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Born to Run

HOW ENGINE OEMS & MROS ARE HELPING OPERATORS THROUGH THE CRISIS

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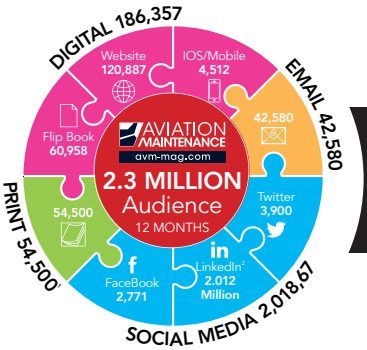
Born to Run

Mindful of the economic challenges their customers are facing during the pandemic, engine OEMs and MROs are doing their best to assist them through the crisis.

Cover image courtesy of Roll-Royce.



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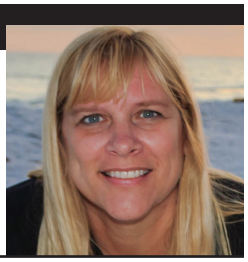

BY JOY FINNEGAN
EDITOR-IN-CHIEF

We can't just not talk about it. The elephant in the room as they say. The thing that impacts every move you make but no one talks about because it is too painful. That is where we are right now. No matter what your beliefs or stand on masks and public health, we are in the middle of a health crisis that is impacting aviation to the highest degree since its inception as a market sector.

So what is happening? As of this writing, there had been 31 million cases of COVID-19 in the world. The epicenter of the outbreak is the United States where there are a reported 6.8 million cases and 200,000 deaths resulting from COVID-19. India and Brazil are both not far behind. There are still travel restrictions in place between numerous countries and confidence in flying remains low, in spite of a recent uptick in travel.

We have had some government assistance to get airlines through the roughest part of the travel stoppage. Some airlines are ready for another influx of money from the government to get them over the hump — the initial round is over as of October 1. Delta might be the outlier among airlines saying that they will not take the next round of Coronavirus Aid Relief and Economic Security (CARES) Act money, instead preferring to utilize their own SkyMiles credit card funds to keep from needing the CARES money. Delta says the new credit facility will "provide gross proceeds of $9.0 billion" to assist them through this prolonged downturn.

All of the airlines are trying numerous strategies to ameliorate the situation such as new cleaning processes, keeping middle seats empty and adjusting workforce by offering leaves of absence and early retirement packages, making historic capacity cuts, parking or retiring older aircraft (and, in some cases, entire fleet types), utilizing passenger planes on cargo-only missions, either belly-only or belly and main cabin says Airlines for America. And Delta's CEO Ed Bastian says they are "leveraging our MRO business and partnerships with Pratt & Whitney and Rolls Royce to secure TechOps employment."

All the airlines are utilizing new cabin cleaning methods to ensure aircraft in their fleet remain sanitary and COVID-free. For example, United Airlines added Zoono Microbe Shield, an EPA registered antimicrobial coating that forms a long-lasting bond with surfaces and inhibits the growth of microbes, to the airline's already rigorous safety and cleaning procedures.

But the simple fact remains that capacity is too great for demand right now and for the near future. "Global airline flights slid last week which appears to be based on airlines dialing back schedules post-summer as a result of limited demand for travel. I believe we'll see airline flights hover in this range for a while as demand grows," says Daniel Baker, CEO, FlightAware.

Airlines for America says for U.S. airlines, passenger volumes remain 65 percent below last year at this time and that the average number of passengers per flight for the week ending September 13 was 69.

For its part, IATA is relaying a message of hopeful realism and calling for the systematic testing of all international travelers before departure. "This should enable governments to safely open borders without quarantine. And it will provide passengers with the certainty that they can travel without having to worry about a last-minute change in government rules that could spoil their plans," IATA CEO, Alexandre De Juniac, stressed at the IATA media briefing on September 22, 2020. China's air travel is rebounding faster since they have seemingly gotten the virus under control. European air travel experienced an uptick in June when some borders were reopened, but generally, load factors remain at record lows there, too.

Richard Brown, managing director of consultancy firm Naveo says 38 percent of the air transport fleet is parked or in storage as of mid-September. "While international travel outside of Europe is severely limited, something of the summer holiday season appears to have been salvaged though it feels like a case of two steps forward, one-step- back as cases rise again, localized lockdowns are enforced, and travel restrictions are imposed [again]," Brown says in his latest report: "Air Transport Fleet & MRO Trends." Brown adds for MRO specifically, "Pre-COVID 2020 MRO spend was expected to be approximately $91B. Instead, due to COVID-19 2020 MRO spend is forecasted to be around 45 percent lower at approximately $50B." Learn from more from Brown at naveo.com.

All of this to say, aviation has a long way to go before things are going to be OK. As we have mentioned before, the impact of this black swan event is far worse than the terrorist attacks in the U. S. on 9/11 or the Great Recession of 2007-2009. Still, I am hopeful.

In any case, please enjoy this issue of **Aviation Maintenance.** Our cover story is focused on how engine OEMs and MROs are helping their clients get through this challenging time. We spoke with all the major engine OEMs, as well as several MROs who do engine work, to see how they are responding and helping.

Non-destructive testing and inspections are always fascinating topics — testing or inspecting an aircraft part without doing any harm to it and returning it to service is science and art. We spoke to FAA and test equipment manufacturer TESTIA to learn more.

We also have another installment of our series "On Guard," written by former NTSB and FAA accident expert, Jeff Guzzetti. He takes a deeper dive into the Lion Air 737 MAX accident. Of course we all know now about the MCAS problem, but there is always more to the story. Guzzetti shows where the maintenance team was lacking. AVM

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Norwegian Extends Agreement with Lufthansa

Norwegian Air Shuttle ASA and Lufthansa Technik have extended their cooperation for the overhaul of the carrier's 90-aircraft Boeing 737NG fleet by another five years. The services will continue to be performed at Lufthansa Technik's location in Budapest, Hungary, within the framework of a Total Base Maintenance Support (TBS) contract, with the first contract events planned for September 2020.

"Lufthansa Technik was winning this contract in a large extensive global tendering process, that was demanding both for Lufthansa Technik and Norwegian. The quality and reliability of past services provided by Lufthansa Technik have convinced us to continue to place our trust in our German partner for the overhaul of our Boeing 737NG fleet," said Paul Salwik, head of Technical Procurement at Norwegian.

"We are pleased that this new contract will continue a successful cooperation with Norwegian that reaches back to 2007. With our services, we want to play our part in ensuring the continued success of this innovative airline," said Tanja Pustolla, responsible sales representative at Lufthansa Technik.

The main characteristics of Total Base Maintenance Support TBS are the guaranteed availability of layovers and a commercial service package geared to individual customer needs. As one of a total of five Lufthansa Technik overhaul sites in Europe, Lufthansa Technik Budapest will provide services within the framework of the new contract. As a TBS customer, Norwegian also has access to the entire overhaul network of Lufthansa Technik for additional or unplanned maintenance events.

Norwegian has been a Lufthansa Technik customer since 2007. The cooperation began with component supply within the framework of a contract for Total Component Support TCS. Later, Lufthansa Technik also took on wheels and brakes maintenance and engine overhaul for

engines of the CFM56-7B type. Since 2012, Lufthansa Technik has providing overhaul services for Boeing 737NG aircraft.

C&L Aviation Group Completes First Bongiovi Embraer 135 Speakerless Sound System

C&L Aviation Services (C&L) has successfully installed a Bongiovi speaker less cabin audio system into an Embraer 135. The system, which uses Bongiovi's patented Digital Power Station (DPS) signal processing technology, coupled with transducers attached to the backside of aircraft interior panels, is the first such system installed into an Embraer 135 aircraft. The resulting sound is an immersive audio experience that produces a high-fidelity sound that remains consistent throughout the entire aircraft cabin, according to the company.

"C&L are experts in modifying and improving regional aircraft like ERJ 135/145 making them the ideal choice for a project like this one," said Rob Hamelink, managing partner at Bongiovi Aviation. C&L has been a great partner of ours for several years and we look forward to working with them for many years to come."

C&L has been modifying and upgrading the interiors and systems inside regional jets for several years, specializing in converting the aircraft into business-class and luxury aircraft. C&L provides interior aircraft refurbishment, engineering, and exterior paint services to convert regional jets such as CRJ and ERJ aircraft from standard "airliner configuration" to 30 seat (or less) aircraft including new seat designs, upgrading interior panels, upgrading lavatories, installing LED lighting, Wi-Fi and other avionics upgrades, electrical outlets, and more.

"C&L is always excited to be able to provide solutions like the Bongiovi system to meet the specialized needs of our customers," said Calvin Tuitt, SVP of Business Development MRO. "Due to our regional and corporate aircraft experience, C&L is a logical choice to complete projects like this one."

Construction of Sulzer's New Birmingham Service Center on Track

Work on Sulzer's new state-of-the-art service center in Birmingham, UK, is continuing to schedule. As planned, the building is now watertight, and attention is turning to the internal construction of the workshop area and the offices. Customers can expect the new facility to be open towards the end of autumn 2020, and in the meantime, the existing service center will continue to work at full capacity.

Located in the Birmingham Business Park, Sulzer's new service center is rapidly taking shape with the main building shell in place and sealed. While the construction continues, plans for moving all the staff and their tools and equipment are being finalized so as to avoid any interruption in service to customers.

"Now that it is watertight, we can really make some progress inside this fantastic building," says Warren Bell, project manager for Sulzer. "The office floors are in and soon we will have a massive concrete pour for the workshop floor. Once this is complete, we will really start to see the various business areas take shape."

The company says much thought has gone into developing the most efficient work flows for each area of the service center. Together, they say the facility will deliver a wide range of capabilities, all using lean manufacturing techniques, to ensure all maintenance and repair projects are optimized.

A specialist logistics company will be relocating all of the machinery and equipment over a two-month period with a seamless move that will ensure that every customer has a smooth transition to the new site. In addition to the existing equipment such as the copper rolling mill, winding machines and the high voltage test-bed, Sulzer is also investing in additional equipment, such as new ovens and paint booths.

"This new facility will be an engineering center of excellence using lean manufacturing principles to ensure an enhanced customer experience," Chris Powles, head of Electro Mechanical Services – EMEA, comments. "The improved working environment and more efficient processes will benefit our employees as well as our customers, who will have uninterrupted, high-level service throughout the transition to the new site."

NCAME Director Nima Shamsaei (l) and Steve Taylor, Associate Dean (r).

FAA Invests $3 million in Auburn University Additive Manufacturing Research

A recent $3 million grant from the Federal Aviation Administration (FAA) to the National Center for Additive Manufacturing Excellence (NCAME) at Auburn University will soon initiate a two-year project focused on improving commercial air travel through the use of 3D-printed (or additively manufactured) metal components.

The project involves fabricating metal parts from multiple industrial-scale metal 3D printers. It aims to specifically address issues related to understanding the variability in performance of the same parts made on different machines, as well as issues related to understanding how microscopic features in the 3D-printed metal affect overall fatigue and fracture properties. Both are key areas in the development of additive manufacturing (AM) specifications that the FAA wants to eventually apply in commercial airlines.

"This is what I call the 'Achilles heel' of additive manufacturing," said NCAME director Nima Shamsaei, Philpott-WestPoint Stevens Distinguished Associate Professor of mechanical engineering. "Such variations make the qualification and certification of AM materials and parts challenging."

The FAA said the partnership is ultimately intended to improve safety by standardizing certification of existing and emerging structural applications of advanced materials, a research area in which NCAME quickly emerged as an international leader, especially in the area of materials used for spaceflight.

Established in 2017 through a public-private partnership between Auburn and NASA, NCAME is also one of the founding partners of the ASTM International Additive Manufacturing Center of Excellence, which aims to close AM standards and workforce gaps.

"By understanding the sources of variability, controlling them, or accounting for them, we can generate more reliable materials data, and more reliable AM products," said Shamsaei, who serves as co-principle investigator (PI) on the project.

Co-PI Steve Taylor, associate dean for research, agrees. "By teaming our faculty, who are global leaders in research on additively manufactured metal components, with the top engineers and scientists at FAA, we are confident that we can develop new knowledge that will help engineers design safer, more efficient aircraft," Taylor said. "Auburn University is honored to be collaborating with the FAA."

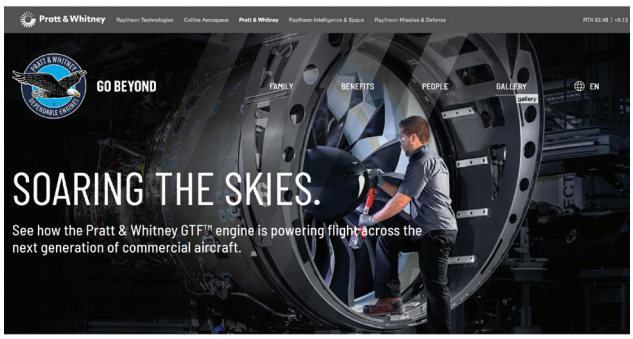
Other investigators on the project include Shuai Shao, associate professor of mechanical engineering; Hareesh Tippur, McWane Professor of mechanical engineering; Nick Tsolas, assistant professor of mechanical engineering; Jeff Suhling, chair of the Department of Mechanical Engineering; Masoud Mahjouri-Samani, assistant professor of electrical and computer engineering; Alex Vinel, assistant professor of industrial and systems engineering; Daniel Silva, assistant professor of industrial and systems engineering; and Jia (Peter) Liu, assistant professor of industrial and systems engineering. Mike Ogles, director of NASA Programs, serves as project manager.

Pratt & Whitney Unveils Enhanced GTF Engine Website

Pratt & Whitney launched an enhanced website showcasing the GTF engine family. The site details the Geared Turbofan's advanced, fuel efficient and environmentally friendly single-aisle engine characteristics. Pratt & Whitney says the site also adds new digital features, including an engine spotter's guide, multimedia gallery and interactive route map highlighting the engine's benefits. See the new website at https://pwgtf.com/.

The company says more than 750 GTF-powered aircraft have been delivered to 48 airlines around the world. With more than six million engine flight hours of experience, Pratt & Whitney estimates that its GTF engines have "collectively saved customers nearly 350 million gallons of fuel, while avoiding over 3 million metric tonnes of carbon emissions." The GTF maintenance, repair and overhaul (MRO) network is available on three continents, Pratt & Whitney says.

Since entering into service in early 2016, P&W says the GTF engine

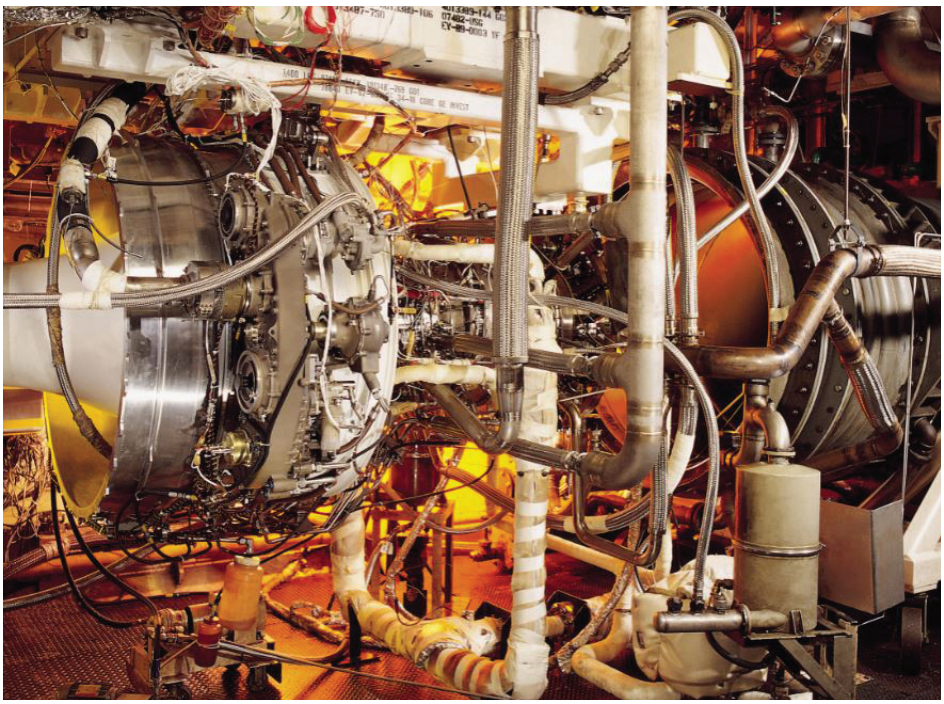


family is delivering on the promised ability to reduce fuel burn by up to 20 percent, and to dramatically reduce regulated emissions and noise footprint.

Element and GE Aviation Team Up to Expand Test Services

A new agreement between Element Materials Technology (Element) and GE Aviation provides Element customers with access to GE's comprehensive product qualification testing (PQT) capabilities.

Building on a 50-year relationship between the two companies, Element expands its current capabilities, providing PQT customers with a broader range of testing in GE Aviation's 40+ global testing facilities. GE Aviation's unparalleled capabilities include testing at temperatures above 1400°F and pressures up to 1000 psia to simulate the extreme conditions that exist inside today's advanced engines. The two companies say combining the capabilities of GE Aviation's test services with Element's existing PQT capabilities "gives customers access to one of the most comprehensive arrays of product qualification testing available globally."



Element and GE say teaming up will allow synergies such as testing at temperatures above 1400°F and pressures up to 1000 psia to simulate extreme conditions.

"We have a proud history of supporting GE's core businesses – aviation, power, renewable energy and healthcare," Rick Sluiters, EVP for Aerospace at Element, says. "I am delighted that we have been able to further cement our relationship through this unique partnership. Combining Element's access to customers with GE's testing strength is a win-win for both companies, as well as for aerospace PQT customers across the world."

Nate Roedig, general manager of Test Systems Engineering & Flight Test Operations for GE Aviation adds, "We are excited to be working with Element to provide the same high quality testing capabilities and service to Element customers that we use every day to test GE Aviation's engines, materials and components."

Barnes Enters Long-term Agreement With GE Aviation for Manufacture of LEAP Components

Barnes Aerospace has entered into a long-term agreement with GE Aviation for the manufacture of components for the LEAP engine program. Barnes Aerospace says it will leverage its expertise and technology in the machining and assembly of complex hot-section engine components.

"As a result of Barnes Aerospace's commitment to drive innovation resulting in industry-leading technical, quality and manufacturing capabilities, Barnes Aerospace has been selected as a key supplier on LEAP engine programs," says Mike Beck, senior vice president, Barnes Group Inc. and president, Barnes Aerospace. "We are delighted to expand and extend our participation on these programs and are driving flawless execution through our Barnes Enterprise System. GE's willingness and confidence to place additional LEAP business and extend long-term contracts with Barnes Aerospace is testament to our excellent, long-standing relationship."

Airbus Canada Transfers A220 Material Management to Satair

Airbus Canada Limited Partnership has officially transferred the overall A220 material management services offer to Satair, as part of the program integration into Airbus. Since July, Satair, an Airbus services company, has taken the lead on global material support and services for A220 operators, working in close coordination with the A220 program team in Airbus Canada.

Airbus says the transfer represents a key milestone for them and a significant step in the overall further integration of the A220 program. "All A220 customers will benefit from the same level of service and global network offered by Satair on all other Airbus platforms," says Rob Dewar, senior vice president, A220 Customer Services, Customer Satisfaction and Product Policy. "This is a significant contributor to improving the overall satisfaction of our growing A220 customer base worldwide."

Satair has taken over material management for the A220 to include: inventory; purchasing warehousing & distribution; customer order handling 24/7 AOG handling and more.

"Satair's footprint of service centers and warehouses will contribute to a greater scope of spare parts available for all A220 operators. Customers can look forward to leveraging Satair's global presence," states Bart Reijnen, CEO of Satair. "We are very proud to be supporting the A220 aircraft with our strong Satair organization."

The A220 material management services transition to Satair started officially on July 1st, 2020. Overall, Satair is now in charge of a range of value-adding activities including planning and inventory; purchasing; quality inspection; certification; warehousing & distribution; customer order handling; 24/7 AOG handling; initial provisioning and tool lease. Over time, as the A220 fleet grows and also gains in maturity, Satair says they will also develop the areas of parts lease, repair and exchange for the A220. The customer order handling of the A220 program is solely managed in the Satair OEM parts and services channel with its global group of Satair companies.

The A220 program headquarters are located in Mirabel, Canada together with main customer services functions, such as engineering expertise and 24/7/365 Customer Response Center. The A220's order book comprises 642 A220 aircraft on firm order as of end of July 2020.

As of the end July 2020, 118 A220s have been delivered to seven operators and are being flown on routes in Asia, America, Europe and Africa.

Bombardier Makes Two Key U.S. Service Center Appointments

Bombardier Aviation recently announced key leadership appointments at its Tucson and Fort Lauderdale service facilities.

Marc Beaudette, who previously led the Bombardier Tucson Service Center, has been appointed general manager of the Fort Lauderdale facility and will continue in his success to further elevate the customer experience and drive the company's customer-centric culture. With 30 years of experience at Bombardier, Beaudette has knowledge of both production and maintenance operations and an understanding of interiors and completions. He will lead the eventual move from their Fort Lauderdale Service Center to their new facility at Miami-Opa Locka Executive Airport.

"Marc is an accomplished Bombardier veteran and has made significant improvements at our Tucson Service Center in the last three years, notably the positive impact on the customer experience," said Jean-Christophe Gallagher, vice president and general manager, Customer Experience, Bombardier Aviation. "I know he will be influential in leading the evolution of our new service facility in Miami-Dade County."

Appointed to the role of general manager of the Tucson Service Center is Michel (Mike) Menard. With 30 years of experience in the aviation industry, Mike began his career as an aircraft maintenance and engineering officer in the Royal Canadian Air Force. For the last 12 years, Mike was vice president and general manager for StandardAero and Dassault Aircraft Services in the United States and abroad, making him ideally suited to take the helm in Tucson.

"We are thrilled to welcome Mike to the Bombardier family – his appointment is a testament to his deep knowledge of the aviation industry and his solid leadership skills," says Gallagher. "Mike's strong background in business aircraft support will be an asset to the team as he works to maintain overall customer satisfaction in Tucson and ensure this key service center continues to be a top choice for our customers."

The Tucson and Fort Lauderdale Service Centers are among nine service facilities in the Bombardier Aviation support network where technicians deliver a range of aircraft maintenance services, modifications, inspections, refurbishment, fly-in repairs and aircraft-on-ground (AOG) service on Bombardier's leading families of Learjet, Challenger and Global business jets.

Marc Beaudette

Mike Menard

Safran Makes Management Appointments

Olivier Andriès has been named executive vice president of Safran. He is a member of the Group's Executive Committee. Andriès will succeed Philippe Petitcolin as CEO of Safran on January 1, 2021. Andriès joined Airbus in 2000, in charge of Widebody Aircraft Programs and joined Safran in 2008 as executive vice president, Strategy and Development. He was subsequently named EVP in charge of the Defense and Security branch, and a member of the Management Board, in 2009. In 2011, Andriès became CEO of Turbomeca (now Safran Helicopter Engines). In 2015 he was appointed CEO of Safran Aircraft Engines.

Jean-Paul Alary has been appointed CEO of Safran Aircraft Engines. He succeeds Olivier Andriès and is a member of the Group's Executive Committee. Alary started his career in 1991 at Snecma (now Safran Aircraft Engines). He moved to Snecma's Commercial Engine division in 2010 as head of customer support. In 2013, Jean-Paul Alary was named executive vice president, Safran Electronics division at Sagem (now Safran Electronics & Defense). In 2015, he was named CEO of Safran Nacelles, and in 2018 he was appointed CEO of Safran Landing Systems.

Cédric Goubet has been named CEO of Safran Landing Systems. He succeeds Jean-Paul Alary and is a member of the Group's Executive Committee. Goubet started as career as a senior civil servant and in 2007, he was named chief of staff for French President Nicolas Sarkozy, a position he held until joining Safran in 2010 as deputy to the deputy chief executive officer, Operations. He was named vice president for CFM programs at Snecma (now Safran Aircraft Engines) and EVP of CFM International in 2011. In 2015 he became EVP, Commercial Engine division at Safran Aircraft Engines, and in 2018, he was appointed CEO of Safran Nacelles.

Vincent Caro has been named CEO of Safran Nacelles. He succeeds Cédric Goubet and becomes a member of the Group's Executive Committee. Caro started his career with Labinal's automotive business, in a series of purchasing positions. He was named head of purchasing at Labinal in 2001, then managing director of the Casablanca, Morocco-based joint venture Matis Aerospace (between Boeing and Safran) in 2005. He moved to Snecma (now Safran Aircraft Engines) in 2008 as head of purchasing, then joined Messier-Bugatti-Dowty (now Safran Landing Systems) in 2013 as EVP, Programs. Two years later, he was named head of the company's Wheels and Brakes division.

Olivier Andriès

Cédric Goubet

Jean-Paul Alary

Vincent Caro

Collins to Bring Fast In-Flight Connectivity to Four Gulfstreams

Western Jet Aviation says they are paving the way for Collins Aerospace's new LuxStream connectivity service to provide the "fastest speeds available on multiple Gulfstream aircraft." Western Jet Aviation, based in Van Nuys, California, and Collins Aerospace anticipate the first Supplemental Type Certificate (STC) from the Federal Aviation Administration (FAA) this month to install the KuSAT-2000 SATCOM terminal on the G450. The G350, GV and G550 aircraft will follow shortly behind, with their STC's slated to be complete before the end of the year.

Western Jet Aviation says they are anticipating the STC for Collins Aerospace's new LuxStream connectivity service to be available for the G450 shortly.

LuxStream, launched in late 2019, offers speeds up to 25 Mbps in the United States and 15 Mbps globally via SES's managed Ku-band satellite network. This new solution, available as part of Collins Aerospace's ARINCDirect portfolio of services, will provide customers with additional benefits including high-quality bandwidth capable of supporting multiple streams of ultra-high-definition content; flexible pricing models and an "always-on service" enabled by the redundancy and resiliency offered by SES satellites; and a turn-key solution with both hardware and service provided by Collins Aerospace, giving the operator one point of contact and access to Collins' industry-leading global support services.

"With Western Jet Aviation's STCs, Gulfstream operators can now go to any Collins Aerospace approved MRO to install the KuSAT-2000, allowing them to experience LuxStream's unparalleled connectivity speeds and services," said Dori Henderson, executive director, Business Aviation & Digital Solutions for Collins Aerospace. "We know in-flight connectivity is one of the most in-demand features on today's business aircraft and we are proud to provide the market's premier service."

"Western Jet Aviation is committed to providing our customers with top-class products and services," said Jim Hansen, CEO of Western Jet Aviation. "When it comes to Cabin Connectivity, we believe the KuSAT-2000 system combined with the LuxStream service meets this mark. The fast speeds and great customer service will be a great fit for our Gulfstream customer base."

LuxStream is powered by SES's global geostationary high-throughput and wide satellite beams, as well as a flexible, intelligent ground network. Its performance has been validated y with more than 25 passengers able to easily access the internet and stream entertainment content to their personal devices at 25Mbps at the same time. Additional LuxStream STCs are anticipated by the end of the third quarter of 2020.

Lockheed Martin Skunk Works Completes First Go-Live with iBASEt

iBASEt, a provider of manufacturing, quality, and MRO solutions that enable digital continuity, shared that Lockheed Martin Skunk Works has achieved with its implementation of iBASEt's Manufacturing Execution System (MES). The first site went live without customization in just eight months, an achievement considering the complexity of the project. Future sites are expected to go live even faster, iBASEt says.

Lockheed Martin's iBASEt MES deployment delivers digital continuity across the company's manufacturing engineering, process planning, shop floor execution, and quality management operations. Over the coming years, iBASEt's MES will be deployed across multiple Lockheed Martin sites.

"Our digital continuity strategy consolidates multiple existing systems into a single platform, allowing for the necessary retirement of many outdated legacy systems," explains Brad Leech, senior manager, MES Implementation at Lockheed Martin Skunk Works. "The improved capabilities of the system allows our team to quickly adapt, delivering more value to our customers."

"It has been exciting to work with Lockheed Martin along their digital thread journey. Together, we have redefined how a successful MES solution can be deployed within the complex discrete aerospace and defense manufacturing industry," says Naveen Poonian, CEO and president at iBASEt. "In times of change when facing extreme challenges, leaders rise to the occasion and innovate to take the industry to the next level – we are now experiencing this firsthand and have learned a great deal as part of the process."

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More Schools Join the FAA UAS Collegiate Training Initiative

The Federal Aviation Administration (FAA) announced 15 more schools have been selected to participate in the Unmanned Aircraft Systems (UAS) Collegiate Training Initiative (UAS-CTI).

The new schools are:

- Austin Community College, Austin, Texas
- Atlantic Cape Community College, Mays Landing, New Jersey
- Big Bend Community College, Moses Lake, Washington
- Blue Ridge Community and Technical College, Martinsburg, West Virginia
- Carroll Community College, Westminster, Maryland
- Clark State Community College, Springfield, Ohio
- Elizabeth City State University, Elizabeth City, North Carolina
- Florida State University, Tallahassee, Florida
- Fullerton College, Fullerton California
- Kansas State Polytechnic, Salina, Kansas
- Liberty University, Lynchburg, Virginia
- Middle Tennessee State University, Murfreesboro, Tennessee
- Mitchell Technical College, Mitchell, South Dakota
- Southern West Virginia Community and Technical College, Mount Gay, West Virginia
- Yavapai College, Prescott, Arizona

The FAA's CTI program allows educational institutions to collaborate with the FAA to help students pursue their aviation career goals. The UAS-CTI program recognizes institutions that prepare students for careers involving UAS, commonly referred to as drones. The new schools join 26 schools that have already been selected to participate in the program. These previously selected schools are listed below:

- Blue Mountain Community College, Pendleton, Oregon
- Central Oregon Community College, Bend, Oregon
- Dakota College, Bottineau, North Dakota
- Embry Riddle Aeronautical University, Daytona Beach, FL, Prescott, AZ, and Worldwide Campus
- Green River College, Auburn, Washington
- Gulf Coast Community College, Panama City, Florida
- Hazard Community and Technical College, Hazard, Kentucky
- Hinds Community College, Raymond, Mississippi
- Idaho State University, Pocatello, Idaho
- Indiana State University, Terra Haute, Indiana
- Mira Costa College, Carlsbad, California
- Mountain Empire Community College, Big Stone Gap, Virginia
- Mountwest Community and Technical College, Huntington, West Virginia
- Niagara Community College, Sanborn, New York
- North Carolina State University, Raleigh, North Carolina
- Northeastern Technical College, Cheraw, South Carolina
- Northland Community and Technical College, Thief River Falls, Minnesota
- Northwestern Michigan College, Traverse, Michigan
- Oklahoma City Community College, Oklahoma City, Oklahoma
- Palomar College District, San Marcos, California
- Santa Rosa Junior College, Santa Rosa, California
- Southwestern College, Chula Vista, California
- Tallahassee Community College, Tallahassee, Florida
- University of Maine at Augusta, Augusta, Maine
- University of North Dakota, Grand Forks, North Dakota
- WSU Tech, Wichita, Kansas

The FAA launched the UAS-CTI program in April 2020. Participating institutions will engage with the FAA, each other, general industry, local governments, law enforcement, and regional economic development entities to address labor force needs. UAS-CTI school graduates will have the knowledge and skills needed to pursue a successful career in a UAS-related field.

Post-secondary institutions with UAS curriculums seeking recognition as UAS-CTI partners may still apply for this distinction. Program guidelines are posted at FAA.gov. The FAA Reauthorization Act of 2018 (Public Law 115-254) required the FAA to establish a collegiate training initiative program relating to unmanned aircraft and to establish a process to designate consortia of public, two-year institutions of higher education as Community and Technical College Centers of Excellence in Small Unmanned Aircraft System Technology Training.

North American Aerospace Industries Announces Merger with Aircraft Interior Recycling Association (AIRA)s

North American Aerospace Industries (NAAI, Kinston, North Carolina, USA), a provider of sustainable end-to-end aircraft recycling, has merged with Aircraft Interior Recycling Association (AIRA, Sheffield, South Yorkshire, UK), a total aircraft interior support company. The merger will offer new opportunities for airlines, aircraft owners and OEMs to generate new revenue streams, gain savings, reduce their carbon footprints and help address critical social needs. All of these things will become important in the post-pandemic period, the companies believe.

"AIRA is the only aircraft interior recycling company that has developed the scientific expertise and technical know-how to properly recycle end of life aircraft interiors and waste materials from manufacturing," says Sven Daniel Koechler, PhD, president and CEO of NAAI. "Since our top priority is to provide sustainable aircraft recycling services through which 100 percent of an aircraft is recycled or up-cycled, gaining the ability to effectively address one of the most challenging aspects of an aircraft's recycling – its composite plastic interior components – is a major achievement for us. We are very proud of our new alignment with AIRA. Together, we intend to revolutionize aircraft recycling, transforming it into an industry which delivers enormous benefit across the entire chain, from OEMs, MROs, airlines, and leasing companies to the general public and the environment."

AIRA's Tony Seville, managing director, adds, "This is two companies coming together with a mutual vision and solutions to the major challenges of recycling aircraft correctly, with all of its many different materials and with the environment foremost in mind.

SD Reaches Major Milestone with Install of 2,000th FlightDeck Freedom

Satcom Direct (SD) has achieved a milestone for its FlightDeck Freedom (FDF) datalink service by activating its 2,000th aircraft. The head-of-state customer signed for the service to take advantage of its unique configuration options, ability to integrate third-party flight planning services, evolving compliance support, and the streamlining of flight crew and ground operations workflow.

Specifically designed for business and military aviation, SD says FlightDeck Freedom features an open architecture design to support every type of avionics and datalink-capable airframe and can be customized to meet each customer and/or aircraft platform's mission needs. On launch in 2007 it was the first datalink service to give allow customers to select, upload from and communicate with preferred third-party trip planning services. SD says it is still the only datalink service provider with a comprehensive offering of flight planning options. FDF also continues to be the only service that supports flight deck and cabin communications enabling crew to monitor connectivity and troubleshoot issues in real time to better manage passenger expectations.

In addition, FDF enhances operational safety through direct delivery of automated notifications including hazardous weather, route and security alerts, and supports real time aircraft and fleet tracking worldwide, which can be monitored from the ground and in the air. The GeoNotification feature details when aircraft are approaching a defined geographic area which may affect connectivity or be defined as sensitive airspace.

Integrated with SD Pro, the digital flight operations management system, data shared through FDF synchronizes flight crew with ground operations keeping team members informed about aircraft performance in real time to support improved flight operations, budgeting and maintenance scheduling, SD says. FDF also supports fleet compliancy with FANS, ADS-C and CPDLC to meet evolving Air Traffic Control safety requirements and the changing landscape of business aviation operations.

"Our focus is to always enable our customers to manage their flights and operations using the services, products and systems that best suit their needs. FDF was one of our first services built using open architecture to allow integration of third-party services," says Chris Moore, president of Satcom Direct Business Aviation. "Reaching this milestone demonstrates the market's hunger for integrated services that streamline the workflow. As the digitization of aviation continues to evolve, we will continue adapting and modifying our products to meet the changing requirements of flight crew, ground operations and the business aviation infrastructure."

Sustainable Fuel Now Available with New Beechcraft Cessna Turboprop and Jet Deliveries

Textron Aviation says they are offering customers the option to choose an initial tank containing Sustainable Aviation Fuel (SAF) with delivery of new Beechcraft turboprop, Cessna turboprop and jet aircraft. SAF delivers a cleaner source of fuel to power turbine aircraft. Customers of Textron Aviation's service center in Wichita, Kan. also have the option of refueling with SAF as part of their service experience.

"SAF equips air travelers with the ability to lessen the impact of their journeys on our planet, and we are proud to be making this fuel type available as part of our new aircraft delivery experience," says Christi Tannahill, senior vice president, Customer Experience. "SAF can reduce CO2 emissions by up to 80 percent over the fuel's lifecycle, compared to those made from fossil sources and provides an active way for the aviation industry to lower its overall carbon footprint. In 2019, Textron Aviation flew a wide array of aircraft to major industry events such as EBACE and NBAA-BACE using SAF, and it is something we will seek to do for future events. Offering SAF for customer deliveries demonstrates an important next step in Textron Aviation's commitment to sustainability."

As an industry, general and business aviation is alone in having developed internationally agreed-upon carbon emission reduction standards for both aircraft and operators. The industry is committed to addressing climate change with focused goals on achieving carbon neutral growth and reducing CO2 emissions by 50 percent by 2050 relative to 2005.

Textron Aviation also announced earlier this year it is harnessing Kansas winds with a 20-year wind energy agreement signed with Evergy, Inc. This initiative will meet nearly all electricity needs through renewable wind energy across the company's facilities located in Wichita and Independence, Kansas. Evergy's new green energy program will empower Textron Aviation with a clear path toward achieving its long-term sustainability goals using the abundant, affordable and renewable wind energy in its home state of Kansas.

OAS Helicopters Signs Up for Rusada's ENVISION

The Nigerian charter operator OAS Helicopters has awarded Rusada a contract for the use and implementation of its MRO and Flight Operations software, ENVISION. Odengene Air Shuttle Services Limited (OAS) has operated in the region since 1992. Headquartered in Lagos and operating out of Port Harcourt, OAS recently acquired a new AW139 helicopter for use in supporting oil and gas operations for the Nigeria National Petroleum Corporation.

As well as signing up for several of ENVISION's key modules, OAS are also employing its Flight Operations solution to help organise their flights and crew.

This new deal further strengthens Rusada's footprint in Africa and will be supported by their MEA team, based in Dubai.

"We were looking for an industry-proven, all-in-one solution for our operation," says Edwin George, deputy managing director of OAS Helicopters. "In ENVISION we found a system with comprehensive capability and a logical interface that will serve to significantly increase the efficiency of our operation."

"The awarding of this contract during the current pandemic, is recognition of Rusada's ability to implement, advise and support our customers remotely," says Rusado CEO, Julian Stourton. "Work on the project with OAS has already begun, and not only are we finding this remote approach pragmatic, but also very efficient. We look forward to a long and successful relationship with OAS Helicopters."

"Our focus is to always enable our customers to manage their flights and operations using the services, products and systems that best suit their needs. FDF was one of our first services built using open architecture to allow integration of third-party services," says Chris Moore, president of Satcom Direct Business Aviation. "Reaching this milestone demonstrates the market's hunger for integrated services that streamline the workflow. As the digitization of aviation continues to evolve, we will continue adapting and modifying our products to meet the changing requirements of flight crew, ground operations and the business aviation infrastructure."

MD Helicopters Receives Certification for MD 530F MGTOW Increase

MD Helicopters (MDHI) has received FAA certification to increase its MD 530F single engine helicopter's internal max gross take-off weight (MGTOW) from 3,100 to 3,350 lb. This increase allows the MD 530F to support extended range, increased mission versatility, more time on target, and additional mission equipment options.

"We're pleased to provide our current and future MD 530F customers expanded versatility with a 250-pound increase in allowable weight," says Nick Nenadovic, vice president, Aftermarket and Customer Support. "The MD 530F is a favorite among law enforcement agencies and utility operators around the world thanks to its unrivaled maneuverability and hot-high capabilities. When our customers asked for more versatility in this workhorse, we listened. This best-in-class aircraft is now even more desirable, cementing it as the aircraft of choice well into the future."

MD Helicopters' Experimental Flight Test Engineering team says they conducted a comprehensive range of tests required to prove the aircraft meets or exceeds all FAA performance and safety requirements at the new max weight. These included performance and handling, acoustic, flight load, and height velocity tests performed at different pressure altitudes, temperatures, and wind conditions. Tests proved the aircraft met all requirements while still maintaining sufficient margins for safe autorotation at the higher MGTOW. MD submitted certification paperwork to the FAA for the increase in January 2020.

The MGTOW affects only internal weight. MGTOW with external loads remains at 3,750 lb.

To take advantage of the increased MGTOW, customers can order the upgrade kit, which includes a new rotorcraft flight manual (RFM) supplement assigned to the aircraft serial number and a VNE IAS (knots) placard reflecting the increased MGTOW for display in the aircraft.

SkyCourier Testing Advances

Textron Aviation completed the successful flight of its second Cessna SkyCourier (P1) flight test article in mid-August. The milestone flight for the high-wing, large utility aircraft comes just two-and-a-half months after the prototype Cessna SkyCourier first took to the skies on May 17. The P1 aircraft is the first conforming production flight test aircraft and is the first airframe configured as a freighter.

The first flight of P1, piloted by Peter Gracey and Todd Dafforn, lasted one-hour and 35-minutes reaching a max altitude of 14,200 feet with a max speed of 210 ktas. The aircraft will be used for the flight test program, primarily for systems testing, including propulsion, environmental control and avionics.

BORN TO RUN

HOW ENGINE OEMS AND MROS ARE HELPING OPERATORS THROUGH COVID-19

James Careless

The catastrophic travel slump caused by COVID-19 has resulted in thousands of aircraft being grounded worldwide. This unprecedented situation has substantially disrupted aircraft maintenance and overhauls, including in the critically important engine sector.

Mindful of the severe economic challenges their customers continue to face during the pandemic, engine OEMs and MROs are doing their best to assist them through this crisis. Aviation Maintenance magazine spoke with the OEMs and top MROs to find out what they are doing to help.

COVID-19's Impact

Understanding the engine MROs' responses to COVID-19 begins with assessing the pandemic's impact on themselves and their aircraft clients. To put it simply, everyone has been experiencing real economic pain.

"The effect of the COVID-19 pandemic on our business was immediate. As many airlines grounded their fleet at least to some extent, the need for full overhauls declined quite drastically," says Marc Wilken, Lufthansa Technik's senior director of Product Sales/Engine Services. "Airlines [who were] still operating kept those aircraft in the air that did not require any major cash injection like engine overhauls or big base maintenance events."

At Pratt & Whitney, "Aircraft and engine utilization was significantly impacted during the pandemic, though we are seeing narrow-body aircraft return to service as the domestic markets recover, and continued strong demand in the cargo segment," says Joe Sylvestro, the company's vice president of Global Aftermarket Operations. The ways in which aircraft owners/operators

Joe Sylvestro
VP, Pratt & Whitney

have responded to this trend – and the impact it has had on Pratt & Whitney – depends on their specific financial circumstances. "Some customers are taking advantage of this period as a time to get some needed maintenance completed while others are deferring maintenance if possible in accordance with their revised business and fleet plans," Sylvestro says.

Pratt & Whitney's experience has been shared by other engine MROs such as GE Aviation and StandardAero.

"We are adjusting our MRO operations to align with reduced market demand and evolving customers' needs," says Mike Hoffmeister, GE Aviation's general manager of Customer & Product Support. "For our legacy engines, we adjusted our engine induction schedule and spare parts forecast accordingly. A positive dimension resulting from the crisis has been the opportunity to accelerate our upgrade program for the GTF engine fleet, especially retrofits of the low pressure turbine to improve the fleet health to ensure our customers are well-positioned for the recovery. To this end, we are expanding the GTF MRO network capabilities and capacity globally to support customers as the fleet continues to grow."

"StandardAero's commercial aviation sector has clearly been the hardest hit, and we have seen a direct impact to our commercial engine MRO volumes," adds Jeff Poirier, VP/GM of StandardAero Turboprops and Fleets. The only good news is that the company's broad portfolio of commercial aviation, business aviation, military, helicopter and component repair businesses is "offering us some insulation from the more immediate impact of the pandemic," he says.

Pivoting to Survive

Pivoting is the buzzword of the COVID-19 era. It refers to refocusing a company's business activities to pursue sales where work is available and to turn away from sectors where it is not.

To help their aircraft customers survive, the world's engine MROs have had to pivot. Doing this successfully hasn't been easy. "The initial challenge was understanding the magnitude and speed of change within our airline customer base, many of whom were dealing with operational hours, fleet forecasting and hypothesis for their own capacity," says Carl Glover, vice president Sales & Marketing - Americas with AAR's Aviation Services Group.

Having assessed the new normal of COVID-19 and how it is affecting demand for engine MRO services, AAR went back to the strategic drawing board. "This then proceeded to a game plan for dealing with customer needs on capitalization of fleets, assets and flexible ways to work through the pandemic," Glover told Aviation Maintenance. "For instance, we had some cargo customers who were heavily involved in the movement of support for global PPE, healthcare assistance and freight who we focused upon for operational reasons."

Like AAR, Rolls-Royce has undertaken a similar reassessment; one that has

Pratt & Whitney says aircraft owners/operators have responded to the current situation in various ways. Some are taking advantage of it to get needed maintenance completed while others are deferring maintenance if possible.

consumed a lot of unplanned in-house hours. The reason: "Our customers still have the same number of aircraft, but the utilization has changed – so while the number of aircraft flying at any one time has reduced, in fact our workload has increased, because we now have to understand new customer requirements," says Lee McConnellogue, Rolls-Royce's senior vice president of Aircraft Availability Services. "That means additional maintenance schedules for those in service, and challenges such as engine storage, preservation, and the creation of proactive maintenance plans to allow customers to be ahead of the curve for when times improve."

If this isn't enough, engine MROs have had to become ultra-responsive to clients whose normal business practices – based on pre-pandemic business projections – have been thrown into chaos. This includes supporting airlines revising their engine maintenance plans now that corporate revenues have become uncertain with no return predictability anywhere in sight.

"Customer decision-making (has) slowed down as we worked through the new norms and rhythms of demand," says AAR's Glover. "What was clear was once they made a decision, we had to be reactive and flexible to support them; whether that be inventory, component repairs or hangar capacity."

Motivated to Help

The financial health of engine MROs is directly tied to the success of their aircraft owner/operator clients. So it is clearly in the MROs' self-interest to do everything they can to help owner/operators survive the pandemic.

Engine MROs also want to help their clients during this difficult time because they are all in the same business together; namely aviation, which is as much about the passion of flying as it is the pragmatism of paying the bills. As a result, the motivation that engine MROs feel to assist aircraft owner/operators is genuine.

How these engine MROs are helping varies from company to company. But overall, engine MROs are responding to COVID-19 by learning what their clients are doing to cope and then supporting those efforts.

MTU says they are seeing increased focus on smart repairs, on-wing/near-wing repairs, smaller workscopes and an increase in the use of used serviceable material (USM). MTU image.

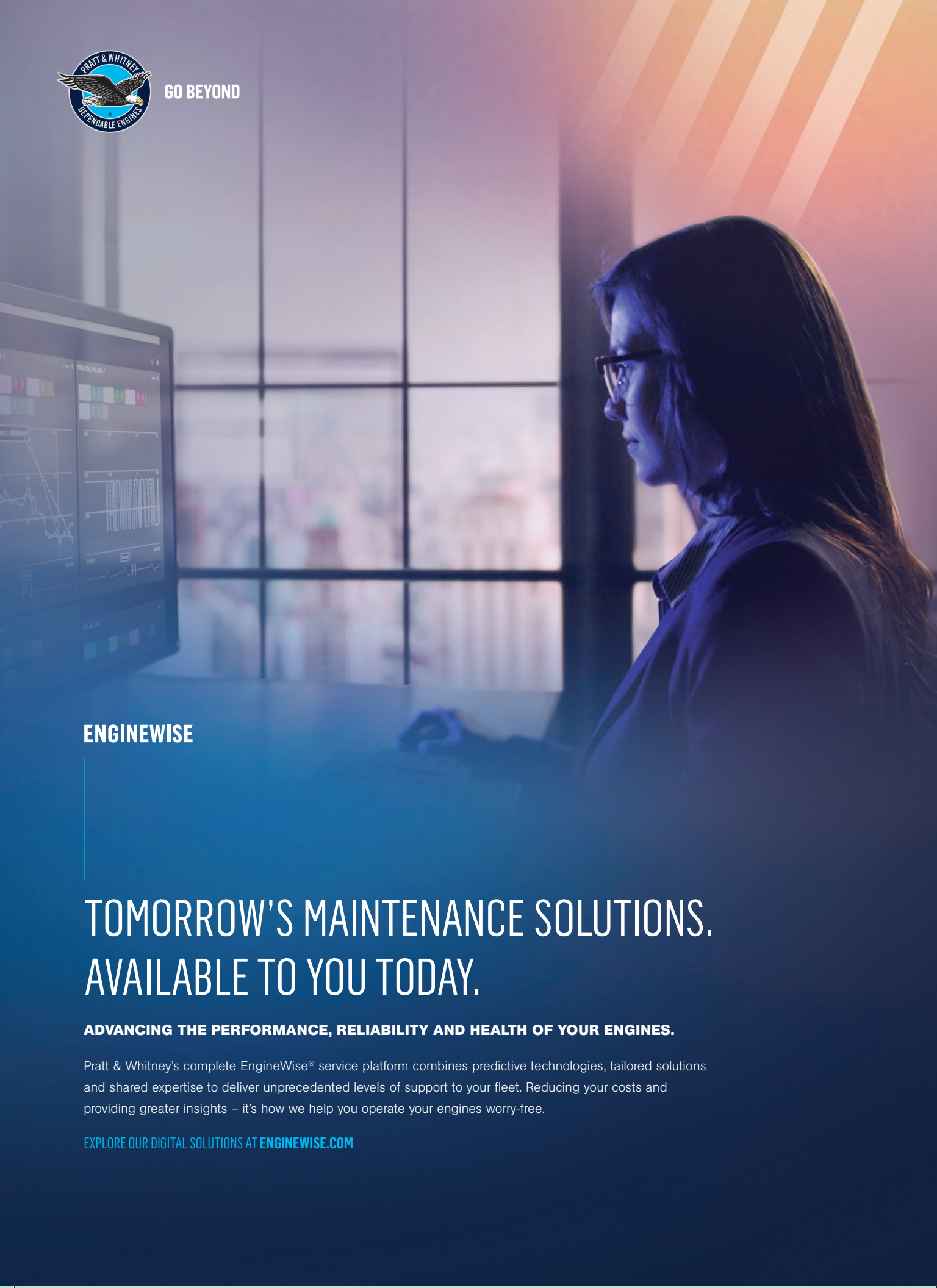
Martin Friis-Petersen
SVP, MTU Aero Engines

"Some airlines are concentrating on short-term savings with cash preservation as the main objective, while others are focusing on long-term planning," observes Martin Friis-Petersen, SVP of MRO Programs with MTU Aero Engines. "MRO providers must flexibly meet both these goals to provide the best solution for customers in today's market. Further, we have been seeing more of a focus on on-wing/near-wing repairs, smart repairs, smaller workscopes and an increased usage of used serviceable material. This is because MRO decisions have been almost exclusively budget-driven in recent months."

Pratt & Whitney says they are working closely during this period to advise and assist their customers. "We're providing guidance and training on engine preservation requirements and supporting return to service operations to minimize any potential issues," adds Sylvestro. "Through flexible service offerings, we are actively supporting our customers' fleet planning and maintenance schedule adjustments. Where it makes sense for our customers and Pratt & Whitney, we are assessing contract terms to create more joint value in the long term."

Meanwhile, "AAR's MRO network domestically and in Canada is involved in supporting our customers with both short and long-term storage solutions," says Glover. "Some aircraft have had components removed to support non-stored fleets so this represented some challenges to have component availability."

GE Aviation says it is focused on being flexible during COVID-19, adjusting its services and procedures as necessary to align with its clients' adjusted operational strategies. To make this happen, "some activities to support airline and other operator fleets to keep them in the air have



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Rolls-Royce reports their workload has increased during the pandemic citing challenges such as engine storage, preservation and the creation of proactive maintenance plans in preparation for better days. Rolls-Royce image.

changed," says Hoffmeister. For example, he says, "earlier this year, new guidelines were provided for engine covering solutions when more covers were needed at once globally due to parked aircraft. We've also kept our engine preservation and de-preservation recommendations updated. In cases where our customer support teams would normally be on site, we've arranged customer virtual training for engine borescope inspections for airline mechanics, which have been well received."

For any GE engines that have been grounded during COVID-19, GE Aviation field service and customer support teams have been working with aircraft owner/operators to proactively perform maintenance actions related to engine preservation, returning engines to service and complying with Service Bulletins. "The unique challenge, as a result of the pandemic, is the scale and number of impacted commercial aircraft engines at a given time," Hoffmeister stresses. "To address this, we've released "Maintenance Minute" videos with fleet-wide recommendations for mechanics and technicians, and offered tailored virtual training. GE is also prioritizing individual customer questions to provide a quick response."

All of these changes notwithstanding, the fundamentals of engine MRO service remains the same; namely to keep aircraft engines properly maintained and overhauled in accordance with their manufacturers' guidelines. So despite the unique adjustments made by MROs to better serve their clients during COVID-19, "our global base of clients are primarily requiring the same services as prior to the pandemic; namely maintenance, repair and overhaul in addition to engine condition trend monitoring (ECTM) support," says StandardAero's Poirier. This said, "we have provided engine preservation services to a number of customers who parked their aircraft following the onset of the pandemic earlier this year, and have also provided return to service (RTS) support to those operators who have since resumed flying."

Restoring Parked Engines to Service

On July 23rd, 2020, the Federal Aviation Administration (FAA) issued Emergency Airworthiness Directive AD 2020-16-51 for Boeing 737 NG and Classic aircraft engine bleed air 5th stage check valves. "Corrosion of the engine bleed air 5th stage check valve internal parts during airplane storage may cause the valve to stick in the open position," said AD 2020-16-51. "If this valve opens normally at takeoff power, it may become stuck in the open position during flight and fail to close when power is reduced at top of descent, resulting in an unrecoverable compressor stall and the inability to restart the engine."

The AD 2020-61-51 applies to approximately 2,000 U.S.-registered Boeing 737 NG and Classic aircraft that have been in storage. This AD warns that those engines could have corrosion that could lead to a dual-engine failure. Since complying with AD 2020-16-51 requires these 737 owner/operators and inspect these valves before resuming flight, the

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potential impact on airlines trying to restore pre-pandemic service levels is profound.

Engine MROs like CFM International, a 50-50 joint venture between GE Aviation and Safran Aircraft Engines, is aware of the problem and has been working on it. "This action is related to a Boeing external bleed air valve that interfaces with the engine," says Hoffmeister. "We are working closely with Boeing in its resolution of this issue."

CFM International isn't alone in tackling this issue. "The 5th stage valve topic was one we assisted some of our clients with in both our Amsterdam and New York shops; both are OEM approved for the valve overhaul," says AAR's Glover. "We had some other RTS (Return to Service) tasks identified during checks, but are fortunate that most of our customers that we were storing aircraft for are MRO clients who are close to our respective maintenance and engineering groups."

The fact that these 737s suffered valve corrosion problems is due to so many of these aircraft being unexpectedly grounded on short notice. But even during chaotic events such as COVID-19, this problem is avoidable. "The important thing was for any engine placed into short- or long-term storage to have been prepared properly and this is something that our service team has been able to assist customers with," says StandardAero's Poirier. "A key step is to ensure that any exposed gears and bearings are oiled and covered, in order to avoid corrosion from humidity."

This air valve corrosion issue underlines the importance of proper aircraft maintenance at all times; even during pandemics. "Grounding aircraft for an uncertain period of time and reactivating them, sometimes on very short notice, is a complex task," says Lufthansa Technik's Wilken. "Talking specifically about engines, we have created a service package which includes engine care during storage itself like preservations, re-inspections and the rectification of findings but also services during reactivation like engine washes, (doing) any repair work required and engine/module swaps."

"Additional inspections should be performed on parked and during aircraft transition events," added MTU's Friis-Petersen. "As a result, we have seen increased requests for engine services. Upon industry restart, we expect the number of requests to increase further."

Engine OEMs and MROs are doing their best to assist operators through the COVID-19 crisis. MTU images.

New Opportunities

Like many disruptive events, the impact of COVID-19 upon the aviation industry has opened up new opportunities for engine MROs. "For example, many freighter operators saw very strong demand and almost

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Rolls-Royce reports that after the period of grounding, they are starting to see some aircraft coming back into service. Rolls-Royce image.

no interruption in their business," says Wilken. "Here we were able to attract engine business from these customers."

Lufthansa Technik is also seeing increased demand for its localized Mobile Engine Services repair station network. With bases in Frankfurt (Germany), Montreal (Canada), Tulsa (USA) and Shenzhen (China), the company can dispatch mobile repair crews to affected aircraft equipped with CFM56-5B/-7B and V2500 engines.

As well, remotely-delivered services are increasingly popular with engine MRO customers. A case in point comes from AAR. "We have seen an increase in demands for remote reporting, digital imagery of components alongside inspections, and engineering reports all in the shared digital space," says AAR's Glover.

The same is true for GE Aviation: "Before COVID-19, aircraft and jet engine mechanics would travel to one of GE's or CFM International's training centers for hands-on learning," says GE Aviation's Hoffmeister. "Now, due to global travel and social distancing restrictions during the outbreak, more training is being delivered to customers on their laptops and mobile phones."

Starting in July 2020, GE has held a series of webinars to teach customers how to use GE's and CFM's self-service customer portals in order to make service requests and share critical data.

Looking Ahead

There's no two ways about it; COVID-19 has been absolutely brutal to the global aviation industry. And the future is equally uncertain.

"In terms of business, 2020 will be a very bad year; no doubt about that," says Lufthansa Technik's Wilken. "The engine MRO sector is suffering overall and will take some time to recover. However, we see ourselves well-prepared to manage this crisis and to get out maybe even stronger than before."

"The outlook varies by segment and by geographic location. A number of markets have seen little or no impact, with our military and freight/cargo operator base remaining relatively untouched by the downturn," says StandardAero's Poirier. "In general, our regional airline operators are in better health than the long-haul segment, and we are hopeful that the industry's gradual recovery will continue over the coming months and years."

"As the crisis is on-going and developments in particular regarding travel regulations and restrictions are continually developing, this is hard to predict," says MTU's Friis-Petersen. "Generally speaking though, we are seeing the benefits of our flexible #SmartNewNormal approach, have been inducting customers' engines, and are confident we will recover even stronger from the effects of this crisis."

"After a period of grounding, it's good to see some aircraft coming back into service," agrees Jacqui Sutton, Rolls-Royce's chief customer officer – Civil Aerospace. "(But) It's clear that the industry will take several years to recover to pre-COVID-19 levels, but aviation is a resilient industry."

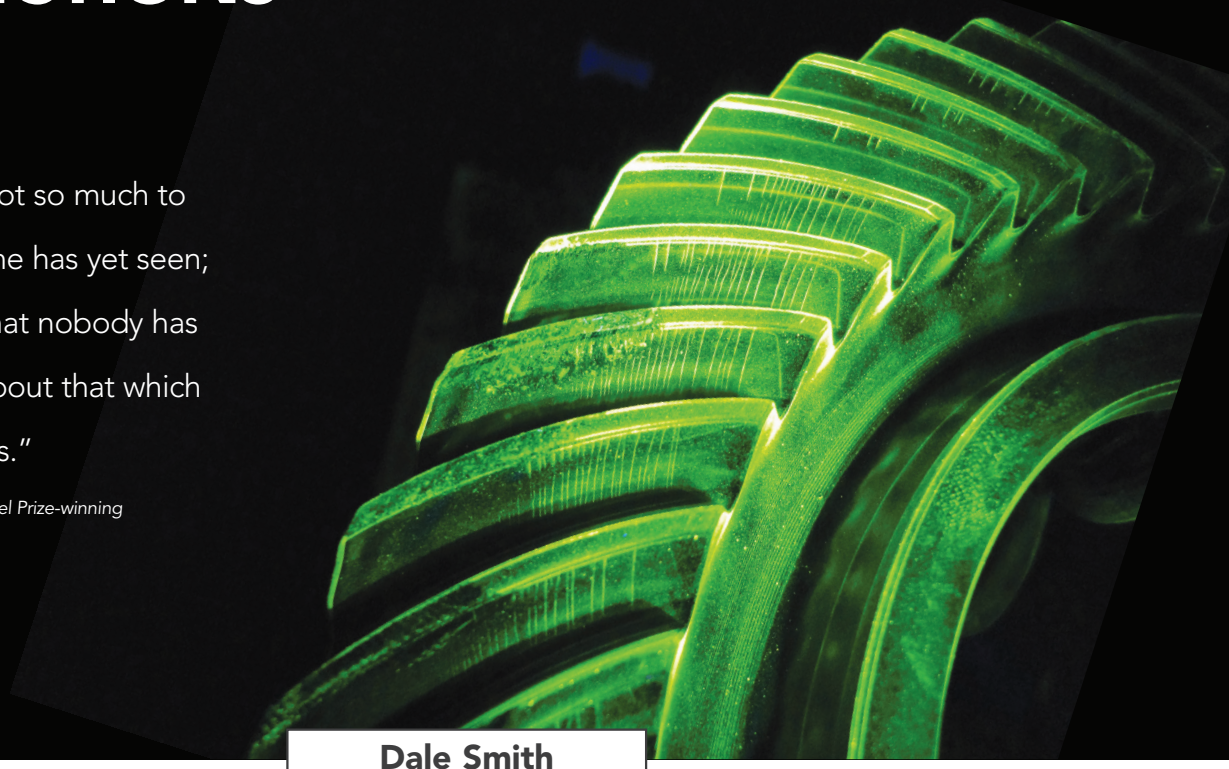
Whatever happens in the months to come, "we're keeping close contact with our customers to ensure that we are positioned for when they need us," says AAR's Glover. "The road to recovery is anticipated to be a lengthy process beyond the horizon of 2020, so as a company we're focused on short-, medium- and long-term demands."

"The aviation services business is driven by aircraft utilization," concludes GE Aviation's Hoffmeister. "While it's too early to predict when the commercial aviation recovery worldwide will happen, there are encouraging early signs of improvement in pockets of the world, such as China." AVM

INSIDER'S GUIDE TO NON-DESTRUCTIVE TESTING AND INSPECTIONS

"The task is...not so much to see what no one has yet seen; but to think what nobody has yet thought, about that which everybody sees."

- Erwin Schrödinger, Nobel Prize-winning Austrian physicist.



Dale Smith

With global passenger traffic still reeling from the COVID-19 pandemic, it's painfully obvious that airlines are going to be postponing aircraft replacements well into 2021 and beyond. That means that the current fleet is going to be extended beyond their operator's original plans.

As a result of operators putting higher and higher usage demands on their aircraft, nondestructive inspections (NDI) and nondestructive testing (NDT) are going to play an increasingly important role in every phase of airframe and engine maintenance. Keeping one step ahead of critical wear will be key to keeping these aircraft flying and their passengers safe.

With this increasing emphasis on NDI and NDT, the editors at **Aviation Maintenance** felt it was a good time to contact the FAA to get the agency's perspective. For NDT industry insights we also talked with aerospace NDT service provider Testia's (an Airbus Company) chief commercial officer, Teddy Canadas, and marketing manager, Adrian Coronel.

Teddy Canadas, CCO, Testia

Before we get into the meat of our NDI/NDT Q&A, let's start by defining what nondestructive inspections and nondestructive testing are.

"The differences between the two concepts may not be easy to see for people outside the

Testia says its Thickness Tool helps make efficiency leaps in the hangar. It has a phased array ultrasonic testing (PAUT) roller probe and includes acquisition, analysis and reporting software for super quick thickness measurements after blending areas of corrosion. Testia image.

professional perimeter of NDT. Let's put some light on the subject starting from the basics," Coronel explains. "Nondestructive testing is defined by the American Society for Nondestructive Testing as, 'The determination of the physical condition of an object without affecting that object's ability to fulfill its intended function.'"

"Nondestructive inspections define the maximum size of life-limiting defects that could be present at a given time. Inspection requirements are determined by the anticipated service loads, the desired service life, and by the damage tolerance designed into the structure," he adds. "Thanks to these two definitions we can say that NDT means applying different methods to achieve the physical condition's determination in a repeatable way. The different methods could be ultrasonic, eddy current, magnetic particles, etc."

"Nondestructive inspections refers to the act of applying those methods (UT, ET, etc.) to specific specimens following specifics parameters and requirements to detect and measure defects, then report it following a specific procedure to be compliant with regulations," Coronel concludes.

What, if any, impact has the Southwest Airlines' engine blade failure had on the FAA's requirements for NDI/NDT processes and training?

FAA spokesperson:

Operators of CFM International, CFM 56-7B engine models must comply with Airworthiness Directive, AD 2018-26-01 dated Jan 10, 2019. The AD requires a reduced initial inspection interval and a repetitive inspection interval every 1,600 hours of the fan blade dovetail concave and convex sides using Ultrasonic inspections (USI) or Eddy Current inspection (ECI) methods. If a fault is found, the fan blade is replaced prior to further flight. Trained and qualified personnel are required to perform the Ultrasound or Eddy Current Inspections.

Coronel:

The authorities released an Emergency Airworthiness Directive #2018-09-51 on April 20, 2018, that describes procedures for performing an ultrasonic inspection for cracks of the fan blade dovetail and removal of cracked fan blades from service.

Due to this tragedy, the authorities recommended increasing the frequency of inspections, but they didn't suggest any changes to the procedure or parameters, which makes us conclude that the processes and training are still considered sufficient to ensure safety
.

How have the FAA's requirements for NDI/NDT training and facility authorization/approvals changed over the past five years?

FAA spokesperson:

The FAA's requirements for NDI/NDT training and facility authorization/approvals have not changed very much over the past five years. While regulations do not specifically define requirements for organizations that accomplish NDIs, multiple regulations that have been in place (e.g., Title 14 of the Code of Federal Regulations (14 CFR) part 121, § 121.375 and part 145, § 145.163) require certificate holders to have training programs to ensure that employees who perform maintenance/inspections are trained and qualified.

Additionally, per § 121.367, a certificate holder must ensure that it provides competent personnel and adequate facilities to properly perform maintenance. There is no specific national standard in the United States for NDI/NDT training; however, there are industry and international standards acceptable to the FAA that are used to establish training programs.

Testia calls their Smart UE1 product "the Swiss-army knife of NDT inspectors." They say this wireless, light-weight device (2kg) offers both ultrasonic and eddy current testing capabilities in a single device. Testia image.

Coronel:
It is very difficult to make an assessment on the topic, because aerospace regulations and procedures are constantly evolving over the years. Once this context is set up, we would say that the NDT training and approvals are always at the very edge of the NDT "state of the art", which means that the knowledge transmitted and the technologic infrastructure to train new inspectors is considered updated and sufficient by authorities. Let's not forget that all activity is under close oversight of international authorities (ICAO), national authorities (FAA, EASA), local authorities, and NDT associations like ASNT.

As evidence of this, you can consult the FAA Memo "Qualification standards for nondestructive testing" issued on 6/2007 by AIR-200, AFS-300, The National Resource Specialist for Nondestructive Testing and the Chief Scientific and Technical Advisor for Nondestructive Evaluation.

Will the recent long-term grounding of so many of the world's commercial aircraft have any impact on the FAA's requirements for more frequent nondestructive inspections of critical airframe and engine components?

FAA spokesperson:
Air Carrier airplanes, affected by long term grounding orders, are placed in a preservation/storage program that requires numerous tasks that protect the airplane from environmental conditions and damage while not in service. When an airplane is brought out of a preservation/storage program, another series of de-preservation tasks are performed to prepare the airplane for its return to service and airworthiness requirements.

The only time an NDI/NDT would be performed prior to return to service is if an NDI/NDT inspection task is due or past due and the particular NDI/NDT inspection is required to be accomplished prior to the airplane's return to service in an airworthy condition.

Coronel:
Not at all, in fact, the approach is in the other way around. FAA issued a document called, "Flexibilities for Managing Scheduled Maintenance Requirements Due to the COVID-19 Public Health Emergency." It describes how operators subjected to a Continuous Airworthiness Maintenance Program (CAMP) can request short-term escalations (STE) to gain flexibility to manage the scheduled maintenance intervals, while continuing to ensure the airworthiness of the aircraft. The FAA only provides STE authorization to CAMP operators through the issuance of an Operations Specification (OpSpec) or Management specification (MSpec).

Operators who are authorized to exercise STEs are able to use short-term escalation procedures to extend maintenance intervals temporarily for aircraft, powerplant, systems, or other selected items. They may request Principal Inspector (PI) approval to be able to exceed certain limitations of their current STE program if needed.

In short, this means that all operators can alter their maintenance & inspection program in maximum of 30-percent of the current schedule and this cannot be applicable on a fleet-wide basis. It is only applicable case-by-case. So, there is no evidence of FAA asking operators for more frequent nondestructive inspection different from the already stated in maintenance documentation.

With the growing use of 3D printed parts in aviation, how has the FAA amended NDI/NDT guidelines for these new-generation parts?

FAA spokesperson:
The FAA is working with industry, academia, and other state and federal agencies to develop consent standards for the manufacture, certification, and inspection of additively manufactured parts.

Coronel:
Both authorities [FAA and EASA] are intensively working with Agencies, OEMs, and Tier1suppliers to optimize NDT evaluation techniques to set more certification & qualifications standards. In

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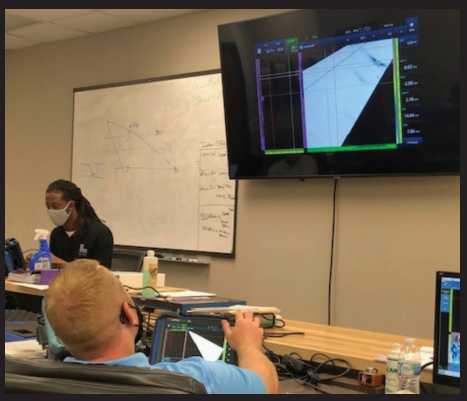
Olympus and Lavender Collaborate to Support Advanced NDT Training



NDT technicians use OmniScan X3 flaw detectors during a PAUT class at Lavender International's training facility in Houston, Texas.

Olympus has provided its new OmniScan X3 phased array flaw detectors with full matrix capture (FMC) and total focusing method (TFM) to Lavender International's U. S. facility to support their advanced training courses. Lavender is an NDT training provider, offering courses in NDT techniques for internationally-recognized central and employer-based certification programs at their training facility in Houston. They were one of the first to provide a high-temperature hydrogen attack (HTHA) detection training course designed to educate experienced technicians to more reliably detect the early stages of HTHA. Lavender says they also offer other advanced NDT courses in time-of-flight diffraction (TOFD), phased array ultrasonic testing (PAUT) and manual ultrasonic testing (MUT).

With this collaboration, Lavender and Olympus hope to help ensure that the next generation of inspectors are equipped with the latest technology and knowledge to become experts in full matrix capture (FMC) and total focusing method (TFM) techniques, they say.
"We're excited to provide Lavender International with new OmniScan X3 flaw detectors with FMC/TFM to continue supporting their global training requirements," says Steven Berube, executive director of Global NDT Sales and Marketing at Olympus. "Lavender has been an Olympus Training Academy member since 2004 and continues to use the OmniScan flaw detectors as part of their advanced phased array and TOFD course syllabus. Our collaboration has proven to be an excellent support for various industries and inspection service providers as OmniScan flaw detectors are some of the most widely-used PAUT instruments in the world."

"We are pleased to be an Olympus Training Academy member and will continue to invest considerably in technical equipment to ensure that the Lavender training experience continues to be of the highest quality at our US and UK training centers and satisfies the demand for new NDT inspection technology," adds Tim Armitt, managing director at Lavender International.

2016, the FAA issued a report on the outcomes of a workshop dedicated to Certification/Qualification of AM [additive manufactured] parts.

In one report the National Aeronautics and Space Administration (NASA), stated that the current additive manufacturing standards are very limited, and this lack is an industry-wide issue. For instance, NASA requires NDT at the "Raw Part Inspection" step, then once again at the "Final inspection/ Acceptance" step.

Quality assurance and NDE procedures were also cited on the report as a significant challenge. Nearnet or finished shapes, complex geometries, and as-built, or even post-processed, surface finishes were all cited as challenges for inspection. Many parts may require sophisticated volume inspections, such as computed tomography, augmented by actual cutups.

In 2019 EASA and FAA organized a workshop to continue this effort. The main outcome regarding NDT, is that it is considered key activity to descript unexpected defects, root cause, detection, and validation of acceptance limits.

To summarize, FAA & EASA are collaborating with main players to review the advances and inspection improvements on a case-by-case basis; while at the same time working to achieve industrial escalation on a safe, traceable all across the industry.

What should an operator look for in a third-party NDI/NDT provider(s)?

FAA spokesperson:

There are five recommended elements used to assess an organization's ability to perform NDI functions. When choosing a third party NNDI provider, they should look for five elements of the NDI organization. These five elements comprise a systematic NDI evaluation process that can be used to evaluate any NDI organization, from manufacturing to maintenance. Here is a list of those five elements:

Documentation. Documentation pertains to written procedures, processes, specifications, and/or methods that air operators or air agencies use to perform and control NDI activities.

Organization. A corporation or other similar entity established to provide or receive NDI services.

Environment. The general physical condition of the NDI facility (e.g., housekeeping, storage, safety, consumable management, equipment);

Calibration. The process by which an item is checked against a standard.

Training. Training ensures that NDI inspectors are qualified to perform NDIs. An NDI organization should maintain records in order to document the training and retraining of NDI personnel, including the methods used.

These five elements represent the underlying system that an NDI organization needs to have in place for satisfactory NDI operations.

Coronel:
In this context airworthiness and safety are top priorities, so the trusted and certified capabilities would be the first thing to look at. The second one should be global footprint because working with a provider that can reach operators' international maintenance sites will increase efficiency and savings.

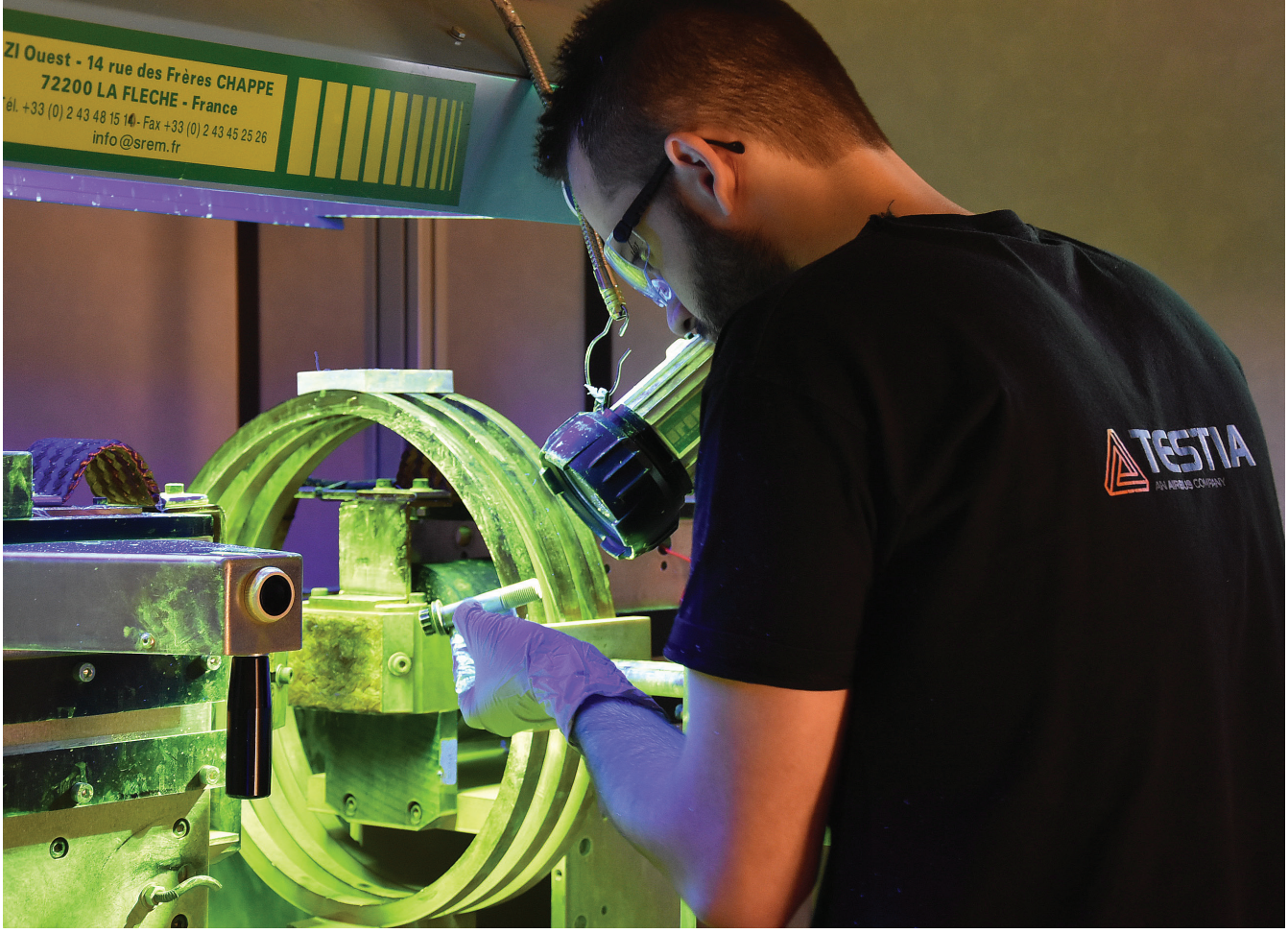
Airworthiness and safety should be the top priorities when choosing an NDT shop.

Last but not least, we would recommend looking for full "360-degree" service providers that can inspect, train and provide aero-specific inspection tools. The

ASNT Selects Inaugural Class for the RISE Leadership Development Program for NDT Professionals

ASNT announced its inaugural class for the RISE Leadership Development Program for NDT Professionals this August. The class includes 21 NDT professionals from the United States, Spain, India, Trinidad, and Nigeria employed in advanced manufacturing, materials research, oil and gas, aerospace, energy, engineering, technical services, and higher education.

"We are excited to welcome this truly global community of professionals to the RISE program!" remarked ASNT Executive Director Neal Couture. "These outstanding individuals will embark on a 15-month journey which will help develop their skills as leaders and advance their careers in nondestructive testing." Couture notes he expects RISE graduates will make significant positive impacts within their workplaces, their industries, and the global community. "We congratulate the inaugural class and look forward to watching them rise and lead the nondestructive testing community."



According to FAA guidance, there are five recommended elements used to assess an inspection organization's ability to perform NDI functions. The five elements are documentation, organization, environment, calibration and training. Testia image.

reason behind is to build turnkey packages that are fully adapted to customer needs. This enables to find the best Make vs. Buy strategy and to introduce significant OPEX & CAPEX savings.

For instance, this is what Testia does by complementing inspectors with combo inspection-tools (like the famous 8-in-1 SmartUE1), tasks-specific tools (like the ThicknessTool bringing 95-percent savings), or Go-NoGo devises (like the CladTool, allowing an A&P to quickly perform a clad inspection without chemicals).

What would you say is the biggest misconception that owner/operators have regarding airframe or engine NDI/NDT practices?

FAA spokesperson:

The biggest misconception that owners/operators have regarding airframe and powerplant NDI practices is that when using a third party contracted service, the responsibility for the airworthiness of the airframes, powerplants, and components have shifted to that third party contracted service performing NDI. It is not the owner/operators who always retain the responsibility for airworthiness.

Canadas:

Probably, the potential lack of awareness about the strategic importance of NDT for business. Would that be for operators or MROs, NDT often comes as a bottleneck. An AOG or an un-expected inspection never comes when we expect it. So, resources are often limited, while many different skills, and tooling have to be maintained to ensure preparedness in case of need.
However, by putting the right strategic attention into this field, maintenance and operations managers can generate both savings and overflow flexibility, through the right balance of subcontracting and inspection devices.

NDT is currently developed, applied, and controlled by authorities by a sufficiency approach. It would be key for operators to see the big picture of NDT by leveraging constant innovations and trusted partners.

This is the DNA of Testia to support this overall approach in many different ways. From the inspection workforce, training, and tools to Research & Development projects. With a constant and uncompromised focus on keeping aircraft flying safely and bringing efficiency to the business. AM

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THE INDONESIA 737 MAX ACCIDENT:

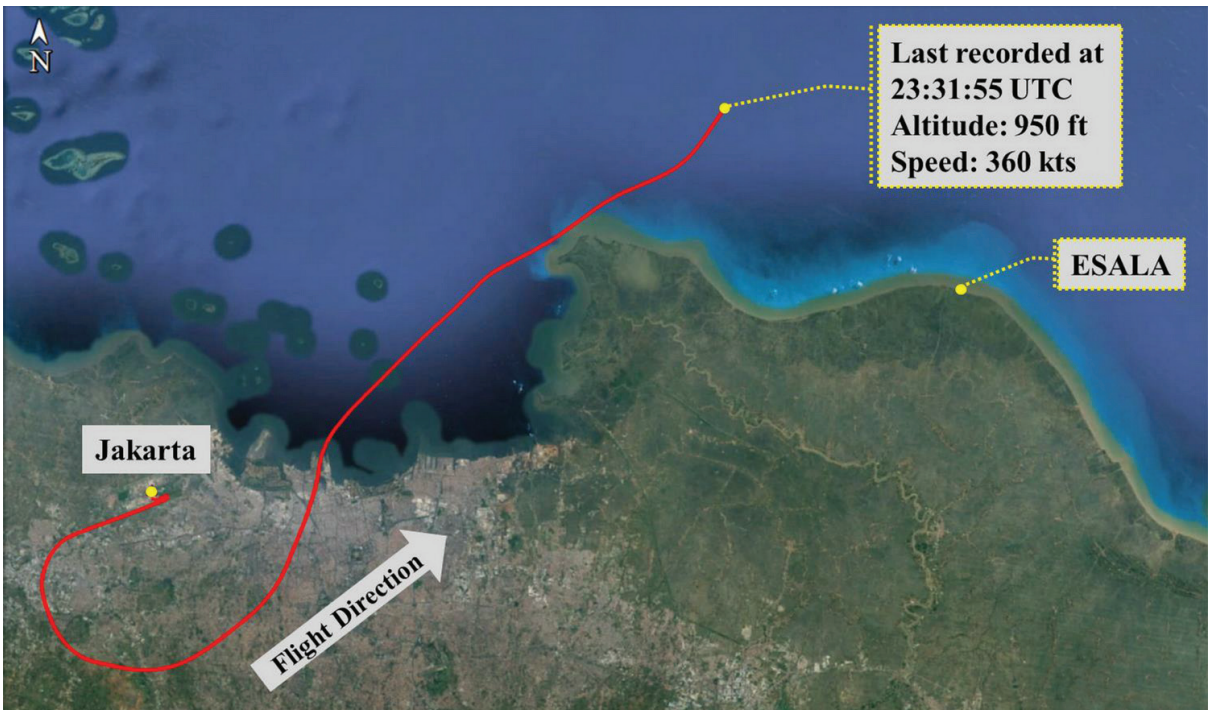
HOW IMPROPER MAINTENANCE ALLOWED A DESIGN FLAW TO BE FATAL

Jeff Guzzetti

It's been nearly two years since the tragic crash of Lion Air flight 610, a Boeing 737 MAX airplane that descended into the sea a few minutes after takeoff from Jakarta, Indonesia with 189 souls on board (see graphic showing flight path on page 37). It was the first of two MAX accidents that occurred within a five-month period that prompted the grounding of the hottest selling airliner in the world.

Before the accident, Boeing was riding high with orders for thousands of the jets. Some people now have doubts that the company will recover from the damage to its reputation. Just last month, a Congressional committee released a scathing report that detailed numerous missteps by Boeing and the FAA in the design of the "Maneuvering Characteristics Augmentation System" — or MCAS — that was added to the 737 series airframe to provide anti-stall movements to compensate for improvements in engine power and aerodynamic efficiency. During the accident, the MCAS received faulty indications from a broken Angle of Attack (AOA) sensor which repeatedly attempted to nose the airplane over after takeoff.

I get it. Assumptions that were made by FAA and Boeing about flight crew response to malfunctions — even though consistent with current industry guidelines — turned out to be incorrect. More shocking to me as an aeronautical engineer is that MCAS was designed to rely on only a single AOA sensor,



Lion Air flight 610 took off from Jakarta's Soekarno-Hatta International Airport early on the morning of October 29, 2018. Less than 15 minutes later it crashed into the sea, killing everyone on board.

making it vulnerable to erroneous input. I freely admit that Boeing and FAA must be accountable to a portion of the culpability of this crash.

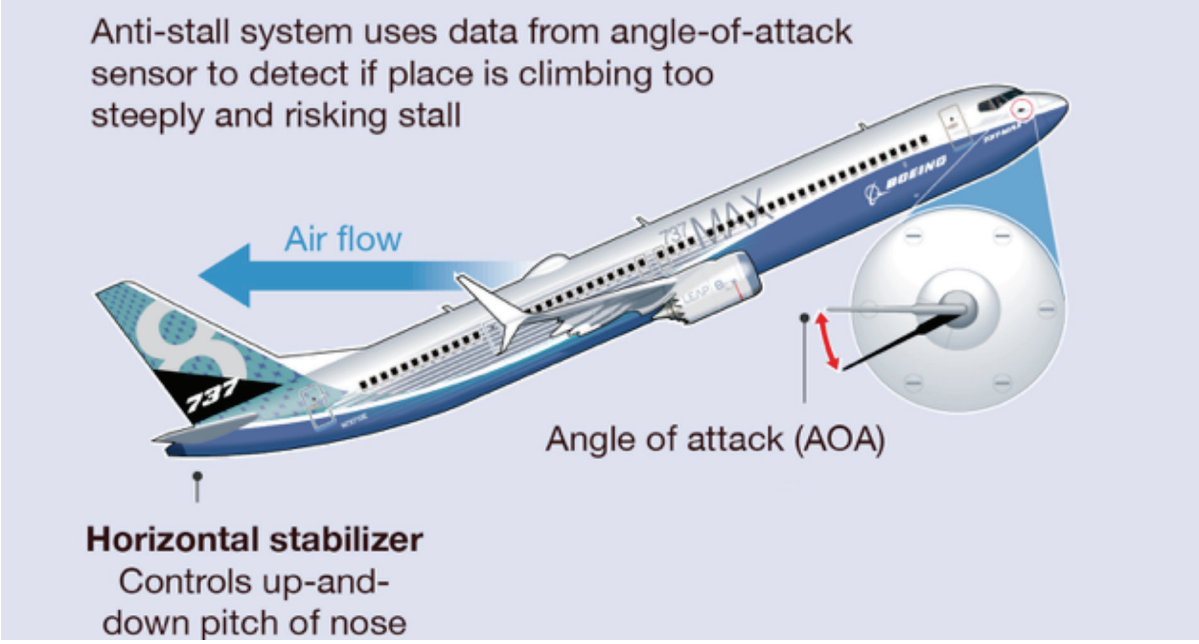
However, the lessons learned from the equally shocking investigative findings — findings of improper maintenance — have not been heard above the roar of the public's red meat appetite to rail against the greed and arrogance of a U.S. corporation, and the excessive delegation of FAA certification. Simply put, these lesser-known findings clearly indicate that the Lion Air accident would not have occurred if proper maintenance was performed by the airline, its maintenance provider, and a U.S. repair station.

The Accident and a Foreign Investigation

The flight 610 accident occurred at 6:33 a.m. on a Monday morning in Indonesia, which was Sunday evening for me in Washington DC. The date was October 29, 2018, and I was a couple months away from my planned retirement as the director of FAA's Accident Investigation Division. When the call came in, I knew it was a big deal. A newly designed U.S. airplane model had crashed on a clear day after the flight crew reported a flight control problem a few minutes after takeoff. The airplane was three months off the factory floor and had logged only 443 total flights at the time of the accident. With an investigation of this magnitude, so much for coasting into retirement.

Because the accident occurred in a foreign country, the NTSB and FAA were only "participants" in the investigation which was led by the Indonesian authorities in accordance with longstanding international protocols. If a country designs, builds or operates and aircraft that crashes in another country's territory, then the country — in this case the U.S. — has a right to participate in the other country's investigation so that it can take care of any in-house issues. The U.S. sent a team of 12 investigators led by the NTSB with "advisors" from Boeing, GE Engines and the FAA. I immediately dispatched one of my investigators to serve as the FAA lead advisor, and he was accompanied by an FAA 737 project test pilot.

The recorded ADS-B data of the Flight 610's track indicated a series of roller coaster maneuvers. Given the pilot's air traffic transmissions about a flight control problem, it didn't take long for Boeing and FAA to determine that MCAS was commanding repeated movements of the horizontal stabilizer trim system. MCAS is activated without pilot input and only during



The then new and misunderstood MCAS software overrode the pilot's instructions and pushed the nose down numerous times.

manual, flaps up flight. The MCAS function becomes active when the AOA exceeds a threshold based on airspeed and altitude (see graphic above). I was literally getting a crash course on the airplane's design from the FAA certification engineers, and they were hitting me up for any scrap of information from the accident. Three days after the accident, the FAA issued an Emergency Airworthiness Directive to all 737 MAX operators to immediately shut off the electric stabilizer trim switches should a similar scenario occur. Meanwhile, Boeing promised to fix the software.

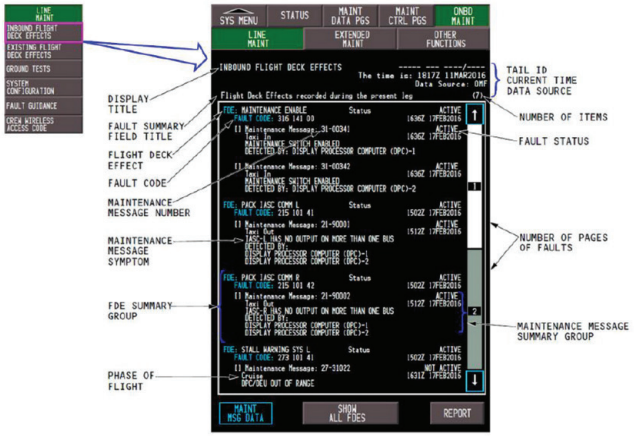
Suspicious Maintenance Activity

But, as with all accidents, there was more to the story. The Indonesians immediately interviewed the mechanics who last worked on the airplane, but they did not allow any of the U.S. team to participate in those interviews. Instead, they relayed what the mechanics said. A review of flight and maintenance logs from the accident airplane revealed write-ups from previous flights indicating problems with the altimeter readings and indicated airspeed during the three days leading up the accident.

The flight data recorder from the accident airplane showed that on a previous flight the captain's airspeed indicator was inoperative at start-up but the crew took off anyway.

All the faulty indications occurred on the left (captain's) side of the cockpit displays. The respective crews wrote them up repeatedly. In between flights, mechanics attempted to resolve the problems. They conducted built-in (BITE) tests, reset circuit breakers, cleaned parts and reconnected electrical plugs. They kept zeroing the fault messages and approving the airplane for revenue flight without determining a root cause. They kept dispatching a faulty aircraft, over and over again, with passengers.

When the flight data recorder was recovered from the sea floor (see graphic), it indicated the pilots took off on one of the flights even though the captain's airspeed indicator was inoperative at start-up! Lion Air had a spotty record of 11 accidents and incidents since its founding in 1999.



Shown here is the 737 MAX unit that provides stored system information for maintenance personnel. If a problem is annunciated in the cockpit, a mechanic can access the Onboard Maintenance Function (OMF) to determine the necessary maintenance action.

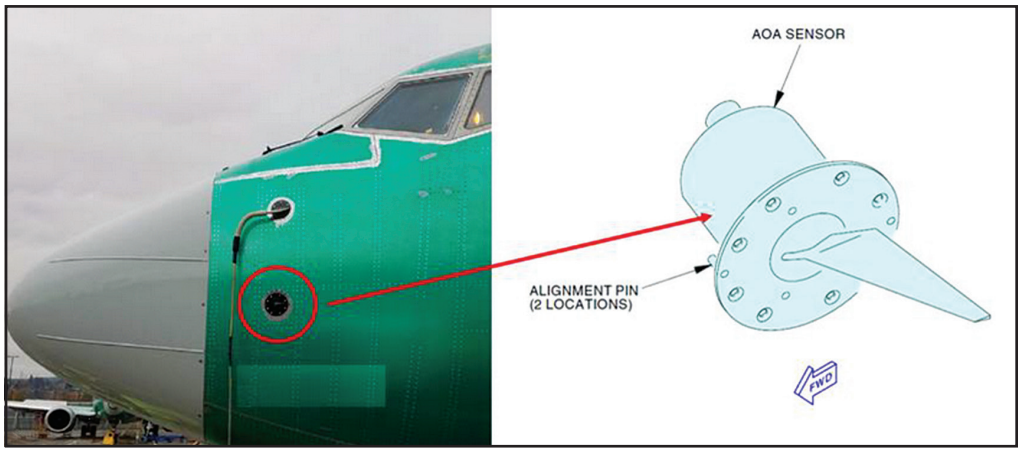
Rumors of a deficient safety culture were circulating around the rapidly expanding low-cost air carrier in Indonesia. Unfortunately, the investigation did not delve deeply into these issues.

Replacement of the AOA Sensor

Two days before the final flight, the accident airplane arrived in Bali and the flight crew reported that the airspeed and altitude flags appeared again along with disengagement of the auto throttle. The 737 MAX is equipped with a unit that provides stored system information for maintenance personnel. If a problem is annunciated in the cockpit, a mechanic can access the Onboard Maintenance Function (OMF) to determine the necessary maintenance actions (see graphic this page).

In response to an error message indicating a possible AOA failure, the mechanics in Bali needed to replace the left-side AOA vane on the nose of the airplane (see graphic). However, no spares were in stock, so the mechanic requested one from airline's Maintenance Control Center in Jakarta. Instead of receiving a new part, he received a used one that was older than the airplane itself. The AOA probe had been reworked at a Part 145 repair station in Florida and shipped to Lion Air one year before. More on that issue later. Still, why not have several new AOA indicators in stock if your airline is purchasing billions of dollars of 737 MAX airplanes?

In the maintenance log in Bali, the company technicians documented the replacement of the AOA vane and completion of a required "installation test" to ensure it was properly calibrated. The test involves deflecting the AOA vane up and down while



In the maintenance log in Bali, the company technicians documented the replacement of the AOA vane and completion of a required "installation test" to ensure it was properly calibrated. Later it was determined that this test was likely not actually completed.

observing the digital display indication on the Stall Management Yaw Damper (SMYD) computer box in the avionics compartment for each position. While the log indicated that the test was completed, it did not contain the recorded test values that were required to be recorded as per the company's maintenance procedures. The airplane was buttoned up, passengers were loaded, and the airplane departed Bali for Jakarta.

On the flight to Jakarta, the FDR recorded the value in the left AOA sensor was approximately 21 degrees higher than the right AOA sensor. This discrepancy should have been discovered by the installation test that the mechanic claimed had been performed. As a result of the erroneous AOA input, the airplane's stick shaker on the captain's side began to shudder, multiple cockpit annunciators were lit, and the crew struggled to keep the airplane level. They finally shut off the electric trim switches but continued to fly for more than an hour with the stick shaker vibrating. When they landed in Jakarta, they reported a couple of annunciator lights, but did not convey the actual trauma of what occurred during the flight. As a result, mechanics again checked and reset some buttons, and cleared the airplane for the next flight — the accident flight.

What's Wrong with this Picture?

About two weeks after the crash, NTSB and FAA investigators asked the Indonesians for additional details from the mechanic who said he performed the AOA sensor installation test in Bali. A few hours later, the mechanic provided investigators photographs of the SMYD unit that were purported to be taken during the actual test on the accident airplane as evidence of a satisfactory installation test result. Why would a mechanic take photographs of his maintenance work? And why provide this information so late in the investigation? Something was not right.

I took a look at the pictures and worked with Boeing and FAA engineers as they gleaned information from the digital displays and unit part numbers. The part numbers did not match the accident airplane. The time shown on one of the displays was a time before the arrival of AOA sensor spare part. Investigators confirmed that the photographs of the SMYD units and cockpit displays were not that of the accident aircraft. To my amazement, these facts, which were cited in the final report, garnered very little attention. As a former employee of the DOT Inspector General's office, I can tell you that someone would be going to jail if something like that happened in the U.S.

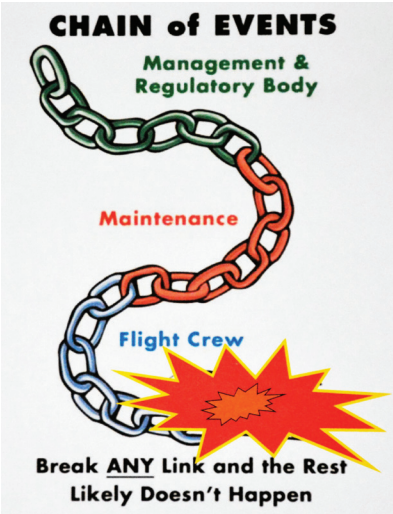
The Aftermath and Lessons Not Yet Learned

To add insult to injury, the Florida repair station that provided the faulty AOA sensor utilized several pieces of test equipment that were not specified in the AOA's Component Maintenance Manual. Additionally, no written instructions were produced to operate the test equipment that was being used. Investigators opined that the improper test equipment could potentially introduce a bias into the AOA probe, a bias of a similar magnitude to that seen on the flight data recorder, if a certain mode switch was inadvertently positioned. It was clear to me that the AOA sensor was improperly calibrated at the FAA-certificated repair station. Enforcement action by FAA's Flight Standards office followed.

As a result of the Lion Air accident, I stayed on with the FAA a bit longer until the dust settled a bit from the investigation. The final report was issued by the Indonesians a few months later. I retired about two weeks before the second 737 Max accident that occurred in Ethiopia. That investigation is still pending. I have read in the media that a

bird strike may have taken out one of the AOA probes on takeoff, prompting the MCAS to fire. Still, I have questions about how that accident occurred given the issuance of the FAA Emergency Airworthiness Directive after Lion Air.

Yes, Boeing and FAA must accept a portion of the culpability for a flawed design. However, accidents are always due to a series of events, like links in a chain (see graphic). In my view, the Lion Air accident exhibited maintenance malpractice that rivaled the Alaska flight 261 accident from 20 years ago that I wrote about in the March 2020 issue of Aviation



Breaking any one of the links in the Lion Air flight 610 chain of events before or during the flight could have prevented the accident.

Maintenance. The similarities with that accident and Lion Air 610 are undeniable. Both airliners plummeted into the sea following the unintended movement of the horizontal stabilizer that was later determined to be a single-point failure.

With Alaska flight 261, the lessons learned about the improper maintenance were plentiful and impactful. Unfortunately, the same cannot be said about Lion Air 610 because of the anti-Boeing buzz. If you are reading this article, please allow these lessons to be heard. AVM

MRO INSIDER:

THE AMAZON OF BIZ JET PARTS AND SERVICES?

Joy Finnegan

Andy Nixon, founder of MRO Insider says their online portal is an easy to use resource for sending your aircraft maintenance/upgrades needs out for quote to multiple facilities at once. Wait a short while and multiple sources could come back with their quote saving much leg work and time.

Then, with quotes in easy-to-compare format, it is simple to weigh the different options available. Nixon says it is imperative that technicians and management be able to compare hard data between quotes and MRO Insider allows this to happen. Service providers pay a subscription fee to have access to the requests for bid.

"Owner/operators can select the aircraft in their fleet, choose which service is needed, specify a timeframe, and can send equipment lists, maintenance tracking documents or photos," says Nixon. Once submitted, service facilities subscribed to the MRO Insider network are notified of an RFQ (request for quote). They log in and can either request additional information from the owner/operator or submit a quote. Each maintenance facility has a profile page with photos and customer reviews with the main goal of the website being to improve transparency and efficiency in the maintenance quoting process for aircraft owner/operators.

The core MRO Insider team consists of (l-r) Andy Nixon, Lindsay Nixon, Perri Bischoff and Craig Miracle. MRO Insider image.

The company launched in 2017 and has grown quickly since then. In February the company announced the registration of more than 500 corporate aircraft on their maintenance quoting marketplace. Think of it like Amazon, where you can search for a particular product and look at numerous options before purchasing, from new to all levels of used and from multiple vendors. Rather than having to make multiple calls to numerous shops to price compare yourself, wait for return calls, ensure work-scopes are the same and then decide, MRO Insider says it does all this with the click of the return key, once the parameters of your job are entered into the request for quote (RFQ).

With quotes in hand, users can follow up with individual companies with further questions. Nixon says the process brings pilots, owners, operators, and MRO providers together and will improve the customer experience.

Nixon, from Michigan, comes from an aviation family. From his great grandfather, to his grandfather – with whom he still flies today – to his cousin who started a kit plane company, it seemed inevitable that he would end

up in aviation. He was always more interested in the business side of the industry and says he came up with the idea when he was the director of sales and marketing for Toledo jet. "Basically the whole driving force was, I was quoting work. I was going out and seeing these customers in our area. And I was just getting pummeled with marketing because we didn't really have a budget. I mean, people were flying over our head to Cleveland!"

The idea he had was to keep smaller facilities who may be better able to service specific needs at an affordable price, "stage front." "And so that's how it came about. It is just a way for [them] to get exposure and get a look at customers that we're driving to the website or the app, that they might not normally be able to reach," Nixon says. "And, I thought it'd be cool to start my own business," he laughed at the naivety of the thought, now that he has the work of three years behind him.

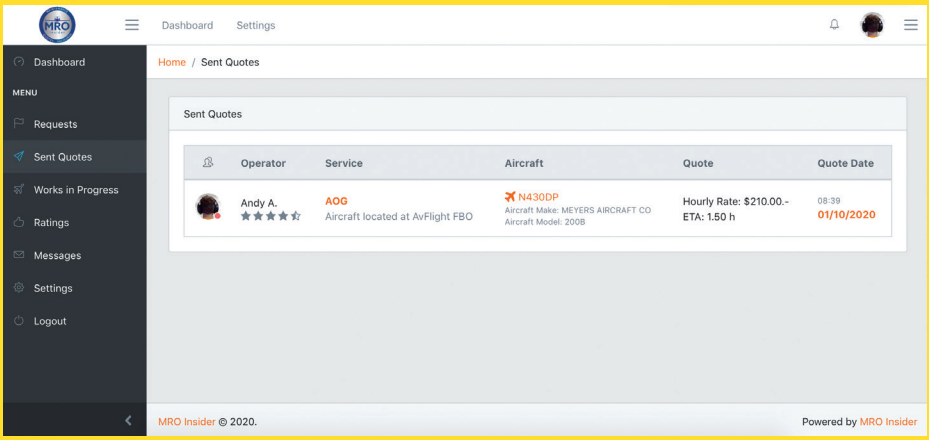
"The larger companies, they have 40 salespeople running around. We're after the people that, you know, have two salespeople that can't always be out and about," Nixon says. "The smaller shops sometimes have the ability with personnel and tooling to complete the jobs and their work quality is excellent, but they don't have any kind of a marketing team and so they're losing out jobs," Bischoff says. Bischoff adds, "I think that's one thing that we're really providing to shops, is that when they have the capabilities, but they don't have the front end stuff like a large marketing team, we're able to help them get those customers. And those customers may even be closer than somebody else they've used and they may never have even heard of them."

In the beginning the company focused on scheduled maintenance. "That was kind of our core business," Nixon says. The website was basic and didn't even have hard coding Nixon says. But customers and industry mentors helped the company hone their product. Customers told them they didn't even have to email and call. "People asked us, 'Can you just make it ping out to people that are in the area?' We said sure! That's the basis of our app for AOG and detailing and parts, is that it'll broadcast out to anybody in a 300 mile radius," he says. "Users put in a description and boom, there it goes. So we let the market determine what's priced, basically. We just released a messaging feature in it too, so both parties can communicate kind of like WhatsApp or Facebook Messenger, back and forth with each other. And then at that point, we pretty much step out." They then ask for a review at the end, again similar to an Amazon review.

Nixon says they keep the process simple and on the up and up. "We don't do finder's fees, we don't do kickbacks, we don't share customer data. So that's what really separates us from our competitors." He adds that they refuse to give out the information which he says "drives a shops nuts. They don't even have to put in tail number - they put in nicknames because sometimes bigger companies just don't want people to know who it is [making the RFQ]," Nixon says.

"We really pushed to mobile because everything is going that way. We stripped down from the website and made the app really user friendly," says Perri Bischoff, director of marketing. "It's simple. It's got an easy user interface. We took a lot of feedback from not only shops, and owners and operators, but even other people about what they liked and disliked about apps within other industries. What made them work? What kept them going back to it and using it? And so the app was developed with two years-worth of feedback off the website."

Some of the feedback the company was getting was about the time spent just chatting with sales people from service providers. "Probably the biggest thing that we hear is, you know, 'I need this quote, I've got six airplanes I'm managing. And the guy wants to tell me about his fishing trip for 45 minutes! And then I don't get the quote. I've got to follow up with them,'" he relays. Operators were saying they couldn't get quotes the same day and there was a lot



Rather than having to make multiple calls to numerous shops, wait for return calls, ensure work-scopes are the same and then decide, MRO Insider says it does all this with the click of the return key, once the parameters of your job are entered into the request for quote (RFQ).

of wheel-spinning. "I was dumbfounded that all salesmen didn't respond the same day and get things done as quickly as possible. And so that was our biggest surprise," Nixon says and where they focus – getting the answers quickly.

A relatively new use just came up. The scenario was a Citation 10 operator needed to replace or check something on the vertical stabilizer. They needed a scissor lift to do a job. "They did not have a way to get up there. So they pinged out via our app that they were looking for a scissor lift in Austin, at the airport there and they were able to rent it from a 135 operator actually that's on the field. They don't do outside maintenance, but they were willing to run it out to them to use it," Nixon explains. "So that's just that whole peer-to-peer building this community and trying to help out the operators well as the providers, as much as we can." After that first success, the company says they will expand this capability.

The company also hopes to add a type of virtual DOM to the service at some point in the future. "We're going to be doing and ask an expert- type, virtual DOM kind of a thing. Basically, if somebody is AOG or has a question, whether it's a big time DOM or it's a part 91 guy that has a chief pilot handling stuff, they can message and reach out to these experts that we'll have loaded on the app with their picture and description of what air frames are comfortable with," Nixon explains. "We're going to be a go to source. You can whip out your phone and ping them and say, Hey, I have this giant inspection coming up on my aircraft. "Is there anything I need to look for, can you help me manage the project? Can you check the invoice when it's done, all of that stuff will then be available here shortly at their fingertips."

Asked if the pandemic has impacted their business, Nixon says no. "We're still a startup company, but we're up 43 percent from this time last year. So, we've had a big increase. And then with the app coming out, we've seen business go up. One of our bigger operators, their business went up as a result of COVID. They never stopped flying and they actually increased the number of aircraft they were managing. And so we have had nothing but positive stuff so far happened," Nixon says.

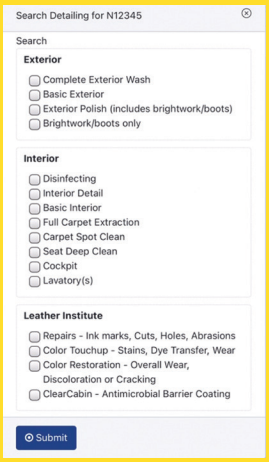
Nixon is especially pleased when he can help put someone "on the map" as he calls it. For example, he mentioned a small facility in Dallas whose customers rave about them. [The owner] used to work for Bombardier and went off on his own. He does Learjet stuff. His customers rave about him: honest, transparent. But he's got to get his name and his brand out there. We just got him signed up last week. And so we like discovering those shops," Nixon says.

The company is also committed to some social issues like encouraging young people to get involved in aviation, potentially working with inmates at local prisons and they have begun a carbon offset tree planting program. They have some property in Northern Michigan a source for ordering oak trees. "Every single RFQ that goes through our website we add to our list of tree planting. This fall we're going to do a company retreat and we're all going go plant the trees. At some point we would like to include some of our other shops or operators that want to be a part of that. I think we're the only people that are hands-on doing something like that in business aviation," Nixon says.

Nixon feels their only competition is the old mind set of doing things the same old way. "We are definitely competing against the old way of doing things. But, everything is going digital and mobile. And we're not going to see that go away obviously now, especially with the pandemic," he believes. He says the pandemic has accelerated the trend.

The company says they don't want to do away with the relationship aspect of the business, however. "We're like the conduit to accelerate people's relationships. We're not trying to completely replace it. We're just helping you get there faster," says Bischoff. This relationship aspect is the impetus for MRO Insider to partner with Wyvern to offer a Q SMS program to smaller shops.

"It will be another way for us to validate who's on our network," Nixon says of the process. They are working with their first client on this partnership to establish an affordable audit program designed for those smaller shops. "One of our big goals is that everybody will be on this Q SMS. We want everybody to know that if you come to MRO Insider, this is what it is like, it's a boutique of these vetted shops with top-notch people," Nixon says. AVM



This shows an example of a request for quote for aircraft detailing. Users select the areas they want detailed by simply clicking the boxes. Once that information is entered, it is broadcast out to shops doing that type of work in a 300 mile radius.

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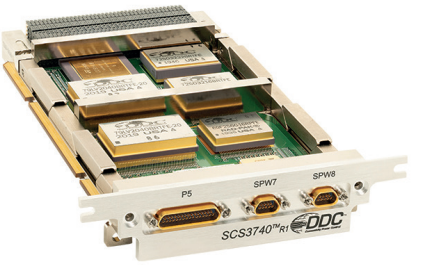

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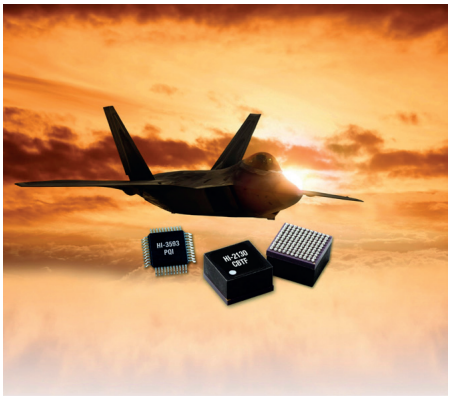

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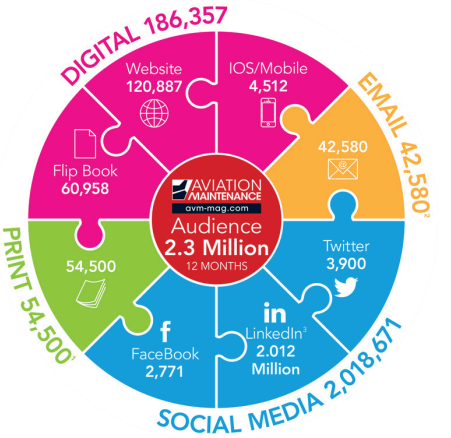

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Back to the (Electric) Future

Howard Fuller

There is an ancient Chinese curse that I'll paraphrase: "May you live in interesting times."

In aviation right now, we are indeed living in such an era. The airlines are largely grounded and being an A&P Mechanic is not the guarantee of industry respect or lifelong employment it once was. In General Aviation, one can watch the grass growing among the training aircraft at most small airports. With the cost of avgas at record levels, training is a luxury even well-to-do individuals can ill-afford. The news is not all bad, however.

Significant progress is being made in electric aircraft, with a few flight schools employing early electric powered gliders for their main training aircraft. In the U.K., for example, Skyborne Airline Academy, based at Gloucestershire Airport, has recently ordered ten all-electric light trainers from Bye Aerospace (www.byeaerospace.com) of Broomfield, Colorado.

Bye expects their E-Flyer 2 to be the first all-electric aircraft to receive FAR 23 certification. The critical design review took place on June 5 and the next phase of the flight test program is currently underway. The company says its aircraft will reduce operating costs by a factor of five over equivalent piston-powered training aircraft, as well as generating far less noise and zero inflight emissions.

Another manufacturer, Pipistrel, (www.pipistrel-usa.com) headquartered in Slovenia, produces an extensive line of light aircraft including several that are all-electric. With the available,
interchangeable long wings, the Alpha Electro serves as a self-launching two-place sailplane that is eminently suitable for training, thus eliminating the need for towplane services. It is also usable for airplane training when employing the optional short wings.

In the transport category, all major engine manufacturers are moving ahead with electric powerplants, some with prototype engines in flight test programs using transport category aircraft.

In the U. S., while the traditional Part 23 manufacturers are still offering piston-powered trainers in very limited production numbers, the winds of change are blowing strong from Wichita to Vero Beach.

Siemens, (www.siemens.com) the European electrical conglomerate, has developed a 260KW aircraft powerplant that appears ideal for medium-performance singles and twins. That portion of Siemens was recently acquired by Rolls-Royce.

On the West Coast, Harbour Air has flown a DHC-2 Beaver on floats with the MagniX 500, a 750hp electric powerplant. That motor is slated to eventually replace the PT-6 in several airframe models, including the balance of the Harbor Air fleet and is flying today in a Cessna Grand Caravan electric prototype. Do you see the trend developing here?

It appears to this writer that the only limitation at present is battery capability, but that technology is also leaping ahead at lightspeed, with Elon Musk at the forefront. I long ago learned not to discount Mr. Musk's capabilities in the electric propulsion field. In my neighborhood, it seems like one out of three new cars is a Tesla 3 lately. Tesla stock is worth more than GM, Ford and Fiat-Chrysler combined, so he must be doing something right.

Tomorrow's General Aviation airports may well be located closer to the population centers due to their being in compliance with stricter noise limitations. The new light aircraft will fit right in with quieter electric powerplants. FAA and EASA regulations will almost certainly still encompass strict airframe maintenance requirements, however, even though it is highly unlikely that the mandated training curricula for A&P schools will keep pace with the new technology. I would suggest that if you want to keep your skills up-to-date, you may want to look into attending a factory school at one of the above electric motor manufacturers.

Well, take it or leave it, there's the general aviation future for you. As Lawrence Fishburn famously says in The Matrix, "I can only open the door for you...it's up to you to step through." AVM

Formerly with Wyvern Consulting Howard Fuller in formed independent consultancy JTI Air Holdings to continue aviation safety audits. Currently developing alternative-powered fixed and rotary wing aircraft both manned and unmanned.

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By Jason Dickstein

Correlating Risk Consequence and Likelihood

This is the fourth article in a series about Safety Management Systems (SMS). In the first article (see page 48 of the January 2020 issue of Aviation Maintenance), we examined some hazard identification strategies (looking at ways to identify the things that could go wrong in our systems). In the second article (see page 48 of the May/June issue), we began looking at the process of using risk assessment to analyze identified hazards by explaining how to establish a "likelihood" scale that is relevant to your business needs, and how to calculate a "likelihood" for each identified hazard. In the third article (see page 48 of the July issue) we continued our examination of risk assessment by looking at the process of using "consequence" as a second metric for analyzing risk.

This month we will examine how to correlate "consequence" and "likelihood" together to get a product that represents the relative risk associated with the hazard. We can use this risk product to help make risk mitigation decisions, and also to measure the effectiveness of our mitigation efforts.

I strongly recommend that you go back and read the first three articles if you have not looked at them recently. They are each pretty short, and they lay a foundation that will make it much easier to understand what this article is talking about. These prior articles are available in the back issues found on the Aviation Maintenance magazine website.

To review, we have previously discussed the identification of hazards (in the January 2020 issue), and the correlative assignation of likelihood levels (from the May 2020 issue) and consequence levels (from the July 2020 issue) to those identified hazards. If you are looking for more detail on how to assign these values, then please look at the earlier articles.

Typically, these assignments are only relevant within the system in which they are assigned. For example, one system might assign a likelihood level of 3 and a consequence level of 4 to a particular hazard, and another system might assign very different numbers to the same hazard. This could be because the scales of the systems are defined differently, it could be because the likelihood and consequence levels are themselves defined differently, or it could be because the hazard has different actual and potential effects within a particular system. The important thing is to use the system that you defined so that you can assign values that provide a relative risk rating. Such a rating will be relative to risks of other hazards identified and enumerated by your system.

Let's look at the two scales that we used as sample for a repair station SMS in the past two articles. First there is a scale for likelihood (*Exhibit A*):

Exhibit A

Likelihood Level	Likelihood Description
1	Never has occurred and the hazard is unlikely to ever occur
2	Never has occurred but the hazard could reasonably occur
3	Has occurred, and without mitigation, the hazard would probably occur less often than once per month OR never has occurred but the hazard is likely to occur in the future
4	Has occurred, and without mitigation, the hazard would probably occur more often than once per month
5	Has occurred, and without mitigation, the hazard would likely occur on every project

And second there is a scale for consequence (*Exhibit B*):

Exhibit B

Consequence Level	Consequence Description
1	**No safety effect**: Failure conditions that would have no effect on safety, e.g.: • a failure to follow CMM recordkeeping instructions that have no safety effect
2	**Minor**: Failure conditions that would not significantly reduce system safety, e.g.: • A slight reduction in safety margins or functional capabilities • A slight increase in personnel workload (such as a routine work process change)
3	**Major**: Failure conditions that would reduce the safety capability of the business, or of a customer, or the ability of personnel to cope with adverse conditions, e.g.: • Significant reduction in safety margins or functional capabilities • Significant increase in personnel workload
4	**Hazardous**: Failure conditions that would reduce the capability of the business, safety of a customer, or the ability of personnel to cope with adverse safety conditions, including: • A large reduction in your safety margins or functional capabilities (e.g. conditions that can permit improper maintenance) • A reduction in your customer's safety margins or functional capabilities (e.g. a quality escape that might not prevent proper operation) • Physical distress or higher workload such that personnel cannot be relied upon to adequately manage safety
5	**Catastrophic**. Failure conditions that are expected to affect the operation of a component, part, or element such that it can no longer function as intended for the customer, e.g.: • Improper maintenance • A quality escape that would prevent proper operation

We've assigned numbers to the different levels (one through five in each case). By multiplying the numbers we can get a product. The product of the two represents a risk rating. For example, if likelihood is 4 and consequence is 4 (hazardous), then the product of the two is 16. If the likelihood of another hazard is 2 and the consequence is also 2 (minor), then the product is 4. These numbers are not absolute, so they do not tell us anything when analyzed outside of our system; but within our system they tell us that the first hazard (with a 16 risk product) should be a higher priority for mitigation than the second hazard (with a 4 risk product). This allows the owners of the system to prioritize their hazard mitigation projects to focus on the hazards that pose the most significant risk.

The simple multiplicative comparison is not the only way to approach these figures. For example, if your system prioritizes consequence over likelihood, then you might consider developing risk products by a formula like [consequence x consequence x likelihood]. This approach squares the consequence value which makes it a much greater influence on the final risk product number. For example, in a straight multiplicative model, a hazard with a consequence of 4 and a likelihood of 3 yields a risk product of 12; and a hazard with a consequence of 3 and a likelihood of 4 also yields a risk product of 12. They are weighted equally in such a model. But in the consequence-squared model, a hazard with a consequence of 4 and a likelihood of 3 yields a risk product of (4x4x3=) 48; while and a hazard with a consequence of 3 and a likelihood of 4 also yields a risk product of (3x3x4=) 36. Now the first hazard is prioritized over the second one for purposes of identifying an order in which to mitigate the hazards. Notice that our hypothetical hazards did not change, but only the way that we analyzed them changed.

The products of the likelihood and consequence numbers can also be used to help us set mitigation targets. By examining the products, the SMS system-owner can determine which risk products are acceptable and which risk products are unacceptable. Those hazards that have risk products that are deemed to be unacceptable would need to be mitigated in order to reduce their risk products to an acceptable level. In the next article in this series, we will discuss risk mitigation strategies.

A matrix of acceptable/unacceptable risks might look like this *(Exhibit C)*:

Exhibit C

		Likelihood				
Consequence		5	4	3	2	1
	5 - Catastrophic	unacceptable	unacceptable	unacceptable	unacceptable	review
	4 – Hazardous	unacceptable	unacceptable	unacceptable	unacceptable	acceptable
	3 – Major	unacceptable	unacceptable	unacceptable	acceptable	acceptable
	2 – Minor	unacceptable	acceptable	acceptable	acceptable	acceptable
	1 – No Safety Effect	acceptable	acceptable	acceptable	acceptable	acceptable

In this matrix, we have established that certain risk products are considered to be acceptable, and certain risk products are unacceptable. In our sample, there is also one risk product that is marked in yellow as "review:" this is for catastrophic hazards that would be unlikely to ever occur. When hazards in this yellow-review risk-product are identified, they will be subject to additional review in the system to determine whether to mitigate them (so it is not acceptable nor unacceptable until the review has assessed it). When the system is newly-implemented, there may be many hazards that pose unacceptable risks. The numerical products found my multiplying the likelihood and consequence numbers can be used as a mechanism for prioritizing hazards in order to determine which ones to mitigate first.

The goal is, of course, to mitigate all of the hazards to an acceptable level. In our matrix, this means reducing the likelihood or consequence to a low enough level to move the risk product into the green. Eventually, a measured approach to SMS hazards should reduce the risk associated with the known hazards to acceptable levels. But this doesn't mean that we are done!

We can also amend our risk product matrices as experience shows us that certain risk products need to be prioritized, and also as successful mitigations help to reduce total system risk.

Perhaps, after working in the system for two years, our hypothetical SMS-owner will feel that the business has successfully mitigated the risks posed by many of the identified hazards, and now the business is ready to begin mitigating the next round of hazards. The business might change the acceptable/unacceptable risk matrix by lowering the bar for mitigation so that the new matrix looks like this *(exhibit D)* :

Notice that the new matrix has changed some acceptable risks to unacceptable, which means that the business will develop new mitigations to further reduce the risk products of hazards in those categories to acceptable (green) levels. It is possible that some hazards that were mitigated from red-to-green in the prior matrix might need to be further mitigated after this change resets the concept of what is acceptable.

This approach allows the business to use its risk product acceptable/unacceptable matrix as a tool for continuous safety improvement, by moving the levels of acceptable safety to force constant im-provement. AVM

Exhibit D

		Likelihood				
		5	4	3	2	1
Consequence	5 - Catastrophic	unacceptable	unacceptable	unacceptable	unacceptable	unacceptable
	4 – Hazardous	unacceptable	unacceptable	unacceptable	unacceptable	unacceptable
	3 – Major	unacceptable	unacceptable	unacceptable	review	review
	2 – Minor	unacceptable	acceptable	acceptable	acceptable	acceptable
	1 – No Safety Effect	acceptable	acceptable	acceptable	acceptable	acceptable

In the next issue, we will look at how to use mitigations in order to reduce likelihood levels and consequence levels of identified hazards. By changing the likelihood level, consequence level, or both, the system can effectively reduce risk posed by hazards. As we will see in future articles, this helps to drive an effective audit schedule as well as becoming an effective and objective change management tool. Want to learn more? We have been teaching classes in SMS elements, and we have advised aviation companies in multiple sectors on the development of SMS processes and systems. Give us a call or send us an email if we can help you with your SMS questions.

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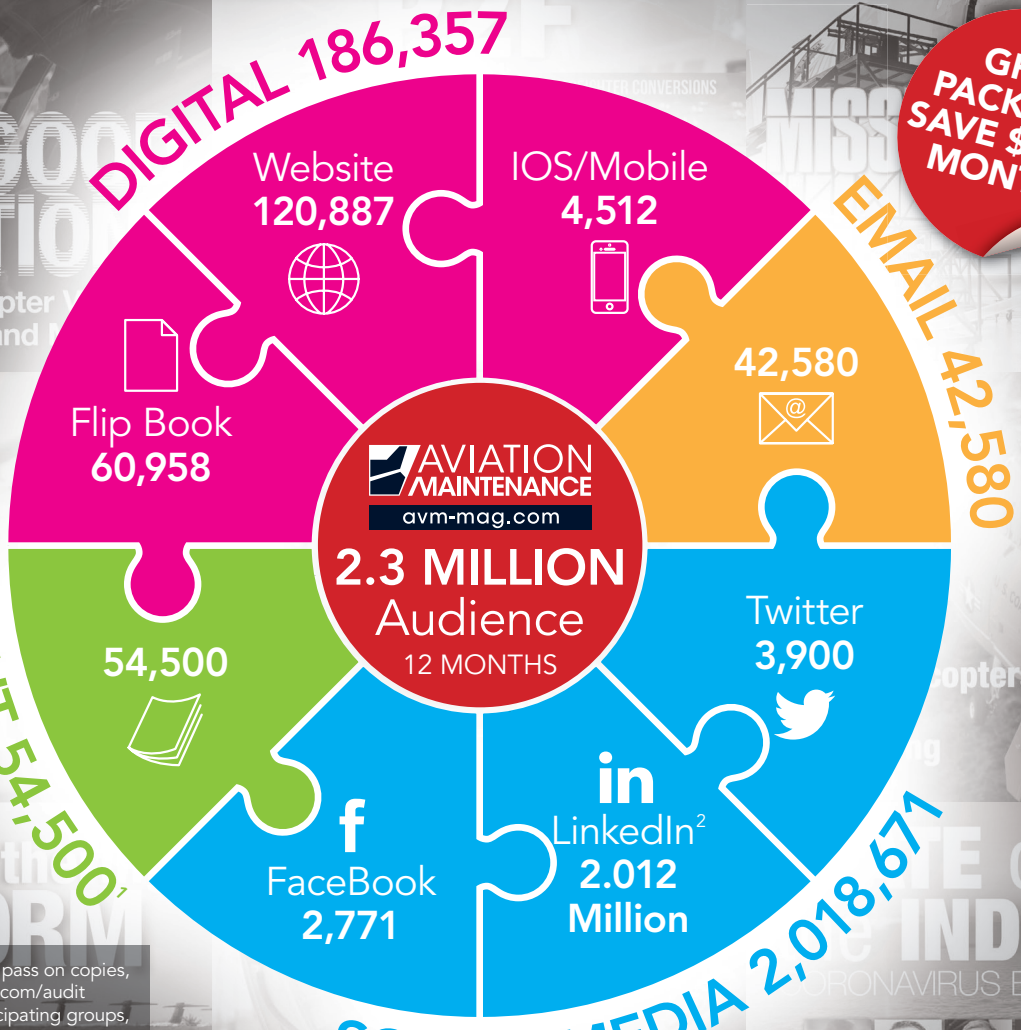

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