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CONTENTS

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SEPTEMBER 2019 VOL 38 ISSUE 5

DEPARTMENTS

COVER STORY

12

The Brave New World of Training

Enter the brave new world of training. **Aviation Maintenance** magazine takes a look at new technologies being used in the training of aircraft maintenance mechanics. These new technologies include virtual and augmented reality.

On the cover: L3Harris's Augmented Reality (AR) maintenance training solution. Image courtesy of L3Harris.

CATEGORIES

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MAX Saga Continues

BY JOY FINNEGAN
EDITOR-IN-CHIEF

In May I wrote here about the Boeing 737 MAX situation up to that time. Boeing was optimistically predicting the MAX to be up and flying by August. But August has come and gone and the predictions became September…October…December and even now the latest talk is January of 2020 or beyond. Southwest doesn't plan to be able to use the MAX until Jan. 5. Air Canada says Jan. 8, recent reports state.

In June, Boeing had FAA pilots come to their engineering flight simulator to review scenarios. Certainly they tested out the flight regimes in which the Maneuvering Characteristics Augmentation System (MCAS) system would be used. Boeing says the MCAS system was used to "enhance the pitch stability of the airplane – so that it feels and flies like other 737s." A Boeing statement released early this summer says, "MCAS is designed to activate in manual flight, with the airplane's flaps up, at an elevated Angle of Attack (AOA). Boeing has developed an MCAS software update to provide additional layers of protection if the AOA sensors provide erroneous data. The software was put through hundreds of hours of analysis, laboratory testing, verification in a simulator and two test flights, including an in-flight certification test with Federal Aviation Administration (FAA) representatives on board as observers."

In late June as the FAA reviewed the 737 MAX software update during simulator sessions, the FAA found an additional need and asked the company to address it through software changes. "The FAA review and process for returning the 737 MAX to passenger service are designed to result in a thorough and comprehensive assessment," a June 26th statement says. "Boeing agrees with the FAA's decision and request, and is working on the required software. Addressing this condition will reduce pilot workload by accounting for a potential source of uncommanded stabilizer motion. Boeing will not offer the 737 MAX for certification by the FAA until we have satisfied all requirements for certification of the MAX and its safe return to service."

Additionally, Boeing says software updates to the system will now compare inputs from two AOA sensors. If the sensors disagree by 5.5 degrees or more with the flaps retracted, MCAS will not activate. Also, if the MCAS is activated in non-normal conditions, it will only provide "one input for each elevated AOA event. There are no known or envisioned failure conditions where MCAS will provide multiple inputs." Boeing says now MCAS will never command more stabilizer input than can be counteracted by the flight crew pulling back on the column. The pilots will always have the ability to override MCAS and manually control the airplane. These updates have been designed to keep bad data from causing the MCAS system to activate.

Civil aviation authorities around the world including European Aviation Safety Agency (EASA) and those from India, China and Canada, have all said they plan to conduct their own flight tests on the MAX, independently from the FAA, when the time comes. EASA has also said it prefers additional redundancy in the system with readings from three independent angle of attack sensors rather than the current upgraded MAX system that has two.

Icelandair worked out an agreement with Boeing to cover costs for their grounded fleet of six 737 MAXs. It was the first carrier to announce a deal with the company since the grounding in March.

Separately, Boeing reported at the end of spring the cost of the MAX fix was topping $1 billion. But by mid-summer the cost was up to $7 billion and still climbing. More airlines will likely receive compensation as well, driving the charges higher.

In another concerning incident, testing for Boeing's new widebody 777X, was suspended in early September when a cargo door exploded outward during a high-pressure stress test on the ground.

A new safety committee established by CEO Dennis Muilenburg in April, reported their findings to the Boeing board in mid-September. A **NYT** report says their recommendations included "changing corporate reporting structures, creating a new safety group, and changing the cockpits of future planes to accommodate new pilots with less training."

Meanwhile, a new FAA Administrator, Steve Dickson – formerly SVP of Flight Ops at Delta Air Lines, was sworn in. Let's hope the two pilots that filed complaints against Dickson about retaliation after reporting safety concerns were the only two, and that those cases were not indicative of a pervasive problem in what seems to be an otherwise stellar career.

On September 19, 2019, Boeing hosted Administrator Dickson in Renton and Seattle, Wash. Dickson, who holds a 737 type rating and flew the aircraft on the line, spent time in the 737 MAX simulator and reportedly held discussions with senior leaders, including Boeing's Kevin McAllister, Commercial Airplanes president and CEO. "We remain committed to working collaboratively with the FAA and other global regulators to safely return 737 MAX back to service," a Boeing statement released at the time of the visit says.

Since the two crashes, numerous government agencies have been researching how the FAA certifies new aircraft and the policy of delegating certification to the manufacturers themselves, as was the case with the MAX. Oversight, or the lack of it, is often mentioned in relation to outsourced maintenance and is once again being bandied about as problematic in regards to certification as well.

It does seem the FAA is being more methodical, thorough and thoughtful this time around. It's said the regs are written in blood. For the flying public's safety, let's hope they do not forget that. AVM

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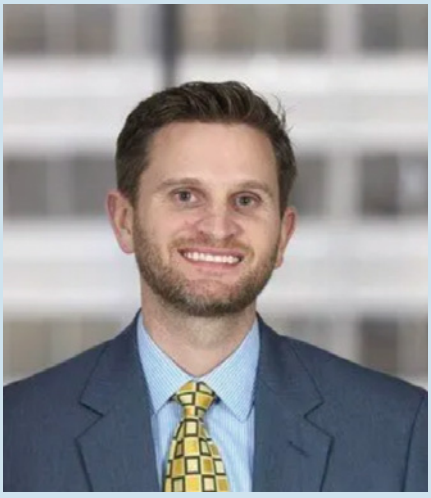
United Airlines Names Tom Doxey SVP of Technical Ops

United Airlines selected Tom Doxey to be senior vice president of Technical Operations, overseeing the carrier's maintenance operations; ground service equipment and facilities maintenance; supply chain; technical services and planning and strategy. Doxey most recently served as vice president of Technical Operations and in his new role will report to United's chief operations officer, Greg Hart.

"I couldn't be more excited to have Tom lead the Tech Ops team," says Hart. "Leveraging his experience leading finance for operations and his passion for people, I know the team will continue their string of record performance under his leadership."

Doxey joined United in 2016, assuming the role of chief financial officer for operations, overseeing teams that provide financial and analytical support to United's operations groups, including Tech Ops. Prior to joining United, Doxey served as vice president, fleet and corporate finance at Allegiant, where he was responsible for all aircraft and corporate finance transactions, materials planning, stores, fleet planning and the financial management of airframe and engine heavy maintenance programs. Doxey started his airline career at US Airways, where he held various roles in financial planning and analysis.

He holds a bachelor's degree from Brigham Young University and an MBA from Arizona State University.



HAECO Group Appoints Frank Walschot Chief Executive Officer

Frank Walschot will join HAECO Group as chief executive officer effective December 1, 2019.

With more than 30 years of experience in the aviation industry, Walschot was most recently CEO at SR Technics. He has previously worked in the aviation MRO industry in Europe, the United States, Singapore and mainland China.

"Frank brings with him a wealth of knowledge and international experience in the MRO industry," Merlin Swire, chairman of HAECO Group, says. "I am confident that his leadership will help to deliver long-term sustainable growth for the HAECO Group."

Summit Chan will continue to act as Interim CEO at HAECO until December 1. He will then take up the role of group director Corporate Development, and retain his current roles as chairman of HAECO Xiamen and HAECO's other China Joint Ventures.

Lufthansa Technik Component Services Expands Tulsa Capabilities

Lufthansa Technik Component Services (LTCS) in Tulsa, Okla. continues to grow by expanding into additional capabilities. Recently, the company received the approval of the Civil Aviation Administration of China (CAAC). The Chinese authority has approved LTCS as an "adequate organization to accomplish maintenance of components." Additionally, LTCS has become the 33rd design department of Lufthansa Technik's EASA 21/J Design Organization (DO) and the first one in the Americas.

The DO status allows LTCS to create their own approved data. "This is a big step forward in developing further repair methods to improve the component services of the company," Lufthansa Technik says. The company hopes this status will help their customers with shorter turnaround times, reliability improvements and from overcoming material obsolescence.

"In 2017 the idea was born, that LTCS should have their own design engineers to be as flexible as possible in a constantly changing aftermarket environment. After two years of training and mentorship program, LTCS is very proud to start this new chapter with three Design Engineers," said Tobias Baumgart, COO of Lufthansa Technik Component Services.

More than 680 employees are employed at its eleven locations throughout North, Central and South America. The company offers a comprehensive bandwidth of Maintenance, Repair and Overhaul services for aircraft components. The maintenance of commercial aircraft components encompasses a wide range of services from repairs of single components all the way to a complete material management system with access to Lufthansa Technik's comprehensive component pool.

Gulfstream Expands Appleton Service Center/Opens Gulfstream East Campus at Savannah Headquarters

Gulfstream has added significant focus on service and support by growing their facilities in two locations. The company officially expanded its maintenance, repair and overhaul (MRO) operations at Wisconsin's Appleton International Airport with the opening of a newly built aircraft maintenance facility. The facility has been operational since Aug. 10.

The190,000 square-foot/17,652-square-meter building, northeast of the airport terminal, cost about $40 million to build. The expansion to the Appleton service center includes 101,853 sq ft/9,462 sq m of hangar space, which will accommodate 12 Gulfstream G650ER or G650 aircraft. In addition to offices, back shops and general support space, the expansion adds a new sales and design center and increased customer access to Gulfstream's design portfolio. The project, announced in February 2018, has resulted in nearly 100 new jobs at Gulfstream Appleton, with the potential for more in the next few years.

"This beautiful facility represents the most significant expansion we've had in the 20 years we've been here. It is a tremendous asset to our site and the community," says Derek Zimmerman, president, Gulfstream Customer Support. "It will help us enhance the reliability of our growing fleet, support more customers and elevate their experience, continue to maintain a high level of safety and provide a world-class workplace for our employees.

Gulfstream Appleton's service center and large-cabin completions facility spread over approximately 500,000 sq ft/46,452 sq m. and offers major inspections, structural modifications, major avionics installations and safety upgrades. In 2018, Gulfstream says their Appleton facility had nearly 500 aircraft visits.

About a month later, on September 13, Gulfstream opened its new maintenance, repair and overhaul (MRO) facility at their headquarters in Savannah. The company has dubbed it the Gulfstream East Campus.

Gulfstream says the 202,000-square-foot/18,766-square-meter building located on the east side of Savannah/Hilton Head International Airport was built with an investment of more than $55 million and gives Gulfstream more than 1 million sq ft/92,903 sq m of dedicated MRO hangar, office and back shop space in Savannah. This expansion will result in approximately 200 customer support-related jobs over several years, some of which will be filled by graduates of Savannah Technical College's Aviation Technology Division.

"This is a great day for our customers as well as Savannah, Chatham County and Gulfstream," said Mark Burns, president, Gulfstream at the ribbon cutting ceremony. "We are very excited about this expansion, which follows the recent entry into service of our two all-new aircraft, the Gulfstream G500 and Gulfstream G600. To help ensure those aircraft and the rest of our growing fleet continue to have the best service and support in the industry, we built and staffed this fabulous facility."

Gulfstream also has a service center opening scheduled for late 2019 or early 2020 in Van Nuys, Calif.

"By growing the number of maintenance facilities and combining them with our fleet of rapid-response vehicles and Gulfstream Field and Airborne Support Teams technicians, we're offering our customers more service and support options, more accessibility and more flexibility," Burns says.

about people

Duncan Adds Weverka

Duncan Aviation's long-time lead designer Rachael Weverka will be transitioning to the Modifications Sales Team in Lincoln, Nebraska. Weverka will be responsible for paint and interior sales on the Gulfstream and Embraer teams. "We're extremely pleased to have Rachael join the Sales Team. With her design background, she fully understands the refurb process and will help our clients navigate through the sales and planning process," says Nate Klenke, sales manager of Modifications. During her nine years as a designer for Duncan Aviation, Weverka has worked on a variety of models, and she has extensive experience on numerous airframes.

Yingling Elevates Nichols to President and Expands Roles for Short and Williams

Lynn Nichols, chairman and CEO of Yingling Aviation, has announced the elevation of his son Andrew Nichols, the firm's current CFO, to the position of president. "The move is the 'logical next step' in our generational succession plan, designed to provide a smooth transition for the company and position it for continued success," Nichols says. "Lonnie Vaughan, who has served admirably as Yingling's president for the past seven years, will effectively 'swap' positions with Andrew, returning to the post he held prior to being named president in 2012," the senior Nichols explains. A licensed private pilot, Andrew Nichols is a graduate of both Kansas State University and Wichita State with degrees in Finance and Business Management. He has worked in a variety of roles for the firm while in high school and college. He came to Yingling on a full-time basis in 2010 after serving in the finance department of Cessna Aircraft Company following graduation from KSU. Lynn Nichols also announced expanded roles for Chris Short, director of Maintenance and Rebecca Williams, director of Parts. Short's responsibilities will now include oversight of aircraft »»

about people

maintenance, avionics, interiors and aircraft paint services. Williams' position has been broadened to include management of propeller sales, repair and overhaul services.

KADEX Aero Supply Adds Mann to Sales Team

KADEX Aero Supply has welcomed Colin Mann to their team. Mann joins KADEX as the regional sales manager at their Calgary, Canada location. Mann is a licensed avionics AME with 20 years of aviation experience in aviation sales, marketing, aviation management, aviation maintenance, training and development, and parts distribution for both civilian and military aviation industry. Mann moved from Australia with his wife in March 2010.

SR Technics Appoints Jean-Marc Lenz as New CEO

SR Technics announced the appointment of Jean-Marc Lenz as new chief executive officer beginning in early September, 2019. Lenz succeeds Frank Walschot.

SR Technics says Jean-Marc Lenz and Frank Walschot worked side by side for many years, and Lenz played an active role in business operations, quality, safety and Lean CI. Walschot is expected to remain available until the end of November this year to support the transition.

Lenz has more than 30 years of experience in the aviation industry, most recently as chief operating officer and accountable manager at SR Technics.

"We recognize Frank's contributions to SR Technics, most recently in building an effective team and positioning the company for the future. Jean-Marc has extensive experience in the aviation industry and is particularly a quality focused and customer-oriented executive," says Ning Wan, chairman of SR Technics. "He is well positioned to lead us forward. On behalf of the Board, I would like to wish Jean-Marc all the best in his new role and thank Frank for his great achievements at SR Technics."

Werner Aero Services Acquires Boeing 737-800 MSN 28221

Werner Aero Services has acquired a Boeing 737-800, MSN 28221. The aircraft has entered the disassembly process and components will become available shortly to support B737 customers worldwide. The spare parts will be used to supplement Werner Aero's asset management programs and are also available for lease or outright sale.

"We are expanding our Boeing platforms to support airlines worldwide and are in the process of acquiring additional airplanes. We see great demands from our 737NG airline customers for the various types of support we provide, including spare parts and engines," said Mike Cazaz, CEO of Werner Aero Services.

Duncan Nabs SmartSky STC For Challenger

Duncan Aviation has received FAA approval for a Supplemental Type Certificate (STC) that will allow installation of SmartSky's air-to-ground connectivity system for Challenger 601, 604, 605 and 650 aircraft. SmartSky's network brings new, high-performance Wi-Fi to business aircraft, powered by a mix of advanced 4G LTE and 5G technologies.

Among the many engineering services Duncan Aviation provided, Russ Kromberg, certification coordinator worked with SmartSky's technical team regarding the optimal placement of the antennas to achieve the best in-cabin speeds and connections possible, the company says.

"We are working on STCs for several additional makes and models for the SmartSky equipment," says Kromberg. "Those STCs, slated for completion in 2020, are for the Challenger 300, Learjet 45, and Falcon 900 and 2000."

"Duncan Aviation… knew exactly what their customers wanted and provided critical input for our design requirements," said SmartSky chairman and CEO Haynes Griffin. "Our system meets or exceeds that high bar Duncan Aviation helped set, giving customers the internet speed they've long demanded using SmartSky's patented bi-directional, low-latency network."

about people

Ward Joins DAS/FLITE as VP

Mike Ward has joined DAS/Flite as the vice president of Sales, Parts and Component Repair. Eli DaSilva will assume a director of Business Development role and report to Ward, along with the sales team.

Ward has 25 years of aviation experience and most recently worked for Spirit AeroSystems in Wichita, Kansas, as the senior general manager for its Aftermarket MRO operation. He has spent the majority of his career in the VIP interior modifications business for wide body head of state aircraft. He also formerly served as director/GM for Hawker Beechcraft Services and Textron Aviation Services' MRO service center in Houston, Texas.

about people

Skyservice Appoints Sharpe to Director of BD

Skyservice Business Aviation has appointed PJ Sharpe to the position of director, Business Development, USA. In his new role, PJ will build awareness of the Skyservice brand within the U. S. market to support business development activities for the company's range of business aviation services: Fixed Base Operations (FBO), Aircraft Management, Charter, Aircraft Maintenance and Aircraft Sales and Brokerage. Sharpe will report directly to Lyne Barbeau, VP, Business Aviation. "We are pleased that PJ will oversee business development for Skyservice in the U. S. market. His level of expertise in the aviation industry and success in developing new markets will help support Skyservice's growth in the U.S.," says Barbeau.

Textron Aviation Opens New Parts Facility in Australia

Textron Aviation opened an aircraft parts warehouse in Australia to support its fleet of business jets, turboprops and piston aircraft. The parts warehouse will be co-located at Essendon Fields Airport with Premiair Aviation Maintenance, a Textron Aviation Authorized Service Facility.

"With Premiair established as our new ASF for Australia, we are enhancing our regional parts availability. This represents another step in our ongoing commitment to Textron Aviation aircraft owners in Australia and across the Asia-Pacific region," says Brad Thress, senior vice president of Parts and Programs at Textron Aviation.

Customers, operators, MROs and channel partners will have the option to purchase factory direct parts through Textron Aviation's ecommerce website or local sales and support staff. Parts will be shipped locally from Essendon.

"Adding this new parts facility to Textron Aviation's support capabilities increases its level of customer service for Beechcraft, Cessna and Hawker aircraft in the region," says Paul Montauban, managing director of Premiair Aviation. The new Australia facility follows the recent expansion of Textron Aviation's Singapore parts warehouse.

Piper Aircraft Apprenticeship Program Offers Chance to Earn While Learning Manufacturing Career Skills

From left to right, Thomas Boor, Emily Fritzler, Jonathan McClain, Ervin Nixon, Harry Brubaker, George Gonzales, Aaron Dixon, Ryan Crook, Logan Burnette, Conner Kroll.

Piper Aircraft has begun an apprentice program and their first group of apprentices has started their two year-program. The first nine apprentices, who started work in August, will shadow skilled aircraft assembly workers and learn all aspects of fabrication and assembly of aircraft during the two-year initiative. Additionally, they attend technical classes and receive hands-on training designed to qualify the participants as a Journeyman in Aircraft Assembly. Each apprentice is a paid employee of Piper Aircraft and receives a full benefits package.

"The Piper apprentices are part of a high-tech version of the ancient tradition of apprentices learning a trade requiring specialized skills by working with an experienced professional. This program provides the necessary training, mentoring and support enabling apprentices to successfully pursue a long-term career with growth opportunity as a Piper employee," said president and CEO, Simon Caldecott. "As we look to the future and consider our current aircraft sales and order backlog, the apprentice program will help ensure that Piper has a strong and agile workforce for the years to come."

The application period for the 2020 Apprentice Class will open in January 2020. The application can be found on the Piper website at www.piper.com under the Careers tab. For questions regarding the program, please e-mail: apprentice@piper.com

about people

West Star Adds Marler, Cohen

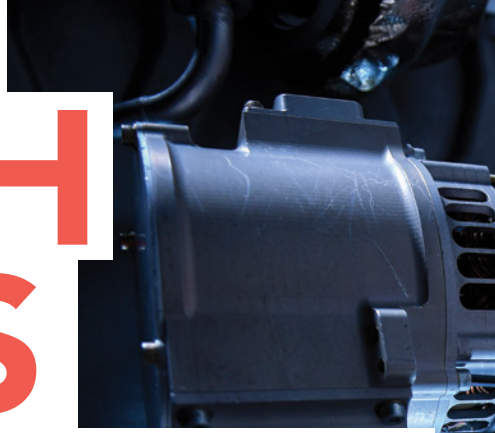
West Star announced that Larry Marler has been named as the technical sales manager at their Chattanooga, Tenn. location (CHA). Marler has 35 years of aviation experience with previous positions held at Midcoast, Dassault Falcon Jet and StandardAero, and has been at West Star for just over three years. He graduated from Broward Community College and served in the U.S. Air Force. West Star also announced that Jason Cohen has been promoted to Bombardier Global program manager at their Grand Junction (GJT) facility. Cohen has 30 years of aviation experience, and has been at West Star for eight years serving on the Bombardier Technical Sales team. He acquired his A&P license from Colorado Tech, as well as obtaining his pilot's license from Aero Training of the Rockies. AVM

West Star Aviation Announces Retirement of Bob Rasberry

After nearly 20 years, Robert (Bob) Rasberry, chairman of the board at West Star Aviation, is retiring. Rasberry will continue with West Star's board of directors as chairman emeritus and join Norwest Equity Partners (NEP), a middle-market equity investment firm and parent of West Star Aviation, as a senior advisor supporting NEP's continued interest in aviation-related investments.

Rasberry, in collaboration with co-founders, Sam Haycraft, Jim Swehla and Mike Durst, acquired the small MRO, Premier Air Center, in East Alton, IL in 2002. West Star Aviation in Grand Junction, Colo, was added in 2005, and ultimately, the companies were united and rebranded as West Star Aviation. The Company has grown from 150 employees to more than 1,400. "I find much comfort and pride in knowing that I leave West Star in extremely capable hands. Many leadership decisions have been made over the past several years to prepare for this day, including appointing Rodger Renaud as chief operating officer and president, and hiring an industry veteran, Jim Rankin, as CEO. Their commitment to our employee and customer-centric culture is unwavering and aligns with the same principles upon which West Star was founded," says Rasberry.

HIGH TECH IMMERSES MAINTENANCE TRAINING



By Charlotte Adams

Military, corporate, and A&P trainers are adopting game-based, first-person technologies as fast as they can. These virtual technologies engage students and supplement lectures and manuals. But the jury is still out on which approaches are best suited to which training tasks.

Technologies range from virtual maintenance trainers (VMTs) to virtual reality (VR) and augmented reality (AR). Found in classrooms, VMTs – desktop-based simulators -- offer students 3D training scenarios through which to learn aircraft systems and troubleshooting.

AR and VR require the use of goggles to present images of objects or whole environments. AR overlays images and information on a real object and presents virtual objects while students are still anchored in the here and now, whereas VR calls up a completely virtual world.

VR can be good for beginners, as part of familiarization training. FL Technics, for example, is introducing VR into the basic training of aviation mechanics, the company says. Its first module covers the opening of the reverse thrust engine of a 737NG.

VR is also suited to tasks that are complex and tricky enough to be hard to convey by traditional means, that are too difficult or expensive to use the real equipment to train on, or that require environmental elements such as high noise levels, says Pete Boeskov, chief technologist with Boeing's Training & Professional Services unit.

Boeing, for example, has fielded a VR procedures trainer for aviation maintenance to a military customer. "The use case tends to be where you want to simulate an environment with a certain level of chaos to prepare you for the real thing," Boeskov says.

VMT content is also deployable. DiSTI, for example, provides a subset of its U.S. Army UH-72 Lakota VMT for remote use. Segments loaded onto an iPad or Windows-based tablet can be launched in the field as refresher training via "autoplay lessons," says Kevin Mikalsen, director of global marketing.

L3Harris's Augmented Reality (AR) maintenance training solution provides hands free or tablet enabled repair, replace or troubleshooting operations. L3Harris image.

Using virtual reality (VR) headsets, aircraft maintainers interact with a virtual platform including familiarization exercises on how to repair/replace parts or perform troubleshooting. L3Harris image.

Prior to performing a task, users can go through the lesson, interact with it, show they have completed it, and prove that they're competent and capable of executing the procedure, he says. DiSTI's VE Studio framework allows content to be pushed to desktop/ mobile, VR, or AR devices.

Whether VR/AR training in civil aviation is the equivalent of classroom training is still a gray area, says Allan Bachan, a vice president with ICF. Frequently regulators wait until some level of maturity can be demonstrated, he says.

VR for maintenance is still in the innovation arena, Bachan says. It's one thing to service a landing gear in a lab but another to do it in a hangar with all the heat, dirt, noise, and heavy components. In the lab you don't get wires scratching your fingers or glycol spilled on your overalls. And you don't find yourself bent over in a funky position, he says. So while productivity might be great in the lab, it would drop in the real world.

L3Harris asserts that maintenance training costs are decreased by 20 percent through the use of AR/VR/MR (mixed reality) training technologies vs. traditional methods. The company says it has quadrupled student throughput based on the use of virtual training. With further enhancements to its learning management system (LMS), it expects to achieve 30-50 percent reductions in training times, adds Lenny Genna, president of L3Harris's Military Training Sector. (LMS is the software that helps instructors track student progress.)

Boeing has done some controlled studies concerning the use of virtual approaches. "Even things like desktop simulators bring that learning-by-doing element," Boeskov says. And the technologies can reduce the cost of training. "We've demonstrated we can get the same outcomes without having to spend as much time at the actual airplane."

Karen Jo Johnson, an associate professor in the Department of Aviation Technologies at Southern Illinois University Carbondale, is doing a doctorate on ways to teach

troubleshooting to A&Ps. With the help of a former student, Gary Tippin, Johnson has created an animation of hydraulic schematics. The simulation can be activated by a smart phone or operated from a web site. You can interact with it and introduce different scenarios into it. The animation allows you to see the fluid flow that makes the components move.

Johnson hasn't designed the structure of her experiment yet, but the crux of the dissertation is to judge the effectiveness of the technology in teaching skills such as troubleshooting. She hopes to include all of the students in the school's aviation technology program – 110 to 130 men and women – in her study."People know that students don't go home and read textbooks," she says. "I think that's why you're really seeing a lot of this technology come into the system." She's "trying to see if it works."

Boeing has extensive experience creating and utilizing a variety of extended reality systems for pilots, maintenance personnel and crew. Boeing image.

Augmented Reality

A collaborative environment where students in a class are looking at the same virtual landing gear – something Boeing has demo'd -- is a good use case for AR, Boeskov says. The students can interact with it, actuate it, move it, and highlight things. And it makes sense in the real maintenance world "where you're providing knowhow at the point of use."

But there are challenges, such as field-of-view and visibility in daylight conditions. In AR, which mixes virtual and real worlds, the two have to be aligned, Boeskov says. "It's got to be seamless."

L3Harris is also working on AR with "reachback" capability, so that someone deployed in the desert can connect with an expert and send photos back and forth to refresh the maintainer about how to perform a task like a helicopter blade replacement. "It's like a rehearsal," Genna says. The company's Unified Maintenance Solution (UMS), which combines VMT, LMS, AR, VR, MR, and reachback, has not yet been sold to aviation customers.

GE Aviation, partnered with Upskill, ran an AR trial a few years ago, using the enterprise edition of Google Glass. The idea was to see whether the technology could help mechanics in engine assembly tasks. The experiment integrated a wireless torque wrench from Atlas Copco and provided a real-time display of how much torque mechanics were applying to different fittings, nuts, or bolts, says Ted Robertson, systems engineering program leader. When they hit the right torque, the system would take a photo so that there was an "historical record of them torqueing the right thing at the right time."

The project looked at 15 mechanics performing tasks on a borrowed CF34 engine. In the morning a mechanic would do two maintenance tasks with traditional tools and GE would measure the time it took. In the afternoon the mechanic would perform the same two tasks using the virtual assist and have the time measured. GE found that the technology decreased task performance time by about 10 percent, Robertson says. He got very positive feedback from the workers, about 85 percent of whom thought the system would reduce errors in the workplace.

DiSTI has done proof-of-concept VR and AR training modules for the EC145, the commercial version of the UH-72, involving tail rotor replacement. The AR project translates "training" to "performing" the task, guided by the images in a HoloLens AR headset, Mikalsen says.


FL Technics has begun implementing VR modules for the basic training of aviation mechanics and is set to expand its list of modules to cover the full scope of maintenance training. "Our main goal is to reduce the time it takes new mechanics to enroll in the company," says Zilvinas Lapinskas, CEO at the company. FL Technics image.

Naval Aviation Maintenance

The Navy has developed the Multipurpose Reconfigurable Training System (MRTS) 3D, which is based on large, multitouch flat panel screens that run a family of simulation applications. Using gaming technology, it immerses

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students in a 3D, first-person virtual environment. Content also can be injected into headsets for VR-type training, says Tyson Griffin, head of advanced technology products for the Naval Air Warfare Center's Training Systems Division.

One aviation application involves the mobile electric power plant (MEPP) used to start aircraft. Sailors learning how to operate and fix the MEPP first interact with the equipment in a simulated environment, explains Capt. Tim Hill, the commanding officer of the Training Systems Division.

The division has also performed research, looking at the repair-and-replace procedure for the alternator of E-28 arresting gear used at airfields, says Randy Astwood, head of the Human Performance Science & Technology Group. The research suggests that people made more substantial errors during desktop training vs. VR training. The VMT and the VR systems were shown to be equally immersive, but the VR students had better recall, perhaps because they couldn't "just click through the training – they had to pay attention and work through it.

There are cost savings, as well, Capt. Hill says. Although a MRTS application costs "somewhere less than a million dollars," a trainer using real aircraft parts costs much more, and the virtual trainer will be able to "have every failure mode that's possible." Training via virtual technology can be less expensive, faster, and more engaging.

Another Navy initiative, Ready Relevant Learning, focuses on giving sailors just the right training at just the right time rather than jamming 90 percent of their training into their first six to 18 months in the service, Capt. Hill says. An associated concept is the use of job aids, such as tablets or VR/AR gear throughout sailors' careers, so when they encounter a task for the first time, they have something to help them through it.

For the P-8 the Navy is looking at VR and AR for complex tasks such as removing and replacing pods, Griffin says. But so far it has not fielded any VR or AR maintenance trainers. VR can provide good situational awareness and an understanding of the size and scope of the equipment you're dealing with, Griffin says. But for fine motor movements, it's not mature enough to provide the level of precision the Navy needs.

Among the challenges of delivering training to deployed personnel are logistics, equipment ruggedness, and transmission issues such as emissions, information assurance, and bandwidth.

Boeing

Boeing emphasizes content reusability. Its Extended Reality Learning Framework (XRLF) architecture "allows the reuse of assets across a broad spectrum of delivery modes," Boeskov says.

Boeing's VMT, Microsim, is tied into XRLF. Targeted at tablets and laptops, Microsim is available at the company's training centers and is licensable to customers. It does not require a server.

Boeing has some streaming proof-of-concepts. A cloud-based solution would "give us the scale, reach, and bandwidth to hit a large number of users and endpoints," he says. He expects to see hosted streaming applications in two to three years.

VMTs

VMTs account for most virtual training today and are effective at providing a lot of information in an immersive manner. VR has a role in tasks such as familiarization training – navigating around an aircraft to find a specific LRU panel -- says Phil Perey, head of technology for CAE's defense business.

But VR can't provide the same depth of systems information or diagnostics understanding as a VMT can. "When you put the VR on, you lose so much," such as screens with the maintenance manual, training tasks, and cockpit view, Perey says.

CAE provides the VMT for the A400M. The primary goal of the VMT was to avoid the need for a real aircraft to get crews up to speed, Perey says. To this day the forces using the A400M "don't typically have a dedicated aircraft" for crews to train on. VMTs can be extended to VR – "you're basically mapping the desktop into a VR headset," he says.

Bill Russo, aviation program director at The University of D.C. Community College's aviation program.

UDC

The University of D.C. Community College's aviation program has been using an L3Harris 737-800 VMT since January, thanks to a grant and internal funds. There is a large projection screen up front and a multimonitor computer system for each pair of students, says Bill Russo, aviation program director.

The virtual airplane "does everything exactly the way the real airplane would," he says. In the hydraulics class students can see how the fluids move. They also can see the bigger picture – how the hydraulic system works with the landing gear, for example. Because students are learning aircraft systems on a 737-800 VMT, they have knowledge that is "more in tune with the current needs of the industry," Russo says. "Almost no A&P schools teach commercial aviation maintenance."

He can insert faults like the failure of an avionics cooling fan and have students troubleshoot it. Students interact with an electronic version of the manual and the aircraft system, so they're learning both. They can remove and replace components per the manual. The first time through, Russo shows them the procedure and they follow along; the second time two students come up to the instructor station and demonstrate to the class; and the third time they do it on their own.

The VMT can replicate inflight problems like a TCAS alarm to show students how it presents to the pilot. The VMT also can simulate an in-flight TCAS failure, which triggers a fault code

that they can troubleshoot.

Although the school hasn't been using the VMT very long, Russo says that students that have used the technology have scored much higher on quizzes, projects, and finals than similar students the previous year.

But VMTs are pricey for A&P schools, says Crystal Maguire, executive director of ATEC, the Aviation Technician Education Council. "They are more the exception than the rule." There are also some things – like welding and fabric – that you can't teach with high tech.

GE Aviation

GE Aviation is planning a training technology upgrade. Today students at its Customer Technical Education Center (CTEC) are issued tablets with PDF-formatted materials and a PDF editing tool while instructors operate "smart boards" – large, interactive white boards. These can display models of engines that can be disassembled and reassembled virtually.

As soon as 2020 GE aims to introduce a homegrown VMT, coupled with a new learning management system that employs cloud delivery, so that lessons can be streamed to remote locations.

GE's Chief Engineer's office is using VR for analysis, says Brandon Richards, senior engineer. For VR the office uses GE content in its cloud-based distribution system, GE App Dash; F110 maintenance awareness, which provides 3D, immersive content for the F110 engine; the Siemens Teamcenter Visualization Mockup; and the HTC Vive headset.

Dynamic Adaptation

Another trend is the dynamic customization of training to individual needs. Charles River Analytics (CRA), partnering with DiSTI, is developing an intelligent VMT, known as MAGPIE, under a contract with the Air Force Research Lab. The "intelligent" part involves the system's ability to monitor students' behavior and, based on their grasp of the material, to dynamically adapt how the course is being delivered, Mikalsen says.

Aircraft Propeller Service, a full-service propeller shop, offers its own Propeller University, or Prop U, a more traditional style of hands-on training utilizing real propeller products. APS image.

MAGPIE software can actually track the student's performance in reference to a given standard or set of steps typically taken and can diagnose and adjust the scenario flow and content, as needed, to help the student progress, explains Winston Bennett, readiness product line lead, at AFRL's Warfighter Readiness Research Division. It can understand where student's gaps are and move the student back in the curriculum to ensure the "building blocks" are built, he says.

The "intelligent tutor" uses various AI algorithms to dynamically track performance and guide training exercises, explains Sean Guarino, CRA's principal scientist for human effectiveness. Ongoing work will revise scenario parameters -- including faults and environmental stressors -- based on the skill level of the trainee, he says.

Smaller Scale

Texas State Technical College is working on developing labs using X-Plane flight simulation software running on Alienware gaming hardware with Occulus Rift VR, says Kelly Filgo, executive director of special projects. The software includes a startup sequence for the 737-800.

"There's no substitute for the real deal," he says, and the school has a PT-6 and other airplanes that students can start up. But no A&P school can afford a 737. The lab – not yet in official classroom use – would give students a better understanding of how individual systems work together and make them better troubleshooters.

At WSU Tech, part of Wichita State University, Diana Holladay, a lead instructional designer, created an interactive animation of the axes of an airplane. Although it was "cartoonish," it would be appropriate for an introductory lesson about how an airplane functions, she says. Instructors liked the idea, which could be a step toward making worksheets interactive. She focuses on starting small and using free apps on ubiquitous devices like smart phones.

We're at the beginning, Holladay says. The software has to be customized to the aviation niche. She hopes to partner with other aviation schools or companies or make a trainer "specific to us." Her department is already gaining AR experience, using zSpace to develop a virtual crime scene for police science instruction.

Prop U

High tech notwithstanding, there's still good value to traditional approaches. Aircraft Propeller Service, a full-service propeller shop, offers its own Propeller University, or Prop U, for training employees of the operators it supports.

"We have actual products," says Joe Mayer, chief inspector. With enough lead time, APS can teach students using their company's products. The training, based on OEM technical data, can help lower customers' operating costs, he says. "Each class is unique." AVM

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The **Aviation Logistics Network**

Turning a vision into a brand recognised world wide

You will have seen the highly colourful orange logo of the Aviation Logistics Network though various forms of advertising.

But what does it mean and what does it represent?

The Aviation Logistics Network or ALN as it is commonly known was the vision of a group of private logistics organisations based in Germany, France and the UK who had specialist knowledge and dealings with companies involved in the supply of parts for emergency Aircraft On Ground (AOG), Critical and Routine shipping needs. The conception 10 years ago involved three founding companies covering only 20 locations, today the network has grown to encompass over 60 world class organisations within its ranks with in excess of 380 locations worldwide providing 24/7 AOG support to many of the worlds leading airlines and MRO organisations.

How do you create a network from scratch with a global presence that operates around the clock serving the diverse needs of an Industry which in itself has a myriad of complex challenges to meet both within its supply chain and with its own supplier base?

The first challenge was to identify if there was a genuine need and alternative to the global integrator type of service on offer to the Industry. Independent companies have to be by their very nature nimble and quick to react to compete in a global market place. Therefore ALN was established to identify those nimble and best in class companies and then fuse them together under a brand that became "Aviation Logistics Network". Only the very best organisations with a proven track record in serving the aerospace Industry were invited to participate. This is an ethos that remains in place today.

ALN partners (each organisation within ALN has exclusive partner status) work closely with each other to provide dedicated transportation solutions for whatever logistical challenge its client base may have, be it the transportation of the smallest component, the movement of the latest type of aircraft engines or Charter requirements.

Uniquely the network has within its ranks an ex VP of maintenance, ex flight engineers, staff who have worked in fleet and engine leasing not just logistics and freight forwarding. From the very start the aim of the Network was to provide a fresh and different approach to the unique challenges faced by Airlines/MRO/Leasing and aftermarket companies.

Industry professionals expressed their dissatisfaction at the lack of choice in the market place and felt many logistics organisations professed to know their needs but in reality the services provided were unsophisticated with little understanding of the pressures an AOG situation can bring and often the wrong service being used leading to costly delays. ALN was created to address these issues, however we realised that to do so we had to first look at the challenge in a different way to others, this lead to many airmiles being flown to have face to face meetings with logistics companies who professed an interest in the concept. Crucially on-going initiatives and meetings both formal and informal with all sectors involved in the aerospace industry to identify the key areas where the clients wanted to see improvement. The key most

important issue that became apparent time after time was the importance of communication and human interaction.

Naturally we now live in an era of unprecedented technology and many organisations simply expect their clients to track and trace their shipments via on-line web portals, it is our belief that clients want more than simply an electronic record, they want and appreciate the interaction of a professional who only works with aerospace organisations and who is 100% responsible/focused on their shipment and who is highly trained (ALN is ISO9001 accredited and runs its own training academy) and supported by a network solely dedicated to the aerospace supply chain.

During the early years of ALN emphasis was placed primarily on developing the network throughout the EU and Europe not surprisingly as the founding organisations were British, German and French. Once that had been achieved the next key market to look at was Asia with the incredible growth in aerospace in countries such as China, Singapore and Malaysia it became a top priority to have those markets covered, then North America, Middle East followed by Africa.

But how does a company become an ALN partner?

Many organisations apply but few are selected, in the main we look for independent businesses that can demonstrate a culture of customer service, compliance and know-how. Within ALN there are large national organisations, medium and niche sized companies. The size of the organisation is not important but a commitment to excellence is. Within ALN we have organisations such as Time: Matters the express division of Lufthansa, Davies Turner Air Cargo the UKs leading Independent logistics group, Daher the French Industrial Aerospace Manufacturing Group, Central Global Cargo (Germany) a niche aerospace forwarding specialist with decades of expertise in AOG to many of Germany's top aerospace companies. Both Davies Turner and Central Global Cargo are the original founders of the network whilst Daher Group is a shareholder.

Perhaps the most surprising thing about ALN, it is not designed to run for profit but purely for the benefit of its partners and their clients. This gives ALN a lot of credibility as both its partners and their client base can be assured that the sole reason for the existence of ALN is to promote excellence in the Aerospace Supply Chain.

The organisation due to its multi talented and disciplined personnel has the ability to charter an aircraft at short notice, deliver by hand an AOG if required, air freight an aircraft Engine, truck an outsize load, store/move landing gear or many aftermarket parts throughout its network worldwide.

How is the network run day to day?

ALN has a board of Directors elected by the members. Directors stand for a minimum of three years and after this time they can either step down or elect to serve a further term. There are in total 5 directors, two are permanent appointments as they are the co-founders (The Managing Director and the CEO).

All directors provide their time freely and receive no salary from ALN. Additionally there is a full time ALN Agency Relationship Manager employed to administer the smooth day to day running of the network and to work with and support the partners within ALN.

Funding the network comes from the ALN partners. All partners are required to pay an annual fee to participate in

the network, agree to the terms and conditions of membership and code of conduct, and agree to promote the interests of the network in support of its joint client base world wide. ALN has been recognised within the Industry for its commitment to quality and was admitted in 2015 as a Corporate Partner of The Royal Aeronautical Society.

Today the total workforce of the combined partners within the Aviation Logistics Network numbers in excess of 35,000 with a yearly turnover in excess of US$6 Billion per year in logistics and forwarding. This allows shared economies of scale to be achieved within the group which in turn benefits the client base of ALN.

What innovations has the network developed?

Over the past decade ALN has pioneered several different and novel solutions that have addressed specific requirements in the transportation and supply chain. Examples include Flite Cube a foldable and portable engine cradle designed to support P&W 100 series engines that can be used both as a shipping & engineering cradle and when not in use folded for ease of storage. Track and Trace technology with real time tracking of high value assets such as aircraft engines via a device that attaches to the engine in transit and monitors location /shock monitoring /temperature control (Case Track).And a secure AOG portable parts storage solution (Securium) which can provide additional AOG emergency storage solutions via a keyless entry and chip and pin encryption system which gives the logistics provider access only to the specific part required ,this is especially helpful to companies with limited manpower and storage capacity.

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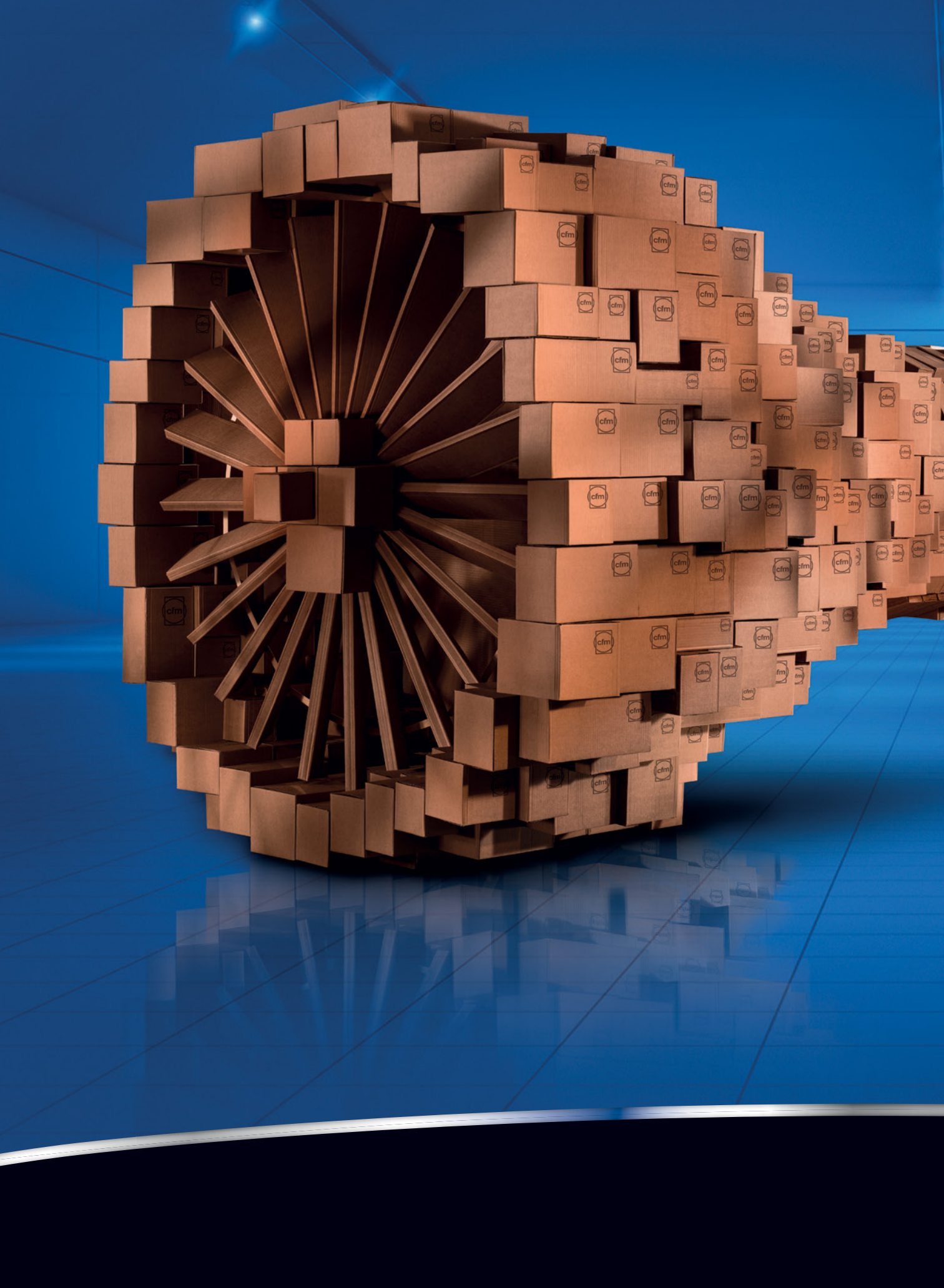

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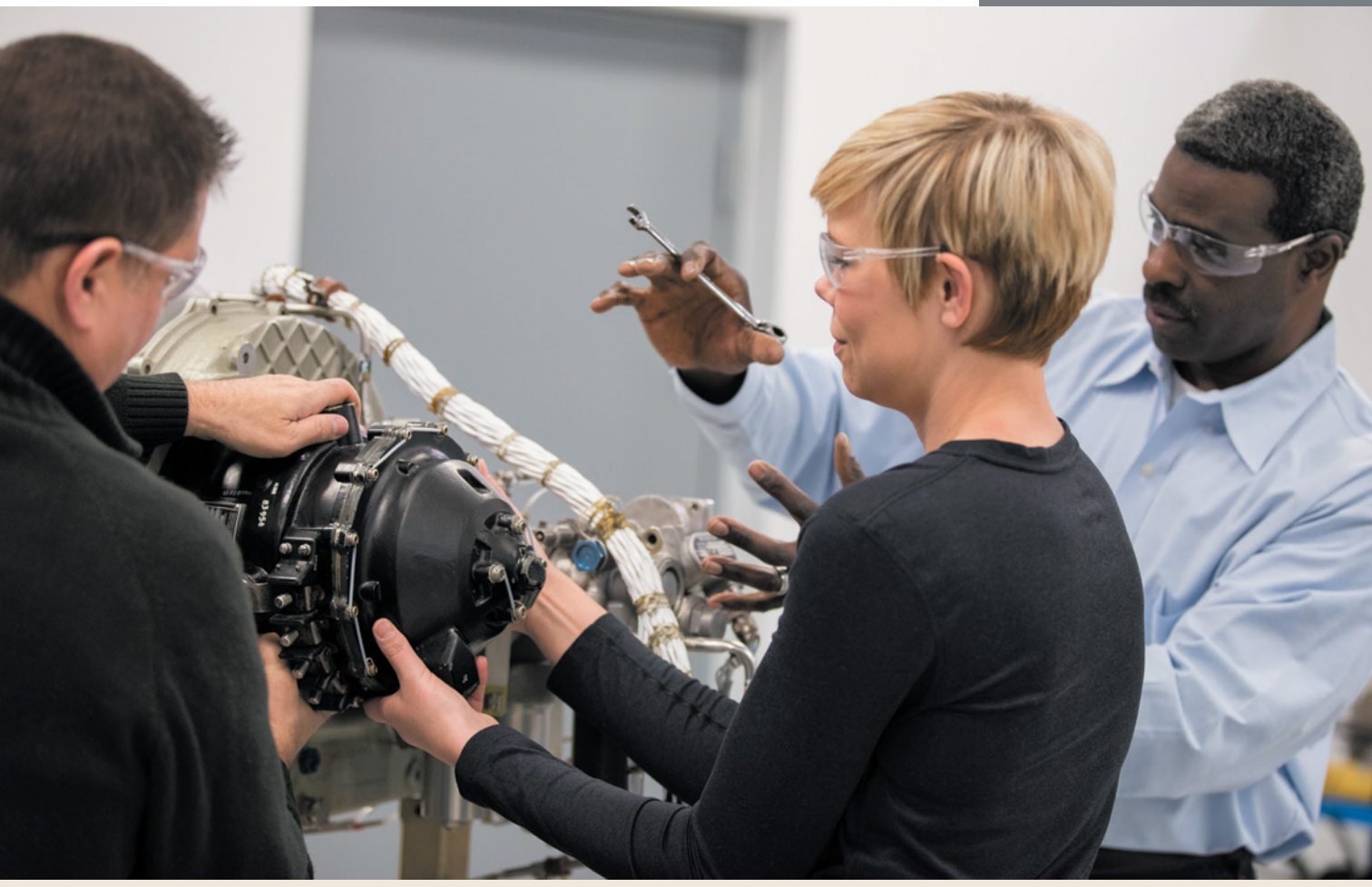

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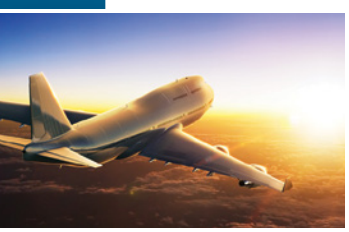

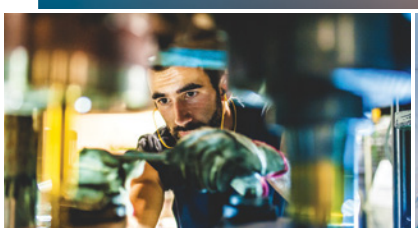
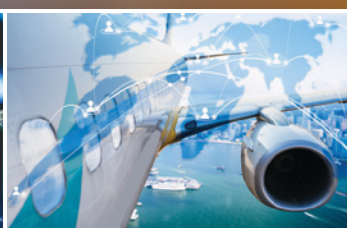

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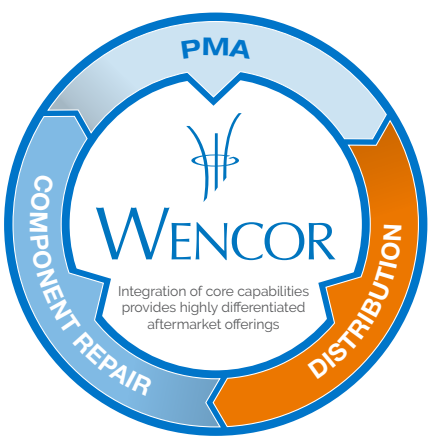

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TIPS FOR CHOOSING AN MRO

By Dale Smith

Whether it's piston, turboprop or jet, fixed- or swing-wing, sooner or later every business aircraft is going to need the care of an experienced maintainer. And like with every other type of service provider, it's best to find the right one long before the work begins.

Duncan Aviation image.

So, what do finding a great restaurant and choosing an MRO for your business aircraft have in common? Probably lot more than you think. Successfully finding either requires a blend of research, referrals and some really good luck.

And, like trying out the latest trendy international cuisine, the task of finding a quality MRO, without the heartburn, is made even more difficult if you are new to the particular aircraft in need of the work. After all, every aircraft is created from a unique recipe.

"If you are new to the particular type of aircraft, then the best first step is to ask around. Find other owner/operators with that same type and see who they use for maintenance," explained Alan Monk, service sales manager for Duncan Aviation, Battle Creek, Michigan. "What you are going to be looking for is a shop that has a great reputation for its skill set, expertise, and knowledge about that type of aircraft."

"It's important for the owner/operator to be looking for a maintenance facility that best suits their needs as it relates to airframe capabilities, training, experience, downtime and their OEM relationships," stated Banyan Air Service's director of MRO services, Charlie Amento. "They have to be able to trust their maintenance facility to provide quality service, on time and as quoted – all with the customer's needs being their top priority."

The Hunt is On

That's all well and good, but the question remains how do you go about finding an MRO that will meet all of your requirements. And, unlike scoping out a new restaurant, it's not as easy as glancing at the latest reviews on Yelp.

As Randy Mengel, vice president and general manager of StandardAero's Maryville, Tennessee facility explained, it's vitally important to take the time to visit the MRO's facility long before you need to schedule the work. Meet with their team. Look at how their facility is laid out. Is it clean and organized?

"The number one thing is to ask questions about their experience with your aircraft and about the skill levels of the technicians who will be working on your aircraft," he said. "Also, ask to see referrals and references for other customers operating the same type of aircraft and then contact those references yourself."

While we're on the subject of asking and answering questions, all of our industry experts said that clear, honest and timely communications is a differentiating factor in the "to whom do I give my business" equation.

"Everyone has their own idea of what 'good communication' is and you need to make sure that the MRO's team is prepared to meet your expectations. Ideally, the MRO will be proactive in telling you about how their ongoing communications are handled,'" Mengel said. "If they're not, then you need to voice your expectations and the MRO needs to live up to them."

"All companies say they are easy to work with but I would want to see examples of how they communicate," Monk said. "All kinds of unforeseen issues can come up during the maintenance event whether it's a discrepancy or an incident or just something that falls outside the work scope – you need open, honest, direct communications throughout the project."

"It's more difficult than it sounds. You need communications and transparency throughout the entire project. I don't hide things from my customers and they don't hide things from me," he said. "Everyone needs to be clear on every issue and you have to be willing to listen and hear each other out when issues arise."

"In my experience, there is rarely, if ever, one supreme correct opinion. You need to be open to working out every situation," Monk said. "That is what I would be looking for if it were my airplane going in for a maintenance event."

Yours, Mine and Ours…

It seems like one gigantic cliché, but you really do want to find an MRO that treats your airplane like it is one of theirs. You really want "white tablecloth" level service.

Our experts all agreed that one way to help assure that you are going to get that kind of attention is to select an MRO that is large enough to have dedicated service representatives – or whatever they call them – assigned to your airplane. One point of contact that is single-mindedly responsible for making you feel like the most important person or airplane in the shop.

"Banyan assigns a service manager as our 'single point of contact' from the beginning of the project to the end," Amento said. "This ensures an open line of communication and helps build a trustworthy relationship with our customers."

"Our MRO is all about partnering with the customer," Don Campion, President of Banyan Air Service stated. "We ask ourselves, 'What would we do if we owned the aircraft?'"

"We share what we believe brings the customer the most value when tasked with an inspection, modification, avionics upgrade or routine maintenance event," he said. "Our goal is to customize our MRO services to enhance the benefit of personal aircraft use and ownership."

"In the end, you are entrusting this organization and it's people with your aircraft and money," Campion said. "Make sure you're comfortable knowing that you will be getting the service you are paying for."

And speaking of money…

A Good Quote

One of the biggest hurdles you'll face during the entire fine-an-MRO-process is getting comparable quotes from multiple. If they're all over the place, you can waste hours trying to figure it all out. You're probably sensing a pattern here, but again, it's up to you to set the rules for what you expect in your quote.

"I would say the first step in getting an accurate quote is to provide the MRO's sales representative, or whomever is doing the quote, with an accurate, well planned and highly

Find out about the shop's experience with your aircraft and about the skill levels of the technicians who will be working on it.

detailed TO-DO list for the event," Monk said. "It's not hard to do. Most owners these days are on some kind of aircraft management program like CAMP and they have maintenance 'Do Lists' that the owner/operator can easily customize to their needs."

Along with the "to-do" list, you also need to include all of the detailed information about the aircraft, its usage – if it's on a Part 135 Certificate, for example – a detailed inventory of all recent maintenance tasks and modifications and whatever you feel is important for the MRO to know about. As long as it's well organized and accurate, an MRO can never have too much information about your airplane.

"The important thing is you need to give the exact same information to every MRO you are shopping so

Take the time to visit an MRO's facility long before you need to schedule work, says Randy Mengel, vice president and general manager of StandardAero. StandardAero image.

they can give you a quote based on consistent information and expectations," he said. "That way nothing is left open for interpretation or guesswork. Good shops never want to be put in the position of having to assume anything – they always get it wrong."

And, it should go without saying, but here goes: If you change any specification or requirement to your to-do list, then make sure you share that will all the MROs involved. Your goal is to keep the proverbial playing field as level as possible.

Another way to approach your quote requests is to ask the shops if they offer "flat-rate" pricing for the particular type of work you need done.

"For many routine type inspections and maintenance needs, there is a lot of risk reduction with that pricing model," Mengel said. "Of course, you have to make sure you fully understand any and all inclusions and exclusions contained in each shop's flat rate price. Their work scopes can vary quite a bit."

Mengel said that among the things you need to ask about are what kind of additional costs fall outside of the flat-rate price? And at what point does a component go "beyond economical repair?"

Also, don't overlook the need to ask the shop about their warranty policy. No two are the same.

"You want the warranty program in writing before you deliver your airplane," Mengel said. "How will they support their work after you take delivery and for how long? Three-, six, nine- or 12 months? How to they handle AOG situations if it's related to the work they did in that timeframe? Don't wait until it's too late to ask."

Some Things Just Won't Add Up

Okay, the quotes are in and you've reviewed them in detail to make sure you fully understand what they include. The only problem is, one of them is way, way lower than the others. And while you may be temped to get that one signed before they realize their mistake, logic says this is not the time for a hasty decision.

"This is when I would ask them how many times they have completed this kind of work on your kind or airplane in the past year or so," Monk said. "They may not have a clue as to the exact amount of work a particular inspection or maintenance task takes on your airplane. Now's the time to reaffirm their level of experience."

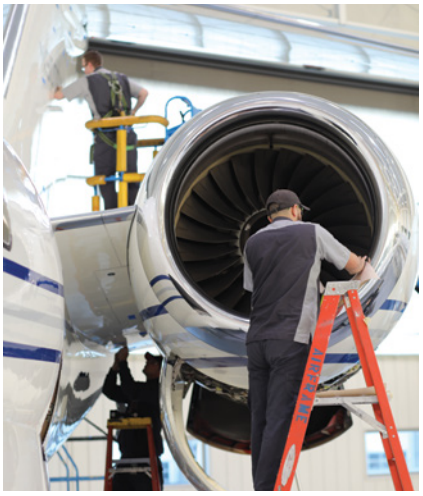
And, like in most things, the lowest quote is rarely the best quote.

"Settling with the least expansive option is often a big mistake," Amento said. "Price is a big factor for most operators, but you should never jeopardize quality and service for a lower price. You have to look at the big picture and factor in all of the securities that come with the more reputable shop."

"When it comes to maintaining a multi-million dollar asset like a business jet, it's not about the lowest price, but which shop will bring you the best overall value? Who has the experience, knowledge, on-site technical representatives and overall customer service that will give you and your owner the best experience?" Monk said.

"Pricing is rarely the most important element in selecting the right shop for your situation – it's more about the overall value they deliver," Mengel said. "Some smaller MROs will provide a 'teaser' rate proposal to the owner just to bring them in the shop. Then hold the aircraft captive with all the add-on charges. It happens."

Banyan Air Service's director of MRO services, Charlie Amento says trust is key when choosing a shop. "They have to be able to trust their maintenance facility to provide quality service, on time and as quoted." Banyan image.



Alan Monk, service sales manager for Duncan Aviation stresses to ask around to find a shop that has a great reputation. Duncan image.

"It's not only about the pricing, but also the right scheduling and support. Remember, no part of an aircraft's maintenance is a solitary event. It's all connected," he said. "The owner, operator or DOM needs to take a holistic view of the entire lifecycle of the MRO visit."

Mengel's mention of scheduling is something operators often tend to overlook. Depending on the aircraft type and level of maintenance being performed, the MRO representatives interviewed for this story are looking at shop space availability anywhere from three- to 12-months down the road.

"Many shops are understaffed, so planning well in advance gives you a better chance of getting the maintenance you need at the shop you want to work with," Monk stated. "Sufficient planning will give the shop time to get all the necessary parts in stock and have room in the hangar so they can get the airplane in and out as efficiently as possible."

"You can't lose sight that the aircraft's owner has their schedules also. They want the airplane when they want the airplane, so good long-range planning and coordination with the owner's and the shop's schedules will help avoid any unpleasant situations," he said. "The closer you are to the date of the needed event, the less likely you are to be able to meet everyone's schedules."

"A very large inspection on a very large cabin aircraft may actually need to be scheduled a year out," Monk said. "The more time the MRO has to plan the work, the better." AVM

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Provisional Cont

	Avionics	CONNECTED aircraft	AEROSPACE testing
			Wedne
9am			JOINT
10.30am			Netwo
11am	**Mandates and Regulatory Framework Updates** Enhanced safety and communications between the aircraft in the sky and the ground control continue to dominate the industry as technology becomes and increasing driver. What's the latest regulations and how are regulators and mandates impacting on the industry? What needs to be installed in the aircraft to meet these mandates and what is the impact on avionics for operators?	**The Connected Aircraft Revolution: Increasing the Benefits of Connectivity** With technology developing at a rapid rate, what do we now mean by the 'Connected Aircraft'? A truly Connected Aircraft becomes a great business enabler and offers airlines and the broader industry great benefits and opportunities. What are these and how can we deliver enhanced services and solutions for a more integrated aerospace world?	**Urban Air Mobility, EVTOLS and UAVs** The concept of Urban Air Mobility is rap but with little in terms of regulations and the impact on the airspace – what do we test for if we have hundreds in the sky? V requirements, how do we appropriately what about acoustic emissions tests, how autorotation, what about detect and avo we discuss some of the requirements and
12.30pm			Delegate Networking Lun
2pm	**CNS** What are the latest developments and trends in Communication, Navigation and Surveillance surveillance and flight tracking to mitigate these possibilities. How can we optimise infrastructure and how can enhanced surveillance contribute towards safety and security? What is safety services approved? How do we make positioning more robust with hybridisation? How do we transition from SES to the next systems using the EASA framework?	**Connectivity, Communications and Technology** For the Connected Aircraft, communications systems are key, but each offer different benefits and solutions. What you can do with satcom, LEO, L and Ku Bands? What type of system is best for different communications such as traffic, ACARS messages, safety services and non-safety services?	**Complex and Embedded Systems** With systems becoming more complex a integration of systems of systems, greate multicore processors, how can we ensure certification integrity? What are the issue GPGPUs with no current regulatory guid we test blockchain authentication to ide In this session we investigate the challen and caliation of complex and embedded
3.30pm			Networking Coffee Brea
4.00pm	**Connectivity, Architecture and Cybersecurity** As the aircraft becomes more integrated and connected, security and safety concerns are becoming heightened. What are the challenges with connected FMS and what are cyber security implications of IMA? How do we ensure safety and security with the increasing use of multicore processors?	**Application and benefits of Connectivity** What are the applications of connectivity and how do these most benefit airlines/operators and the supporting supply chain? Here we explore case studies of connectivity applications.	**High level integration and testing** Where systems are becoming more com we successfully achieve high level testing of systems at multiple levels. How can w integration of COTS components (espec from other industries) for safety and effic the impact on multicore, digital twins an manufacturing, and what role can predic play? How do we employ measures to en security and integrity?
5.30pm			Netv

			Thurs
9am	**Data, usage of data, trends and monitoring** Avionics needs to analyise more and more different types of data rates – data which is difficult to treat with single protocol/architecture, causing major under or over use of bandwidth. How can new services and applications be better supported? What is the Data Value Chain and benefit of data sourcing (collected by airlines)?	**The Impact of the Connected Aircraft on ATM** What services can be expected from ATM and what is the value chain of connectivity? Where can the connected aircraft contribute to the wider chain and how can it impact on other operations within the 4 As?	**Space, High Altitude & EMC Testing** What are the challenges in Space, High A Testing and the impact on testing of criti What are the results of ageing and obso what do we test for single event or mutli How and for what can we test smaller co miniaturised for space?
10.30am			Networking Coffee Brea
11am	**Challenges for Avionics in the Environment** The impact of the aviation industry has been in the spotlight for its adverse impact on the environment, yet huge strides have been made to reduce the environmental impact of aircraft. What are technical capabilities for environmental challenges, how do we decrease emissions and what is the CO2 limitation challenge? What is impact of given technology of environment (at different stages of flight) and what realistic role can can electrical power play?	**Aircraft Data management solutions and Cyber security** As data becomes more prolific and more 'valuable' to an organisation, how do we control this flow of information and who 'owns' the data? As processing data offline becomes more economical, what are data limitations, how do we value data and share just required data and ensure its security?	**Electrification, Aerostructures, Materia** With more new materials in aerostructure are required to successfully test from birt do we standardise testing for 3D printing inks, graphine, ALM for temperature, pre corrossion, reliability, obsolence or robus Electrification brings new power supply i potential problems for avionics. How can develop reliable tests of electrical systen
12.30pm			Delegate Networking Lun
2pm	**Innovations in the Industry** With more research and investment being applied in urban mobility, single pilot operations and autonomous systems, what does the future hold and what part will avionics have to play? How do we develop standards for use of AI and machine learning and what impact will autonomy have on the pilot and passenger?	**Future of Connectivity and Satcom (Funky Future Stuff!)** What could be done in the future with connectivity? With giant leaps in technological development, what is possible, how can AI and machine learning benefit safety and security? What are other industries doing with connectivity that could be applicable to the aerospace industry?	**The Future of Testing** With Machine Learnign and AI the curren future of the aerospace industry, how do designing and testing for automation? H identify what to test and to what standar ensure safety of systems and how to test such as transition from automation to pil versa? In this session we take a look at w of testing holds.
4.00pm			Co

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ference Agenda

	Flight Ops iT	MRO iT	CERTIFIED TRAINING
esday 18th March			
OPENING KEYNOTE			
orking Coffee Break			
idly developing, d understanding e have to What are the test a crash, w to test without oid? In this session d implications.	**The Business Case and Use Case for Flight Ops IT** A well-established use case motivates airlines to investigate new Flight Ops technologies, while the business case quantifies these benefits and encourages investment. This session addresses the 'combined business case'; that is, the importance of partnerships between airline departments in addition to third party providers. An IT support team's role in realising potentials is also addressed.	**Creating a value case – the business proposition – ROI** Significant investment in IT/technology is required to ensure successful digitalisation of systems, often with ROI not immediately visible. How do we create a value case for new mobile application of new systems and to help transform maintenance, increase productivity and efficiencies?	
nch			
and the er use of e testing and es with GPUs and ance? How can ntify corruption? ges in testing d systems.	**EFB Operational Use & Regulations** The Electronic Flight Bag (EFB) has been in operational use for some time, however implementation and use is closely regulated. The regulatory framework is summarised, and benefits analysed via real use cases. Maximising the use of the EFB requires integration of various data sources, and subsequent training for Flight Crews on effective use of these technologies. Explore key considerations here.	**Industry Standards and Regulatory Framework Update** What are the latest regulations for IT in MRO, how does this affect the airline and industry in the future and what do we need to do to comply with the latest standards? What are the problems with legacy systems moving to modern platforms and what are the best approvals processes?	**Introduction to the Emerging & Required DO-326/ED-202-Set: Aviation-Cyber-Security Regulation for Safety** **Optimizing DO-178C/DO-254 Avionics Software & Hardware Development Guidelines**
k			
plex, how to g and testing e test the ially those iency. What's d digital tive maintenance nsure data	**Additional Operational Drivers** When one considers Flight Ops IT, the EFB is a leading factor. Yet there is a wealth of additional benefits on offer other than fuel savings and efficient route planning; process efficiencies and greater operational reliability are recognised here. To define these wider operational drivers, real-time data, weather 'nowcasts', and ground handling / line maintenance efficiences are explored, combined with an appreciation of Flight Ops IT in the overall enhancement of Flight Safety.	**Business modelling and Risk modelling** Technology and data being used for predictive maintenance provides many challenges. Why is predictive maintenance important, but what are the risks involved and how can this affect the business model and supply chain?	
working Reception			
day 19th March			
Altitude & EMC ical components? lence? How and event effects? mponents	**Data – Standardisation, Management and Analysis** An airline's ability to ingest and analyse flight data efficiently, then filter effectively to pilots via a suite of EFB applications is complex but of key importance. Interfacing different applications to communicate and process data is one aspect, while assimilating various data standards, codes and formats from a mixed fleet of aircraft is another. Learn from the experiences of airlines, OEMs and software providers.	**Data, Analytics & Cyber Security** Big data provides the potential to facilitate maintenance planning and predictive maintenance, and the opportunity to optimise decisions, but how do we best achieve this? What role can machine learning and digital twins play? What is our ability to maximise the use of data and how do we ensure data transfer/delivery is secure?	
k			**Model Based Development (MBD) Techniques & DO-331 application for Aviation Software Development: moving from Documents to Models** **Applying the New Mandatory Aviation Systems/Safety Regulations: ARP4754A (with ARP4761/A)** **The Emerging & Required DO-326/ED-202-Set Essentials: The Airworthiness Security Process, Methods & Considerations**
als	**Innovations** Development and progression are vital aspects of technology. Join this session to see what is evolving to benefit flight operations, and what innovations can / will extract additional value for airlines. The capabilities offered by new and emerging aircraft types are discussed, in addition to an exploration of what other industries are doing and how this might inspire aviation's own technological endeavours.	**Technology** As technologies advance at rapid pace, how do airlines best take advantage and ensure technology gets into the production environment? How can we successfully and safely implement newer generations of mobile technology, software in legacy systems and paperless systems? What should the long term digital strategy look like?	
es, new processes th to death. How g, conductive essure, loads, stness? issues, providing n electrification ns?			
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nt buzz for the we approach ow do we rds, how do we t new processes ot and vice what the future	**Joint Panel Discussion: Conflict between Flight Ops and Maintenance – able bedfellows!** How can MRO IT and Flight Ops IT best work together for maximum efficiency and minimise turnaround times? With the advent of paperless aviation, where doe TechLogs, EFBs and CabinLogs converge and how can the supply chain best support the airlines to ensure complex decisions are made easier?		
onference Close			

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HOT PRODUCTS 2019

There are a wide variety of new tools and products out in the marketplace that have been designed to help mechanics and MROs do their work more efficiently, and to keep employees safe and organized. All these products are designed with two things in mind, safety and the bottom line. If, for example, an inflatable igloo-type structure can help mechanics work more quickly, safely and protect them from harsh environments, then it will be worth every penny. If a mister/humidifier can create a better environment for paint facilities by removing dust and fumes, again, it will be worth every penny. If a storage device can help keep track of expensive electronic equipment by storing and tracking them, well you get the idea – it is all going toward the bottom line of profitability. Check out these products and more in our hot product roundup for 2019.


1

Igloo MX

1

21 years ago, Aer Lingus approached marine company JB Roche with a problem. Aer Lingus needed maintenance done on the ramp/apron. But with the wind and rain common to Ireland their work times were long and kept the planes grounded longer necessary. They asked JB Roche to come up with a product to keep mechanics warm and dry. The unique design of the IglooMX was created as a solution. The IglooMX can be erected around the necessary part of the aircraft by two people in less than 15 minutes and is easily heated or cooled depending on the outside climate. The durable material used allows IglooMX to be used for more than 10 years if cared for properly. The hi-tech fabrics were designed to withstand the harshest weather conditions. They protect against the severe cold, intense heat, rain, snow, and dust. Hangar time is expensive. Because the IglooMX structure allows for climate and weather control outside the hanger, it can cut turnaround time on an engine change over from 19 hours to 6.5 hours.

Lighthouse Safety

Falls continue to be at the top of OSHA citations for companies and according to Lighthouse Safety, two workers die each day due to falls. In a fall, in .67 seconds you've traveled seven feet, that is not enough reaction time to grab hold of anything, giving the faller 50/50 chance of surviving a fall 15-30 feet. Fall protection is a must in the hangar. Years ago, a Gulfstream facility required a fall protection system be integrated into their workspace and approached Lighthouse Safety. They have since gone nationwide in the aviation industry with their fall protection products. Lighthouse Safety has been doing engineering, training and installation for fall protection systems for more than 30 years. They engineer systems for any type of hanger, with the option for low trigger heights of 5-7 feet. They have the ability to provide engineered drawings before installation to show full coverage for each specific hanger. These engineered systems help businesses and their facilities meet safety standards set by OSHA and ANSI. Lighthouse Safety also provides post installation training.

Collins Designs Automated Guide Vehicle

Collins Aerospace boasts of a culture of continuous improvement to optimize operations for efficiency and effectiveness and to provide the best service for their customers. They say combining proven processes and procedures with new products have been critical to their success. For example, they have designed an Automated Guide Vehicle (AGV) at their Monroe, N.C. facility. This AGV creates operational efficiency between facility departments by collecting pertinent data to maximize tasks. At their Singapore facility, they say they have reduced total lead time by 3.5 hours by reducing operator walking distance by more than 90 percent by leveraging an Autonomous Intelligent Vehicle. Building on these successes, Collins says they are strategically looking at other areas of automation to better leverage these advanced capabilities and materials planning within their MRO facilities.

Avionics Performance Testing from Factory to Flight Line

The VIAVI (formerly Aeroflex) IFR6000 Transponder Test Set has been the industry standard for more than a decade for transponder and traffic testing. The FAA ADS-B mandate has brought more users and capability to the IFR6000, including an ADS-B auto test with a PASS/FAIL designation. VIAVI recommends using the UC-584 Antenna Coupler to avoid signal interference. Visit our website to learn how VIAVI avionics test solutions can help prepare you for the modernization of airspace. For more information go to https://www.viavisolutions.com/en-us/product-category/test-measurement/avionics-test/ads-b-compliance

Mantec Services Inc. Magnetic Safety Bumpers

5

Recently Mantec Services introduced a line of magnetic safety bumpers. The company says it saw a need and used knowledge from their custom foam safety bumper line to create this new version. The magnetic bumpers feature easy installation and relocation – no screws needed. These bumpers have a durable urea coating for improved damage prevention and additional UV protection and are made from waterproof, closed cell foam. The bumpers come in 24", 36", 48" and 60" lengths. Mantec says the magnetic properties of the bumpers make them easy to install in hard-to-reach places. The powerful magnets used inn these bumpers can cause flux so the company cautions use to avoid using them around devices sensitive to magnetic flux. Mantec also has a full line of safety bumpers that are in use by OEMs, airlines, and MROs. Mantec says they can custom design and manufacture their regular safety bumpers to suit individual needs.

Coolture

6

Coolture was founded after designer Van DiBernardo was diagnosed with multiple sclerosis. Battling with a cumbersome, unattractive cooling vest that he wore to battle heat intolerance, he decided the product could be improved and created his own design. DiBernardo and his team realized that there were many applications for their vests across multiple industries, professions, and consumers. When the body cannot get rid of excess heat, it will store it. As the body continues to store heat, workers begin to lose concentration and may become irritable, sick, or in extreme cases even die. Every year, thousands of workers become ill from occupational heat exposure, leading to heat injury and heat stroke. Cooling the core body eliminates the mental and physical exhaustion that can lead to accidents on the job, while also helping to prevent heat injury. Workers most at risk of heat stress include those who are 60 years of age or older, are overweight, have heart disease or high blood pressure, or take medications that incite heat intolerance. The Coolture classic vest is made from durable, athletic, exterior fabric and has 100% memory recall that uses Outlast "space age" technology, developed for NASA that absorbs and stores body heat. 3M Thinsulate prohibits the sun from affecting the CoolPaks inside the vest. Similar to dry ice, Coolture CoolPaks freeze colder than ice or gel, remain colder longer and weigh less than ice or gel. These versatile vests can be heated to provide warmth in cold climates as well.

Ikeuchi Makes AKIMist "E" Foggers for Use in MRO/Paint Facilities

7

Dust and paint suppression systems and humidification systems like AKIMist "E" are offered by Ikeuchi. These customized solutions can be adapted to a customer's hangar. Ikeuchi takes into account the various influences that have an impact on the solution offered. Sanding and painting in the same hangar can cause issues for MRO paint shops, one of them being dust particles in the air. The AKIMist "E" system sprays small water droplets in the air during and after the sanding process to suppress dust. The water droplets attach themselves to dust particles, and weigh them causing them to fall down to the ground. The water droplets that are sprayed into the air serve as a natural conductor for ions, thereby preventing static charge. These two effects prevent dust particles from sticking to objects. Paint fumes will also be absorbed by the water droplets, cleaning the air in the process. In addition, adding more humidity in the air helps to improve the drying of water-based solvents, Ikeuchi says. Using air and water, pneumatic nozzles can create small-sized droplets. These small droplets will not break; dust will be suppressed without wetting the environment. Precisely engineering the droplet size and distribution creates a uniform fog curtain so the target space will be effectively humidified. Ikeuchi says their systems are easy to install and can be added on to existing HVAC systems.

SupplyPoint Solutions Take Control of Handheld assets

8

Innovative RotoPoint carousels and Clear Front Locker systems by SupplyPoint are designed to ensure t achieve both security and user-friendly access to valuable assets such as handheld scanners and mobile devices, which are becoming more prevalent in the MRO environment. Inventory and asset management is made easy, reliable and cost effective by removing the worry and cost of important devices becoming misplaced or accidentally damaged.

RotoPoint provides a scalable and cost-effective inventory carousel solution for the secure management of a wide range of handheld assets. Running from a standard, single-phase 120V supply, the high capacity of the unit makes the management and control of scanners and mobile devices easy. Available in three sizes offering up to 468 locations with 24/7 availability, the system can be easily reconfigured in line with individual requirements. For instance, every other column divider in RotoPoint is removable, allowing each compartment to be made twice the width to suit larger scanning devices.

Access to each compartment is controlled for maximum security, with all transactions logged to a specific user and cost center, thus providing full and accurate audit and reporting capabilities, SupplyPoint says. The majority of compartments in RotoPoint are hidden from view behind sturdy sliding doors, while contents can be randomly distributed around the carousel, further reducing the risk of unauthorized removal.

SupplyPoint's Clear Front Locker provides an economic inventory access solution. The system is ideal for larger handheld scanners or mobile devices, with each locker consisting of three vertical stacks which can be configured using three, six or nine electronically controlled clear-front cupboards. These functional and intelligent powered cupboards provide recharging and serial/asset tag tracking via scan in/scan out capability.

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AEA Regional-Central	Oct 2-3	Kansas City, MO
MRO Europe	Oct 16-17	London, UK
NBAA	Oct 21-25	Las Vegas, NV
AEA Regional-East	Nov 4-5	Daytona Beach, FL

Aviation Maintenance, FAA, and Designees

By David Schober

For anyone working in the aviation field, it should be no shock that the role FAA plays in our industry has changed over the last several years. The trend started decades ago with the pilot community when FAA no longer provided check rides and written tests, in favor of transferring those activities to persons "Designated" by the Administrator. That practice has evolved to the point where most FAA offices no longer provide services that we (and our customers) have expected in the past and quite frankly have taken for granted as things FAA should be providing. Services like the issuance of Airworthiness Certificates, Ferry Permits, Field Approvals and many others are no longer being provided by the various FAA offices and instead, FAA is referring maintenance providers to Designees for those services.

When it comes to Technical Designees, there are several. The regulatory authority for designations comes from 14 CFR §183. That group of regulations covers all designees, but on the technical side there are Designated Mechanic Examiners (DME), Designated Parachute Rigger Examiners (DPRE), Designated Aircraft Maintenance Inspector (DAMI), Designated Engineering Representative (DER), Designated Manufacturing Inspection Representative (DMIR), Designated Airworthiness Representative (DAR), and Organization Designation Authorization (ODA). For our discussion, we can eliminate the DPRE, as most of us aren't dealing with parachutes, the DME since we pretty much all worked with one of them when we got our A&P certificates, The DAMI since they are only involved with military flying clubs overseas, and the DMIR as they are most often associated with facilities that have Production Certificates and build airplanes. We will also leave out the ODA as these are organizations, and not individuals.

This leaves us with DERs and DARs. As the titles imply, a DER is most commonly associated with Engineering, or more correctly, the approval of engineering documentation, and observing testing to verify engineering analysis, and the DAR is most commonly associated with the issuance of Airworthiness Certificates. As you may have guessed, within the system of designees, there is nothing that is simple! DERs and DARs all have limitations on what they can do, and each has a "Letter of Authorization" (LOA) that outlines what authorizations they have and the types of aircraft they can apply those authorizations to.

The DER

The majority of DERs work on TC and STC type projects. They are the focal point in approving the engineering documentation developed during a project to get an aircraft, engine, or propeller Type Certificated, or to get a specific modification to an aircraft, engine or propeller STCd. A subset of the DERs have what is known as Repair or Alteration Authority. These are the DERs that can help make your life easier. But wait, not all DERs can approve data for all things. DERs are broken up by specialty. These specialties are Structures, Powerplant Installations, Mechanical Equipment, Electrical Equipment, Radios, Engines, Propellers, Flight Analyst, Flight Test Pilot, and Acoustical. These groups are further broken down into subcategories, so it will likely take some research to find the right combination of DERs to provide approval for all the data necessary for a given alteration or repair. Remember, you only need approved data for Major Alteration and Major Repairs, and within the DER handbook (Order 8110.37) DERs are expressly prohibited from providing approval for minor alteration and minor repairs. DERs (in the capacity of DER) only approve data. The data they approve can come from any source. When a DER generates that data, he isn't functioning as a DER, but as an Engineering Consultant. You as a mechanic, or your client can provide the engineering data if you have the expertise to do so.

The DAR

There are two different kinds of DARs, Manufacturing DARs and Maintenance DARs. Unless you are working with an STC project, or another project where things are being produced, it is unlikely you will need a Manufacturing DAR (DARf). Typically, they provide Conformity Inspections and Initial Certifications. Working in the maintenance side of things, it is much more likely that you will have need of a Maintenance DAR (DARt). The maintenance DAR provides what are known as Recurrent Certifications. This can be as simple as replacing a lost Airworthiness Certificate, or as complex as exporting or importing aircraft, engines, propellers, or parts. Certain DARt's have authority to provide Field Approvals just as an FAA Safety Inspector does (Make a notation in Block 3 of the FAA Form 337 approving the data shown in Block 8). Like the DER, all DARs have limitations on what functions they can perform, and those functions are identified in their LOA. These are limited by Function Code (defined in Order 8000.95), and further limited as the specific managing FAA office defines. DARs are limited geographically to their managing office and need special authorization to work "out of district".

Major Repair and Major Alterations

As maintenance providers, your primary contact with Designees will be to support Major Repair and Major Alterations on your client's aircraft. To that end, defining Major Repairs and Major Alterations correctly is paramount. All too often, the mechanic working a project will simply throw up his hands and say "This is a Major Repair, or Major Alteration" without fully researching if it truly is Major! There are several source documents to help make that decision. 14 CFR §1.1, and §43 Appendix A are the starting point. That said, the best two references are AC43-210A and Order 8300.16A. Both of these documents have flow charts that are very similar that will walk you through the decision process of a) is this a Major Alteration / Major Repair, or is it a

Minor Alteration / Minor Repair. It will further define the type of Data that will be required – can it be done with Engineering Data, Field Approval, or will it require an STC. When working through either flow chart, if you answer the questions accurately, many alterations or repairs that you may have thought were major are actually minor and can be done with acceptable data and returned to service with only a log book entry. A good practice to use would be to document your decision logic based on these flow charts in the log book so even if the decisions are questioned, the log entry shows that you did due diligence in making the decision. An additional document to refer to when making the Minor/Major decision and helping to determine the level of certification needed is the AFS-300 Major Repair and Alteration Data Approval Job Aid. This document can be found on the FAA FSIMS web site. Once a repair or Alteration are determined to be Major, the next step is getting the required Approved Data. Order 8300.16 outlines what previously approved data may exist. The AFS-300 Job Aid identifies if a repair or alteration can be done via Field Approval (DAR) or DER approval (DER), or if it will require an STC (Processed through the FAA Aircraft Certification Office).

The next action that require research is the development of a Certification Checklist. AC43-210 provides a brief description of how to do this, but start with the Certification Basis for the aircraft in question. This can be found on the TCDS for the aircraft. Using that Certification Basis, identify every regulation within that Certification Basis that the specific repair or alteration will or may change the way compliance was shown by the original TC holder, and determine how you will show compliance to that regulation with your repair or alteration. If you are using DERs to support the project, that Certification Checklist determines what specialties the DERs will need to complete the project. For all Major Repairs and Major Alterations, the aircraft will need to at least meet the original Certification Basis, and in some cases, may need to meet some more recent regulatory requirements. Keep in mind that you, as a mechanic can perform most of this research, or you can hire a DER or DAR to do the research for your client. If using DER approvals, before you sign block 7 on the 337, it is your responsibility to ensure that all items on the certification checklist have been resolved. Have all the required Approved Data before starting the project. Many aircraft have had alterations started, only to find that the scope of the alteration requires an STC. A typical STC will take over 2 years to complete and could cost in the hundreds of thousands of dollars in engineering and testing. Don't start cutting metal until you have the approved data!

Other DAR Services

Your clients may ask your advice on aircraft purchases and aircraft sales. If any of these transactions involve international transactions, get a DAR involved early! There are specific steps that need to happen in a precise order for these transactions to be successful. It may cost the client some money up front, but could save them significant time and money on the back end of the transaction.

Replacement Airworthiness Certificates are a constant issue. They get lost or mutilated from use. A DAR can issue a replacement Certificate relatively easily.

Many FSDOs will no longer issue Ferry Permits. Clients need to understand that when a DAR issues a Ferry Permit, the DAR has to physically inspect the aircraft. This usually involves travel expenses and time that will be billed to the client. The FAA has the option of issuing a FAX or Email Ferry Permits, the DAR does not have that option. Compounding this is the fact that the DAR (while also being an A&P) is prevented, by policy, from making any necessary repairs to the aircraft prior to determining that it is "safe for the intended flight" so an A&P will likely need to go to where the aircraft is located to make any temporary repairs.

Designees can provide significant technical support in the course of aviation maintenance and client services. Unfortunately, many of those services were viewed as free from the FAA in the past, but Designees earn their living by providing those services. Another advantage of using Designees is the ability to discuss proposed projects without direct interaction with FAA. The Designee is responsible for those FAA interactions, and in many cases can provide guidance on how to satisfy the regulatory requirements that you may not have considered. AVM

David Schober is an A&P, IA and Vintage Aircraft DER. He has been an airline director of training, president of a Part 135 charter operation, DOM of a 145 repair station and is currently working with the Department of Navy supporting their fleet of commercial deriviative aicraft.

The Little Things

By Bob Baron, Ph.D

Every time I teach a Human Factors (HF) course, I always like to talk about the little things. What I mean by the little things is screws, bolts, fasteners and other types of hardware. The things that can probably fit in the palm of your hand and only cost a few dollars. Yet, these little things have caused some big maintenance-related aircraft accidents and incidents:

- One of the most well-known accidents is Continental Express Flight 2574, an Embraer 120 that crashed in Texas in 1991. All 14 onboard were killed. The accident happened because 47 screws were not put back on the horizontal stabilizer after a shift change.

- A de Havilland DHC8, operated by CC Air, lost the number 1 right-hand leading edge on departure from Charlotte, North Carolina. The leading edge panel had been removed for maintenance and the bottom screws had not been reinstalled. The flight crew was able to land the aircraft without further incident.

- A de Havilland DHC8, operated by Jazz Air, had a three-foot piece of the wing leading edge (with the de-ice boot attached) separate from the left wing on the takeoff run. The aircraft returned to the departure airport and landed without further incident. When the leading edge section was examined, it was determined that the 14 screws that secure the leading edge section to the bottom of the wing were missing.

- An aircraft (undisclosed type) had a tailpipe/thrust reverser depart the aircraft, causing substantial damage to the pylon and engine. The investigation revealed that only 4 of 42 bolts holding the tail

pipe assembly were tight. This was due to a lack of documentation during a shift turnover to inform the incoming crew that 38 of the 42 flange bolts that held the assembly to the core were loosened. The examples could go on and on…

What was the common thread in each of these accidents and incidents? The maintenance errors occurred during shift turnovers and they involved the little things (screws and bolts). One does not have to be a rocket scientist to figure out what went wrong. It's very straightforward. The errors boiled down to slack shift turnovers that led to screws and bolts being forgotten about due to a lack of communication. When something gets taken apart, it usually needs to be put back together again the same way, including the screws and bolts that secure the component.

None of the above accidents and incidents would have happened if procedures were being followed. Aircraft maintenance is not based on luck. It's based on documented procedures; procedures that, if not followed, can cause bad things to happen. Forgetting to put back 47 screws on an airplane may not sound like a big deal, but it certainly was for the passengers and crew of Continental Express Flight 2574. They paid for the error with their lives. And even though that particular accident happened a few decades ago, the same problem exists with some shift turnovers to this very day. This is totally unacceptable.

Typically not the fault of a single mechanic, these events are almost always the manifestation of an unhealthy safety culture, with the mechanic simply acting as a trigger puller for upstream organizational pathogens that have been lying dormant in the system for years.

HF training helps to prevent these types of events from occurring, but HF training is not a magic bullet; it's an awareness building tool, and it's still up to each and every single maintenance organization to support the transfer of learning from the classroom to the hangar floor. That means that management must be onboard!

I can teach you all you need to know about HF. But in the end, it's up to your organization to foster a safety culture that will prevent the little things from causing big problems. Take a good look at your shift turnover process. Are procedural deviations becoming the norm? Are shift turnovers too casual, where there's a lack of communication (documented, verbal, or both) between the incoming and outgoing shifts? If you answered yes to one or both of the above, you might be heading for trouble. And that trouble might just be due to the little things. AVM

Dr. Bob Baron is the president and chief consultant of The Aviation Consulting Group, Inc. He conducts training, research, and program implementation in Human Factors, SMS, CRM, and LOSA worldwide. Dr. Baron was an adjunct assistant professor at Embry-Riddle Aeronautical University from 2009-2012. He taught the Graduate Capstone Project and Research Methods for Aviation/Aerospace courses. He was also a full-time faculty member at Everglades University from 2004-2011, where he taught Safety Management and Human Factors courses at the Graduate level. He has also served as a consulting editor for the FAA's International Journal of Applied Aviation Studies (IJAAS) and currently serves on the editorial board for the Journal of Airport Management (JAM) and the Journal of Aviation/Aerospace Education and Research (JAAER). Learn more about Dr. Baron and TACG at www.tacgworldwide.com.

Traceability, Evidence, and Trust in the Aircraft Parts Industry

By Jason Dickstein

This is an article about complying with maintenance regulations. We rely much more on traceability and documentation, today, than we did twenty years ago. But as we rely more on traceability, it is important to reflect on why we rely on traceability, what is the purpose of the traceability, and based on these first two factors, what traceability should be acceptable.

Answering these three questions is an important exercise in identifying the right evidence to use in ascertaining an aircraft article's airworthiness.

It is important to recognize that whether an article is airworthy is a simple binary function. It is or it isn't. If we lose the documentation for the article, then this does not make the article unairworthy; but it may make it more difficult to prove the airworthiness. This simple binary function becomes more complicated when we consider the wide range of evidence used to demonstrate airworthiness. This use of evidence – this reliance on aviation documentation - is really an exercise in abstraction.

There are many areas of study that examine levels of abstraction. Philosophy of Language studies the difference between a word, the denotation of the word and the connotation of the word. Computer science languages are abstractions that translate into machine code written in ones and zeros. Numbers are abstractions that can stand for a quantity of physical objects. Even words are abstractions. The word "computer" used earlier in this paragraph, is an abstraction that denotes the thing you use for accessing online parts databases. We know what the word "computer" means, and we also know that the word cannot be confused with an actual computer.

Aviation mechanics deal with abstractions on a daily basis. When an aviation mechanic installs an aircraft article, that mechanic must ensure that the article installed will return the aircraft to a condition at least equal to original condition. That means the installation has to be airworthy.

It is possible to ensure airworthiness through direct measurement. We can measure the dimensions, metallurgical properties, and other key airworthiness properties of an aircraft article to verify its airworthiness. We can also rely on system elements; for example, we can rely on the fact that a production approval holder is not allowed to release an aircraft article from its quality system unless the article is airworthy. And when we start to rely on system elements – and the traceability associated with those elements, then we begin to engage in an exercise in abstraction, in which we rely on someone else's documentation of a fact, rather than our own direct personal knowledge of that same fact.

How do we know that an aircraft article was released from a quality system? Typically, the installer has not seen the article released from the manufacturer's quality system; instead, we rely on other evidence to demonstrate this fact. This sort of evidence can be based on someone with direct personal knowledge, like a production approval holder's certification, or someone with indirect knowledge, like an air carrier that assured the airworthiness of the article at the time it was received by the carrier.

When we buy dish soap in the store, we typically don't worry about whether it will work; we assume that the dish soap will function as expected. But airworthiness is so important that we have historically asked for evidence to support the allegations of airworthiness for aircraft articles.

The FAA's rules specify a performance standard – namely that the installation must return the product to a condition at least equal to its original or properly altered condition; however, the FAA's regulations do not specify what evidence is sufficient to prove the airworthiness of the article.

We can contrast this with the European aviation safety regulations managed by EASA. Those regulations specify the sort of evidence that must be received: in the European system, most aircraft articles need to be accompanied by an EASA Form 1. Other forms of evidence are thus typically insufficient (but implementations can vary).

In the United States system, there is no hard standard for what evidence is sufficient and what evidence is not sufficient. The FAA's chief counsel's office has made it clear that the evidence of airworthiness can be generated through test and analysis of an article (to make sure it meets the appropriate airworthiness standards) or through reliance on other persons. One source of evidence can be manufacturers. In recent years, the FAA has changed its rules to permit production approval holders (PAHs) to issue the FAA Form 8130-3 as a "birth record" for new articles. This is great for newer articles, but the authority did not exist until recently, and many older articles were not documented at birth with 8130-3 tags.

We can still rely on the regulatory structure that requires the PAH to ensure airworthiness of articles before they are released from the quality assurance system. This means if you buy an aircraft article direct from the PAH, then you know that it was airworthy. And if the chain of commerce suggests that the article was released by the PAH, then this also provides evidence of airworthiness. This can be accomplished using something other than back-to-birth traceability (back-to-birth is, of course, a commercial norm for life-limited parts but is usually not appropriate for other aviation articles).

FAA guidance has also suggested that other forms of PAH evidence may be acceptable to "provide evidence that an article was produced by a manufacturer holding an FAA-approved manufacturing process." This includes PAH documents such as shipping tickets and invoices. It also includes unregulated PAH markings, like standard inspection stamps. The industry has also relied on commercial features like PAH packaging to provide evidence of source.

Aviation has a tradition of relying on evidence to demonstrate airworthiness, and a corollary tradition of relying on trusted sources, like certificate holders, to provide that evidence. This has meant that we rely on the accuracy of statements

from certificate holders to support our airworthiness findings. This evidence can come from manufacturers, from repair stations, and even from air carriers. As certificate holders, we trust their statements. So, if an air carrier surpluses an article, and provides evidence that the article is new, and was produced by a particular PAH, then we have a tradition of trusting that evidence. This evidence has often taken the form of a statement from the air carrier, like a packing list identifying the identity and condition of the articles in a surplus lot. The industry's trust is based, in article, on the fact that the government typically approves the air carrier's receiving inspection system (the FAA has an entire advisory circular explaining what the system should look like).

How important is trust to our industry? It is so important the we reserve the most stringent punishments for those who violate that trust.

Falsehoods have traditionally reflected a disqualification to hold an FAA certificate. Even if this was not evident from case law, I would know it because Judge Geraghty of the NTSB administrative law court would remind me of this during our encounters – he always felt it important to remind the industry that inaccuracy and falsehood are the most terrible of sins in the aviation world. When I was a young lawyer, the Judge would explain to me that the FAA relies on documentation to perform its oversight functions. If that documentation is not accurate, or is misrepresented, then this undermines the essence of the FAA's oversight role.

Violating this trust through fraud or misrepresentation yields severe penalties. It can lead to a lifetime ban from the industry, and criminal penalties can range from 15 years for merely misrepresenting the quality of an aircraft article to life in prison if that same article malfunctions.

Our aircraft articles system is based on this sort of trust. We trust that FAA-approved manufacturers will produce airworthy articles. In the United States, this trust is based on the FAA's approval of the design (which verifies that the design meets FAA safety standards), and the correlative FAA approval of the production system (which verifies that the production quality system is sufficient to ensure that articles produced under the system will meet the FAA-approved design). We trust that certificate holders will provide accurate statements about the articles that were received into their systems.

Over the past twenty years, the distributor accreditation system has infused an added element of trust into the system. Accredited distributors typically pass along necessary elements of the evidence that they receive to the next partner in the chain of commerce; they also retain all received documents in their system in order to maintain the audit trail. Although traditionally the accredited distributor has not make airworthiness determinations, the FAA has started to nominate FAA designated airworthiness representatives (DARs) who are able to work in an accreditation environment, review the information, and issue an 8130-3 tag on behalf of the FAA when the evidence is sufficient to show that the article is airworthy

The system for confirming the airworthiness of aircraft articles at the time of installation remains an evidence-based system. Sources like the FAA's accreditation advisory circular provide guidance about what sort of evidence may be acceptable, but ultimately the installer must decide what sort of evidence is credible.

Next time you look at a traceability document, think about who you are trusting and why. AVM

Disclosure: Jason Dickstein is the General Counsel of the Aviation Suppliers Association, and was a member of the EASA rulemaking committee described in this article.

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