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Military Maintainers

Has the Mechanic Shortage Reached the Services?

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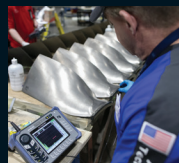
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June / July 2018

EURO MRO
THE FIRST OF A
TWO-PART LOOK AT
EUROPEAN MROS



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SWA 1380 FOCUSED
THE INDUSTRY ON
INSPECTION TECH



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TO SAFE FLIGHT





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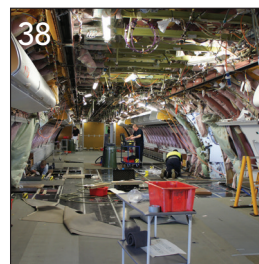
Military Maintainers

Is the military experiencing a shortage of aircraft maintenance personnel? We asked the Air Force, Navy and Army. Find out what they had to say in this feature by Dale Smith.

On the cover: Airman 1st Class Juan Melendez, 660th Aircraft Maintenance Squadron, opens up a service panel to access a KC-10 Extender aircraft engine at Travis Air Force Base, Calif. The 660th AMXS is responsible for the safety and reliability of the fleet. *US Air Force photo by Heide Couch.*



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Hoping for More Hackathons

BY JOY FINNEGAN
EDITOR-IN-CHIEF



We are in a time of great change, in the world and in our industry. Tempting though it may be, I'll not talk about all the changes in the world and stick to our industry. We are in a transition period between the old way and the new way. It is an exciting time. And we have to pick up the ball and run.

I'm of course talking about the digitization of aircraft, connectivity including Ka- or Ku-band, inflight entertainment, Big Data, trend monitoring, predictive maintenance, training and even electronic signatures and documentation and how all of that is impacting aviation maintenance. The technology that we have at our finger tips today would astound Charles Taylor and his colleagues, the Wright Brothers.

In addition to the miracle of flight that allows passengers to "sit in a chair in a metal tube hurtling through the atmosphere," incredible advances also allow us to communicate with that aircraft and those passengers in numerous ways. Work and entertainment happens as a matter of course aboard those aircraft in the passenger cabin with Internet access, live TV, multiple movie options, games and more. And when denied those luxuries passengers often feel inconvenienced. Up in the cockpit we have navigation systems, ACARS, and sensors throughout the aircraft offering condition monitoring, if not in real time yet, it will be coming soon.

But more than simply nav and IFE, aircraft today are virtual flying computers. We have covered and talked about these technologies here for years, but the time is now. We need to leverage those technologies right now, as quickly as possible. There is no time to waste anymore wondering if all this is good or bad, necessary or not, overkill or too expensive. Technology has spoken – it is ready. We must now embrace it. Like it or not, aircraft today have the ability to produce half a terabyte of data every flight. Now we must leverage that to the good.

In the long run, these technologies are going to improve safety and save operators money. Aircraft operation and maintenance go hand in hand. This technology and the data it produces are going to improve safety and reduce operational costs, especially for maintenance. We have to start planning for the day when aircraft maintenance consists of a simple software download (it is happening in many systems already).

As we move towards this all-connected world, monitoring aircraft systems will provide real-time data so time is not wasted on multiple physical and visual checks by teams of people. One person looking at data will determine whether the brakes need to be changed or whether those brakes are wearing evenly, saving time and money. This type of monitoring will allow for better planning and staging of parts

at crucial times and locations.

Yes, we will always need sheet metal workers and those who can tear down an engine and put it back together, but going forward, we also need to acknowledge that there will be less of that and more software downloads, debugging computer systems, coding and the like.

Training must keep pace. We need to integrate these types of technologies into the training of our new generation of maintainers. Perhaps adding that kind of training would help to entice young, tech savvy minds into our field of work. Take a look at the hackathon story on page 10 of our Intelligence section. WestJet held the event, "a sprint-like event that computer programmers and software developers used to collaborate and create solutions" in their hangar. We need more of this type of creative, thought-provoking training and challenges in our world.


We need to keep pushing ahead and demanding the type of training our industry needs to keep pace with technology. Maybe a third rating is called for that covers connectivity, computer systems and data as they relate to aircraft maintenance, in addition to Airframe and Powerplant certificates.

We have some great stories this month to help you keep up with the happenings in our business. First, our cover story, page 30, addresses the military maintenance world's need to find and retain mechanics to help maintain the safety and security of our world. Find out if they are having the same challenges as the civilian world in finding the next generation of aircraft mechanics.

We take a look, as we do every year at the MRO market in Europe. The area is thriving and growing so much we had to break our story into two parts. In this issue we start with a look at Eastern Europe and that story starts on page 16.

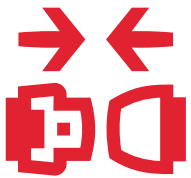
After the Southwest Airlines uncontained engine failure and subsequent inspections, we thought it would be a good time to look at non-destructive inspection technologies such as borescopes, eddy current, ultrasonic, liquid penetrant dye and magnetic particle tests, to see what developments are happening there. That piece starts on page 22.

We also have some interesting info on wiring on page 38 and grease on page 40. Finally, Jason Dickstein addresses electronics records and signatures, a bane of our industry for years, in his Legal Spin column. He offers clear guidance on use of these technologies and the background on why it is such a hard mountain to climb on page 41.

Enjoy your summer everyone – hope to see you at hackathon soon! 



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Gulfstream Enhances Employee On-the-Job Training Lab



Gulfstream Aerospace has added a G600 fuselage, main door and wing as well as a G650 fuselage, door, interior and wing to their hands-on lab to help the continuing education experience of their technicians. Gulfstream Aerospace image.

Gulfstream Aerospace recently enhanced its On-the-Job Training (OJT) Laboratory with two additional aircraft structures: an all-new Gulfstream G600 fuselage, main entry door and wing and a Gulfstream G650 fuselage, door, interior and wing. The additions are aimed at ensuring Gulfstream technicians continue to provide aircraft owners and operators with a first-rate service experience, the company says.

"The structured, hands-on OJT Lab has educated more than 500 of our new technicians in the longstanding Gulfstream tradition of providing customized, technically proficient service that exceeds customer expectations," said Derek Zimmerman, president, Gulfstream Customer Support. "The ability to get hands-on training for the newest and most popular aircraft in

our fleet in a realistic yet controlled environment elevates our technicians' understanding of our product line and ensures they continue to hone their skills and practice new techniques."

The OJT Lab, created in March 2016, comprises 16,000 square feet/1,486 square meters of dedicated space in Gulfstream's Technical Training Center (TTC). Along with the G650 and G600, the lab houses a Gulfstream GV with functional landing gear. The aircraft are used to train new employees in several areas, including panel removal, sheet metal work, leading edge removal/servicing and proper maintenance documentation, while giving established technicians the opportunity to sharpen existing skills or learn new ones, such as window sealing and G650 main entry door rigging.

EASA Certifies Robertson/StandardAero Retrofittable Crash-Resistant Fuel Tank



European Aviation Safety Agency (EASA) has approved certification for StandardAero's retrofitable crash-resistant fuel tank (CRFT) system for the Airbus Helicopters AS350 and EC130 family of light single helicopters. The newly approved CRFT was developed in partnership with Robertson Fuel Systems.

StandardAero achieved Federal Aviation Administration (FAA) certification in early December 2017 and has since begun delivery of CRFT kits to its customers, including launch customers, Air Methods and WeatherTech Aviation. Successful installation of 11 crash-resistant fuel tank retrofits had been completed in the U. S. by February of this year. Since FAA certification, StandardAero has delivered 40



CRFT kits to its customers and has been actively engaged with several fleet operators interested in enhancing their fleet with this new technology.

"Our industry as a whole is keenly focused on making safety enhancements a reality, and StandardAero is proud to not only be at the forefront of this critical initiative, but to now be able to deliver this life-saving equipment to European operators as well," said Rick Stine, president of StandardAero Components, Helicopters & Accessories.

The CRFT is designed as a direct replacement for legacy AS350 models, including the AS350 D, AS350 B/B1/B2/BA/B3 and AS350 B3e (H125), as well as for the EC130 B4. The kit solution is field replaceable, with installation and technical support provided by StandardAero. The tank's design features a crash-resistant fuel bladder with slightly greater capacity than the legacy fuel cell, and introduces magnetic field sensor fuel gauging technology, a recessed sump drain valve, quick-change cartridge fuel pump design and vent system roll-over protection. The CRFT is compliant with the latest FAR Part 27.952 fuel system crash resistance requirements and is the only approved retrofitable solution that is compatible with use in combination with the manufacturer's cargo swing and other cargo swing solutions, according to StandardAero.

Liebherr Uses Trade Show to Highlight Careers Workshop



Visitors at the ILA Berlin Air Show got to learn about careers in aviation maintenance and manufacturing with Liebherr-Aerospace. The company highlighted these opportunities during the Career Workshop organized by the German Aerospace Industries Association (BDL). An Airbus A350 nose landing gear, more than four meters high showed the way to the Liebherr booth, where visitors had the chance to inform themselves about career and training opportunities and ask the Liebherr human resources team questions about potential jobs and careers. *Liebherr images.*

about people

Rankin Takes Helm at West Star

Jim Rankin was named CEO of West Star Aviation recently. Bob Rasberry has been named chairman of the Board, and Rodger Renaud will remain president and COO.



Helm

Rankin began his career in aviation as a pilot flying for Midwest Airlines accruing over 11,000 flight hours. He was president & CEO at Air Wisconsin Airlines and most recently, he was the president & CEO of Oregon-based Columbia Helicopters. He will be located at the East Alton (ALN), IL, facility.

Duncan Adds Kelly and Perry to Roster

Tim Kelly has landed a new position as Regional Avionics sales manager. Kelly has more than 30 years of aviation starting his aviation career in the United States Navy and then worked for Bendix-King/AlliedSignal Aerospace and Honeywell.



Kelly

Kelly also recently completed a nine-year term on the Aircraft Electronics Association (AEA) Board.

Mina Perry has also joined the company in their Human Resources team, working out of the Provo office. Perry will be responsible for making contact with future employees, preparing their paperwork, setting up orientation, and many other various tasks that pertain to human resources and team member services.

Million Air Hires New GM

Lauren Rones Payne has been named general manager of Million Air White Plains at Westchester County Airport. She comes to Million Air from the luxury fashion industry, most recently as general brand manager for Gucci. "Lauren's work with high-end clientele and her familiarity with Westchester and the surrounding area made her the perfect fit for the position," said Roger Woolsey, CEO of Million Air.

about people

FSI Names Zarate Interim President of Services Division



Zarate

FlightSafety Int'l. has named Hector Zarate interim president of FlightSafety Services Corp. He replaces Ron Ladhier who will retire at the end of June. Zarate assumes responsibility for all operations of FlightSafety Services which provides military aircrew training, advanced technology training devices, support for computer-based workstations and support for simulators at 15 U.S. military bases. Programs include the KC-46 ATS, T38 CLS, KC-10 ATS, HC-130P and MV-22/V-22 Osprey CLS.

West Star Adds Schroeder to Sales

West Star Aviation added Keith Schroeder as regional sales manager (RSM) for West Star Aviation. Schroeder will be responsible for the company's Midwest territory which includes Illinois, Missouri, Wisconsin, Minnesota, Iowa, Kansas, North Dakota, South Dakota, Nebraska and Manitoba Canada.

Cutter Promotes Wilson to Director



Wilson

Mark Wilson was promoted to a newly created position of Pilatus Program director at Cutter Aviation. Wilson will direct all business for their new Pilatus Center which is comprised of repair stations, Pilatus satellite centers, Pilatus fleet operators, and Pilatus wholesale parts and warranty support within the Southern California, Arizona, New Mexico, Texas, and Colorado Pilatus territory. CEO of Cutter Aviation.

Elliott Hires Husa as Sales Manager

Elliott Aviation has hired Brian Husa as regional sales manager. He brings nearly 30 years of aviation experience to the company including executive sales, technical sales and client service. Husa will be responsible for executing regional sales strategies in the Midwest region.

CIRCOR Aerospace & Defense California Receives AS9100 Rev D Certification

CIRCOR Aerospace announced that its Aerospace & Defense California business has been awarded ISO 9001:2015 + AS9100 D certification by its registration partner, SAI Global.

CIRCOR Aerospace & Defense California previously had been awarded AS9100 Rev C. Rev D includes a concentration on product safety, counterfeit parts, the human component in risk management and a leadership focus on customers and quality.

"Achieving ISO 9001:2015 + AS9100 D demonstrates our commitment to quality, customer satisfaction and compliance, as well as the effectiveness of the CIRCOR Operating System and Continuous Improvement culture," said Scott Kite, CIRCOR Aerospace & Defense Corona Site quality manager.

"We would like to thank the entire team for their dedication and enthusiasm to take the business to the next level," said Corona site leader, Terry Manders. "This new certification is a tangible result of CIRCOR's mission to drive commitment and accountability throughout all levels of the organization."



Barfield To Distribute Falgayras Components in the US

Barfield, the U. S. bridgehead of AFI KLM E&M's global MRO network, has signed a regional distribution agreement with Falgayras, a mechanical, electrical and electronics engineering OEM located in the aviation cluster around Toulouse in southern France. This is an exclusive multi-year agreement involving a selection of Falgayras products, and in particular windscreen wiper systems (wiper arms, blades and motors) fitted as original equipment to many Bombardier CSeries and Mitsubishi MRJ family aircraft, as well as Airbus Helicopter helicopters.

This latest partnership strengthens Barfield's growth strategy in the area of aircraft component distribution – one of the company's three businesses along with maintenance services and the supply of Ground Support Test Equipment (GSTE). Barfield already markets a wide range of aircraft parts in the Americas under partnerships with OEMs, including Stelia, Airbus EAP, and Siemens Elta.

Aircraft Maintenance Outsourcing Act Introduced

Senator Claire McCaskill (D-MO) and Representatives John Garamendi (D-CA) and Dan Donovan (R-NY) introduced the Aircraft Maintenance Outsourcing Disclosure Act of 2018 (H.R. 6028 S. 3026) earlier in June.

This bipartisan legislation requires public reporting of U.S. airline maintenance practices. The Transport Workers Union of America (TWU) endorsed the bill.

This bill would allow air travelers to know the location where heavy maintenance was performed, prior to purchasing their airfare. The bill would require airlines to list on their websites the cities and countries in which their aircraft undergo heavy maintenance. That same information also would be provided to consumers as they shop for flights, as well as on ticket confirmation and boarding passes.

"The American public deserves truth when flying. When deciding which airline to fly or which flight to buy, it shouldn't be a privilege to know where airlines are maintaining their aircraft," said John Samuelsen, TWU International president. "This legislation allows the flying public to make informed purchasing decisions, while supporting regulators' efforts to ensure all aircraft maintenance work is held to a uniform high standard of safety and security."

A series of Inspector General reports and a recent study from former-DHS Secretary Tom Ridge's firm assert that foreign repair shops servicing U. S. aircraft are not held to the same level of scrutiny or standards as American shops. "Before someone buys a ticket or boards their flight, they ought to know when and where that plane was last serviced—and whether it was done here in this country by the finest mechanics in the world, or done abroad by foreign workers," McCaskill said. "This is a commonsense step to give consumers some peace of mind."

"We look forward to working these lawmakers to turn the Aircraft Maintenance Outsourcing Disclosure Act of 2018 into law," Samuelsen said.



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A handwritten signature in white ink that reads "Johann C. Bordais".

Johann C. Bordais
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IAI appoints new CEO for IAI North America



Israel Aerospace Industries (IAI) has named Swami Iyer as CEO of IAI North America, its U. S. subsidiary. Iyer will be responsible for all IAI operations in North America, including its subsidiaries Stark and ELTA North America.

"The US represents 75 percent of the global defense market for IAI. We plan to focus and grow within this market," Harel Locker, IAI's Chairman of the Board said. "I welcome Swami Iyer as the new CEO of IAI North America. Mr. Iyer has a wealth of experience, professional, business and managerial capabilities. I am confident he will succeed in unlocking the potential available to IAI in the US market."

VSE Aviation Singapore Appoints BendixKing Asia Pacific Distributor

VSE Aviation Singapore has been appointed as a BendixKing Distributor for the Asia Pacific region to supply avionics, flight controls, display units and installation kits. VAI operations maintains inventory for immediate shipment from its Singapore warehouse including communication and navigation units, audio control units, transponders, GPS receivers, installation kits and much more.

"We're pleased to add BendixKing products to our distribution portfolio in Singapore," commented Paul Goffredi, president and COO of VSE Aviation. "The Asia Pacific region is rapidly expanding its use of business and general aviation aircraft so this appointment is very timely. The BendixKing product line enhances the growth strategy we have implemented both for VSE Aviation and the Asia Pacific region," continued Goffredi.

WestJet Holds Hackathon



More than 100 members of the tech industry from 17 companies came to Calgary for WestJet's inaugural #hackinthehangar Challenge. Teams were challenged to create and build world-class digital solutions focused on WestJet's premium and global travelers.

The #hackinthehangar is focused on building digital solutions in a collaborative and fun environment, in a unique venue at a much greater velocity than ever before," said Alfredo C. Tan, WestJet's chief digital and innovation officer. "This hackathon is an exciting step towards helping us think, move and act more like a tech company in some key parts of our business. This will help position WestJet as an industry leader in transforming the guest experience. Bringing this level of creative talent from some of the most innovative companies in the world to Calgary at this scale is incredibly unique. We're looking forward to seeing what some of the brightest minds in tech combined with our passionate employees and guests can create when given the opportunity to rise to the challenge and work together to win."

Attendees flew in to participate in the first-ever #hackinthehangar. They came from across North America and included teams from Adobe, Amazon, Deloitte Digital, Facebook, Google, Hootsuite, Huge Inc., IBM, LinkedIn, Media Experts/IPG, Microsoft, Panasonic Avionics, Sabre, Salesforce, ServiceNow, Snapchat and Twitter. Each team was complemented by two WestJet employees and a premium guest traveler.

The hackathon concept, made popular in Silicon Valley, is a sprint-like event that computer programmers and software developers use to collaborate and create solutions in a short amount of time. Now inclusive of all areas of business, they also serve to create a fun and collaborative environment for people to come together to try out new ideas and build prototypes at a greater velocity than normal. Hackathons are about approaching things with a philosophy around continuous improvement with no finish line. This type of thinking is embedded deep in the culture of companies like Facebook, Instagram, Amazon, Adobe and Google.

WestJet says its goal is to drive towards becoming a global airline with the introduction of their Boeiong 787-9 Dreamliner. The company will operate an average of 777 daily flights to 90 destinations. The airline recently made its first foray to the European mainland by launching daily direct flights between Halifax Stanfield International Airport (YHZ) and Paris' Charles de Gaulle Airport (CDG) last month.

WestJet's inaugural Hackathon happened on Monday, June 18 at their Russ White Hangar.



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Romanian Carrier Just Us Air Chooses Commssoft OASES Software

Just Us Air, a recently established private airline based in Romania, has become the latest member of the OASES user community.

Having recently received its Air Operator Certificate (AOC) from the Romanian civil aviation authority - Autoritatea Aeronautica Civila Romana (AACR) - Just Us Air has now commenced passenger charter flights from its base at Bucharest Baneasa airport. The airline operates an Airbus A319-100 available on a full charter, wet lease or ACMI basis and will shortly be adding a maiden A321-231. Just Us Air is promoting its services to tour operators, air transport brokers and other airlines.

Just Us Air has opted for the Core, Airworthiness and Planning with options on future access to the Materials and Line Maintenance Control modules of the OASES system. OASES has already been rapidly implemented for the A319 by Commssoft's Bucharest-based implementation specialists working closely with Just Us Air staff, accessing the system through Commssoft's Private Cloud service, avoiding the need for the airline to install additional hardware.

"Just Us Air will be our fourth Romanian customer - further evidence of the global success of OASES. As expected, the implementation process went quickly and smoothly, supported by the local Commssoft team," said Nick Godwin, Commssoft's managing director.

"For us, it was critical to select a reliable partner that could aid our rapid start up with personalised support. Commssoft, with its local implementation team, provided that," Mircea Mitch Mecu, technical director at Just Us Air, added.

Parini Honored as One of "29 Who Shine" in Massachusetts 2018

Erica Parini of Sandwich, Mass., one of the first graduates from the Cape Cod Community College (CCCC) Aviation Maintenance Technology program has been named one of the best of the best in Massachusetts' Public Higher Education, one of the "29 Who Shine" for 2018, and was honored in ceremonies at the State House in May.



She received her Associate of Applied Science degree in Aviation Maintenance during CCCC's Commencement Ceremonies in May as well.

John Cox, CCCC president, and Aviation Maintenance Technology faculty member Robert Nelson joined in praising Parini at the Commonwealth's annual event that recognizes graduates from each Massachusetts higher education campus. Governor Charlie Baker, education leaders, and legislators, gathered with faculty, students and families at the base of the Grand Staircase at the Massachusetts State House for the afternoon ceremonies.

"I am extremely proud to see Erica's academic as well as technical program excellence recognized, along with her strong leadership ability and links within her discipline and industry. She completed a very intense airframe and power plant educational and training program with straight "A's" and will complete her Associate of Applied Science Degree with the same outstanding academic achievement. She is an excellent example of the best within Massachusetts Higher Education," noted President Cox in comments about the recognition.

Parini recognized her mentor, AMT Program faculty member Robert "Bob" Nelson, saying, "He has always had every ounce of confidence that I will do nothing but the best. He has always pushed me to do more, and better, and not doubt myself... Bob, with his wealth of knowledge, experience, his passion and devotion to teach, and his advice, and his connections, it is apparent as a student, Bob puts his heart and aviation soul into giving us all the information he can to help us along the way."

Parini was selected from among a number of outstanding CCCC nominees, based on very specific criteria established by the Massachusetts Department of Higher Education.

TACG Offers Human Factors Train-the-Trainer Course for Aircraft Maintenance

The Aviation Consulting Group (TACG) will be holding a Human Factors Train-the-Trainer Course for Aircraft Maintenance in Myrtle Beach, S. C. in August. The forty-hour, five-day course is designed for company employees who will be responsible for developing and teaching human factors courses. The course will run August 13-17, 2018.

TACG says the course covers an introduction to human factors, "The Dirty Dozen", safety culture, communication, facilitation techniques and adult learning principles, as well as various case studies and exercises. Classes are conducted 8am to 5pm daily. Also included are course book and a certificate of training. For more information go to www.tacgworldwide.com.

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OEMServices and Whippany Actuation Systems Partner

OEMServices will operate component aftermarket services for Whippany Actuation Systems' operators in the Middle East, Africa and Russia.

The component services provided by OEMServices include a one-stop shop through its worldwide service centers for repair needs and a 24/7 AOG desk and hotline answering operators' needs within an hour. OEMServices says its expertise will ensure that the adequate solutions are immediately provided to optimize repair turn-around times and minimize operational interruptions.

"Whippany is excited for the new opportunities that the partnership with OEMServices brings. OEMServices' global outreach will help bring Whippany closer to operators and strengthen our pursuit to maintain the high reliability our products have become known for," said Erik Schwind, Business Development manager, Whippany Actuation Systems.

"We are proud of this new partnership with Whippany Actuation Systems. Extending our customer portfolio in the Americas has been a real priority for OEMServices. This new contract reaffirms our ability to offer customer proximity and quality service to companies worldwide," said Didier Granger, president of OEMServices

Airbus and THAI Sign MRO Joint Venture

Airbus and Thai Airways International (THAI) have signed an agreement to establish a new joint venture maintenance and overhaul (MRO) facility at U-Tapao International Airport near Bangkok.

The accord was signed at Airbus headquarters in Toulouse in June by Usanee Sangsingkeo, acting president, THAI; and Eric Schulz, chief commercial officer, Airbus, in the presence of Prayut Chan-o-cha, Prime Minister of Thailand and Guillaume Faury, president Airbus Commercial Aircraft.

The new MRO will be one of the most modern and extensive in the Asia-Pacific region, offering heavy maintenance and line services for all widebody aircraft types. The facility will feature the latest digital technologies as well as advanced inspection techniques, Airbus says.

JetBlue Founder Neeleman Reportedly to Start New Airline Called Moxy



JetBlue founder David Neeleman is reportedly launching a new airline possibly to be called Moxy. The airline is said to be based on the low-cost carrier model similar to JetBlue and less like Spirit Airlines, and will operate the Bombardier C-series aircraft. Reports say the preliminary order is for 60 Bombardier CS300s.

The start-up would begin service in 2020 with a goal of using secondary airports at the major cities. Start-up

funds are being raised now. According to Airline Weekly, the funds are coming from several sources including the former Air Canada CEO Robert Milton, the former ILFC CEO Henri Courpron, and Neeleman's own fortune.

Scott Group Releases New Luxury Carpet Collection for Aircraft/Yacht/Home

Luxury carpet company Scott Group Studio has just released their latest luxury aviation and yachting carpet collection, Turas. The company says the collection was inspired by the Irish word for journey. The collection's designs were inspired by cultural travel and movement such as ancient symbols, irregular cracks in glaciers, and the ocean's currents. These ideas were incorporated into the designs.

The collection is a part of the brand's Scott Group Custom Carpets division of all hand-tufted rugs, made in America at their factory in Grand Rapids, Michigan. Each design is comprised of a silk and wool blend, and can be customized to interior cabin furnishings of any style and scale.

Scott Group says they will be making many of their carpets like the ones from the Turas collection capable of working for both residential design and aviation/yachting. Theoretically the same rug could be in a home and in the client's private transportation such as aircraft or yacht.



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Pentastar and the Bell's Beer Bayview Mackinac Race Extend Partnership

Pentastar Aviation has extended its partnership with the Bell's Beer Bayview Mackinac Race for 2018. Pentastar has been a sponsor of the race since 2015. The world's longest consecutively run freshwater race, organized by the century-old Bayview Yacht Club, is in its 94th running.

"We cherish the partnership between Pentastar Aviation and Bell's Beer Bayview Mackinac Race," said Gary Shoemaker, 2018 Bell's Beer Bayview Mackinac Race Chair. "The top-quality sailing we have on the waters is the same top-notch quality that Pentastar Aviation has in the air. Taking a jet charter to the island would provide quite the spectacular view of all our boats below. We appreciate our partner's commitment to one of the summer's top events."

"It's an honor to support the Bayview Yacht Club and the regional sailing community during this iconic race," said Greg Schmidt, Pentastar Aviation's President & CEO. "We are looking forward to another exciting race."

Registration is now closed and preparations for the 202 boats and more than 2500 sailors participating in this year's running are well



underway. The race begins at 11:30 a.m. on Saturday, July 14 just north of the Blue Water Bridge in Port Huron. The competitors will cover either 204 or 259 nautical miles of Lake Huron, depending on class and wind, over two to four days and finish at Mackinac Island in the Straits of Mackinac.

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Eastern European MRO: High Ambitions, Expanding Range



By Charlotte Adams

The European MRO marketplace has grown and thrived. In our annual foray into the European market segment, we are taking a two-part look at the region. We start, in this first part, with a look at Eastern Europe. Next issue we will delve into the Western European segment.



While the Eastern European MRO market is much smaller than its Western European counterpart, it is ramping up to new levels of capability. These companies are agile, ambitious, and hungry for business. They are clearly laying the

groundwork for continued growth.

Eastern European MROs have traditionally been strong in heavy maintenance since they have relatively lower labor costs,

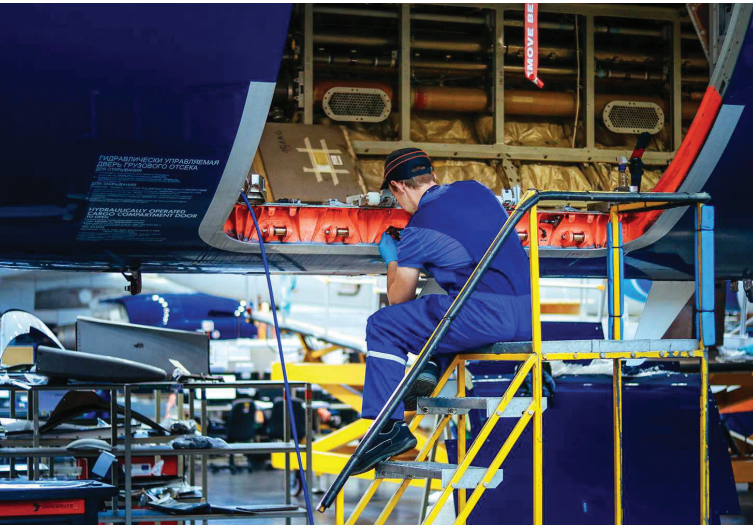
says Richard Brown, principal with ICF. But Eastern Europe is growing stronger in engine maintenance and MROs are rapidly adding services such as aircraft painting, component maintenance, leasing, asset management, continuing airworthiness management organization (CAMO) monitoring, and interior refurbishment.

The region has challenges, such as rising labor costs and competition from lower-wage countries. But Eastern European MROs are enthusiastically adopting new technologies – from 3D printing to augmented reality — and are winning new customers not only in the East but in Western Europe and Asia Pacific.

Opportunities

Poland soon will host two major new engine maintenance joint ventures. In 2017 Lufthansa Technik (LHT) and GE laid the foundation stone for XEOS, which will focus on the next generation of GE large engines, says Robert Gaag, LHT's senior vice president for corporate sales EMEA.

The second Polish JV, put together by LHT and MTU Aero Engines in December of 2017, is Engine Maintenance Europe, or EME Aero, which will focus on overhauling Pratt & Whitney geared turbofan engines. MTU estimates that EME Aero will have an annual capacity of more than 400 shop visits for PW1000G-series engines – the same that power the A320neo family of aircraft. The facility is slated to be up and running in 2020, says Leo Koppers, MTU's senior vice president of MRO programs.



FL Technics has recently completed a CAMO audit and OASES integration project for a Spanish long-haul carrier, Plus Ultra Líneas Aéreas. The airline used FL Technics to complete their Airbus A340 fleet's airworthiness data check, CAMO software integration and training of its engineering team. FL Technics images above and top right.

Eastern Europe is a beehive of activity with companies such as FL Technics (Lithuania), Magnetic MRO (Estonia), Aeroplex of Central Europe (Hungary), and LHT in Budapest (Hungary) and Sofia (Bulgaria).

Analysts disagree about the region's near-term growth prospects. ICF projects MRO demand in Eastern Europe and the Commonwealth of Independent States (CIS) will expand from 2017 to 2027 at a 5.5 percent compound annual growth rate, beating the projected global annual growth rate of 4.6 percent over the period. MRO spend in this region is expected to grow from about \$6 billion in 2017 to about \$10 billion by 2027.

Other analysts paint a less optimistic picture, citing economic sanctions placed on Russia as a deterrent to stronger growth. Oliver Wyman, in its 2018-2028 global fleet and MRO forecast projects that Eastern Europe will grow at 2 percent annually over the period.

Forecasts aside, Eastern European MROs are doing the right things. They are winning new customers, adding new services, adopting the latest technologies, and expanding their footprint to other corners of the world.

FL Technics

Late last year FL Technics announced contracts with Lufthansa Group airlines, Germanwings, for base maintenance and Swiss International Air Lines for base maintenance, engineering, and Design Organization Approval (DOA) services. Earlier this



FL Technics says the use of LEAN management principles in its MRO business in previous years led to increased profitability in 2017. FL Technics has been using LEAN for more than four years, according to CEO Zilvinas Lapinskas.

year it announced a similar agreement with another Lufthansa Group carrier, Eurowings Europe. FL Technics also performs line maintenance, component support, engine and APU management, CAMO services, and technical training.

In addition to new business in Europe, Moldova, and Russia, FL Technics is looking to Asia, where it is already an approved spare parts supplier to Asiana Airlines, AirAsia X, Nok Air, Bangkok Airways, T'way Airlines, and Indonesia's GMF AeroAsia. The MRO has a hangar in Jakarta, Indonesia, for base maintenance and plans to open base maintenance facilities in Thailand and China, says CEO Zilvinas Lapinskas.

FL Technics has employed LEAN philosophy for more than four years, which has resulted in improved turnaround times and re-engineered customer support processes, he says.

Magnetic MRO

The Chinese firm, Guangzhou Hangxin Aviation Technology, completed acquisition of Magnetic in April 2018. "Following this ... change in shareholder structure, we are creating substantial synergies and new business opportunities in Asia," says Jan Kotka, Magnetic MRO's chief operating officer.

Revenues have jumped from 50.5 million euros in 2016 to more than 90 million euros in 2017. Growth has been generated mainly from existing customers, Kotka says, thanks to new business models and services.

Magnetic's newest facility is a paint hangar it opened in November 2017 at its home base in Tallinn, Estonia. The 2,853-square-meter facility features a "custom docking system" which can serve different aircraft types. The MRO provides commercial and VIP painting services for a range of aircraft,



Magnetic MRO COO Jan Kotka. Magnetic MRO image.

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Magnetic is looking at new business opportunities in Asia after being acquired by Guangzhou Hangxin Aviation Technology. The MRO has added asset management services through Magnetic Parts Trading, a JV with Crestline Investors; added engine top case repair and bushing replacement; partnered with Kuehne+Nagel on global engine stand management, and teamed with Component OH Services for landing gear overhaul and repair, among other initiative. Magnetic MRO image.

including the 737 MAX and the A320neo family as well as “all other narrow-body aircraft.”

Magnetic also has added asset management services through Magnetic Parts Trading Ltd., a JV with Crestline Investors formed in Q4 2017. The unit focuses on acquiring aircraft and engines for immediate part-out or short-term lease and subsequent part-out, Kotka says. This JV “has been our key leverage to support our expansion strategy to asset management ... and to differentiate us from the low-cost, labor-intensive regional MROs.” So now Magnetic can not only maintain aircraft, but also lease aircraft and provide or lease new engines, he says. Magnetic qualified as a CAMO in 2015.

Magnetic already has booked 75 percent of its heavy maintenance slots in Tallinn for the 2019/2020 winter season to Austrian Airlines. The company also has added engine top case repair and bushing replacement, partnered with Kuehne+Nagel on global engine stand management, and teamed with Component OH Services for landing gear overhaul and repair. MAC Interiors, a UK company the MRO acquired in 2016, has provided entry to premium MRO services.

Aeroplex, meanwhile, provides base and heavy maintenance, line maintenance, aircraft storage, component repair, aircraft handover services, and even Wi-Fi installation. Recently it announced line maintenance capability for the A320neo. Its Bloomberg profile cites CAMO engineering, maintenance planning, and record keeping/archiving. The Part 145-approved station also performs major modifications of aircraft structures.

Challenges

The top European MRO challenge is high labor costs, which put pressure on margins and force MROs “to reinvent their business models and strategies constantly,” Kotka says. But he sees “niche and growth opportunities for relatively small MROs like Magnetic through ... agility, quality, and reliability of integrated services.” FL Technics also cites rising labor costs and a shortage of engineers and specialists.

Eastern Europe also faces keen competition for airframe maintenance from neighboring countries such as Turkey – with Turkish Technics and MNG Technic – and from the likes of JorAMCo (Jordan Aircraft Maintenance) in the Middle East.

Despite growing industry concerns about OEM encroachment, FL Technics sees opportunities for cooperation. The OEMs “are just too big to maintain a smoothly running global aftermarket support network on their own,” Lapinskas says. “It’s no secret that air carriers express concerns over parts delivery time, customer support flexibility, and some other issues.” What airlines expect from MROs is flexibility and efficiency – during both contract negotiation and execution, he says. “It’s not the size but the attitude that matters.”

Technology

FL Technics agrees that AI and big data analytics, as well as information security technologies like blockchain, will be key for MROs. Blockchain technology promises to play an important role in record tracking, preventing the use of counterfeit parts and ensuring that documents aren’t altered, Lapinskas says. It also can save time for lessors during aircraft redelivery.

“And let’s not forget about artificial intelligence-driven chatbots,” which can help HR teams in searching through multiple on-line job platforms for potential candidates, Lapinskas says. Chatbots integrated within platforms like Facebook Messenger, WhatsApp, Viber, and Skype “could automate many processes like AOG support, when the systems instantly react to an RFQ [request for quotation] with a quote and even allow [users] to order parts and set delivery locations.”

Magnetic MRO also is using augmented reality for livery visualization prior to painting, Kotka says. Besides introducing 3D printing into aircraft parts production, Magnetic is using HTC Vive virtual reality headsets and software to provide customers simulations of what the interiors would look like when changes are made. **AM**



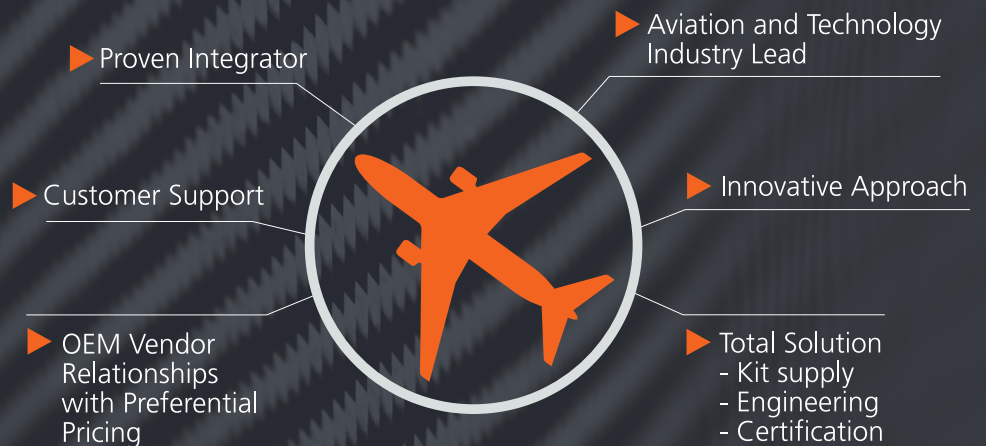
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NDT Testing Struggles to Incorporate New Technologies



By Kathryn B. Creedy

T

he urgent inspections of the CFM International CFM-56 resulting from the Southwest Flight 1390 uncontained engine failure which killed a passenger, focused the industry's attention on Non-Destructive Testing (NDT). But the workhorse GE engine is not the only one undergoing urgent ultrasonic inspections. The 380 Trent 1000 Package C engines are also

undergoing inspections resulting from several engine failures owing to failed compressor, turbine blades and seals (see sidebar page 28). Both are under Airworthiness Directives.

While the CFM 56 inspections relate to the apparent fatigue failure of a blade, the Trent problem is the premature failure of the compressor powering the 787-8 and -9. The engines are being inspected for cracking or signs of wear on turbine blades. Disturbingly, almost a third of engines failed the initial required checks and require weeks-long repairs, according to Rolls-Royce.

Rolls is accelerating the development of the permanent fix to the Intermediate Pressure Compressor rotor issue seen on affected engines. The revised compressor blade has been installed in a test engine and will begin testing in early June. First parts are expected to be available for engine overhaul in late 2018, rather than 2019 as originally planned.



Southwest Airlines Image

The Flight 1380 failure was the second for Southwest which experienced a similar incident in Pensacola in 2016. Since the Pensacola incident, CFM International developed a multi-phased inspection program of the 14,500 large CFM56-7B fleet with 77,000 blades inspected to date. The program will result in a full accounting and tracking of the entire 330,000 CFM56-7B fan blade population.

New Inspection Tools on the Horizon

While current inspection methods are well accepted, a review by Aviation Maintenance revealed new and better methods are difficult to incorporate owing to cumbersome approvals for changing inspection processes. New technologies have emerged, and while current technologies are robust, according to aviation maintenance experts, incorporating these technologies face a tough road.

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"Maintenance, repair and overhaul facilities are usually the last place new technologies are adopted," says Shawn Ehrhart, Constant Aviation director of Operations for NDT. "That's not for lack of desire. We are hemmed in by the OEM manuals that dictate how NDT is to be handled. These are programmed inspections which dictate using older technology despite advances such as the arrayed eddy current and phased array ultrasound technology. I embrace new technologies now being employed in aviation, but they are mostly being used in research and development (R&D). When it comes to in-service airframes, the manuals are very old school."

Inspection Methods

Liquid Penetrant or Magnetic Particle

There are several methods for NDT. Liquid penetrant testing (PT), also known as liquid penetrant inspection (LPI) or dye penetrant inspection (DPI), is a common method used to identify surface-breaking defects and discontinuities in metal and other nonporous materials. PT involves applying a colored liquid and allowing it to be drawn into minute surface openings by capillary action. Defects become visible under UV light or by the contrasting color of the dye.

Magnetic particle testing (MT) uses magnetic fields to locate surface and near-surface discontinuities in ferromagnetic materials. When very fine ferromagnetic particles are applied to the metal, they will be drawn into discontinuities on the surface to flag flaws. PT and MT are generally considered affordable and effective NDT techniques, but each has limitations. PT testing can only detect surface cracks and requires the purchase, handling, and disposal of chemicals. MT testing is effective only for inspections of ferromagnetic materials. The inspection process for both techniques, including surface prep and cleanup, is time consuming and test results can vary depending on the skill and patience of the inspector, especially when the work environment is challenging.

Eddy Current Testing

Eddy current testing is a nondestructive technique capable of detecting surface and sub-surface defects including cracks, corrosion and heat damage in conductive materials. In aviation, ECT is used to inspect skins, stringers, frames, rivet holes, tubing, and many other ferrous and non-ferrous components. In simple terms, ECT involves placing a probe or coil against a metal surface. The probe generates an electromagnetic field which induces electrons to flow into the material. Any cracks or changes in metallurgical structure will distort the flow like eddies in a river; these distortions are captured and analyzed by an instrument and displayed for the technician to review. The results are precise, and because ECT generates a digital record, inspectors can share, store, and review inspection data.

Ehrhart suggested part of the problem is efforts to keep maintenance costs down. "But, there are emerging technologies that would help us do our jobs better, faster and probably would improve our detection rate," he said. "That rate is already high but we are not at 100 percent and it could go up."

Constant Aviation does eddy current, ultrasonic, liquid penetrant dye and magnetic particle tests for a wide array of aviation customers including the commercial, business aviation, military and R&D. Ehrhart said 70 percent of his division's testing involves eddy current methods, noting other industries do not use it as much as aviation and aerospace. Each method addresses a different goal, he explained. "Manufacturers are doing more volumetric inspections using x-rays and ultrasound at the foundry or manufacturing level," he said. "Once an aircraft gets into service the technique switches to eddy current, liquid penetrant



Olympus Image

dye and magnetic particles for most airframes flying today. For aircraft like the Dreamliner, the inspection methods are vastly different.” (See sidebar page 23).

Carbon Fiber

Advances are coming, too, for carbon fiber inspections, according to the Journal of Alloys and Composites, which recently published a new technology on carbon fiber health monitoring. The new research is on non-contact inspection methods especially for those areas isolated from conventional health monitoring systems.

The problem is the difficulty in detecting cracks before they occur using acoustic and ultrasonic inspections. While these methods can spot flaws, information on operational loads and stresses such as vibration, temperature and impact, are missing.

More than a decade ago FAA tested adhesive film sensors to assess such stresses using resonance sensors glued to composite panels after the introduction of a flaw. However, new research has developed a better, non-contact method.

The method embeds circuits in the composite materials to accomplish the same objective using soft magnetic circuits between 10-60 microns in diameter to

measure stresses. The team from Russia’s NUST MISIS Center of Composite Materials was led by Professor Sergey Kalshkin. The method lays micro-wires in a grid between plies to assess how materials react to external magnetic fields. The team wants to develop a field prototype and says the wires do not affect the structural property of the material.

Olympus

While such carbon fiber testing is in the future, several companies have developed advances in technologies for current testing methods for more conventional airframe materials.

Olympus, for instance, utilizes digital signal acquisition and visualization technology in its EPOCH 650 flaw detector, ideal for ultrasonic inspection of turbine blade roots to detect flaws that cannot be seen with the naked eye. The company, which already works with several major domestic and international airlines as well as MROs, indicated this technology may detect the internal structural failure of a blade root which can experience significant fatigue over time.

While ultrasonic inspection technology has been used in aerospace maintenance for many years, the advances employed by

Olympus deliver improved signal quality for more confident inspection analysis, as well as improving the technician’s user experience, which makes such inspections faster and more accurate.

Olympus says ultrasonic flaw detectors, such as the EPOCH 650, use advanced pulsing and receiving techniques within a highly portable, battery-operated form. They include multiple onboard reporting tools and a data filing system to allow technicians a simple way to communicate inspection results, said the company. The EPOCH 650 has a menu structure for instrument settings, calibration and software feature adjustment, as well as the direct-access key approach and a full VGA resolution display.

Olympus recently introduced the iPLEX G Lite ultra-portable industrial videoscope for visual inspections of small or difficult to access locations. The videoscope is a successor to the UltraLite model but retains the small size and light weight for one-handed operation. It has a touch screen monitor and electrically-operated tip articulation, enhanced image processing with LED illumination and a freeze-frame and automatic recording functions.

What happened to the CFM-56?

In the Southwest 737-700 incident, the CFM-56-7B engine exploded at 32,000 feet over Pennsylvania, destroying the engine, cowling and a window and causing rapid decompression. The event also damaged the wing, fuselage and horizontal stabilizer, according to the National Transportation Safety Board. It also raised questions about the durability of the engine cowling, the majority of which was missing.

The Board reported the No. 13 fan blade separated at the root although the dovetail remained intact on the disk. The recovered blade showed six fatigue crack arrest lines and striations consistent with low-cycle fatigue crack growth. The engine had more than 32,000 cycles since service entry and maintenance showed the blades were overhauled at 10,712 cycles before the accident using visual and fluorescent penetrant inspections.

This was the second such failure. Southwest experienced a similar event in 2016 out of Pensacola when a fan blade fractured. A CFM International Service Bulletin and an FAA Emergency AD in April recommended ultrasonic inspections of all fan blades on the -7B series engine with 20,000 cycles and subsequent inspections at 3,000 engine cycles.

With the field inspection programs instituted since 2017, operators use the ultrasonic probe on the flight line, according to GE. If any indicators are present, the fan blade then undergoes the full eddy current inspection. If indicators are still there, the fan undergoes a full cut up and analysis. So, there is essentially a three-stage process going on if indicators appear, and final results can take weeks and months. GE said findings to date have not led to any changes in the current inspection program.

NTSB is currently researching the number of cycles associated with fatigue crack initiation and propagation in the No. 13 fan blade to determine whether any changes to inspections are needed.

GE, part of CFM International, reported prior to the Pensacola incident, it used the fluorescent penetrant test on fan blades during routine shop visits. After the incident, the company moved to the more accurate eddy current method. There have been two fan blade-out incidents with the CFM56-7B fleets in 21 years of operation. More than 75,000 blades have been inspected and the company reported there were no findings to change its guidance for the current inspections program. (See timeline on page 26)

Olympus touts the iPLEX's improved imagery. The PulsarPic image processors constantly optimizes images by reducing halation, balancing exposure and increasing gain quality.

It also has a WiDER Dynamic Extended Range technology as well as adaptive noise reduction, enabling inspectors to see fine details across the image by enhancing contrast and reducing noise, in addition the iPLEX G Lite provides interchangeable UV or IR illumination.

Advances in imaging, in fact, are the biggest thing that has happened for borescope testing, according to USA Borescope's Bill French, a sales manager for the company. His company supplies and repairs boscopes for various industries including aviation/aerospace. French indicated imaging is important since the accuracy rate is closely tied to the quality of the image. Aviation and aerospace constitute 50 percent of USA Boscopes' business.

Today's image quality is a night-and-day improvement over the quality just 10 years ago, he said. "They include more features in smaller packages at lower costs," he said. "We've gone from 40-pound cases a decade ago to a one-pound unit inspectors can hold in their hand. That camera chip at the tip comes in two different types – a CCD image sensor which is the higher quality, cleaner image but at a higher cost. There is also the CMOS image sensors,

which, historically has been a lower cost option but you sacrifice image quality. However, CMOS has changed in the last three years so it is closing the gap with

CCD, used for commercial jetliners. CMOS is used for regional and private jets but the difference in laymen's terms is the difference between a DVD and Blue Ray."



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Zetec

Under comparable conditions and with a skilled technician, single-coil eddy current testing and particle testing will produce comparable pass/fail-type results, according to Zetec, a company producing eddy current and ultrasonic NDT tools and software. However, a handheld eddy current tool with a C-scan display can present a digital “big picture,” helping inspectors find more defects in less time. More advanced instruments can conduct dual-frequency testing, digital conductivity testing, and nonconductive coating thickness measurement.

“Today, the market is shifting toward portable tools with powerful software, touchscreen interfaces, ergonomic designs and longer battery life,” Daniel Richard, Zetec technology manager, explained. “This combination makes eddy current testing feasible for anyone who wants faster, more accurate inspections. The choice of probe is also important. There are eddy current probes for specific aircraft applications like rivets, lap splices, and welds. For example, a dedicated bead-seat probe lets users inspect the bead seat on a wheel with only one pass.”

The problem with liquid penetrant and magnetic particle testing is the extensive preparation and clean-up work. Two years ago, Tovatech entered the aviation/aerospace field expanding beyond its original target audience in the chemical and

pharmaceutical research communities.

It is essential all traces of dyes and particles are removed, according to Tovatech’s Bob Sandor in a recent blog post. His company produces ultrasonic cleaners used by airlines, including American’s Tulsa facility. The airline employs the company’s 37kHz S180H Elma ultrasonic cleaner which is equipped with a heater and timer that use LED lights to indicate both set and actual cleaning time and clean temperatures. Depending on the number and condition of parts, cleaning cycles range from 30 minutes to an hour.

“Cleaning is accomplished by billions of microscopic vacuum bubbles that implode on contact with tremendous force to blast loose and carry away contaminants on items placed in the ultrasonic cleaner’s bath,” he wrote. “Because of their small size they can penetrate minute cracks and crevices unreachable by brushes, sprays or other mechanical methods. It is faster, more effective and less costly than other cleaning methods, it is used for disassembled parts and performing quality check standards.” The other problem with these testing methods is they don’t indicate the depth of the flaw.

“They are easy and inexpensive but they lack the precision and depth needed to identify flaws and their characteristics,” Zetec’s Richards told Aviation Maintenance. “Magnetic particle or eddy current, for example, can only be applied to

components that can be magnetized but again, it doesn’t indicate the depth of the flaw. What you need is digitization so that you can take digital pictures, so you can monitor the flaw over time. You also need



Zetec’s MIZ-21C is a portable hand-held eddy current device with a touchscreen. Zetec image.

CFM Timeline (continued from sidebar page 25)

- *Early 2017:** CFM met with the FAA / EASA to lay out multi-phased CFM56-7B fan blade inspection strategy.
- *March 2017:** CFM issued first service bulletin (SB) recommending ultrasonic inspections for CFM56-7B engines with 15,000 cycles accumulated since last shop visit – focus on oldest fan blade population.
- *June 2017:** CFM issued second SB recommending ultrasonic inspections for specific serial number fan blades that have accumulated more than 20,000 cycles.
- *March 2018:** EASA AD issued for first two SBS.
- *April 20, 2018:** CFM issued third SB recommending ultrasonic inspections for CFM56-7B engines with 30,000 cycles to be completed by May 10 (about 650 engines). This portion of the SB receives FAA & EASA emergency ADs. The SB also recommends inspections of CFM56-7B fan blades with 20,000+ cycles to be completed by the end of August 2018 (about 2,500 engines) with inspections of CFM56-7B fan blades when they reach the 20,000-cycle threshold. After first inspection, repeat at 3,000 cycles. Second FAA AD issued on this portion of the SB. When operators do not know the cyclic accumulation of a blade, it is to be inspected.
- *May 10, 2018:** Revision to the April 20 SB recommends customers prioritize inspections for about 5,400 engines that include fan blades with more than 20,000 cycles, as well as engines with 20,000 cycles and at least one shop visit to be completed by June 30th. Inspections of the remaining population should be completed by August 31, 2018. At press time, GE also reported that customers were 100 percent compliant with the 20-day inspection requirement and the 20,000 inspections were 40 percent complete.



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Zetec produces several NDT tools used in aircraft NDT, including the TOPAZ family of ultrasound instruments. Zetec image.

the ability to reach inaccessible places.”

His understanding of the Southwest incident showed the flaw was inside the material. “You need to identify such flaws before they reach the surface and cause a failure,” he said. “To identify flaws within the materials by x-ray requires too much radiation and the construction of a huge bunker for larger components. That raises concerns about tracking and securing the radioactive material.”

“We know that advanced technology is not low cost but if there is a critical flaw we are a good partner to find it and make a complete assessment including depth,” he said. “With the CFM 56, over two years they found the flaw where it was expected but the failure occurred earlier than expected. The problem is when the flaw is not where it is expected but perhaps five to 10 millimeters away. Conventional ultrasound would not be sufficient to find that. Our phased array could have caught the flaw in a different location.”



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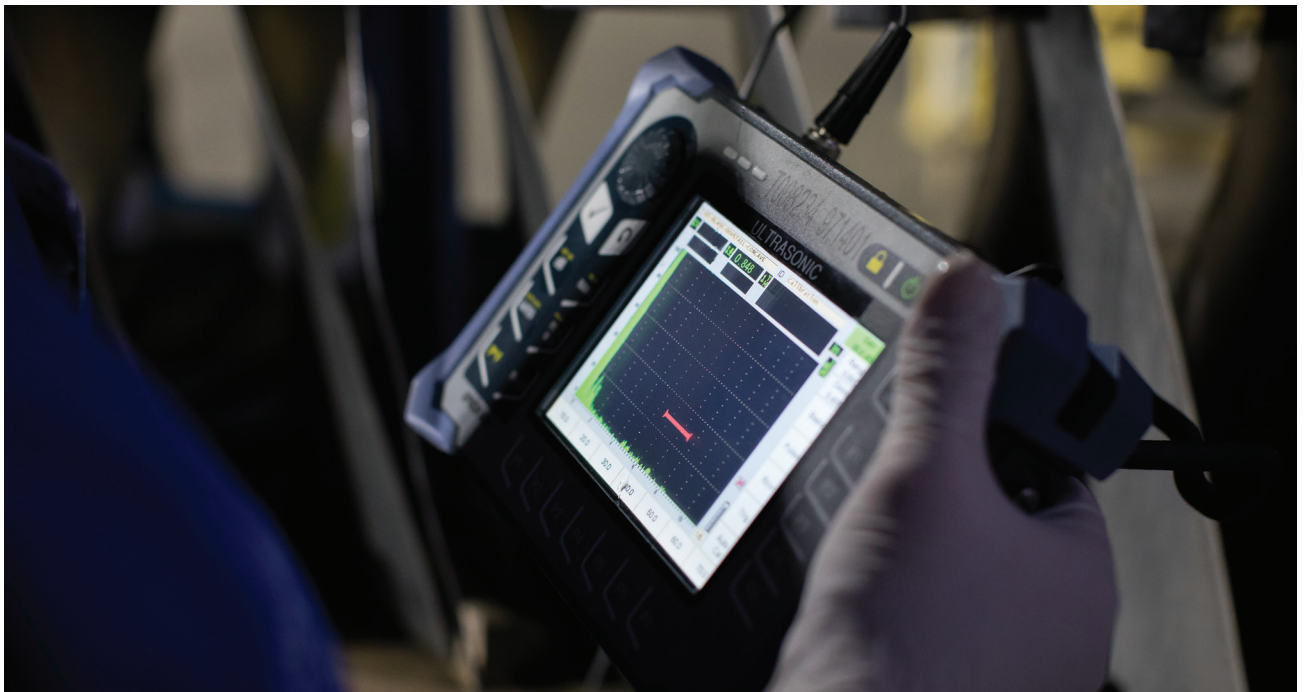
Trent inspections resulted from engine failures

In April, the FAA and EASA issued Airworthiness Directives for Boeing 787-8 and -9 aircraft powered by Trent 1000 Package C engines limiting ETOPS operations. The issue results from several engine failures of Trent 1000 Package C engines owing to failed compressor and turbine blades and seals, according to the FAA.

Inspections resulted in numerous reports of cracked blades resulting in unscheduled engine removals, resulting, as Boeing reported, from the IPC stage 2 blades having a resonant frequency that is excited by airflow conditions existing in the engines during operation at high thrust settings under certain temperatures and altitude conditions, according to the AD. The vibrations can result in cumulative fatigue damage that can cause blade failure and consequent engine in-flight shutdown.

Rolls-Royce recently warned the 787 groundings expected to reach 50 aircraft, resulting from the June 9 deadline for Trent 1000 inspections. About 30 aircraft, including British Airways, Air New Zealand and Virgin Atlantic are grounded (at the time this was written), according to the Rolls-Royce.

There are 380 engines in service covered by the April AD mandating additional intermediate compressor. The company has trebled the number of affected engines it is working on at a time.



Southwest Airlines Image

NTSB is currently researching the number of cycles associated with fatigue crack initiation and propagation in the No. 13 fan blade to determine whether any changes to inspections are needed.

Zetec produces several NDT tools that are commonly used in aircraft NDT, including the TOPAZ family of ultrasound instruments; the Surface Array Flex Probe for eddy current inspections; and the MIZ-21C portable eddy current instrument.

TOPAZ instruments are fully integrated, high-performance phased array ultrasonic testing devices that combine the hardware and software necessary for challenging inspections.

The Surface Array Flex Probe is designed to produce faster, more accurate eddy current inspections. It can be combined with the Zetec MIZ-200 Eddy Current Array Instrument plus Velocity Acquisition and Analysis Software for a complete inspection solution.

The MIZ-21C is a portable hand-held eddy current device with a touchscreen to make inspections more efficient and more accurate. It has a long battery life and improves productivity since it can reduce inspection time by up to 95 percent compared to conventional pencil probes.

As new technology is fielded for increasingly more accurate and efficient flaw detection, the industry will have to begin the heavy task of revising inspection manuals and methods to accommodate them. Coupled with advances in data analysis, this new technology has the potential to head off such problems especially in hard to reach or reduced visibility environments. **AVI**

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Is the Mechanic Shortage Impacting the U.S. military?

by Dale Smith

Is the much-anticipated shortage of commercial aircraft mechanics going to impact the ability of the U.S. military to keep its combined fleets prepared



Left, Aviation Structural Mechanics 2nd Class Jesse Owens, left, and Christiana Pressley, assigned to the Strike Fighter Squadron 81, perform maintenance on an F/A-18E Super Hornet on the USS Harry S. Truman. U.S. Navy photo by Specialist 3rd Class Kaysee Lohmann. "In some instances, our recruiters have brought in prior-duty service maintainers who have been separated from the military for as many as 10-years," says Chief Master Sargent Dong Kim, USAF USAF Image above.

and diverse fleet of aircraft, rotorcraft and unmanned aerial systems mission ready?

To find the answer, **Aviation Maintenance** contacted representatives (in alphabetical order) of the U.S. Air Force, U.S. Army and U.S. Navy to get current insights on the maintenance population in the U.S. military.

U.S. Air Force

It's not surprising that the U.S. Air Force ended FY2017 with over 5,300 aircraft of all shapes and sizes in its global inventory. And, while the need to keep each and every one of them mission ready is a priority, that doesn't mean that the Air Force's aircraft maintenance ranks have been immune to budget cuts.

In fact, as recently as the end of FY15, past budget restrictions had led the Air Force to experience a deficit of some 4,000 aircraft maintainers. But that was then...

As Chief Master Sargent Dong Kim, Aircraft Systems Career Field Manager, U.S. Air Force explained it; over the past two years they have made significant inroads into filling that gap to a point where today, the deficit is down to only 400 maintainers.

"The original shortage was the result of a decade's worth of program changes within the Air Force as a whole. Sequestration and other budgetary restraints actually combined to cause the drop," he said. "It was the purposeful cuts that took place and not a lack of interest."

"A key point is the fact that aircraft maintainers in the Air Force typically retain better on an aggregate perspective than the rest of the Air Force in comparison," Chief Kim said. "From my perspective of having served over 27-years as an Air Force aircraft maintainer, is that there is a lot of personal and national pride in what we do."

"We do things very well and we work with the same aircraft

If you're involved in any way with aircraft operations and/or maintenance, you can't help but have heard that we're standing on the precipice of what many believe will be an industry-changing shortage of pilots and aircraft maintainers.

Highlighting the need for maintainers in particular, according to a recent report by global business analysts Oliver Wyman, the gap between the available pool of experienced aircraft maintainers and the need will grow to nine-percent in the next 10-years.

The report attributes much of that shortage to the fact that over that period a large number of the current Baby Boomer-fueled workforce will retire. Obviously, that's putting a huge burden on the commercial side to find, train and retain the numbers of mechanics they will need to keep the global fleet flying.

But, you ask, should this prediction come to be true, what impact will it have on the U.S. military's ability to keep its aging

How Integrated Maintenance & Supply Software Maximizes Asset Availability and Reduces MRO Costs for Military Forces

A Closer Look at GOLDesp MRO Software from Tapestry Solutions, a Boeing Company

THE MRO CHALLENGE

Sustaining complex military assets across land, air, sea and space is more challenging than ever for Maintenance, Repair and Overhaul (MRO) personnel. With increased deployments, logisticians are under pressure to keep mission-critical equipment operational, despite declining MRO budgets. The challenges are compounded as military equipment becomes more sophisticated, smarter and powerful. Next-generation systems are built with advanced materials, sensor-driven data and connectivity – requiring more proactive maintenance approaches and technical expertise.

At the same time, logisticians continue to struggle with materiel obsolescence issues related to aging equipment. A major issue is obtaining readily available parts for the vast amount of aircraft flying beyond their expected lifecycles. The problem is exacerbated by delays caused by fragmented supply chains and information gaps – and these delays can be costly.

Cannibalization: The Last Resort

Faced with a shortage of spare parts and budget cuts, MRO personnel often resort to the inefficient maintenance practice of cannibalization – a strategy in which serviceable parts are removed from one complex asset to satisfy the operational needs of a higher-priority asset.

Cannibalization may be beneficial on a very limited and controlled basis, but the practice actually decreases readiness, and increases maintenance and supply chain costs. With cannibalization, units risk additional maintenance downtime due to incorrect fault identification and/or faulty repairs, and this creates more supply chain turbulence.

Information Overload

With data-driven warfare, information saturation also poses a major challenge for military MRO personnel. Maintenance managers need access to timely and accurate data to ensure mission success.

Maintaining sophisticated



U.S. Navy photo by Mass Communication Specialist 2nd Class John Philip Wagner, Jr.

military assets involves millions of moving parts – spares, work orders, analytics – generating massive amounts of data.

Without automated processes in place, maintenance and supply chain personnel must manually sort through mounds of data to track and manage assets. This can be a laborious, time-consuming task that affects readiness rates.

THE SOLUTION

To effectively execute their missions, military forces need – and deserve – superior equipment that is well-maintained and mission-ready. They require a comprehensive, maintenance management solution such as [GOLDesp MRO & Supply software](#). The developer is Tapestry Solutions, a Boeing Global Services company that specializes in information management software and services.

The military-grade, enterprise software is designed for aftermarket logistics support and Performance-Based Logistics (PBL) management for aerospace and defense customers worldwide. For over 30 years, GOLDesp has helped organizations efficiently manage the world's most sophisticated assets that operate in land, air, sea and space environments.

Modular, Enterprise-Level Software

GOLDesp provides total lifecycle support for every major platform, including fixed-wing and rotary-wing aircraft, armored vehicles, vessels, air defense and space systems.

A commercial off-the-shelf solution, GOLDesp significantly improves maintenance efficiency, increases asset availability and reduces sustainment costs over the total system lifecycle. Built with modular, open architecture, GOLDesp is designed to keep

pace with technology as equipment grows in complexity and scale. This allows for enterprise integration and future growth. In addition, GOLDesp features powerful performance metrics and analytics that enable faster, better decisions.

With these features and more, GOLDesp has emerged as the leading tri-service solution for customers on five continents.

(Continued on next page)



The Right Data at the Right Time

With its fully integrated maintenance and supply capability, Tapestry's GOLDesp MRO & Supply software gives organizations clear insight into the availability of their assets at all times. Serving as a centralized hub for information, GOLDesp captures timely, relevant information –cutting through the clutter – so decision-makers can see the Big Picture. This ensures faster response times, lower sustainment costs and an optimized supply chain.

GOLDesp makes it effortless to track and manage assets, including health and history, from start to finish. GOLDesp gives maintenance planners an effective tool for tracking and scheduling maintenance tasks. With just a few clicks, MRO personnel can review the complete history of any asset – from cradle to grave – and all transactions in between.

The enterprise solution also provides distributed maintenance capability, providing a secure means of linking industry to the battlefield. This “disconnected mode” offers a unique advantage for forward-deployed bases, which can retain centralized visibility and control without an internet connection.

Additionally, GOLDesp provides customers with interface access to the U.S. military standard (MILS) supply system, a major benefit for both domestic and foreign military sales (FMS) customers

Eliminating or Mitigating Cannibalization

GOLDesp ensures mission readiness by eliminating or mitigating cannibalization practices, thereby ensuring maximum equipment availability – whenever, wherever assets are needed. GOLDesp's materiel forecasting capabilities ensure spares are readily available to support maintenance activities.

This minimizes the need for cannibalization by accurately identifying requirements for new parts in advance, while reducing stockpiling of unnecessary spares.

If cannibalization is necessary, GOLDesp ensures all processes are controlled and traceable. The robust software provides quality assurance/ quality control process flows, which helps to reduce delays in replenishing parts for the donor equipment.

GOLDesp CUSTOMERS

Tapestry's GOLDesp customers include the U.S. Air Force, the U.S. Army, the U.S. Navy, the U.S. Special Operations Command, and several international partner nations including the U.K., Saudi Arabia, Kuwait, Oman, Qatar and Romania.

The Boeing Company also uses GOLDesp for its PBL contracts, including support for the C-17 Globemaster III and the AH-64D Apache Longbow. Under the Boeing administration, GOLDesp even supports MRO and supply activities for the International Space Station as it orbits 250 miles above the earth.

To learn how GOLDesp can enhance your organization's maintenance and supply processes, please email Tapestry Solutions at marketing@tapestrysolutions.com or visit www.tapestrysolutions.com

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and crews on a daily basis," he said. "So there is a great pride of ownership whether we are maintaining a 60-year old aircraft or a brand new F-35."

"It's very unique, very precise, very different work than what you see on the civilian side," Chief Kim said. "There are some similarities when you look at the large, wide-body aircraft the Air Force owns, but all the other aircraft and systems are very specific to our nature. The challenge is absolutely very attractive."

But, while Air Force maintainers do what they do for pride and service to our country, Chief Kim, as does the entire Air Force, stresses the need to continually offer attractive retention programs to ensure it retains its skilled professionals.

"For example, we offer higher tenure extensions for technicians in specialized areas where we know there is a critical need for their specific skill set in the civilian world," he said. "If they go beyond their higher tenure we have the ability to promote to retain those Airmen. The Air Force offers lots of opportunities for advancement."

"In some instances, our recruiters have brought in prior-duty service maintainers who have been separated from the military for as many as 10-years," Chief Kim explained. "They came back at the same grade as when they left. The program was very successful. And not just with prior Airmen. We also recruited prior Army, Navy and Marine Corps maintainers. They all came back to direct duty. No backtracking."

While current recruitment efforts have been successful, Chief Kim said that the Air Force has made it a priority to ensure the pipeline of qualified Airmen maintainers is sufficient to meet ongoing needs.

"It's not that we met the mark, we must continue to meet it as we grow the aircraft inventory and maintenance needs," he said. "For example, we need to support the F-35 growth and we need more maintainers specifically trained to do that. This aircraft has more integrated systems so our technicians need to be trained to have a more integrated approach that is more diverse and holistic."

"Technology is helping us do that," Chief Kim said. "Aircraft systems are more advanced and integrated with more maintenance capabilities built-in now. We need to develop and train our technicians to meet that changing need. It's a very exciting time. Our maintainers are excited to be here."

U.S. Army Aviation

According to Command Sergeant Major Gregory M. Chambers, Aviation Branch Command Sergeant Major, U.S. Army Aviation Center of Excellence, Fort Rucker, Alabama, the Army is not currently experiencing, nor does it anticipate, that it will have any problems meeting its requirements for trained aircraft – and particularly in its case – helicopter maintenance personnel.

"The Army as a whole is not having any problems with enlisting maintainers. But the important point is first and foremost, whether they are maintaining an aircraft or flying it, the number one thing they have to perform is service to our country," he said. "They are an Army soldier above all."

"We have approximately 11 different Military Occupational Specialties (MOSs) that we train for to work on our three major aircraft type, which are the CH-47 (Chinook), UH-60 Lima/Mike



While the Army says it is currently having no problem filling its requirements for enlisted personnel to meet ongoing maintenance needs, they are faced with the ongoing challenge of retaining these valuable people. US Army photo.

(Blackhawk), and the AH-64 Delta and Echo (Apache)," CSM Chambers said. "We also have training for our UAS Grey Eagle and Shadow platforms."

While the Army offers a diverse array of occupations for aircraft maintainers, CSM Chambers stressed the fact that each specialty and training program is unique to its assigned job.

"The big difference between the Army and a mechanic in civil aviation is that the civilian mechanic with an A&P license is asked to do a myriad of tasks on the aircraft. They kind of go along from an apprentice to a journeyman to a master-type career path," he said. "It can take 30-years to gain their level of high proficiency."

"Since we don't have that long in the Army, we have a variety of different Military Occupational Skills that a soldier can concentrate on and become very proficient in that skill very quickly," CSM Chambers said. "For example, our 15 Bravo, which



All the branches of the military say they are offering incentives for retention once personnel have enlisted. They cite opportunities for travel, education and experience as reasons for eager enlistees. "Our mechanics are very specialized and take great pride in their areas of expertise," according to Command Sergeant Major Gregory M. Chambers, U.S. Army Aviation. US Navy photo above and US Army photo left.

are aircraft powerplant repair mechanics, only work on engines: main engines and APUs. Our 15 Delta power train mechanics only work on power trains. Nothing else. Our mechanics are very specialized and take great pride in their areas of expertise."

CSM Chambers also said that while the Army is currently having no problem filling its requirements for enlisted personnel to meet ongoing maintenance needs, they are faced with the ongoing challenge of retaining these valuable people.

"Where we run into problems is retaining maintenance experience at our Staff Sargent grade," he said. "That individual has between six- and 12-years experience. It's not all areas, but a few in particular right now include AH-64 mechanics, UAS mechanics, UAS operators and air traffic controllers."

To help keep these highly skilled professionals in the service, CSM Chambers said that the Army has developed a number of incentives retention bonuses and 24-different credentialing/licensing programs to earn enlisted military personnel.

"One of the key credentialing programs we offer is the FAA Airframe and Powerplant license," he said. "The FAA says they need a minimum of 30-months of experience in various MOSs before they can take the test so they stay to get the experience they need. The A&P license is what every technician wants because when they do get out of the Army are prepared for a civilian job."

"At the end of the day the Army can offer a soldier a large cash bonus or training incentive to enlist for another six-years, but sometimes it's not the money at all," CSM Chambers said.

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In the Atlantic Ocean, Sailors assigned to Strike Fighter Squadron 211 perform maintenance on an F/A-18F Super Hornet in the hangar bay on the aircraft carrier USS Harry S. Truman. While the Navy maintains they are not experiencing a shortage of maintenance personnel, they say they are experiencing, "areas of sub-optimal levels of technicians within specific specialty skills." U.S. Navy photo by Specialist 3rd Class Kaysee Lohmann.

"It can be any number of reasons they want to leave the service: quality of life, career change, family status change or other situations."

U.S. Naval Aviation

With no disrespect meant to the other U.S. armed forces, the maintainers charged with keeping the U.S. Navy's diverse fleet of fixed- and rotary-wing aircraft have, arguably, the hardest task. After all, they're the ones challenged with keeping the Navy's front-line aircraft in top shape, while located hundreds of miles out at sea.

But, that high-level of adversity is exactly what draws so many want-to-be Navy aircraft maintainers into that branch of service in the first place.

"Working on Navy aircraft as part of a squadron is a unique experience and one that sets the Navy apart from all of our competition," stated Lieutenant Commander Jessica McNulty, spokesman for Navy Recruiting Command. "Nowhere else is a person going to get the education and experience we offer as well as the perks of continued college or technical training, as well as a chance to see the world – all paid for by the Navy."

"And it's all while you work aboard one of our state-of-the-art aircraft carriers or shore maintenance facilities," she added. "The friendships and camaraderie will last a lifetime. No other employer offers the opportunity of being forged by the sea the way the Navy does."

But, even with all that Navy life offers it, like the other armed forces it does face challenges when it comes to having adequate numbers of trained aircraft maintenance technicians.

According to Captain David Whitehead, Head Officer/Community Manager, U.S. Navy, while there are currently adequate numbers of aircraft technicians in the aggregate levels for Naval Aviation, there are areas where they are experiencing, "areas of sub-optimal levels of technicians within specific specialty skills."

Capt. Whitehead explained that currently they are below the ideal counts for technicians specializing in key areas including,

engine maintenance, aircraft electricians, structural mechanics, safety equipment/life support and electronics technicians.

"The Navy's high tempo operations and deployment frequency, specifically for TACAIR (Tactical Air Command) squadrons, challenge the retention of our aircraft technicians," he said. "As we continue to grow and modernize the Navy, we face continued competition for talent, especially within the civil sector of the aviation industry."

"As we face this increased competition for our talented workforce, both our monetary and non-monetary incentives are consistently being reviewed to ensure we attract and retain adequate levels of aircraft technicians," Capt. Whitehead said. "Additionally, we have a process to validate future requirements and plan new accessions each year."

"In areas where previous budgetary limitations have restricted our accessions, we are able to provide additional resources in the form of extra new recruits to bolster personnel levels," he stated. "We also have an apprenticeship program that provides flexible manning options."

Capt. Whitehead also explained that the Navy's ongoing job prioritization process allows the U.S. Fleet Forces Command to adjust priorities to fill the most critical requirements on a monthly basis, which helps minimize any adverse impact to individual ratings or commands.

With regards to retaining their trained maintenance specialists, along with the monetary incentives Capt. Whitehead mentioned earlier, the Navy is also initiating ways to help current Sailors advance.

"If a Sailor has trouble advancing through the Navy's advanced exam process, we are allowing them to extend their careers for an additional one- or two-years to enable them to take advantage of increased opportunities to complete the exam process," he said. "Additionally, there are many initiatives that focus on offering more career choices and expanding professional development opportunities to encourage Sailors to stay Navy. **AM**

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Image by Joy Finnegan

What You Can't See Can Hurt You — How To Protect Wiring

by Raphael Jacobelli

Aircraft wiring is critical to safe flight as it supplies data/signals to critical avionics/flight equipment. The FAA has recognized the importance of wiring and created regulations for the Electrical Wiring Interconnection System (EWIS). Two key factors have contributed to this increased focus: the aircraft fleet is aging and repeated flights can affect the integrity of the wiring and advances in avionics means that more wiring harnesses are being loaded into old and new equipment.



On July 17, 1996, the center fuel tank of TWA Flight 800 exploded just 12 minutes after departing JFK International Airport. It crashed into the Atlantic Ocean with total loss of life.

In response, the FAA created the "Aging Transport Systems Rulemaking Advisory Committee" (ATSRAC) composed of airlines,

OEMs, and regulators. The ATSRAC inspected 81 in-service aircraft and found 3,372 wiring/electrical distribution discrepancies that included deteriorated wiring, corrosion, wire chafing, wire arcing, improper bend radius, improper installation and repairs as well as contamination by metal shavings, dust, and flammable fluids.

Over time, wiring insulation becomes brittle and prone to cracking, which exposes the conductor and creates the potential for hazardous electrical system malfunctions, such as a short circuit or airframe arc. Rubbing and chafing can accelerate this and then condensation, fluid containment, metal shavings, dust and debris can bridge the gap between a wire conductor and an adjacent metal structure.

What is disturbing from the ATSRAC study is that all 81 inspected aircraft were airworthy, in-service and had received numerous prior inspections and progressive/preventive maintenance. Until this review, wiring had rarely received special maintenance or inspections, even though it was widely known that

wiring discrepancies or failures caused delays, unscheduled landings, IFE system problems, and both non-fatal and fatal accidents.

Chafing Is the Leading Issue

According to a Piper Aircraft Special Airworthiness Information Bulletin (SAIB), "Several airplanes showed unacceptable wire separation from hydraulic lines and /or adjacent structure below the floor-mounted main power distribution circuit breaker panel. The inspections also showed early signs of chafing, which can lead to thermal stress and arcing in an area where flammable liquids are routed. These conditions could sustain an uncontrollable fire in an inaccessible area below the pressurized deck."

The U.S. Navy (NAVAIR) has large datasets on this topic: it shows that as many as one million-man hours are spent annually in troubleshooting, isolating, locating and fixing wiring faults: chafing contributed to more than a third (37%) of all wiring failures on Navy aircraft from 1980-1999 (see Table 1).

According to a recent study called Growth Opportunities in the Aircraft Wire and Cable Market, "the increased number of orders for new aircraft across the globe and modernization of the existing aircraft are the key factors that are expected to drive the aircraft wire and cable market during the forecast period.... the aircraft wire and cable market is projected to grow at the highest CAGR during the forecast period."

Wiring protection generally and chafing in particular is clearly a systemic issue that needs to be controlled. The aging transport fleet and the growth of avionics just make it more important.

Aging Fleet and Advanced Avionics

The safety and utility of commercial and military aircraft have been greatly improved by the integration of advanced avionics which help reduce pilot workload, increase situational awareness, and facilitate cockpit resource management.

These advances include: ADS-B, Digital (FBW) Fly by Wire Flight Controls, (AFCS) Automated Flight Control Systems with Coupled Navigation, FADEC (Full Authority Digital Engine Control System), and HUMS (Health and Usage Monitoring Systems) to name a few. All these advances have meant that harnesses have grown in both size and complexity.

Aircraft wiring harnesses can be quite large, 20-30 feet in length, weigh 50-75 lbs. with multiple branches or break outs. Routing harnesses of this size and complexity is time consuming and tedious since all of this wiring must pass through penetrations in metallic structure that are, on average, 3.5 inches in diameter. Harnesses are secured from point-to-point by MS cannon plugs typically with connector back shells for added strength and to eliminate tension on individual wires and are held in suspension by padded clamps mounted to provisions on the airframe.



Spring-Fast grommet edging by Device Technologies is made from spring steel encapsulated in an abrasion resistant polymer and snaps on without glue.

An average harness may be routed through as many as 15-20 penetrations in the air frame structure and all of this must be performed without strain, abrasion or cracking of the insulation and protective braiding. When harnesses are routed and suspended in space they are very often in close proximity to adjacent structures, so using anti-chafe protection, a.k.a. grommet edging, is critical to protect the wiring integrity.

EWIS is Born

Armed with the wiring discrepancy data the FAA created regulations for EWIS or the Electrical Wiring Interconnection System. EWIS is the recognition by the FAA that wire and its associated components must be treated as a critical aircraft system.

The official definition of EWIS according to CFR.14 Part 25.1701 is: "Any wire, wiring device, or combination of these, including termination devices, installed in any area of the airplane for the purpose of transmitting electrical energy, including data and signals, between two or more intended termination points.... the term "wire" means bare and/or insulated wire used for the purpose of electrical energy transmission, grounding or bonding. This includes electrical cables, coaxial cables, ribbon cables, power feeders, and data-buses."

Essentially EWIS recognizes that the wiring and associated components for a flap actuator are as critical to the safety of flight as the flap actuator itself.

EWIS – Separation and Anti-Chafe Requirements

The broad goal of EWIS is stated in CFR14.25.1707 (I): Each EWIS must be designed and installed so that there is adequate physical separation between it and other aircraft components and aircraft structure, and so that the EWIS is protected from sharp edges and corners, to minimize potential for abrasion/chafing, vibration damage, and other types of mechanical damage.

Wires suspended within the airframe are clamped every 14-18 inches and require a minimum .375" clearance between the wire/cables and the metallic structure. However, in reality the harnesses move over time, gust loads and maneuvering may cause them to shift out of their nominal position or sag/droop in some places while pulling and creating tension at others. This typically results in diminishing bend radii which can cause the wires to come in contact with the metallic structure.

Wire Anti-Chafe Protection 101

According to the FAA and EWIS Best Practices, "Grommets suitable for the environment must be used when the wire bundle passes through pressure bulkhead, firewall, and other openings in the structure. The grommet should cover the entire edge and come together at the top of the hole"

On many aircraft, wire anti-chafe protection has long been provided by the MS21266 nylon caterpillar grommet. These nylon strips have no natural retentive strength so have to be bonded to the penetrations with adhesive. Operationally, many of you will know this is a multi-step process. Bond preparation can take on average 20 minutes for contact cement or longer for an acrylic adhesive. Then the grommet must be applied and held in place with masking tape or clamps until the adhesive is fully cured.

Maintenance operations using this method are very challenging because wiring is often hidden deep in the skeleton and fabric of the plane. At most, only 15-20 percent of aircraft wiring can be readily accessed or visually inspected by maintenance engineers or inspectors. Even if the wiring can be accessed, the harnesses in place make the inspection and the bonding/taping/clamping operations far more difficult.

The use of adhesive requires H&S best practices as the adhesives most commonly used are Pliobond Contact Cement and 3M 1300L, both of which contain VOC/HAP, specifically the highly toxic MEK (Menthol Ethel Ketone). This requires ventilation or breathing apparatus depending on the situation.

Historically, this adhesive bond method has a high Cost of Poor Quality as one out of 10 required in process rework mostly due to dis-bondment and "egg-shaping" by the inflexible nylon grommet. This system relies on the reliability of the bond and the quality of the contact cement to protect aircraft.

Latest Technology - EWIS Ready

The alternative is a product like Spring-Fast grommet edging by Device Technologies, which snaps on without glue and is made from spring steel encapsulated in abrasion resistant polymer which gave it retentive strength, anti-chafe and dielectric qualities as well as half the total install cost. Many OEMs and MROs are switching to it.

EWIS has put increased emphasis on the wiring that every aircraft relies on. The data shown proves it is of critical concern. Every aircraft owner is required to make significant investments in safety and convenience upgrades. If you are adding ADS-B or in flight broad band WiFi or just doing standard maintenance, don't forget to assess your EWIS to protect your investment and keep it flying safely. EWIS protection and compliance are critical components in safeguarding your wiring and your equipment. **AVI**

The Impact of Hydrolysis on Grease Performance

By Gary Dudley, PhD

Global Grease Product Technical Advisor, ExxonMobil Aviation



Airlines are operating at lower cost margins than ever before, meaning a single misstep or grounding of an aircraft can potentially result in missed revenue targets. The cost of flight delays in the U.S. is estimated to be as much as \$31 million annually, according to Airlines for America. As a result, technicians have to follow rigorous precautionary measures to ensure aircraft are operating efficiently.

Using the right lubrication paired with the proper storage and handling techniques can have a crucial impact on preserving component condition and enhancing aircraft reliability. This is especially true for greases, which play a pivotal role in protecting flight controls, landing gear systems, bearing assemblies and ground support equipment under a variety of operating environments.

Under extreme environments, grease formulations can be exposed to a greater risk of contamination. One example is water exposure, which can cause grease to undergo hydrolysis, a chemical reaction that can cause a grease's base oil and/or additives to break down. When hydrolyzed, the grease's ability to protect critical aircraft components may be negatively impacted.

Warning Signs of Hydrolysis

Hydrolysis can occur when grease is exposed to excessive water such as precipitation and de-icing fluids on the tarmac, or when it's stored improperly.

Diagnosing hydrolyzed grease is not an exact science, but the following observations can indicate that grease has been compromised (see images):

- Unusual color: When compared to fresh grease, hydrolyzed grease may appear darker, or even black, as seen in the images.
- Abnormal consistency: Hydrolysis can alter a grease's consistency, making it appear softer or stiffer than usual.
- Strong, unpleasant odor: At times, a hydrolyzed grease can give off a distinct odor which is not consistent with a fresh sample.

Hydrolysis may occur immediately after a grease is exposed to water, and the rate is typically impacted by the severity of an application's operating temperatures and exposure to certain elements. However, hydrolyzed greases may show few-to-none of these warning signs throughout a grease's lifecycle. To be safe, technicians should evaluate their grease every 10,000 hours for irregularities and consult their suppliers with any questions.

Reducing the Rate of Hydrolysis

Although a serious condition, hydrolysis is preventable. With this in mind, here are three tips and strategies to help prevent grease from hydrolyzing.

First, choose the right grease formulation. There are a number of grease characteristics to evaluate to help keep the rate of hydrolysis to a minimum. It's important for grease to contain a hydrocarbon base oil, which serves as the backbone of product performance. Hydrocarbon-based greases are less susceptible to hydrolysis.

To protect against hydrolysis, greases should also contain additive technology that provides excellent water resistance. This helps prevent contamination and degradation when exposed to adverse weather and wet conditions.

In addition to water resistance, grease should be well-equipped with robust oxidation and rust inhibitors, extreme pressure additives, and anti-wear and friction-reducing agents that can help further enhance performance in adverse conditions involving exposure to water.

Next, grease must be properly stored and handled. Selecting the right grease is not enough. To preserve grease for the duration of its shelf life, it must be stored properly.

To preserve shelf life, greases should be stored in dry, clean environments between 0° and 40° Celsius. In the event that a stored grease is briefly exposed to severe temperatures or environmental conditions, technicians should consult their suppliers with concerns.

Testing at 121° Celsius

Day 0

Day 1

Day 2



Shown here is the progression of hydrolysis in ExxonMobil's Mobilgrease 33 on the right in each image versus another brand on the left. ExxonMobil says their grease provides exceptional performance and the ability to maintain structural stability in the presence of water.

Once a grease package is opened, the grease should be used as soon as possible. In addition, if improperly stored, the grease may become contaminated and it will likely deteriorate. As a result, the grease will need to be disposed.

And lastly, don't be afraid to consult your supplier. Fortunately, a number of regulations and maintenance checks are already in place to prevent hydrolysis from affecting aircraft components. However, if signs of hydrolysis start to appear, technicians should contact their supplier immediately.

Suppliers can help evaluate grease programs help technicians analyze their aircraft as well as OEM recommendations to identify the best possible mix of greases and oils for their fleets.

Suppliers can conduct lubricant storage and handling studies and provide analysis, assessments and recommendations regarding product storage and handling conditions. Learn more at <https://www.exxonmobil.com/en/aviation>. **AM**



Electronic Records, Traceability, and the FAA's Efforts to Get Out of Its Own Way

The Electronic Signatures in Global and National Commerce Act (ESIGN) was signed into law on June 30, 2000 — 18 years old this year. If there was any justice in the world, we'd all be buying the law a cigar and allowing it to vote.

ESIGN established a general rule of validity for electronic records, contracts, and signatures. Prior to the law, courts refused to recognize electronic signatures and they questioned electronic records.

ESIGN applies to transactions "in interstate commerce," which is a term of art meaning the transaction is open to being regulated by Congress under the Interstate Commerce Clause of the Constitution (most transactions, today, are subject to this clause). Generally, it explains that when records and agreements are required to be in writing, an electronic version counts as a "writing."

ESIGN also applies to federal and state government agencies. They are forbidden from adopting record-keeping rules that would "impose unreasonable costs on the acceptance and use of electronic records." The law explains that if an agency wants to require paper records (to the exclusion of electronic), then the agency needs to show "there is a compelling governmental interest relating to law enforcement or national security for imposing such requirement."

Eighteen years after it was enacted, the aviation industry struggles with full implementation of the law. Even though it's clear that aviation records can be recorded and transmitted electronically, we remain wedded to paper. Nowhere is this more clear than with respect to parts documentation. The industry is still coming to grips with the Maintenance Annex Guidance which imposed a semblance of EASA documentation requirements on receiving inspections (without including the safety valves that exist in the European system).

There are practical reasons the industry prefers paper for aircraft parts. One is because most aircraft parts are unserialized, and it can be difficult to uniquely tie an electronic record to a particular (unserialized) part. A paper record, on the other hand, can be literally, physically, connected to the part. In a world in which we deal with so many different parts coming and going through our warehouses, paper records provide a level of comfort that we are connecting the uniquely correct record to the uniquely correct part.

The FAA has repeatedly said commercial documentation paradigms (like back-to-birth traceability) are not required by FAA regulations. In separate legal opinion letters issued by the FAA's Office of the Chief Counsel, the FAA has specifically stated that there is no Federal Aviation Regulation that requires traceability of an aircraft part to its origin, and the FAA does not require back-to-birth records (not even for life-limited parts — the law only requires current life status on such parts). The FAA has explained that a part may be identified as having been released by a manufacturer as an airworthy part using "a shipping document, a manufacturer's certificate of conformance or material certification, or an FAA Airworthiness Approval Tag, Form 8130-3," but in the absence of such documentation, "the part may be submitted for inspection and testing to determine conformity."

Despite the best efforts of the FAA's lawyers, the industry

remains stubbornly rooted to a paperwork paradigm. One important reason for this, a reason that is tied back to the FAA itself, is that FAA inspectors frequently insist the manuals for FAA certificate holders feature documentation requirements. Once these requirements are published in the manuals, then these FAA-approved manuals drive the documentation requirements which are flowed-down throughout the industry. And because these documentation requirements are not directly tied to FAA regulations, there is no opportunity to apply the ESIGN mandates and protections to them.

This is not an isolated to a few inspectors. It is promulgated through the entire organization through internal FAA orders. For example, the Flight Standards Information Management System (FSIMS) is where the FAA publishes job instructions for the inspectors in the Flight Standards Service. Those instructions advise inspectors who are examining repair stations to inspect the parts to ensure, "There is traceability of material or parts received from distributors and that the records of receiving inspection data are retained and list the name, part number, quantity, and inspection results." This is not legal policy — it cannot be enforced against a repair station that refuses to implement such traceability mechanisms — and the Paperwork Reduction Act would likely preclude the FAA from any attempt to punish a repair station for failure to adhere to the policy. But this sort of language is still causing FAA employees to advise certificate holders that traceability should be obtained, even if the law does not require it.

This traceability paradigm impedes certain efforts to move to electronic documentation, because the electronic documentation doesn't meet traditional notions of traceability.

In conversations with both the FAA and EASA, we are starting to see a new understanding of the value of several important paperwork paradigms. Both agencies are talking about "limiting documentation 'requirements' only to those that are actually valuable to safety (so 'traceability' requirements better match the actual regulatory requirements)," making acceptable safety information about parts more readily available through trusted industry channels (such as developing new DARs in the US and explicitly permitting reliance on certificates of conformity in the EU); and permitting greater reliance on electronic information where availability of such data supports safety.

This is likely to be related to the greater reliance of the rest of the world on electronic data (a reliance that was facilitated by ESIGN), but it is also related to the fact that senior decision-makers in the FAA and EASA are more comfortable with electronic records than were their predecessors (again, a comfort that was facilitated by the impact of ESIGN on other parts of the world of data). These same senior decision-makers are also thinking more critically about what information supports safety (and should be encouraged) and what does not (and therefore unnecessary to the FAA's safety mission).

The ESIGN law is 18 years old this year — now is the time to remove impediments that have interfered with its full implementation in the aviation industry. **AM**



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