance technicians should be on MROs' radar. Oliver Wyman's CAVOK Division projects that demand for technicians will outstrip supply beginning in 2022. In addition, the industry needs to be careful not to add too much capacity given the cyclical nature of our demand cycle and the lengthening of check periods on newer aircraft.

Rich Hopf, BAE Systems

1. WHAT TECHNOLOGY ADVANCEMENTS ARE NEEDED IN THE AVIATION MAINTENANCE INDUSTRY?

The use of digitized data (Big Data) is offering great promise to the aerospace industry. This data will be very useful for those components that wear out or deteriorate during use (like APUs, landing gear, etc.). There are still some fundamental issues to resolve (such as who actually owns the data) that need to be worked out before the information can be fully utilized. For electronic components like ours, we need to understand how we can utilize this information to better support our customers. There is information that could be useful to us such us improved systems diagnostics that would help us (and the operators) reduce no fault found removals. Advance notification of failures with greater detail would also allow us to better position assets and people to improve our turnaround times.

2. WHAT INNOVATION THAT YOUR COMPANY HAS MADE IN THE LAST YEAR ARE YOU MOST PROUD?

We continue to expand our value-added services offerings to our customers. By utilizing our knowledge of field performance, customer needs, part interchangeability, and obsolescence, we have identified multiple solutions to improve the operational performance of our more mature product lines. By taking a proactive approach to both our engine control and avionics products, we can allow our customers to choose several

different methods to improve the field performance of our equipment.

3. NAME AND EXPLAIN THE HARDEST CHALLENGES YOU WILL FACE THIS YEAR AS A LEADER.

We will continue to focus on the 737 MAX and LEAP service entries this year. The ramp up to the new aircraft and engines is the fastest that has ever been seen in industry and we want to see it go well.

4. THERE IS A SAYING, "THE ONLY CONSTANT IS CHANGE." HOW DOES YOUR COMPANY ADDRESS CHANGE IN OUR INDUSTRY?

Our company is focused on continually enhancing the support and services we provide. In addition, we are flexing with the changes in the industry. One area that is rapidly evolving is our path moving to holistic asset management plans that include pooling, leasing and exchanges.

5. WHAT ARE THE BIGGEST BARRIERS YOUR COMPANY FACES IN YOUR QUEST FOR SUCCESS (GOVERNMENT, REGULATIONS, OEMS, PERSONNEL)?

We don't see any major headwinds out there beyond our continuing need for great people to join our organization.

6. IS THE SHORTAGE OF MAINTENANCE PERSONNEL TRULY HERE? IF SO, HOW IS IT IMPACTING YOUR COMPANY AND HOW ARE YOU ADDRESSING THE PROBLEM?

Our customer support and services area has specialized personnel requirements compared to the rest of our business. Finding the right mix of technical and business knowledge with a high degree of customer affinity makes hiring challenging in some cases. We are working on improving collaboration with technical schools and colleges to recruit the best talent for our hiring needs.

7. WHAT SHOULD WE BE WARY ABOUT IN OUR INDUSTRY DURING THE NEXT FIVE YEARS?

Like our peers, we keep a close eye on the evolving dynamics in our industry. Clearly the aircraft OEMs are evolving their approach to the aftermarket, and we are watching closely to see what this means. The growth of fleets in China also is high on our list given the complexities of that market. Finally, I think we will see more on how better protect the integrity of our products from future cyber threats.

Sarah MacLeod, Aeronautical Repair Station Association

1. WHAT TECHNOLOGY ADVANCEMENTS ARE NEEDED IN THE AVIATION MAINTENANCE INDUSTRY?

Aviation businesses have always developed new technology and associated tools to improve productivity and minimize human factor errors. We, unfortunately, too

continued on p43

AEE 19/20 JUNE 18
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All around us, technology is racing forward. Aviation has always been one of the leaders of that race. Nowhere is that more apparent than in the avionics, aviation electronics and ATC end of the business.
Time also seems to be speeding up. In this rapidly changing world we must find ways to keep up or be left behind. Inherently, we all know that businesses that do not adapt will not survive. Adapting to new technologies can be challenging and getting buy-in from top levels of the business down to the last person hired, is crucial.

ICAO estimates that $120 billion will be spent on air transportation systems transformation in the next 10 years. While the NextGen and SESAR modernization programs account for a large share of this spending in Europe and the U. S., there are parallel investment initiatives in other regions.
Both SESAR and Next-Gen recognize the need to integrate the air and ground parts of their air traffic management systems by addressing the efficiency, planning and execution of flight trajectories. The seamless sharing of accurate information is the driving force behind Harmonization, to be certain all parties will be able to work together seamlessly. This framework provides a vehicle for the U. S. and Europe to work together towards interoperable standards with the goal of achieving ICAO global Harmonization.

How can you stay on top of the changes? One way is attending our Aviation Electronics Europe (AEE) event in Munich in June. AEE (Avionics & Flight Ops) will discuss topics and issues of the day and demonstrate and showcase new products, developments, technologies and services available on the market. The program will also cover key elements of the upgrades and retrofits available on the market.

We invite you to join us and the Avionics community in Munich, Germany from 19th-20th June 2018, for the largest gathering of avionics and aviation electronics professionals.

Joy Finnegan, Editor-in-Chief
Aviation Maintenance Magazine

It All Comes Together: Multi-core Systems on All Major Architectures

Tomorrow's virtualized infrastructure will gather countless applications, executing on an open virtualization platform that solves hard challenges such as affordability, safety certification, legacy software integration, and standards conformance.

As a supplier for the avionics industry, you not only need to provide solutions to these challenges, but you must also find a way to optimize your corporate investment across more product lines – from both existing products and new ones that drive greater revenue opportunities.

But today's avionics systems are comprised of many fixed-function, proprietary platforms, making them difficult to manage and expensive to maintain. These systems incur significant operating expenses and risk delays to market because developing each one takes months, maybe years to launch.

Now imagine your next system is built on a standards-based, open virtualization platform that runs multiple operating environments across ARM, Intel, and Power processor architectures – a platform capable of abstracting and running any type of workload, including legacy and new, on a certification-ready platform supporting multiple levels of safety.

With over 220 customers using VxWorks 653 in over 440 programs in over 80 global aircraft, Wind River is the leading provider of modern avionics software platforms. The VxWorks 653 open virtualization architecture can readily migrate proprietary, fixed-function devices across the system, while delivering outstanding performance with cost-saving innovations like robust partitioning for high multi-level safety and security

EUROCONTROL at AEE 2018 – MOC Munich – Hall 1 – Booth B31

EUROCONTROL and EUROCAE will welcome you to their stand to present you with the latest developments in aviation standards and how both organisations ensure standardisation coordination at European level. Over the two days of the exhibition, EUROCONTROL and EUROCAE experts will also deliver conference sessions on the Evolution of the European Institutional Framework and provide you with the latest updates in mandates and regulation, including standardisation, certification and operational improvements.

Visitors will have a unique opportunity to understand both organisations' roles in providing a broader view of the operational context in which avionics are evolving, and how those organisations stay at the forefront of developments through their cooperation and participation in technical groups. Visitors will also have a chance to ask questions and network with our technical experts.

DoD-compliant Removable Storage Module Added to Aitech's Low Power, High Performance Rugged Compact PC (RPC)

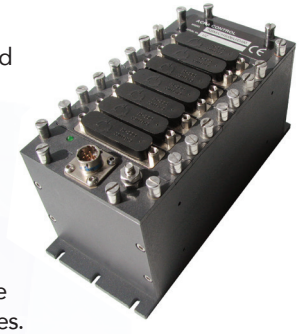
New A172 also incorporates expanded data protection features, additional customization options

Technical Specifications

- Removable mass storage offers quick/secure erase (DoD 5220.22-M) and unrecoverable data destruct
- SWaP-optimized at less than 5 lbs (2.25 kg) in compact, low-profile housing
- Added reliability features include TPM and 50 ms power holdup options
- Available in standard models or cost-effectively customized for specific applications

Available with three Intel processor options and two standard I/O versions, the modular A172 can be configured to handle several data processing environments, especially in high impact, space-constrained applications that need high throughput and secure storage. These typically include manned and unmanned robotic ground and underwater vehicles (UGV/UUV) as well as manned and unmanned fixed- and rotary-wing airborne (UAV) platforms. The RCP can also be used in complete mission computers for these types of unmanned vehicles.

Reduce Unscheduled Grounding Events with Predictive Maintenance



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The delays caused by faulty aircraft systems (e.g. auxiliary power units and air conditioning units) are a major inconvenience to air travellers and an ever-present headache for airline operators. They cause unscheduled aircraft groundings and frustrate customers. Some operators have taken a progressive approach and established preventative maintenance programs to drive higher on-time rates. Predictive maintenance promises to both diagnose aircraft problems and to make predictions about future events.

Keeping a fleet of aircraft operational without the right data to predict system problems is difficult and the majority of current fleets do not collect all parameters necessary. Curtiss-Wright can add a data acquisition system (DAS) with minimal impact on the existing avionics to fill this gap. We are the leaders in providing rugged and flexible airborne DAS and are already proving this concept in the field. This is saving operators, and their customers, from the pain of unscheduled maintenance.

Main Conference Programme

TUESDAY 19TH JUNE 2018

9:00am – 10:30am Opening Keynote

Chair: Woodrow Bellamy, Editor, Avionics Magazine

Innovation Director, Air France*

Senior Representative, Easyjet*

TBC

11:00am – 12:30pm Mandates and Regulatory Updates

What are the latest updates in mandates and regulation and how will these impact the industry and supply chain? Key institutions governing the strategy of regulation and compliance will give an overview of the changing landscape, including standardisation, certification and operational improvements.

Chair: David Irwin, Aviage Systems

SPI/CPDLC (Data Link Service) – Nathalie Dejace, Head of ATM/ANS and Aerodromes Department, EASA

Strategy documents of ICAO (GANP/GASP)/GADSS – Sven Halle, Regional Officer, ICAO*

GADSS Update – TBC

Next-Gen Regulatory Updates – Joseph J. Hance, Project Manager, Office of Inspector General, Office of Aviation Audits, U.S. Department of Transportation*

Working Groups in Progress – Christian Schleifer, EUROCAE

2:00pm – 3:30pm Implementing Mandates & Regulations: Case Studies

How do we successfully interprete and implement new mandates to meet regulatory and operational standards? Case studies and visionary programs demonstrate how we can achieve implementation and compliance.

Chair: Philippe Lievin, Rockwell Collins

Airbus avionics roadmap – Senior Representative, Airbus*

Boeing avionics roadmap – Senior Representative, Boeing*

Development of a Predictive Runway Overrun Awareness and Alerting System – Dr. Gernot Konrad, Engineering Group Head – Human Factors, Gulfstream Aerospace

Current Status and Future trends in the Application of Development Assurance Standards – Senior Representative, AVIAGE SYSTEMS

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4:00pm – 5:30pm Panel discussion – Evolution of the European Institutional Framework

With changes over the years of how the different institutions and organisations involved in the industry operate and collaborate, this panel discussion aims to provide some clarity on the role of each institution, what they do, the current position of the industry is and where it is evolving to.

Moderator: John McHale

Frank Jost, European Commission, Mobility and Transport, Single European Sky, DG MOVE, European Commission

Nathalie Dejace, Head of ATM/ANS and Aerodromes Department, EASA

Peter Green, Head of Standardisation Unit, EUROCONTROL

Christian Schleifer, Secretary General, EUROCAE

Sven Halle, Regional Officer, ICAO*

Marouan Chida, CNS and Avionics Expert, SESARJU/Deployment Manager

Senior Representative, ASD Europe

Senior Representative, Airlines4Europe (A4E)

WEDNESDAY 20TH JUNE 2018

8:30am – 10:30am Advances in ATM, Navigation & Surveillance

This session will discuss the latest in ATM, navigation and surveillance systems developments and what the role and future of satellite/GNSS can contribute to navigation and surveillance.

Chair: Christian Schleifer, EUROCAE

DIGITS – Demonstration of ATM Improvements Generated by initial Trajectory Sharing – Thomas Maier, Air Traffic Management Engineering, Airbus Commercial Aircraft

Added value of an air/ground approach for human performance in engineering the future European ATM system – Sonja Biede, Senior Human Factors Specialist, Airbus & Renée Pelchen-Medwed, Senior Human Performance and Validation Expert, EUROCONTROL

Space Based ADS-B Business Case for the North Atlantic Region – Thea Graham, Manager of Economic Analysis, Federal Aviation Administration

Avionics Manufacturers bet heavily on SBAS – Alejandro Fransoy, EGNOS Marketing and Promotion Expert, ESSP – SAS, Spain

11:00am – 12:30pm Advancing Integrated Systems & Connectivity

With a desire to reduce SWaP of equipment on board whilst providing more connection interfaces in both cabin and deck, these provide connectivity and cybersecurity challenges. How can we ensure safe and secure connections and connectivity, whilst delivering the highest levels of cyber security to protect systems against increasing cyber attacks.

Chair: Willie Cecil, Uptake

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Cybersecurity enhancements for a safety critical ARINC 653 avionics platform – Paul Parkinson, Principal Systems Architect, Wind River

Multicore ARM Processors for Safety Critical Avionics – Gary Gilliland, Technical Marketing Manager, DDC-I Inc

A 2D & 3D Airport Taxi Assistance EFB – Thea Feyereisen, Engineer Fellow, Honeywell International & Gang He, Engineer Fellow, Honeywell International

TBC

2:00pm – 4:00pm Disruptive Technologies and Trends

What is the latest thinking and vision for the industry, and where will future avionics technologies provide real benefits for saving fuel and reducing the cost of flying? As virtual piloting and Artificial Intelligence (AI) begin to demonstrate their impact, what can the industry also learn from converging technologies?

Chair: Alex Wilson, Wind River

Marouan Chida, CNS and Avionics Expert, SESARJU

The Future of COTS: How the Industry is Evolving to Support Safety Certification Requirements – Gregory Sikkens, Director Safety Critical Solutions, Core Avionics

Cross Industry Embedded System Update 2018: Technology, Trends and Ecosystem Development Relevant for Aerospace Industry – Mirko, Jakovljevic, Sales & Marketing Manager, TTTech

Generalized Anthropomorphic Structure of a Situational Knowledge Base for AI Safety Protection Systems of Autonomous Aircraft: Prototyping and Potential Applications – Ivan Burdun, President & Andrew Bubin, IT Engineer, AIXTREE

Overarching Properties: Technology Independent Safety Certification – Joseph Wlad, Vice President, Verocel

For further details on the Main Conference Programme and to register online visit www.ae-expo.eu/programme.

See the Registration page and Preshow guide:

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Certified Training Courses

This year AEE is delighted to offer three one-day courses, enabling you to gain enhanced levels of specialist knowledge, will take place during the two days of AEE and cover:

- Applied DO-178C / ED-12C Avionics Software Certification by AFuzion
- Applied DO-254 & ED-80 Avionics Hardware Certification by AFuzion
- "ARINC 818 Systems" Hands-on workshop and ARINC 818 certification by Great River Technology

For full details visit **www.ae-expo.eu/certifed-training**

TUESDAY 19TH JUNE 2018

Applied DO-178C / ED-12C Avionics Software Certification by AFuzion

- Understanding DO-178's true intent
- Grasp key differences between DO-178B and DO-178C
- Applying DO-178C to Military AND Commercial usage
- Controlling engineering cost/risks
- Improving productivity & leverage Reusability
- Applying ARP-4754A
- New techniques for certification
- Understanding DO-178C's Supplements for:
  - DO-330/ED-215 Software Tool Qualification
  - DO-331/ED-216 Model-Based Development and Verification
  - DO-332/ED-217 Object-Oriented Technology
  - DO-333/ED-218 Formal Methods Supplement

This new, fast-paced 1-Day course teaches attendees the true intent of DO-178C, how to apply changes from DO-178B, and how to minimize cost & schedule by understanding the DO-178 authors' true intent. Developed and taught by the principal author of the world's best-selling book on DO-178.

"ARINC 818 Systems" Hands-on workshop and ARINC 818 certification by Great River Technology

This hands-on workshop will provide a deep dive into the ARINC 818 protocol, and its applications. It is appropriate for system architects, avionics engineers, and production test engineers. Whether you are new to ARINC 818 or have completed many designs, this workshop will provide valuable information that draws from GRT's experience as the world leader in ARINC 818 tools and systems.

Workshop Sessions and Open Lab include

- Overview of ARINC 818
- Best Practices in Testing, Simulating, Debugging, and Validating ARINC 818 systems
- Implementing ARINC 818 Protocol in Your Hardware
- ARINC 818-2 for High-Speed Sensors and Complete Video Systems
- Open Lab and Certification Test
- Get hands-on experience

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WEDNESDAY 20TH JUNE 2018

Applied DO-254 & ED-80 Avionics Hardware Certification

- Understanding DO-254's true intent
- Controlling engineering cost/risks
- Improving productivity & leverage hardware reusability
- Applying DO-254 to FPGA's, ASICs, and PLD's
- Leveraging EASA's & FAA's CAST-27 and SWCEH-001
- Applying DO-254 to IP Cores
- DO-254's Five Plans & Standards for Certification, Requirements, Design, Implementation, QA, & CM
- System versus Hardware Requirement: actual examples
- Using COTS IP
- How to pass DO-254 Audits – the FIRST time

This fast-paced 1-day course teaches attendees the true intent of DO-254, new silicon-technologies for avionics and reducing hardware development costs and risks while still achieving certification. Developed and taught by the principal author of the world's best-selling book on DO-254/178.

ABOUT THE INSTRUCTORS

AFUZION

Mr. Vance Hilderman is Afuzion's director of Avionics Certification. Holding a BSEE and MBA from Gonzaga University, and a Masters in Computer Engineering from USC (Hughes Fellow). Mr. Hilderman was previously the co-founder of TekSci (the world's largest avionics software services company in the '90's), HighRely, and now Afuzion – performing technical avionics software/certification development at companies throughout the world.

Mr. Hilderman has focused on safety-critical avionics software, systems, hardware development and related technical products for 25 years. Considered an expert on safety critical software/computer systems and certification, Mr. Hilderman has consulted with ninety five of the world's one hundred largest aerospace companies plus numerous medical, industrial and telecommunications entities Mr. Hilderman has trained over 11,000 avionics engineers and managers in 40 countries on DO-178B, ARP-4754, DO-178C, DO-254, DO-200A, DO-297, and safety/software development.

GREAT RIVER TECHNOLOGY

Tim Keller (MSEE), Director of Marketing for GRT, served on the original ARINC 818 committee and drafted key sections of the specification. He served as the Industry Editor for the ARINC 818-2 revision in 2013. Prior to joining Great River Technology in 2005, Mr. Keller worked for 16 years as a control systems engineer for real-time embedded systems at Honeywell.

Paul Grunwald (MBA, BCompSc) is Chief Systems Architect at Great River Technology. His 30-year engineering and product-management career includes systems architecture at GE Intelligent Platforms and applications engineering at Philips Semiconductors. He has worked with ARINC 818 for six years and written a number of white papers on the protocol.

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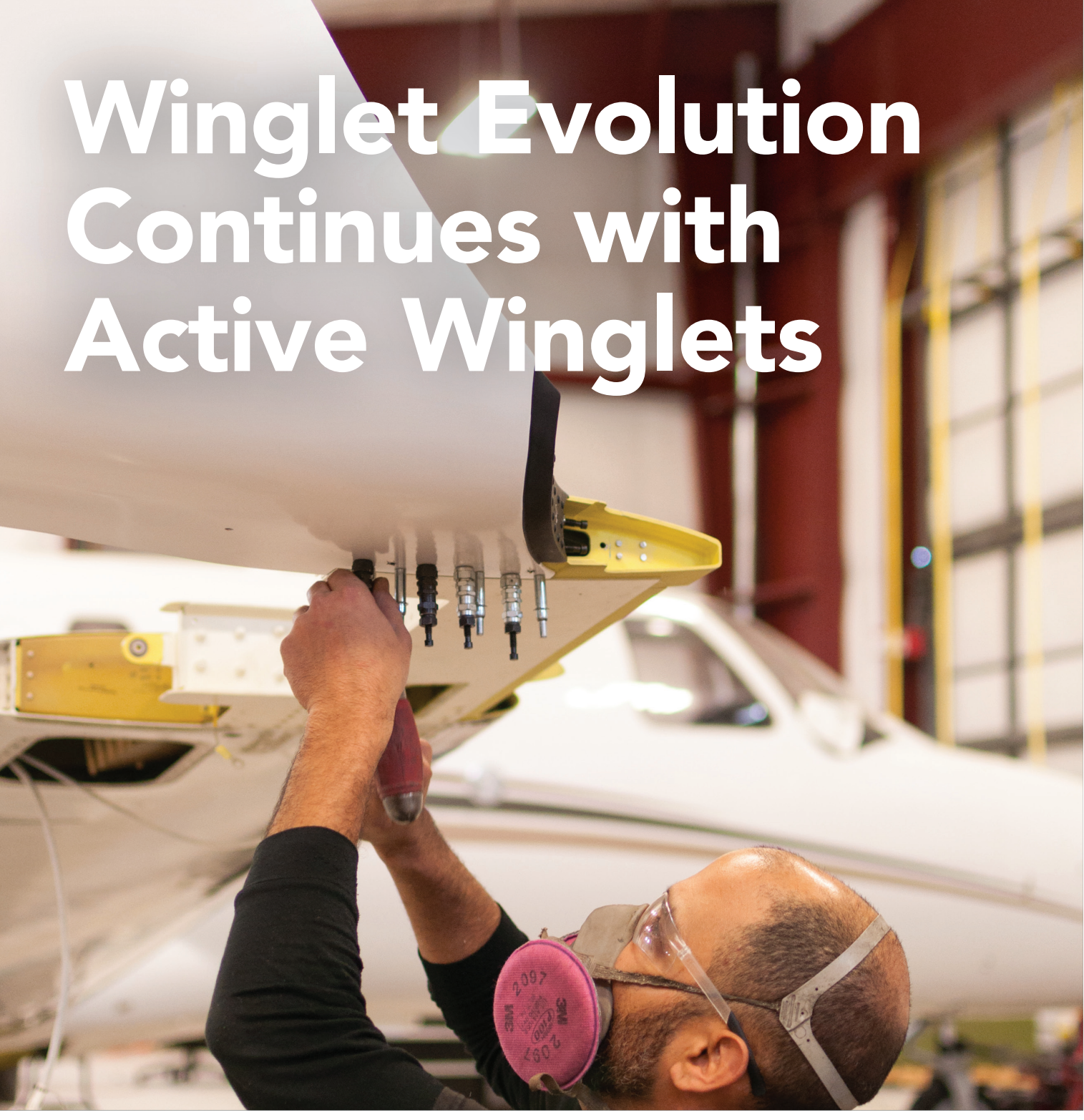
Winglet Evolution Continues with Active Winglets



The evolution of winglet technology traces farther back than many may think—back more than a century, when the English engineer, Frederick Lanchester, patented wing end plates in 1897 and Scottish-born engineer William Somerville attached end plates to the top wing of his biplane 13 years later. In recent decades, incited by soaring fuel prices in the 1970s, the evolution accelerated and ushered the launch of various wingtip enhancements, including canted winglets, wingtip fences and raked wingtips, among others. Learjet was the first original equipment manufacturer (OEM) to provide winglets on a production aircraft, the model 28, in 1977. Today, many bizjets and commercial aircraft are equipped with these devices because they reduce fuel burn by diminishing lift-induced drag caused by air spilling off the end of the wingtip.

by David Jensen

"Regulatory approval of our latest STC amendment for the Citation CJ3 and CJ3+ proves what our existing CJ owners have known since their installs," says Nick Guida, founder and CEO of Tamarack Aerospace. "Active Winglets on the C525, and now on the C525B, dramatically enhance the performance of the aircraft. With ATLAS you can climb faster, fly farther and burn less fuel. We flew our Active Winglet CJ3 from Paris, Texas to Paris, France last year in one stop. This STC also demonstrates how agile the Tamarack team has become in obtaining multiple sequential regulatory approvals, so I am very proud of this accomplishment." Tamarack images.

And the winglet evolution continues. One of the latest innovations comes from a small manufacturer based in Idaho's panhandle, only a short distance from the Canadian border. Tamarack Aerospace Group (TAG), based in Sandpoint, Idaho, has developed its unique Active Technology Load Alleviation System (ATLAS) winglet, the brainchild of Nicholas (Nick) Guida, a former FAA designated engineering representative and TAG's founder and chief technology officer. Formerly employed by several OEMs and once owner of a consulting firm, Guida had considerable experience on retrofit winglets. But he was dissatisfied with the amount of structural reinforcement required to the wing (as much as hundreds of pounds for commercial aircraft) for a winglet installation and wondered if the added structural weight could be avoided by designing a winglet that automatically "turns itself off" during load moments. He conceived an "active" winglet design, which "dumps" the bending loads on wings, thus avoiding the need for structural reinforcement. Guida surmised that such a design could enhance and add to the benefits inherent in "passive" winglets, already installed on many aircraft.

David Stewart, a partner with Oliver Wyman, a New York-based global management consulting firm, put the Middle East

Within the active winglet, ATLAS, TACS or Tamarack Active Camber Surface, appears and functions like a small aileron, moving up and down. Instead of controlling flight maneuvers from pilot input, the TACS serves by reducing bending loads on the wing, and works automatically. Tamarack image.

MRO market share at $8.9 billion with a 4.3 percent growth expected through 2028. He also noted that engine maintenance drives about 60 percent of this spend, a higher portion than other regions because of the preponderance of wide bodies in the Middle East as well as the harsh operating conditions. Today, most of the Middle East engine work is outsourced to third parties. The rest is spread out over airframe, component and line maintenance.

Majority of the work will be for the large fleets purchased by the ME carriers over the last 10 years that are now hitting the ramp up for their first heavy maintenance visits, Stewart said.

He also noted that a major problem is going to be finding a source of highly skilled maintenance personnel. Many experienced mechanics are at their retirement age, with a shortfall of workers to replace them, and there's lots of competition for personnel with the right skills. The Airbus forecast reported an expected demand for 58,200 new technicians over the next 20 years.

An Oliver Wyman study last year found that within 10 years, the worldwide demand for maintenance technicians will outstrip supply by 9%, with perhaps a bigger problem being that an "expertise gap" will be created with the worldwide fleet being divided between older and newer technology aircraft.

Initially for CJs

Guida initially tested his active winglets on a piston-powered Cirrus SR20. After four to five years of design refinement, his company began producing ATLAS winglets for Cessna CitationJet models and succeeded in gaining EASA certification for the system on the CitationJet 525 series (CJ, CJ1, CJ1+ and M2) in 2015. FAA, ANAC and Transport Canada approval soon followed. TAG went to the European Aviation Safety Agency for certification first for the sake of expediency, since FAA's approval process was effected by the federal budget sequestration. Recently, all four agencies have granted supplemental type certificates (STCs) for ATLAS winglets retrofitted on the CitationJet 525A series (CJ1 and CJ1+) and 525B series (CJ3 and CJ3+). STCs for additional CitationJet models, including the 560XL series (Excel, XLS and XLS+) are in the works.

The manufacturer's suggested retail cost for the current STC'd systems on CitationJets ranges from $209,000 for the CJ1 to $319,000 for the CJ3+.

Looking beyond CitationJets, TAG officials are in discussions with operators of other bizjet types, as well as original equipment manufacturers (OEMs), commercial aircraft operators and potential military customers. However, as this is written the company is not prepared to announce future customers or future winglet designs. ATLAS winglets are suitable for "any aircraft with wings," according to company literature. "If there is a large fleet without winglets installed, like the [Lockheed] C-130, then we would have an advantage in outfitting those aircraft," says Paul Hathaway, TAG's vice president-marketing.

The company did unveil a demonstrator model of its Commercial Active Winglet (CAW) for the Airbus A320 at last year's National Business Aviation Association show in Las Vegas, Nev. "We're in discussion with an A320 operator," Hathaway says, adding that he was not able to disclose its name.

How Active Winglets Work

From a distance, the ATLAS system appears like most other winglet designs, with its upturned wingtip. But a closer look reveals why it is different and can truly be called active. On the CitationJets, the system lengthens each wing by about three feet (0.9 m). Within the extension to each vertical winglet there exists a TACS (Tamarack Active Camber Surface). Made of aluminum, the TACS appears and functions like a small aileron, moving up and down. But instead of controlling flight maneuvers from pilot input, the TACS serves by reducing bending loads on the wing, and works automatically.

The load alleviation process is triggered by the ATLAS control unit (ACU), which includes sensors that detect wing loading, say, during steep turns or turbulence. Once the ACU determines if a certain load threshold has been reached it then commands the TACS control unit (TCU), an actuator that moves

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In cruise or normal flight, the winglets move little, if at all, only reacting to alleviate loads as they occur. Tamarack image.

the TACS up or down, to mitigate the load. The entire process occurs within milliseconds. During normal 1G accelerated flight, the TACS is stowed in trail. In cruise, or normal flight, they move little, if at all, only reacting to alleviate loads as they occur.

Being fully automatic, the pilot needs to do no more than press a push-to-test button during preflight to assure the ATLAS system is operational. A red annunciator light will indicate a system failure. Should a failure occur—for example, a TACS locks up—the pilot would simply "slow the aircraft to the indicated airspeed shown on the annunciator, which is still pretty high, typically 160 knots," the official adds.

What if the ATLAS winglet system fails and no warning light illuminates? Tamarack officials have calculated such a failure would occur fewer than once in every one billion flight hours.

The commercial aircraft winglet Tamarack introduced at NBAA holds a different design and offers additional features. In addition to having TACS move up and down, the CAW system has the winglet articulate, twist left to right, to achieve optimal aerodynamics. It also includes a strip on the winglet's leading edge to prevent excessive loads from side gusts. The CAW has sensors providing numerous inputs to determine the optimum TACS deflection and winglet toe angle, taking into account the aircraft's airspeed, angle of attack, g force and flight regime, according to Hathaway. Also, while the TACS on the ATLAS system for bizjets only deflects to unload the winglet, the TACS on the CAW will also "droop" to achieve optimum climb performance.

The Benefits

Most aircraft operators install winglets for the fuel savings, and passive winglets generally provide a three- to four-percent reduction in fuel burn. TAG officials, however, boast a fuel savings that is three

A technician works the attachment of a winglet. No specialized tools are required, except for a dedicated jig. Tamarack image.

and four times greater with its ATLAS system. They have determined that the range of the Citation CJ3+ with active winglets, for example, is increased from 1,700 nm to 2,100 nm plus IFR reserve. "That makes it a coast-to-coast airplane," says Hathaway, referring to the distance across the U.S. "It gives the operator more airport-to-airport options without the need to refuel."

One CJ1 operator reported "a 15-percent gain in fuel savings," says the marketing vice president. "But, of course, the savings ultimately depends on aircraft use. The big benefits come on long trips, going directly to flight level 410, with a full load of passengers on board."

The ATLAS winglets also allow a faster time to climb and better single-engine climb performance. Another CJ1 operator claims he has had his ATLAS-equipped aircraft "climbing to FL400 in 20 minutes and maintaining a 1,000-feet-per-minute climb." He adds that he often flies within the 390 to 410 flight-level range, and before the ATLAS installation, it took "40 to 45 minutes to get there, usually requiring an intermediate stop for a couple of minutes along the way."

TAG lists other benefits from its active winglets: reduced carbon dioxide emissions, improved hot and high performance, higher useful load and lower airport noise. On the CitationJet 525 series, the winglets allow 400 pounds additional maximum zero fuel weight (MZFW). ATLAS's load alleviation also makes the ride smoother and more stable, a benefit especially to passengers. Performance enhancements can be attributed, in large part, to ATLAS's weight-saving, bolt-on design. Finally, as with all winglets, the ATLAS system tenders better ramp appeal, giving the aircraft a more up-to-date appearance and thus greater resale value.

Installation and Maintenance

Regarding maintenance to the ATLAS winglets, there is no change to the normal requirements of inspecting and maintaining the aircraft's wings, says an official. Inspections of the ATLAS system are carried out "during the [Cessna] DOC 4 and DOC 10 inspections, except if the installation has less than 12 months or 100 hours in service," he adds. There is no additional inspection to the wing's hydraulics, since the ATLAS system is all electrical. The ACU has no overhaul time limit, and all other parts are repaired or replaced on an on-condition basis.

The ATLAS winglets are currently being installed on CitationJets at TAG's facility on Sandpoint Airport and at Cessna Service Centers. To supply the Tamarack facility and service centers, TAG currently is producing three winglet kits per week. Cessna Service Center technicians come to Sandpoint for installation training, and TAG sends factory representatives to the service centers to assist their technicians with their first "couple of installations," according to a TAG official.

Usually, two to three technicians attach the winglet. No specialized tools are required, except for a dedicated jig used to ensure the TACS are geometrically correct. Wiring is needed to connect the ACU to the TCUs and to the cockpit annunciator light. Wiring also goes to the LED navigation lights, which come with the winglets.

TAG recently added a second hangar at Sandpoint Airport and increased its ATLAS installation rate from two a month to one a week. "We provide CJ owners with two options," says Hathaway. "If you are having major maintenance on items like avionics or engines, then a Cessna Service Center can install active winglets while the aircraft is in for that work. Alternatively, if you just want active winglets installed with no other work on the aircraft needed, then we can do that in just over a week here at the factory in Sandpoint." Complexity of the winglets' paint scheme could impact the exact installment time. AVM

Change Is in The Air

"Your success isn't based on your ability to simply change. It is based on your ability to change faster than your competition, customers, and business." Mark Sanbornl, American entrepreneur

Seen above and on upper right is an artist's rendition of a 767-300BCF and a 737-800BCF. Boeing says it provides more than 90 percent of the world's freighter capacity. Over the next 20 years, Boeing forecasts a market demand for 1,100 standard-body converted freighters including the 737. Over the next 20 years, Boeing forecasts a market demand for more than 460 wide body converted freighters, including the 767-300BCF, shown lower right, loading cargo. Boeing images.

by Dale Smith

Thanks to the combination of an increased demand for new passenger aircraft and the global explosion of online shopping; passenger-to-freighter conversions are bringing new life to aging airframes.

What does English inventor Michael Aldrich have to do with the rapid growth of passenger-to-freighter (P2F) conversions? Well, probably a lot more than you think. Aldrich invented the Teleputer, which was the fusion of a PC, a TV and early telecom networking technologies. This invention, along with his other work in broadband communications, led to his introduction of the technology that enabled reliable online transaction processing between businesses and consumers, i.e., online shopping or e-commerce.

But, how does that relate to P2F conversions? Simple: with the need to move millions of packages on-demand, e-commerce giants like Alibaba.com and Amazon.com wouldn't exist without overnight airfreight. Consumers want what they bought online today delivered tomorrow.

Overnight airfreight is so important to their business model, that Amazon.com recently signed a deal to lease 40 converted 767's. There are also strong rumblings that the e-commerce giant is talking to Boeing about buying factory-new 767 freighters, but no official word yet.

And from the looks of it, that's just the tip of the proverbial iceberg. According to Ed Clark, vice president of Commercial Managed Programs, Boeing Global Services, "Per the current market forecast, 2,480 freighters are required to meet the market demand over the next 20-years (920 new and 1,560 conversions)."

"Currently all standard-body freighters in the market today are converted airplanes," he said. "Boeing forecasts market demand for 1,100 standard-body converted freighters and more than 460 wide-body converted freighters. We expect demand for the medium wide-body airplanes to continue strengthening, driven primarily by e-commerce."

"In my opinion, the narrow- (standard) body segment there are


BOEING
737
BOEING COMMERCIAL FREIGHTER

Flying Colours will create four different interiors for the Q400 in addition to the fire-fighting role, shown here, for a total of five. The challenge for their engineering team is to make as many of the components common to as many of the configurations as possible to minimize transition time, the company says. Flying Colours image.

the 737-300/-400 and the 757-200 and we can see the entry of the 737NG (-700/-800) in the near future," explained Jacob Netz, senior consultant with Air Cargo Management Group. "Within the segment of the midsize wide-body freighters is the coveted 767-300. At Airbus, some of the last A300-600s are still in conversion, but the future lies with the A330-200/-300 conversions."

"As for the large wide-body freighters, that conversion market is stagnant now," he said. "Some believe that increasing demand for the retired 747-400 will pull some retired freighters back into service, but that seems unlikely now. Right now, the future belongs to the new 747-8F and the 777F. Both of which are new aircraft so there are no conversion projects underway."

Of course not all of the freighter fleet additions will contribute to fleet growth. According to the Boeing Current Market Outlook 2017 – 2036, of the 2,480 freighters added to the fleet, 53-percent will be to replace retiring aircraft and the others will help meet projected cargo traffic growth around the world.

The Wide Lead for Narrow-Body Aircraft

Boeing's freighter forecast also states that about 70-percent of the anticipated P2F conversions will be in the standard/narrow-body category, which is led by the Boeing 737-series freighters.

"It's (737-300/-400) the standard for the narrow-body freighters at the moment. Everybody loves them," stated Robert Convey, VP Sales and Marketing for Aeronautical Engineers, Inc. "Their economics make them ideal to serve the freight integrators' – Amazon, Alibaba, DHL, UPS – primary need to move freight from satellite airport to the main hubs."

"In particular, the -400 holds a standard size container like its predecessor, the 727, so there's good commonality there for operators," he said. "The problem with the –400 is we are running out of good, affordable feedstock. We just delivered our

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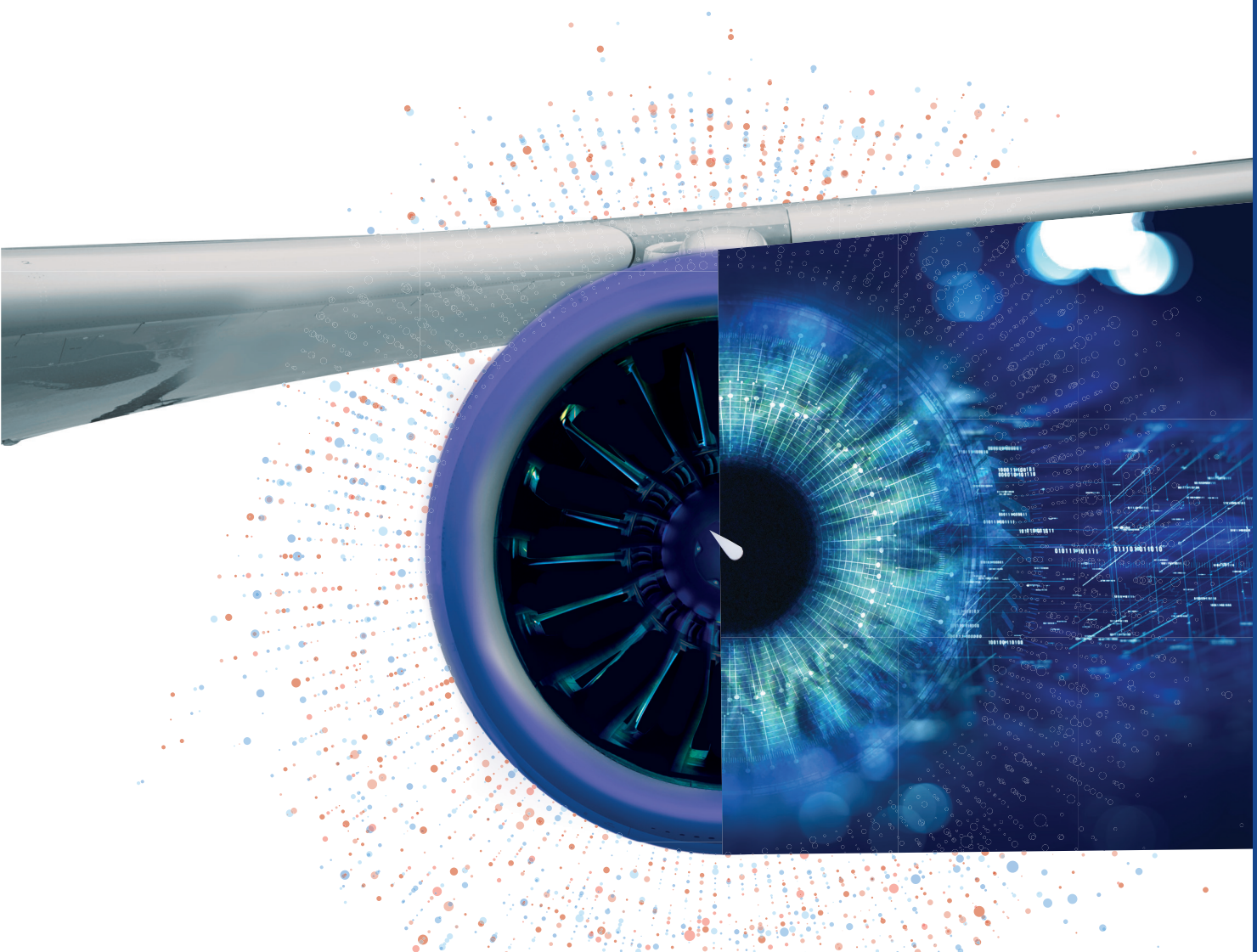

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This cargo door by Aeronautical Engineers is hydraulically operated and actuated from the inside of the aircraft by an independent system. The door control and hydraulic panel are located on the 9g barrier, allowing a single person to operate the door. Aeronautical Engineers image.

one-hundredth 737-400 and when we are finished we will have done about 150 total."

"While the classic 737-300/-400 airplanes will remain viable for conversions for two- or three-more years, the need for more advanced avionics, better fuel efficiency and lower operating costs will increase," Clark said. "The Boeing 737-800BCF (Boeing Converted Freighter) is well positioned as a next-generation freighter."

"We'll be transitioning over to newer NG-series 737's, (-800) so you'll see 20- to 25-year old airplanes being converted that will then fly fright well into 2050s and beyond," Convey said. "Boeing is going to make around 4,000 NGs. That availability, along with good market acceptance and pricing, are the factors that make it the perfect going-forward narrow-body conversion platform."

A Good Conversion Starts with the Right Airplane

So how do the major freighter conversion providers decide on which aircraft to covert?

"It's a little bit of black magic to figure it out," Convey said. "You need large numbers and good pricing obviously, but you also need aircraft that are constructed of a method that is rugged enough for freighter operations."

"Boeing typically makes very robust airplanes, which are perfect. (McDonnell) Douglas certainly did, but their airplanes were very heavy. The current Airbus narrow-body fleet are very light and agile – perfect for passenger use, but not very good for freighter conversions in my opinion," he said. "You also have to look at the configurations of the wings and engines."

"For example, the Airbus A320 configuration is not good for installing a large cargo door ahead of the wing," Convey said. "It's got some critical components right where the left-side door needs to go and we can't change that. Airbus can, but as a non-OEM, it's game over on the A320 conversion for us."

"Aft of the wing on any airplane you have the stress affects of single-engine out torsion on the empennage – excess torque on the tail. The door made the area too weak to those stresses," he said. "Another issue with doors behind the wing is the sweep of the wing. The A320 and MD80's wings are too swept to safely maneuver loading equipment in that aft area."

Once you have the right model, the next determining factor for aircraft selection is an airframe's age. But in the world of conversions, age isn't measured in years: it's measured in cycles. And, as you can well imagine, the lower the cycles, the higher the aircraft's cost.

That fact is forcing operators to now consider airframes that were destined for the recycling bin just a few years ago. In fact, in today's conversion market, even a nearly 30-year old airframe is attractive if the cycle times are low enough.

"Today, operators will by that airplane and spend $1.5 million on a conversion and another $1.5 million on maintenance and then put it back on the road for another 10-years," Convey said. "It's not an ideal situation, but in many cases it's the best you can do now."

He said that today's freight expediters are also more open to converting aircraft with higher cycle times than they were in the past. For example, at 50,000 cycles there are extensive non-destructive testing requirements on a Boeing 737-400. But, as expensive as these inspections are, buying a higher-cycle -400 and doing the all the maintenance is still less expensive than a newer -800 right now.

"You have to keep in mind that the typical short-haul freighter utilization is not very high compared to airline standards," Convey said. "It's typically a thousand hours a year and it's a one-to-one cycle. Most operators fly them two or three flights a day, five days a week. So they're not putting huge numbers on the airframes."

No Two Conversions are the Same

No matter the aircraft type or age, the "typical" P2F conversions share common steps including a thorough airframe inspection, removal of all the passenger equipment (seats, galleys, lavatories, stowage bins, oxygen systems, etc), removing or deactivating passenger doors, replacing and/or reinforcing floor beams, installing

FlyingColours works across the range of Bombardier Aircraft at their facilities. Flying Colours image.

the main deck cabin door (MDCD) and its operating system and the 9g rigid barrier/net, and whatever else is required.

And while that all seems pretty straightforward, don't for the moment think that these are "cookie-cutter" projects.

"When an aircraft is grounded for conversion there are aircraft owners that take advantage to perform fleet standardization or upgrading of the avionics or other systems," Netz explained. "In addition, this downtime is also an opportunity for perform AD's and SB's like the lap joint AD on the 737-300 series."

"With the typical 737 conversion taking three-months, performing these kinds of tasks as well as C- or D-checks while converting the aircraft will generate significant saving and minimize overall downtime for the operator," he added.

"The term 'standard' is not appropriate for conversions," Netz explained. "Each aircraft is an individual challenge for the conversion designers. For example, each aircraft has its own history. Aircraft arriving from different production series and many have undergone different maintenance or major repairs."

"While the newer NG-series will probably be more standardized, the 737-300/-400's were not computer-built airplanes," Convey said. "There aren't huge differences, but for example, some have chemically-milled skins and some don't. We also find differences in frame and fastener locations."

"We get into a conversion and suddenly find a fastener landing in the middle of nowhere, so we have to go get an engineering order (EO) for the deviation for that installation," he said. "There are probably a dozen deviations for every conversion we do now. It's no big deal. Our original conversion STC was based on an older airplane and they change over the years."

"Obviously we don't know about the changes until we encounter them during a conversion," Convey said. "Our engineering team just has to be flexible and work with the airplane we have. It can be an interesting challenge."

Conversion Magic: Turning One Bombardier Q400MR into Five

While successfully completing a P2F conversion would be enough for most companies, Bombardier-series conversion experts Flying Colours Corp., recently won a contract from Conair to convert six off-the-shelf Bombardier Q400MR turboprops into aircraft capable of handling any of five different mission profiles and combinations thereof.

"We will receive the brand new Q400MR aircraft at our St. Louis facility where we will handle all of the engineering, fabrication and installation of the various interior options and accessories," explained Sean Gillespie, EVP, Flying Colours Corp. "There will be a commuter configuration with up to 64 seats, a cargo configuration, a combi-transport configuration and a medevac format for up to six patients. And of course, there's the firefighting version with Conair's proprietary retardant delivery system which can carry water or fire retardant."

"The engineering to be able to develop solutions that can be quickly changed in the field is quite a challenge," he said. "Especially when you consider that while the Q400MR has a long fuselage – perfect for this type of work – it's not a wide fuselage. So space is a premium."

Gillespie also said that one of the biggest hurdles has been designing and producing the flexible interior shell kit for the sidewalls, headliner and windows.

"Some of it will stay in the airplane in various configurations and some will not," he said. "In addition, you have to take into account all the various safety regulations for each configuration, especially when changing from commuter to cargo or a combi configuration."

"Another challenge for our engineering team is to make as many of the components common to as many of the configurations as possible to minimize transition time," he said. "Probably the biggest challenge for that is the combination medevac and passenger configuration. It will have up to six ICU stations on one side and passenger seats along the other side."

"If you take the firefighting side away, we've done all these types of conversions before, but this is the first time we've done them all on one aircraft at one time," Gillespie said. "It's a very unique project and we are delighted to have been awarded the contract."

Gillespie said that by the time you're reading this the first Q400MR is well on its path to becoming the first five-role player in the Conair fleet. Once that aircraft is completed by Flying Colours it will be returned to Conair to have all of the retardant delivery equipment installed at their facility. AVM

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often fail to develop the regulatory basis for requesting acceptance or approval from a regulating agency, particularly the ones overseeing aviation safety.

Take remote connectivity, we can obtain clear audio and video access across the world, allowing safety inspectors, technicians and other qualified personnel to provide training and perform oversight at levels of assurance equivalent to or better than in-person. Why not take advantage of that? It saves time, money and other resources for the agency, for business and is in the interests of safety. We can make it work within the rules; the only thing holding anyone back is the "that's how we've always done it" culture.

The same can be said about the consternation over additive manufacturing – so-called "3D printing" – when Part 21 applies to all methods of production. Just because something is new doesn't mean it can't work within the rules; it's time for our regulatory thinking to catch up with our technology.

2. WHAT INNOVATION THAT ARSA HAS MADE IN THE LAST YEAR ARE YOU MOST PROUD OF?

Making the painful decision to use a new association management system (AMS). A database – which is what an AMS is at its core – is the lifeblood of the organization. When we master the new AMS, ARSA will be able to connect more readily with members and the public. This is a big endeavor for us, so stay tuned as we make it happen. It won't change the fundamental work of the association as the voice of the aviation maintenance industry, but it will help to amplify it.

3. NAME AND EXPLAIN THE HARDEST CHALLENGES YOU WILL FACE THIS YEAR AS A LEADER.

Just like any other year, my challenge is to keep focused on the basic needs of the industry. Just like with technology, it's easy to get caught up in "shiny things," none of which change the fundamental goal: be efficient in regulatory compliance.

Within ARSA that means focusing on the areas that produce the most value for the industry – our strategic plan is built to improve publications, develop and market training resources and expand participation in legislative priorities.

4. THERE IS A SAYING, "THE ONLY CONSTANT IS CHANGE." HOW DOES ARSA ADDRESS CHANGE IN OUR INDUSTRY? HOW DOES ARSA HELP ITS MEMBERS ADDRESS CHANGE?

The more things change, they more they stay the same. ARSA's challenge is preventing itself from being carried away in the excitement of supposedly "new" advancements.

Sure, technologies will present new opportunities and challenges. Of course, businesses will merge and markets will change. Even within ARSA's walls we're constantly rethinking how we work – the new AMS is just one example of that – but it doesn't change the primary basis of our work: regulatory compliance. Rules change very slowly and the association must ensure the agencies can take advantage of advances in technology within regulatory parameters.

5. WHAT ARE THE BIGGEST BARRIERS OUR INDUSTRY AND YOUR MEMBERS FACE IN THEIR QUEST FOR SUCCESS (GOVERNMENT, REGULATIONS, OEMS, PERSONNEL)?

Barriers develop when we get carried away with what's changing and forget about the right ways to do business. There are certainly a lot of challenges facing the industry: regulators will misunderstand and misapply their authority, manufacturers will seek new markets and new employees will be hard to find and retain – these aren't going away. Our mission must focus on our strengths. The association's team balances the needs of every part of the industry and understands how manufacturing, maintenance and operations fit together and impact one another. The biggest barrier to success is "the way things have always been done" culture.

6. IS THE SHORTAGE OF MAINTENANCE PERSONNEL TRULY HERE? IF SO, HOW IS IT IMPACTING YOUR MEMBERS AND HOW ARE YOU HELPING THEM ADDRESS THE PROBLEM?

Whether the shortage is "here" or still "looming" is immaterial. The pressure on aviation businesses is real.

ARSA's members have been clear for years – both anecdotally and through surveys – that finding and retaining technical talent is a nagging challenge. Oliver Wyman's data indicates that the supply of available mechanics will fall short of demand by 2022. Last year, we projected that the inability to fill open vacancies could already be costing repair stations $2 billion a year. Companies tell us it is taking longer to complete work, causing them to turn down new business and decide against adding capacity and capabilities. Add the fact that we're not even "short" of workers yet and it's clear we're already in crisis.

Workforce issues have rightfully become a clear focus of our work. We already have an aviation maintenance-focused job board to help with recruitment. We partner with industry groups that focus on technical education and have supported ICAO's task force on the "next generation of aviation professionals." Just recently, our legislative team created a coalition to advance a workforce development grant program to offer federal money for programs that develop technical talent.

7. WHAT SHOULD WE BE WARY ABOUT IN OUR INDUSTRY DURING THE NEXT FIVE YEARS?

Don't get carried away by changes and lose touch with the fundamentals. Our collective job is and will always be to help set and adhere to international aviation safety standards. From there, businesses can develop tools to exceed government requirements and expand our imaginations.

Gavin Gallogly, Mitchell Aircraft

1. WHAT TECHNOLOGY ADVANCEMENTS ARE NEEDED IN THE AVIATION MAINTENANCE INDUSTRY?

The big drivers of technical advancements in the aviation maintenance industry are tied to the collection, optimization and implementation of data. This process will be a key factor in monitoring the health and predictive maintenance of aircraft in the future. MRO's are being forced to use this information to create integrated logistics and customer support programs that offer a value proposition to their customers. These new

advancements, and the MRO's who successfully embrace them, will improve their supply chains, cut costs and differentiate their products to deliver "measurable" business value and improved bottom lines.

2. WHAT INNOVATION THAT YOUR COMPANY HAS MADE IN THE LAST YEAR ARE YOU MOST PROUD?

At Mitchell, having just celebrated our 30th year servicing the aviation industry, we continuously look to evolve beyond our traditional business model. Most recently, we formed a PMA Development Company called Mitchell PMA, added major distributorships to our expanding portfolio and signed a multi- year component/inventory management program with a global cargo operator. These initiatives help to create value for the company and expand our profile beyond the ad-hoc transactional part of our business. Each year, a higher percentage of our turnover is tied to contractual business transactions as operators become more focused on squeezing efficiencies from the supply chain. If you're not evolving, you're in a slow burn to irrelevance.

3. NAME AND EXPLAIN THE HARDEST CHALLENGES YOU WILL FACE THIS YEAR AS A LEADER.

The biggest challenge Mitchell faces going forward is our ability to maintain our relevance within the supply chain. The aftermarket and the supply chain in general are constantly under assault, making it imperative to develop new business models and revenue streams to remain competitive. This industry transformation, led by improved technology, is designed to lower operating costs and improve margins by exploiting the total product life cycle together with the services to support them.

4. THERE IS A SAYING, "THE ONLY CONSTANT IS CHANGE." HOW DOES ARSA ADDRESS CHANGE IN OUR INDUSTRY? HOW DOES ARSA HELP ITS MEMBERS ADDRESS CHANGE?

In my 25 years' at Mitchell, the recent acceleration of changes within the industry has been explosive. OEM's look to focus on after-sale services for their portfolio of products that yield low risk and higher margin revenue streams over the complete product life cycle. These new advancements will be more disruptive and innovative than anything we've experienced previously. The challenge will be to use this technology and transfer it into actionable processes that reduce operator costs while improving efficiencies and bottom line revenue. We are shifting from solely being a service provider to one that offers value. Pushing products is no longer good enough, you must deliver measurable value!

5. WHAT ARE THE BIGGEST BARRIERS OUR INDUSTRY AND YOUR MEMBERS FACE IN THEIR QUEST FOR SUCCESS (GOVERNMENT, REGULATIONS, OEMS, PERSONNEL)?

The aftermarket is no longer an afterthought! The last few years have shown a greater focus on the exploitation of the traditional aftermarket model into the latest battle ground for OEM's, MRO's, operators and equity companies to capture a greater share of the aftermarket economics. This has driven a consolidation and collaboration like never before. The realignment of products to one which is focused on value added services are designed to match these new market expectations. Mitchell's challenge is to maintain its relevance within the supply chain while creating measurable enterprise value for our global customer base.

6. WHAT SHOULD WE BE WARY ABOUT IN OUR INDUSTRY DURING THE NEXT FIVE YEARS?

Parts distributors are the very foundation of the supply chain. As a privately owned and independent company operating in this "aftermarket" space for over 30 years, my concern is that the used serviceable material (USM) market is being increasingly controlled by large OEM's and PBH providers. This development has accelerated in recent years and I think ultimately could have a more negative effect on the industry by driving out competition and leading to increased pricing pressures. The most desirable material is often controlled and captured by these companies, thereby reducing the availability of feedstock for the broader market and thus impacting supply negatively.

Derek Zimmerman, Gulfstream Product Support

1. WHAT TECHNOLOGY ADVANCEMENTS ARE NEEDED IN THE AVIATION MAINTENANCE INDUSTRY?

I see a lot of transformative process technology on the horizon as we move past traditional, paper-based processes toward a comprehensive digital aircraft experience. For us, it started with the way that we design and manufacture new aircraft. Then we developed better tools to help predict, diagnose and remedy airframe and component issues. Now, it's taking us into areas of digital content authoring and management for a range of publications and maintenance records. We're also finding new uses for virtual and augmented reality to better relay information and guide decision-making.

2. WHAT INNOVATION THAT YOUR COMPANY HAS MADE IN THE LAST YEAR ARE YOU MOST PROUD?

I'm probably most excited about our new Aircraft Ownership Service (AOS) offering. Based on customer feedback, we developed a comprehensive portfolio of services that can be tailored to any aircraft owner or operator, regardless of fleet size or mission profile. This can lower the barriers and burdens to entry for a new operator, while improving efficiency and effectiveness, or plugging gaps, for existing operators. Our customers want flexible, turnkey solutions, and we believe AOS meets that need.

3. NAME AND EXPLAIN THE HARDEST CHALLENGES YOU WILL FACE THIS YEAR AS A LEADER.

We will open multiple new, state-of-the-art maintenance hangars in 2019. As a result, we also anticipate growing our workforce. Overall, this represents a tremendous investment in our services and support infrastructure, and it's only the beginning of this next phase. Much like our product strategy, we have multiple projects in development concurrently and look forward to sharing more about those soon.

4. THERE IS A SAYING, "THE ONLY CONSTANT IS CHANGE." HOW DOES YOUR COMPANY ADDRESS CHANGE IN OUR INDUSTRY?

For us, change really manifests as the value and investment we make to drive innovation and evolution in our products and services. We

have a growing worldwide fleet, award-winning new aircraft designs and an expanding portfolio of customer services and solutions. This is possible because we've built a strong culture of continuous improvement throughout our organization and encourage and celebrate full employee participation. We also actively solicit customer and stakeholder feedback and use those perspectives to help identify, prioritize and measure improvements. Although we are constantly learning and growing, we also benefit from ownership and leadership stability as well as clarity and consistency of purpose.

5. WHAT ARE THE BIGGEST BARRIERS YOUR COMPANY FACES IN YOUR QUEST FOR SUCCESS (GOVERNMENT, REGULATIONS, OEMS, PERSONNEL)?

I think we are as well-positioned as we have ever been to meet the needs of our customers. That said, I still see more opportunity in overall aviation infrastructure development. We are working with our partners across government and industry to help align and simplify regulatory requirements. This runs the gamut from aircraft certification (TCs and STCs) to flight operations (LOAs).

One of our biggest challenges in providing world-class service and support is ensuring we continue to exceed our customers' requirements worldwide. Our international fleet has grown to represent approximately 45 percent of the total fleet, which is approximately 1,260 aircraft. The more Gulfstream aircraft based internationally, the more people, parts and possibly facilities we may locate there. Depending on where your customer's aircraft is, there are import/export regulations and visa requirements to navigate. Often, they vary from country to county. Having a local connection such as a technician that lives in country and/or an importer of record is priceless to provide timely maintenance. We partnered with a Chinese company to form Gulfstream Beijing in 2012; the relationship has been mutually beneficial.

Another challenge is the vast amount of information available on next-generation aircraft with a health and trend monitoring system such as PlaneConnect HTM, which is on the Gulfstream G650, G650ER and our two new aircraft, the G500 and G600. The challenge of leveraging this "big data" that comes in constant streams is considerable, but tools such as our new AOG Resolution Center are helping us implement "predictive maintenance" and proactively repair aircraft before they have issues in the first place.

Workforce development is a much-discussed topic here and elsewhere in the industry. The specific barrier many maintenance organizations face is finding enough qualified technicians.

6. IS THE SHORTAGE OF MAINTENANCE PERSONNEL TRULY HERE? IF SO, HOW IS IT IMPACTING YOUR COMPANY AND HOW ARE YOU ADDRESSING THE PROBLEM?

There is certainly tremendous demand for trained aviation technicians across a range of industries. We've been successful at continuing to attract and retain top talent, but we've also continued to invest in better talent preparation and training for new and existing employees. Our partnering activity with governments and communities starts with promoting STEM and aviation careers in nearby middle schools and high schools. We then work closely to support and grow industry-specific curricula and coordination across A&P schools, vocational schools, colleges and universities. These efforts, along with focused outreach and recruiting of veterans with similar backgrounds and experiences, helps create a viable pipeline of available, industry-ready talent. We then augment with our investments in a dedicated facility and curricula at our internal on-the-job training (OJT) center designed to prepare new employees with Gulfstream-specific skills and experiences in a safe and effective learning environment.

7. WHAT SHOULD WE BE WARY ABOUT IN OUR INDUSTRY DURING THE NEXT FIVE YEARS?

We should be wary of complacency. We all operate in a complex and evolving international ecosystem. At the same time, it's easy to be focused only on the individual opportunities and obstacles directly in front of each of us. We continue to place a premium on advocacy and joint action, so that we can effectively address shared concerns that are important to all owners, operators, manufacturers and stakeholders. I would strongly encourage every member of our industry to engage with their trade association (NBAA, GAMA, etc.) and provide leadership, participation and financial support, so that our voices can be heard and our mutual long-term interests will be promoted and protected.

Todd Duncan, Duncan Aviation

1. THERE IS A SAYING, "THE ONLY CONSTANT IS CHANGE." HOW DOES YOUR COMPANY ADDRESS CHANGE IN OUR INDUSTRY?

Change is guaranteed. Oftentimes, change is good. Occasionally, though, it requires adaptations we would prefer not to make. Either way, I personally believe that if a company is not changing, it's not growing. The same goes for an industry.

Duncan Aviation has a very open and transparent culture that has traditionally not only embraced change, but in many cases, led it. Our management structure is flat and team members have regular access to senior managers. They are encouraged to share their thoughts and observations. Many departments have formal Continuous Improvement committees that meet regularly to discuss ways to improve and make the customer experience, the products and services we provide, and our efficiency better. And dozens of our team members actively serve and influence the industry by participating on OEM advisory boards, industry association committees and leadership, and even trade school curriculum advisory councils. I myself am beginning a two-year term as Chairman of the Associate Member Council (AMAC) of the National Business Aviation Association (NBAA). These volunteer activities are vital to ensure a thriving, changing industry.

2. IS THE SHORTAGE OF MAINTENANCE PERSONNEL TRULY HERE? IF SO, HOW IS IT IMPACTING YOUR COMPANY AND HOW ARE YOU ADDRESSING THE PROBLEM?

Workforce issues are definitely a big concern in business aviation; technician and pilot shortages are hot topics at all of the industry trade shows and conferences. Duncan Aviation is growing and expanding. We started construction in Provo, Utah, this year on a full-service maintenance, modifications and paint facility. When all phases of that construction are complete, our Provo location will employ more than 250 team members, more than five times its current size.

We continue to evaluate new locations for satellite avionics shops and engine Rapid Response Team launch offices. Ensuring access to qualified technical personnel is certainly an ongoing priority for us. We have great programs in place to help us locate the right people. More

than 500 of our current team members, roughly 24%, are military veterans and we work closely with military organizations working to transition people from military to civilian careers. We have a generous tuition-reimbursement program that allows us to hire interested candidates with the right attitudes and competencies and put them to work while they complete their Repairman certificates, their A&P licenses, or even their bachelor's and master's degrees. We even have a reimbursement for private pilot licenses and instrument ratings.

3. WHAT SHOULD WE BE WARY ABOUT IN OUR INDUSTRY DURING THE NEXT FIVE YEARS?

Over the last many years, some Duncan Aviation customers have made us aware of some ethical concerns regarding transparency in business matters. They have heard about secretive finder's fees for maintenance work or aircraft sales transactions. Overall, we have a great industry filled with honest people who operate with integrity. But if the unethical behavior of a few was brought to light or to become more normalized, the industry could be damaged. We are thrilled that the NBAA last December put forth some ethical guidelines for its members in a statement called "Ethical Business Aviation Transactions." Since then, the document has been publicly supported by other industry alphabet associations, large fleet operators, and industry OEMs, thus setting some industry expectations. Ensuring that our industry continues to operate with integrity and in a manner that can make us all proud is something we need to continue to support.

Neil W. Book, JSSI

1. WHAT TECHNOLOGY ADVANCEMENTS ARE NEEDED IN THE AVIATION MAINTENANCE INDUSTRY?

I think the industry has made enormous strides leveraging technology over the last decade. I'd still like to see technology play a larger role in bringing consistency to maintenance troubleshooting, so you don't end up with five attempts at a problem, four of which fail to rectify the issue. This adds unnecessary cost to the operation and is a wide-scale problem.

In many cases today, MRO billing systems are painfully out of date compared to other markets. Most maintenance facilities are still using paper invoices or simply emailing PDFs. This means there is a massive amount of data not being captured for most maintenance events, and the data that is captured isn't easily importable.

2. WHAT INNOVATION THAT YOUR COMPANY HAS MADE IN THE LAST YEAR ARE YOU MOST PROUD?

In 2017, we released a range of consulting services to pair our global network of technical advisors with three decades of real-world operational data. As part of JSSI Advisory Services, we now inspect aircraft, perform appraisals, manage maintenance events and manage insurance claims for insurance underwriters. With programs for almost every make and model of business jet, turboprop and helicopter, we're uniquely positioned to provide these services to the business aviation community.

3. NAME AND EXPLAIN THE HARDEST CHALLENGES YOU WILL FACE THIS YEAR AS A LEADER.

Our core business is continuing to expand at a double-digit rate of growth while we have simultaneously launched a parts business, a consulting business and a new technology platform. We're also actively looking at a number of strategic acquisitions. We're essentially changing the electrical wiring in the house, without turning off the lights.

4. THERE IS A SAYING, "THE ONLY CONSTANT IS CHANGE." HOW DOES YOUR COMPANY ADDRESS CHANGE IN OUR INDUSTRY?

Our business is constantly changing. We approach our jobs with a fair sense of paranoia and are constantly finding new ways to differentiate our programs, our products and service offerings. As the industry continues to evolve and change, we look to adapt with it.

5. WHAT ARE THE BIGGEST BARRIERS YOUR COMPANY FACES IN YOUR QUEST FOR SUCCESS (GOVERNMENT, REGULATIONS, OEMS, PERSONNEL)?

As the business aviation industry continues to diversify and grow, there's a sea of potential business opportunities to pursue. One of the biggest barriers we face is ensuring that we remain focused on our long-term objectives for the company without getting sidetracked along the way.

6. IS THE SHORTAGE OF MAINTENANCE PERSONNEL TRULY HERE? IF SO, HOW IS IT IMPACTING YOUR COMPANY AND HOW ARE YOU ADDRESSING THE PROBLEM?

It's not something we're experiencing directly. However, we recognize our responsibility to inspire and support young people considering careers in the industry. Last year, we supported Shaesta Waiz as she embarked on a 25,000-mile circumnavigation of the globe to inspire girls and young women to pursue STEM and aviation-related education and careers. We have decades of technical expertise on staff and continue to invest in recruiting young talent to the team. For many years, we have worked closely with universities offering strong aviation and aerospace technology programs to bring the next generation into the industry through our annual internship program. We also sponsor two Embry-Riddle Aeronautical University scholarships to help students pursue their aviation dreams.

7. WHAT SHOULD WE BE WARY ABOUT IN OUR INDUSTRY DURING THE NEXT FIVE YEARS?

We're seeing increasing consolidation and downward pressure on the aftermarket, which makes it more challenging for independent companies to thrive. However, competition is critical to the health of the industry and it's important to have a level playing field to ultimately deliver the highest value and quality to the operator.

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By Jason Dickstein

Optimism on Aviation Trade with China

As I sit down to write, America is on the verge of a trade war with China. And as the earliest salvos of that trade war were announced, where was I headed? **China.**

I spent the week, after the President announced the trade sanctions against China, in Shanghai. I was certain that it would be an unpleasant trip in which I would be forced to defend America; but I was wrong. My trip to China was valuable and uplifting and showed that there is an important aerospace future between our two nations.

Several months ago, American and China signed a new implementation procedure to their bilateral aviation safety agreement. The old agreement was a one-way street. Under the old agreement, China agreed to accept all of the aircraft products and articles that the FAA approved, so long as they were accompanied by the right documentation (our old friend, the 8130-3 tag). But America took nothing from China. Our shores were closed to the aeronautical products of China.

A U. S. manufacturer might use a Chinese manufacturer as a supplier, under the old agreement, but the certifications issued by the Civil Aviation Authority of China were useless in America.

All of that changed, late last year. The United States and China signed a new implementation procedure. A reciprocal one.

What does that mean – a reciprocal agreement? It means that whatever China accepts from the United States, the United States is willing to accept from China on a reciprocal basis. U. S. aircraft can be validated in China and Chinese aircraft can be validated in the U. S. Most importantly for the aircraft parts community, the new agreement permits Chinese PMA parts to be accepted in the United States as airworthy parts based solely on Chinese approval, with no need for any additional approval from the FAA.

My plan was to attend a conference in China at which I would discuss documentation norms for both American and European aircraft parts. By encouraging familiarity with traceability norms, I hoped to encourage Chinese air carriers and MROs to buy parts from U. S. sources.

So it was with no small amount of disappointment that I read the news of impending sanctions as the time before the conference became short. I expected to be greeted with stony stares and a dead-end sign.

But that is not who China is.

The Chinese remain interested in buying aircraft parts from the United States, including PMA parts. They recognized the political need to match the U. S. sanction-for-sanction (and in the short term, aircraft parts are likely to be subject to tariffs), but they also recognized the importance of trade between our two nations.

The Shanghai conference featured an address by Liu Yanli, a senior engineer from the China Academy of Civil Aviation Science and Technology, Civil Aviation Authority of China. If the long title is confusing, then perhaps the best way to describe him is that he is an expert from the Civil Aviation Authority of China, which is the Chinese version of the FAA.

Mr. Liu had a lot of useful information, but one comment that caused me to smile was his statement that "We should encourage use of PMA parts." He seemed very optimistic about the prospects for both U. S. and Chinese PMA.

Mr. Liu discussed the Chinese government's PMA regulations and policies. The Chinese government has been approving domestic PMAs since 1988, and has approved more than 800 articles, spread across over 100 applicants. While this is a small sample, compared with the over 1.3 million PMA parts approved by the FAA in the United States, it shows that this is a growing market in China.

Mr. Liu heralded the latest revision to the technical agreement between China and the U. S. – the reciprocal agreement. He lauded the fact that the U. S. has agreed to accept most Chinese PMAs.

Most PMA parts are acceptable between the U. S. and China. Mr. Liu explained that the only parts that are limited are those that are approved for aircraft for which the PMA authority (FAA or CAAC) is not the state of design of the aircraft AND the part is critical in nature. So there are no limits on acceptance of non-critical FAA-PMA parts, and there are no limits on acceptance of critical FAA-PMA parts for U. S. state of design aircraft and engines.

Mr. Liu also discussed the standards for air carrier review of PMA parts being considered for use. He explained that China is still gathering information and suggested that PMA users in China track installed PMA parts to develop reliability data.

One Chinese company noted that most FAA-PMA parts are un-serialized expendable parts. Because they are not serialized, it is difficult to identify and track them as individual parts.

The U. S. air carrier community may have already arrived at a solution that could assist, a growing number of air carriers have found that the safety and reliability record of PMA parts means that there is no need to track PMA replacement parts separately from the production certificate holder parts that they replace. In some cases, though, air carriers have been interested to track reliability data for certain parts. This is particularly true where there was a reliability issue identified for the production certificate holder's part. Delta Airlines has identified production certificate holder parts with subpar reliability records, and replaced them with PMA parts believed to offer increased reliability. To verify these PMA parts, the airline has continued to track the full population of these parts. They have seen dramatic increases in reliability and in mean time between failures (an important safety metric). Mr. Liu offered no objection to the notion of using review of mixed populations, and comparing the mean time between failure metrics of the mixed population to that earlier data for the production certificate holder's part. The audience suggested that a statistically steady reliability rate should indicate that the PMA parts is at least as good as the par that it replaces.

In response to questions, Mr. Liu admitted that some of the information that would be needed to assess a Chinese PMA part's acceptability for import into the U. S. is not yet publicly available. He suggested that the government might, in the future, adopt a database like the FAA's database in order to facilitate sharing of Chinese PMA information.

Mr. Liu explained the importance of PMA parts, in terms of lowering costs and increasing reliability. He noted that for high dollar value items that are increasing in price, PMA represents an important competitive factor. He pronounced that "PMA definitely has a bright future in engine applications" because of the pricing trends in this area. One can easily see that the Chinese government is willing to encourage development and use of PMAs – PMAs from both sides of the Pacific Ocean. And imminent tariffs on aircraft parts aren't stopping them from laying the appropriate legal foundation for that trade.

A bright future for PMA, indeed. And the hope that this ray of sunshine might help illuminate the path forward, toward even greater aerospace trade between China and the United States. AVM

Want to learn more? Then please register for the 2018 MARPA Conference, 2018 in Dublin, Ireland.

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Jim Swehla, West Star Aviation

1. WHAT TECHNOLOGY ADVANCEMENTS ARE NEEDED IN THE AVIATION MAINTENANCE INDUSTRY?

Business jet manufactures continue to design their aircraft with more sophistication to improve on safety, performance, comfort and maintainability. West Star Aviation (WSA), being one of the leading MRO's in the industry that routinely maintains and upgrades these complex machines, must constantly stay on the cutting-edge of technology to provide proper maintenance. Naturally, we need to insure to that proper maintenance is being conducted by providing our technicians with the latest test equipment, tooling and procedures to complete this maintenance. Even more importantly, we owe it to our customers and employees to make sure that our technicians have the proper initial and recurrent training on these sophisticated machines.

2. WHAT INNOVATION THAT YOUR COMPANY HAS MADE IN THE LAST YEAR ARE YOU MOST PROUD?

West Star Aviation has several locations across the continental U.S. which contain a lot of creative thinkers. So probably one of our major improvements recently, that we take a lot of pride, is being named and Organization Designation Authorization (ODA). Being a delegated FAA-ODA provides a streamline method for us to develop, certify and complete Supplemental Type Certificates (STC) to provide our customers with improvements on their aircraft.

3. NAME AND EXPLAIN THE HARDEST CHALLENGES YOU WILL FACE THIS YEAR AS A LEADER.

In today's MRO business we are faced with many major challenges. One of our most difficult challenges right now, which will continue, is finding good qualified people to bring into the organization. The average age of the A&P mechanic is increasing rapidly. According to a recent article in **Forbes Magazine**, the average age of the A&P mechanic is currently at 51-years old. The average age linked with the fact that licensed mechanics leaving the workforce is outpacing mechanic entering the market. In 2016 and 2017 we have experienced a major increase in our business which is continuing in 2018. With aging aircraft requiring more maintenance combined with fewer technicians entering the business during a major surge in our business, this provides a major challenge that will continue.

4. THERE IS A SAYING, "THE ONLY CONSTANT IS CHANGE." HOW DOES YOUR COMPANY ADDRESS CHANGE IN OUR INDUSTRY?

Even though everyone fears change, we feel that change is a good thing. If it weren't for change, we wouldn't have electricity, the automobile, the telephone and heaven forbid we wouldn't have the airplane. We focus on a component of not necessarily make a change, but better yet, making an improvement. As an example, within West Star, we had a need for more capacity in our paint facility in E. Alton. We went to the employees of paint shop and outlined what we wanted to do by increasing our capacity without compromising our quality. The employee group bought in and generated several ideas to change (improve) our processes. As a result we are now able to through-put six to eight more aircraft paint jobs per year without adding brick and mortar. This was a definite change, but we involved our paint job group, they saw it as an improvement which provides better service to the customer without affecting quality.

5. WHAT ARE THE BIGGEST BARRIERS YOUR COMPANY FACES IN YOUR QUEST FOR SUCCESS (GOVERNMENT, REGULATIONS, OEMS, PERSONNEL)?

We look at the FAA, OEM's and the federal, state and local government as key supporters who establish laws, guidelines and regulations by with we can conduct business and succeed. It's very difficult to predict when we might be subjected to new laws or regulations, i.e. tax laws, EPA regulations, OSHA regulations, FAA repair station requirements, OEM policies, etc. We focus on being proactive to insure there is no interruption in the level of service and support we provide our customers.

6. IS THE SHORTAGE OF MAINTENANCE PERSONNEL TRULY HERE? IF SO, HOW IS IT IMPACTING YOUR COMPANY AND HOW ARE YOU ADDRESSING THE PROBLEM?

We presently have dozens of open positions is all different departments for new personnel to key up with our customer requirements. This encompasses maintenance technicians, electrical, avionics, paint, interior, wood cabinetry, engineering, administrative, sales and management people. It does put a stress on our current workforce which requires additional overtime to provide a high level of service to our customers. We are actively advertising on the internet, holding job and career fairs and utilizing recruitment firms to help locate key employees. We are constantly evaluating our pay scales, fringe benefits, and overall working conditions to maintain our current employee base and attract new employees to our organization.

7. WHAT SHOULD WE BE WARY ABOUT IN OUR INDUSTRY DURING THE NEXT FIVE YEARS?

I go back to my previous statement about the business jet MRO business experiencing a problem right now with the lack of skilled personnel, with a lack of key people entering our industry in the upcoming years. **Forbes Magazine** also states that 30 percent of those who finish an aviation maintenance training course end up accepting employment in another industry. The search for qualified candidates is going to become extremely difficult in the future as more new airplanes are put in the market by OEM's, combined with the age of the existing fleet requiring more maintenance, linked with the prediction that there will be fewer qualified people in the marketplace to work on these sophisticated machines. This is not a good situation. AVM

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