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The Big Spend Engine MRO

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October / November 2018

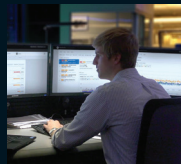
CABIN UPGRADES

TAKING ADVANTAGE
OF DOWNTIME TO
REFRESH THE CABIN



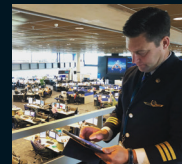
BIG DATA

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Cover image courtesy of MTU Maintenance. Shown in the cover image is Jasmin Schneider, a quality engineer at MTU Maintenance.



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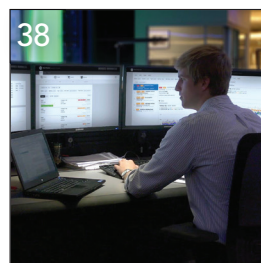
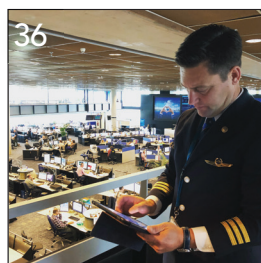
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Adaptation

BY JOY FINNEGAN
EDITOR-IN-CHIEF



Adapting to new ideas and thinking is hard but we must do it. For all of us in the aviation maintenance industry, we must not only embrace change, but anticipate it, and be ready to react when it is occurring. Otherwise, our businesses will not survive.

Times are good right now. But, as someone who has seen the cycles of aviation during the past three decades, a caution. Do not be lulled into thinking the good times will last forever. Sure, ride the wave. Enjoy it. But if you are wise, you will be thinking and planning for when the downturn comes. Saving money, hiring for the good times with an eye not to overdo it and keeping a keen eye towards new technologies that can disrupt the old ways will serve your business well.

Are there any predictions on what the new technologies that will disrupt our industry will be? What do you think will be the unexpected game changer in the maintenance world? Maybe it is already right in front of our eyes and we just aren't seeing it yet. For those of us in the U. S. and some of the rest of the world, do you remember when a cab had to be called for an early morning ride to the airport to catch a flight or a late-night ride home on New Year's Eve? It could be stressful – waiting and waiting for the cab to show up, if it did. Forget about getting a cab on New Year's Eve. The taxi industry was a mess. Then came Uber and Lyft. Those companies radically changed the paradigm of catching a ride here in the U. S. I think they are still working out some kinks in the rest of the world, but here, Uber and Lyft have turned the cab industry on its head.

What will make that kind of radical shift in our industry? Perhaps it will be Big Data. Much talked about. Much worried about. Much maligned as a possible evil force. The question of who owns the data is the first thing everyone still asks at conferences and in interviews about it. But we must get over that fear. Big Data will be a part of our industry and we need to learn to love it. Whatever worries and concerns exist about it need to be addressed to the level that everyone is confident and then we need to move on and flourish in the Big Data world.

The digital transformation and disruption are happening right before our eyes. Predictive maintenance and optimization of aircraft systems will continue to evolve and become better. Connectivity artificial intelligence, big data analytics, cloud, IoT, cybersecurity, augmented reality and blockchain...if you don't know what these things are and how they can impact the maintenance of aircraft, you are already behind the power curve. Learn more about Big Data and how it is impacting maintenance in our Big Data story on page 38.

Also in this issue, we look at engine MRO throughout the globe. Engine MRO constitutes the largest part of MRO spend

in our industry. Learn about the ways engine MRO providers are vying for business with new partnerships, programs and locations. Our engine MRO story begins on page 16.

New advances in digitization and automation find their ways into the cockpit quickly and often first. Boeing has introduced RouteSync in an effort to automate the

“Connectivity big data, IoT, cybersecurity, augmented reality and blockchain...if you don't know what these things are, you are already behind the power curve.”

predeparture sequence for airlines and reduce errors. With the click of a button, a route can be uploaded to the FMS. I visited the KLM operations control center to learn about it. That story is on page 25. Just think of the ways a similarly designed system could work for maintainers in the hangar.

I also visited a growing MRO, Flying Colours. The company is expanding and finding ways to bring the collective knowledge of the automobile industry into their hangars to help streamline work and add scheduling consistency. After speaking with Dave Stewart, who was brought in to champion this effort, I saw that change can be made and with the support of technicians who are tired of the “we've always done it that way” mentality. Find out more on page 46.

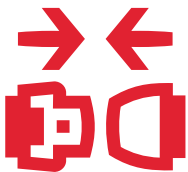
And how's this for disruption. The new FAA Reauthorization Act “includes a provision that could pose a thorny issue for Americans, in that it offers an opportunity for the FAA to potentially side-step traditional rulemaking processes in favor of acceptance of foreign rules.” Mind blown. Find out more from our legal expert, Jason Dickstein in his Legal Spin column entitled, “Accepting Foreign Airworthiness Directives – A More Dramatic Change Than It Might Appear.”

Lastly, we hope you will take a listen to our first sponsored podcast that will be on our website by the time this hits mailboxes. We talked with Matt Mruk, director of business development with Proto Industrial Tools to learn about their aerospace compliance standards, commitment to safety and some of the cool products that can help maintainers do their jobs to the highest level. More info about this episode on page 37. We hope you will take a listen and please stay tuned for more regular podcasts coming from Aviation Maintenance Magazine soon.

Hope you enjoy the issue and may it inspire you to think about, and perhaps even create, the next wave of disruption for aviation maintenance. **AMM**



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Boeing Global Services' Continues Push for Market Domination

Boeing Global Services, one of Boeing's three business units, headquartered in the Dallas, Texas is making headway towards their goal of market domination with many recent business developments.

They announced service enhancements to its integrated digital solutions portfolio saying these will enable better, faster operational decision-making for customers. The announcement comes alongside a series of agreements and orders that they say demonstrate the value of the portfolio.



*Mike Fleming
VP Commercial Services for Boeing*

"The amount of data coming off an airplane will double in the next twenty years," said Mike Fleming, vice president of Commercial Services for Boeing. "We are evolving our portfolio of tools and developing new applications and analytics to help customers take action to improve their operations." New integrated digital solutions include Crossmos, FliteDeck Pro RouteSync and AnalytX.

Boeing has acquired rights to the Crossmos software product from Frankfurt, Germany-based CrossConsense. The application will be adapted for development of a new Boeing Mobile Logbook, providing a full-fleet solution to enable flight and maintenance crews to enter and share maintenance information.

Jeppesen's FliteDeck Pro electronic flight bag has been enhanced with a new weather layer feature that provides increased situational awareness from enhanced data, integrated NOTAM and other flight data updates.

An application version of Boeing subsidiary Jeppesen's Fuel Dashboard Pilot Insight enables pilots to make informed decisions on discretionary fuel in as little as 10 seconds.

Boeing's new Reliability Advisor tool uses data analytics to automate and enhance the process of using logbook data to identify and address cabin maintenance and reliability issues across an airline's fleet.

Boeing's new RouteSync tool streamlines the pre-flight process by instantly uploading flight plan and aircraft performance data, eliminating three to five minutes of prep time on domestic flights and up to 15 minutes on international routes (see related story page XX).

Boeing also announced new digital solutions agreements, all powered by Boeing AnalytX. Air Europa will adopt Software Distribution Tools and Airplane Health Management (AHM) for its 737 MAX fleet. AHM generates real-time, analytics-based predictive alerts while Software Distribution Tools enable airlines to securely manage digital ground-based data exchange and host data locally. Boeing also says it will deploy Maintenance Performance Toolbox across its mixed fleet, which delivers real-time access to information that technicians need to



Boeing is expanding its parts program, Integrated Material Solution (IMS) to help meet supply chain demands, as part of a multi-faceted plan to gain market domination throughout multiple sectors of the aviation industry. Boeing Image.

quickly resolve airplane maintenance issues. (See related information from Boeing in our Big Data story beginning on page 38).

Travel Service will deploy Software Distribution Manager for the 737 MAX and Maintenance Performance Toolbox for its Next-Generation 737 and 737 MAX fleet. Software Distribution Manager is a cloud-based solution enabling airlines to manage the secure flow of operational data to and from the aircraft while on the ground.

Boeing also announced an expansion of its parts program, called Integrated Material Solution (IMS), which it says will help airline customers' meet growing supply chain requirements. This capability streamlines a customer's supply chain by combining multiple services from Boeing's parts solutions portfolio into one fully managed material solution. Integrated Material Solution provides demand planning for consumables, expendables and customer furnished equipment with management of rotatable parts. IMS leverages Boeing's scale with 24/7 parts support and more than 12 million parts in inventory at more than 75 parts depots worldwide.

"The creation of Integrated Material Solution is in direct response to what our customers have been asking for," said Fleming. "Carriers want the benefit of a dependable supply chain that swaps operational complexity for stability."

Along with the enhanced IMS capability, Boeing announced a number of agreements to provide supply chain solutions, including a two-year agreement for component management, test, repair and overhaul with Boeing subsidiary Aviall with El Al Israel Airlines; and two 777-200F landing gear overhaul and exchanges added to its existing contract with Lufthansa Group.



BEYOND MRO

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- LF507 • PT6A • PW100 • PW150A • PW600 • RB211-535 • RE220

about people

Draper to Lead Textron Aviation

Textron Inc. announced that Ronald Draper, Textron Aviation's senior vice president, integrated supply chain (Operations), has been named to succeed Scott Ernest as president and CEO of Textron Aviation Inc. Ernest, president and CEO of Textron Aviation Inc. since 2011, has been named president and CEO of Textron's Industrial Segment and of Textron Specialized Vehicles Inc. Draper has led all aspects of manufacturing operations for Textron Aviation since 2012, including strategic sourcing, quality, support services and aftermarket parts, as well as overseeing the manufacturing operations for the Beechcraft and Cessna product lines.



Draper

AJW Appoints Boni VP

AJW Group has appointed Frank Boni as VP of MRO Sales. Boni, will be responsible for sales of the company's MRO services worldwide for the group. He will also work closely with AJW's leadership, commercial, technical and business improvement teams to develop the maintenance and repair capabilities of AJW Technique, its state-of-the-art MRO facility in Montreal.



Boni

HAI Names Hill Director of Safety

Helicopter Association International (HAI) announced the hiring of Chris Hill as director of safety. In this position, Hill will be responsible for managing the association's existing aviation safety programs and for developing new safety initiatives to benefit HAI's membership and the international helicopter community. Hill has more than 32 years of rotary-wing and operational aviation safety experience. After serving as a helicopter pilot in the US Army and Coast Guard, he served in numerous roles supporting Coast Guard aviation safety, operations, logistics, and acquisitions. He also has extensive commercial offshore experience operating from multiple platform and vessel types in the Gulf of Mexico. For the past five years, he served at Coast Guard Headquarters in Washington, D. C., as the service's civilian aviation safety manager. He served as a safety officer, flight standardization officer, and instructor pilot in three operational assignments. He has an ATP helicopter rating with more than 5,000 flight hours in 12 commercial and military rotary- and fixed-wing aircraft.



Hill

WOW Air Selects Airbus FHS-Components Service

WOW Air selected Airbus' Flight Hour Services (FHS) Components services for its A320 and A330 fleets, covering 20 aircraft and becoming one of the first A330 customers in Europe to enlist Airbus FHS.

The agreement with WOW encompasses CEO and NEO variants of both aircraft families for its fleet, and also includes Airbus' Skywise and Digital consulting services. Airbus will handle component services including: pooling, on-site stock at main base and repairs. Airbus will also set-up an extensive on-site stock in Iceland at WOW's facilities.

WOW selected Airbus FHS for its wide range of services and digital solutions portfolio, and will also benefit from Airbus' FHS global network and capabilities both in the Americas and Asia to secure its global operations. WOW will take advantage of one single interface to manage its whole fleet and components support operations. Furthermore, the FHS service will be 'powered by Skywise' – Airbus' open data platform – helping WOW to enhance its digital capabilities.



New Ownership for Monarch Aircraft Engineering (MAEL)

Monarch Aircraft Engineering (MAEL) has agreed the terms of its new ownership structure, with a transaction in which Greybull Capital becomes the majority shareholder in the leading aircraft MRO provider.

MAEL's lenders PNC will continue to provide facilities and support, and many of the operator's key customers have also expressed their support for the business as the restructuring progresses.

"Today marks an exciting new chapter for Monarch Aircraft Engineering as we plan to move forward with ambitious plans for growth, building on the solid foundations we have built for our business in the past year," Chris Dare, CEO of Monarch Aircraft Engineering, says. "I am grateful to Greybull and to our customers across the globe for their support of our business. I would also like to thank our fantastic, dedicated employees who make Monarch Aircraft Engineering the successful business it is."

In the last year MAEL says it has increased its geographical footprint with the opening of a new component maintenance facility in Northampton, and has created more than 100 new jobs, growing its workforce to more than 800 people. It has also doubled the size of its industry-renowned apprentice training program.

The company says its maintenance facilities at Luton and Birmingham are fully utilized, with an order book full throughout 2019. However, recently, and after the announcement of new shareholders, creditors to MAEL received notices of voluntary arrangement in accordance with the UK's Insolvency Act.





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about people

ADMA Announces New Board of Directors

ADMA has announced their new board of directors. These are broken down into two groups representing distributors and manufacturers. Here is the new board:
Distributor Seats (Term Exp. 2020 first row)



Walter Johns,
Western Aircraft



Gary Dawson,
Hawker Pacific



Don Arrington,
Irwin/Aircraft Spruce



Melissa Nesmith,
Lee Aerospace



Brian Cox,
Tempest Aero Group

Manufacturer Seats
(Term Exp. 2020 left)

Winkler to Remain CEO of MTU Aero Engines

MTU Aero Engines' Supervisory Board has extended the contract of CEO Reiner Winkler by five years until September 30, 2024. The decision was made by a unanimous vote at the Supervisory Board's meeting on October 24, 2018. Winkler has been the company's CEO since January 2014 and previously served as its chief financial officer since May 2005 when MTU went public.



Winkler

Pae Selected as Cadence CFO

Cadence Aerospace has appointed Joyce Pae as chief financial officer (CFO). Ms. Pae has served as Interim Chief Financial Officer of Cadence Aerospace since September 10, 2018. In her new, permanent role as CFO, she is responsible for optimizing the financial performance of Cadence Aerospace, including managing the company's finances, financial planning, risk management, record keeping, liquidity, financial reporting and return on investment. She succeeds Don DeVore, who retired from Cadence Aerospace earlier this year.



Pae

Aero Norway to Provide Engine MRO for SAS

Norway-based engine MRO facility Aero Norway signed a rolling GTA with repair agreement with SAS. This covers scheduled and unscheduled engine removals, maintenance, repair and overhaul for their fleet 67 Boeing 737 600/700/800 aircraft equipped with CFM56-7B engines.

"At Aero Norway the focus is always on delivering the best service and industry-recognized EGT margins and we are globally acknowledged as a leader in CFM56 engine variant repairs. MROs, independent engine owners and leasing companies come to us because of the flexibility of workscope that we, as an independent organization, can offer. This really helps their operational efficiency and the light workscope, fast slot induction and quick turn-around will all deliver tangible benefits to SAS," Rune Veenstra, chief business at Aero Norway, explained. "Aero Norway's capability for on-site assistance was a key factor in the SAS decision with specific regional coverage able to be deployed in Oslo, Stockholm and Copenhagen," Veenstra adds. "Although Aero Norway has worked on several SAS engines in recent times, it is the flexibility we can offer and our commitment to induct unscheduled removals within specific timeframes that underpins this new agreement."

Aero Norway has been a CFM approved facility for more than twenty-five years, and is multi-release FAA, EASA, TCCA, CAAC, GCAA and DGCA.

Flightsafety and USC to Offer New Courses for Maintenance Leaders

FlightSafety International and the University of Southern California, Los Angeles campus, enter into an agreement to provide a comprehensive series of courses for aircraft maintenance department managers.

"We are pleased to now offer our Customers a new series of Human Factors, Safety Management and Accident Investigation courses through the University of Southern California," said Steve Gross, senior vice president. "USC is known as the premier provider of aviation maintenance soft skill training."

The courses include Human Factors in Maintenance, Human Factors in Aviation Safety, Aviation Safety Management Systems, Gas Turbine Accident Investigation,



Helicopter Accident Investigation, Aircraft Accident Investigation, Safety Management for Aviation Maintenance, Safety Management for Ground Operations and Accident/ Incident Response Preparedness.

They can be taken at the USC campus in Los Angeles or onsite at the Customer's location. All these courses will be electives for the FlightSafety Master Technician-Management



Program and can be taken under a FlightSafety Event-based agreement.

"The USC Aviation Safety and Security program was established at USC in 1952 as the first Aviation Safety program at a major research university. Since that day over 60 years ago, we have striven to develop and present the most advanced and relevant aviation safety courses available to all segments of the aviation community," said Thomas Anthony, director USC Aviation Safety and Security Program. "Our instructors are skilled educators with extensive industry experience. Because FlightSafety International and USC are both leaders in their respective aviation roles, we look forward to the dynamic synergy that will come from this partnership."



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100%
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100%
Airline MRO

100%
Adaptiveness



“I’ve been an engine module technician on CFM56 and CF6 engines for 10 years. Thanks to this experience I have joined the LEAP team. I’m determined to provide the best quality and TAT to meet our customers’ expectations, while always looking for ways to improve our processes.”

Leandro Rodrigues Oliveira, Engine Module Technician

AFI KLM E&M has extended its capability list to include maintenance for the LEAP engine, with an MRO service offering that covers both On Wing/On Site support and shop visits. AFI KLM E&M, which has provided support when new engines go into service on a number of occasions in the past, is capitalizing on the know-how of its teams to support early-stage operations on the LEAP worldwide. We are ready to meet the needs of the airlines with services that are always the **Best4You**.

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Safran and LHT Collaborate on A320 Nacelles

Safran Nacelles and Lufthansa Technik signed an agreement for maintenance, repair and overhaul (MRO) services on A320neo nacelles powered by CFM International LEAP-1A engines. The agreement aims to provide operators with flexible and cost-effective services based on the expertise of both companies.

Safran Nacelles and Lufthansa Technik will combine their expertise to propose to operators the development of repair services approved by airworthiness authorities. The two companies say they will rationalize and optimize the use of their respective nacelle end-item stocks worldwide. The companies hope this collaboration results in increased accessibility and solutions to match market demand.

“Our joint approach provides operators with innovative repair services covering the entire nacelle, with benefits that include increased availability of their aircraft, optimized material consumption in maintenance, as well as cost advantages,” said Olivier Savin, Safran Nacelles’ vice president of Customer Support & Service.

“The nacelle’s end-item set – which is composed of the air inlet, fan cowls, thrust reverser, and exhaust nozzle is a considerable investment at an aircraft’s early age,” said Michael Kirstein, senior director - Aircraft Systems at Lufthansa Technik. “With this cooperation, we will be more efficient in



Olivier Savin, Safran Nacelles’ vice president of Customer Support & Service and Michael Kirstein, senior director, Aircraft Systems at Lufthansa Technik shake hands after signing nacelle agreement.

offering our customers full availability and quick access to assets, in all world regions - right from an aircraft’s entry into service.”

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PPG Offers Training Programs

PPG will offer aerospace coatings training to more customers by increasing the number of programs to meet growing global demand.

Nine sessions of PPG’s Aerospace Coatings Academy are already planned in 2019 – four in the U.S. for North American customers, four in Europe

for customers in Europe, the Middle East and Africa (EMEA), and one in Asia for participants from China, Japan and nearby countries. PPG may hold additional training programs to accommodate customer requests.

More than 200 painters, engineers and buyers representing 50 airlines, manufacturers and maintenance operations have attended 14 sessions held since 2015. There is no charge to attend an academy session, which offers hands-on learning opportunities as well as classroom sessions on the latest aerospace coatings technologies.

“After attending the academy for the first time, I found it to be so beneficial that I participated in a second session,” said Christophe Colin, Air France material expert. “I am always learning something from this training and from the PPG experts who are here to support this program. It is good to go into a PPG facility as it gives me the opportunity to meet the PPG team involved on the different topics.”

PPG says it updates the program content as new technology develops and to address customer requests.” By holding the training at PPG facilities, we also afford attendees the opportunity to see PPG coatings operations,” said Daniel Bencun, PPG global director, aerospace coatings. PPG will hold its next Aerospace Coatings Academy in December 2018 at its Barcelona, Spain, automotive refinishing coatings manufacturing facility.



AFI KLM E&M Obtains EASA Approval for LEAP-1B Engine Overhauls

AFI KLM E&M has obtained approval from the European Aviation Safety Agency (EASA) for the overhaul of LEAP-1B type engines. With this latest milestone in its LEAP product industrialization program,



AFI KLM E&M is now authorized to offer a complete array of engine support services to customers that operate Boeing 737 MAX fleets, from inspection to modification, repairs, and overhauls. AFI KLM E&M will become the first non-OEM MRO provider with this approval to support LEAP-1B engines worldwide.

"This approval has crowned our teams' efforts over the past several years to upskill and develop the industrial and technological resources required for this new-generation powerplant," Anne Brachet, executive vice president AFI KLM Engineering & Maintenance, says. "We have been able to work closely both with the aviation authorities and the members of the CFMI consortium (GE and Safran) so that we can help 737 MAX fleets worldwide benefit from our specific know-how as an airline MRO."

AFI KLM E&M operationally launched this new product in spring this year after obtaining approvals from EASA and the Federal Aviation Administration (FAA) for engine line maintenance (on-wing and on-site) for LEAP-1A and LEAP-1B engines. Today the industrialization program continues to be ramped up, and thanks to bilateral agreements between EASA and the FAA, AFI KLM E&M will receive approval from the US authorities in the coming weeks and will thus be able to extend coverage for its 737 MAX engine support services worldwide.

In parallel, the Group is pursuing its development programs that will enable it to offer the same array of all-round services for the LEAP-1A engines equipping the Airbus A320neo.

Air Corsica Signs Up for C-Checks With AFI KLM E&M

AFI KLM E&M has won the call for tenders launched by Air Corsica for C-checks on two of its A320s. The aircraft will be overhauled in Casablanca by Aerotechnic Industries (ATI), a 50/50 joint venture between AFI KLM E&M and Royal Air Maroc. The two checks will take place in the first quarter of 2019 and will include implementation of a Service Bulletin (SB), and cabin maintenance and engineering services.

The contract is further proof of the strong ties between Air Corsica and AFI KLM E&M. "Overseen under a master contract, our current partnership takes in a vast array of services, from component support to engines, airframes and a range of one-off requests," senior vice president Commercial AFI KLM E&M, Fabrice Defrance explains. "We are constantly attentive to Air Corsica and are, therefore, very happy that the airline has once again placed its trust in AFI KLM E&M."

Borescopes R Us to Support Machida Customers

BORESCOPES R US, based in Clarksville, Tenn., says it is stepping up to help former Machida Borescopes customers. Recently, Machida Borescopes was purchased by Cogentix, a provider of medical scopes. Machida then announced it will no longer be providing or manufacturing borescopes in the industrial (aviation) borescope sector. The company is no longer accepting new orders, nor will they repair industrial products, according to a letter mailed to clients and posted on their website recently. Machida was a provider of the Pratt & Whitney Canada's PWC34910-101, PWC34910-106 & co provider of the PWC34910-109 engine inspection kits.

"Due to the fact that Machida has left this industry, BORESCOPES R US is left as the only low-cost provider of PWC engine inspection kits (PWC34910-108 & PWC34910-109)," says Tarcus Box, company manager at BORESCOPES R US. "We are currently in the process of accommodating prior Machida customers in both sales and repairs. We are trying to spread the word to former Machida customers that do not know where to go for service/replacements on their existing Machida units," Box says.

According to Box, they are the only company authorized to sell the PT6 Kit part number PWC34910-109 and the PWC34910-108 Rev.-1 as certified by Pratt & Whitney Canada.

"BORESCOPES R US is still a provider of budget friendly video borescopes that are included in the Pratt & Whitney Canada certified/approved PT6 engine inspection kits PWC34910-108 & PWC34910-109 kits," Box says. "We can provide any additional material you may want/need for those kits. We also still do repairs on Machida borescope units," he stresses. More information can be found at www.borescopesrus.com or contact Tarcus Box at +1 931-362-4009 or tarcus@BorescopesRUs.com.

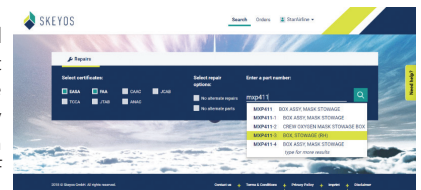
Lufthansa Technik Spin-Off Skeyos Takes MRO Procurement Digital

Skeyos, an independent spin-off of Lufthansa Technik, has been active in the MRO market since January, 2018. At MRO Europe in Amsterdam, Skeyos will deliver insights into the progress of its growing digital procurement platform. Its innovative marketplace is already changing shopping habits across the MRO industry.

Skeyos says purchasers and suppliers alike can benefit from their online marketplace for component services. They have developed the platform to bring the benefits of digitalization to MRO services procurement. "Our experience shows that the industry views digitalization as a mixed blessing. Everybody sees the huge opportunities it provides, but nonetheless also fears the disruptive changes it inevitably brings to everyday operations," commented Pascal Knoll, manager Business Development at Skeyos. The platform's initial go-live in the EMEA region in January at the MRO Middle East in Dubai was later followed by a launch in the Americas region at MRO Americas in Orlando. Before year's end, Skeyos says it will launch in Asia-Pacific.

"Personal contact and close on-site support during phase-in helped us to convince many users of our new platform and to gain their trust that digitalisation can actually become a success story for them with Skeyos. Aermecanica, Czech Airlines Technics and Touchdown Aviation are only some of the companies that signed up to Skeyos recently," said Pascal Knoll.

Touchdown Aviation already tested the platform. "On average the process of receiving quotes till the completion of an overhaul for an A319 overpressure valve takes more time than the few days we now have experienced by using the Skeyos Marketplace," Liedewij Stouten, senior sales support at TDA, says. "We even double-checked with Skeyos if indeed everything had gone well." Lufthansa Technik is also represented on the platform as both purchaser and supplier of capabilities worldwide.



FL Technics Indonesia Awarded Vietnam AMO



FL Technics' subsidiary company, FL Technics Indonesia, has received an Approved Maintenance Organization (AMO) certification from the Civil Aviation Administration of Vietnam. This approval opens the door for the company, based in Jakarta's Soekarno-Hatta International Airport, to start maintaining aircraft registered in Vietnam.

"FL Technics Indonesia have recently taken some major steps to expand the range of certifications. The company recently received an FAA Part-145 certificate and has now added this significant approval from Vietnam's Civil Aviation Authority. With approval from the Vietnam authorities, we will now be able to broaden our reach and assist many more clients registered in Vietnam. This is a great achievement for our company and will pave the way for us to work with many new airlines and aircraft," says Martynas Grigalavicius, CEO at FL Technics Indonesia.

Upon receiving the CAAV certificate, FL Technics Indonesia is now able to provide maintenance services for Boeing B737 and Airbus A320 family aircraft coming from various Vietnamese airlines. FL Technics

Indonesia has already struck partnerships and discussed maintenance solutions with airlines such as VietJet, JetStar, Vietnam Airlines, etc.

"We have a few decade-long experience in MRO business in Northern Europe and we are determined to provide our clients the gained expert know-how, benefits from LEAN implementation in our processes and ensure the European quality standards. We are also focused on providing effective TAT which is extremely important to every airline around the world. All this and our BAY system gives us the advantage to be flexible with each of our clients," says Martynas Grigalavicius.

FL Technics Indonesia operates in a 20 000 m² hangar and office space at the Soekarno-Hatta International Airport in Jakarta, Indonesia and employs around 200 aviation professionals. The company has a wide range of services, such as interior refurbishment services, NDT inspections, composite and structural repairs, spare parts supply and can perform full C and D checks for the Airbus A320 family and Boeing B737 CL/NG aircraft.

S7 Technics Adds Engine Wash Capability

S7 Technics' Moscow Domodedovo-based station has recently launched Cyclean engine washing service. The cleaning technology developed by Lufthansa Technik allows for safe and efficient core engine wash.

The advantages of Cyclean system and related procedures over conventional engine wash operations include reduced time, flexibility, simple preparation procedures and easy handling.

"Regular engine wash results in significant increase of its operating time until it reaches the point when EGT (exhaust gas temperature) Margin deteriorates down to zero and the engine requires a shop visit. It also tangibly improves fuel efficiency, reducing fuel burn by up to 1 per cent, which is vital for airlines now when fuel prices tend to spike," comments Nikita Babkin, S7 Technics director, Engine Services.

Cyclean may be used even on new generation engines such as PW1100G-JM and LEAP-1B and 1A. S7 Technics also offers the service for CFM56-5A/5B/7B, CF34-8 and V2500. Another advantage is the possibility to perform washes up to -10° C, key for their location.

"At present we work with seven engine types, which our main customers either operate or plan to start operating in the near



future. S7 Technics is able to build up additional capability for other engine types within shortest time frame, including those which power widebody aircraft A330, Boeing 747 / 767/ 777 and others" Babkin adds.

Honeywell Announces Major Programs in Both Bizjet and Commercial Sectors

HONEYWELL BIZJET CONNECTIVITY

Honeywell says it is giving business jet operators more control over their onboard data consumption and service usage with updates to several of its GoDirect services. The company says the updates across their engine maintenance service plan, its GoDirect Data Control option, and the new FalconConnect for Dassault customers provide tailored services to individual fleets, helping business jet operators stay connected and better manage their aircraft while cutting operating costs.

Honeywell recently announced usage-based discounts for their Maintenance Service Plan (MSP). The company is changing its signature MSP to a usage-based service plan driven by advanced data — calling this “a new way of approaching maintenance for the industry.” Data analytics have been developed to award discounts based on flight behaviors that have been known to positively affect engine wear, including flight length, throttle settings and flight environment.

Customers can earn discounts of up to 10 percent off their engine maintenance costs for operating their aircraft under optimal conditions. Their GoDirect maintenance portal allows customers to track monthly performance and related savings.

They say their GoDirect Data Control helps operators using JetConneX tailor their onboard connectivity experience to save an average of 30 percent. The service predicts data consumption of streaming video services before a flight, helping operators choose the right connectivity package for their needs.

The company also says Dassault’s new FalconConnect, powered by Honeywell’s GoDirect services, is officially on the market. It provides everything needed for a fully connected experience, including high-speed cabin internet, cockpit safety links and standard ground communication.

HONEYWELL AND OEMSERVICES TIE UP FOR A380 MAINTENANCE



Honeywell and OEMServices have signed an agreement that will see the firms work together to manage the aircraft maintenance costs and expenses of the A380 fleet of an international airline.

The agreement will see Honeywell’s GoDirect Component Services Solutions (CSS) used in conjunction with OEMServices’ integrated component & logistic services. Honeywell says the GoDirect CSS Flight

Hour Program is “designed to enhance aircraft reliability for commercial airlines,” and adds their goal is to help “reduce disruptions to operations caused by the need for component repairs.”

OEMServices says their experience will “optimize repair turnaround times and minimize operational interruptions for the airline.” The component services provided by OEMServices within the scope of the contract include a one-stop shop through its global service centers, a 24/7 AOG desk and a hotline answering the operators’ urgent needs within an hour.

“OEMServices is the A380 nose to tail component services specialist, said Didier Granger, president, OEMServices. We are proud to support Honeywell across this platform and assist our customer with its aftermarket needs.” The collaboration covers a period of eight years.

High Accuracy GE Pressure Sensors

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Formerly known as Druck, the company has over 20 years’ experience in the field of calibrating aircraft’s airspeed and altitude systems. Whether low flying sightseeing aircraft and commercial aviation or combat jets, GE has the products to meet your needs. GE’s Druck product line (ADTS 405 and 500 ranges) have TERPS technology at their core, which delivers unprecedented metrological characteristics* and market leading levels of performance.

* Accuracy, long term stability, precision, performance over temperature, not sensitive to media used for calibration.



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Engine MRO: Are Times Too Good?

Mind the Parts and Labor Pinch Plus Macro Issues

By Charlotte Adams





Engine MRO market will grow from \$32.7 billion in 2018 to \$52.6 billion in 2028. China and India will drive growth. Pratt & Whitney is expanding its geared turbofan (GTF) MRO network in response to receiving more than 2,000 new GTF orders. GE image above.



Challenges abound in the engine MRO market. They include new engine issues, supply chain problems, parts shortages, rising labor costs as well as macro issues such as trade wars, Brexit, interest rates, oil prices and regulation. Pratt & Whitney images left and above.

A

s the U.S. economy rebounds, global air traffic mushrooms, and aircraft production

sizzles, engine MRO enjoys the best of both worlds – deferred aircraft retirements plus demand for work on newer powerplants. Maintenance providers, including traditional MROs, are adding capacity, expanding cooperation with OEMs, enlarging global networks, customizing worksopes, and acquiring smaller players to increase market share.

But challenges loom. A short list includes new engine issues, supply chain problems, and related parts shortages as well as the capacity-straining convergence of MRO demand for older and newer engines. Rising labor costs and the skilled labor pinch as well as macro issues such as trade wars, Brexit, interest rates, oil prices, climate change, and regulation are also factors to track.

“The consideration in the market is whether there is enough MRO capacity to cover the ESVs [engine shop visits] -- some premature -- on the newer fleet whilst sustaining the mature fleets,” observes Carl Glover, AAR’s vice president, sales & marketing – Americas. “We see this as an opportunity for airlines to work with us on used content maximization for inventory spares and engine leasing.”

Oliver Wyman estimates that the engine MRO market will grow from \$32.7 billion in 2018 to \$52.6 billion in 2028. But the good times will roll unevenly. Spending, for example, will tilt toward narrow-bodies in the next decade.

Asia, especially China, will drive growth. By 2028, Oliver Wyman says, the aggregate demand from Asia Pacific, China, and India will more than double that in North America.

The aftermarket is hot. There is a “general expectation” that MRO revenues will grow at a compound annual growth rate-escalated (CAGR-escalated) of 7-10 percent over the next decade, notes Leo Koppers, senior vice president of MRO programs with MTU Maintenance.

Golden Opportunity

Notwithstanding the challenges of working with OEMs, confidence is growing that -- faced with production and logistics headaches -- the OEMs could use MRO support.

OEMs are reaching out. CFM International inked a much-hailed

Proudfoot

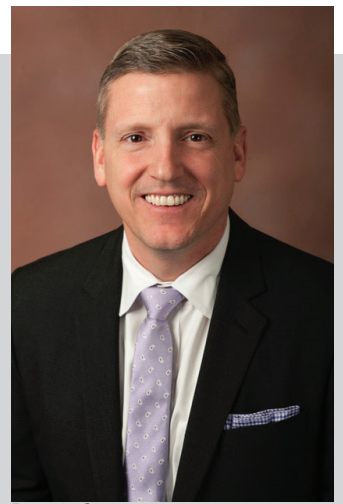
At least one of the engine OEMs is seeking outside help to deal with supply chain challenges. "A major engine OEM" dealing in both commercial and military engines recently hired Proudfoot, a transformation expert specializing in "Lean Forward," its brand of the efficiency methodology, says Dennis Santare, managing director of the firm's new, cross-industry MRO practice, which it defines as "maintenance and repair operations."

This client – like other OEMs – faces supply chain challenges associated with the "aggressive ramp-up required from airframers like Boeing and Airbus," he says. It wants to improve on-time delivery in both production and support. "We are helping them accelerate their operational excellence efforts while the ramp-up happens."

One of the headaches is that some suppliers don't want to invest in technology required to build new parts, Santare says. Proudfoot helps advise on supply chain decisions to optimize the base as well as minimizing waste across the entire value chain.

"The supply chain for engine MROs is struggling to keep up with the high demand [for] shop visits," says Rune Veenstra, the chief business officer with MRO, Aero Norway. The forecasted increase in shop visits for CFM56-5B and -7B engines over the next five years "will create high pressure in the engine shops if suppliers are not able to reduce TAT [turnaround time]," or if the supply of spare parts lags demand.

"There have been examples recently of OEM material shortages in gas path airfoils that have spiked demands for spare engine leases," notes Carl Glover, AAR's vice president, sales & marketing – Americas. "The key consideration is the allocation of engine shop capacity to newer engine variants [while] sustaining older-engine maintenance demands."



Dennis Santare
Managing Director, Proudfoot



openness agreement with IATA -- though no one is sure what it means. And GE Aviation and Pratt & Whitney are expanding their networks. On the other hand, "you can see vertical integration" on the production side, says Marc Wilken, head of product sales & engine lease and services for Lufthansa Technik (LHT). "As the supply chain is significantly squeezed, OEMs are trying to reintegrate some of their suppliers in their production process to eliminate ... bottlenecks." However, this could also improve spare parts supply, he says.

GE is "fully committed to offering maximum choice to customers – now and in the future," says Bill Dwyer, general manager, services marketing. The CFM56, for example, is the "most widely produced engine in commercial service with more than 33,000 engines built." He points out for CFM56 shop visits. "Customers want that choice, they value that choice, and that's one of the factors that drives the preference for our engines."

GE is expanding internal and external capacity. GENx engines, for example, are starting to see their first performance restoration shop visits. To meet the demand, it's added capacity at its shops in Scotland and Brazil. GE also touts joint ventures (JVs), such as XEOS in Poland -- with LHT -- which will service the GENx-2B, and eventually, according to plans, the GE9X. The OEM also has announced a JV with SIA Engineering Company for a GE90 and GE9X overhaul facility in Singapore. Another JV, GE Evergreen Engine Services in Taiwan, targets the GENx.

Dwyer estimates about 4,800



MTU Maintenance is expanding capacity at all locations. By 2027 the company will have added 50 percent more capacity. It's adding shop space in Hannover, expanding a logistics center in Berlin. MTU Maintenance Canada introduced V2500 capabilities in late 2017 and may add CF6-80C2 capacity as well. MTU images.



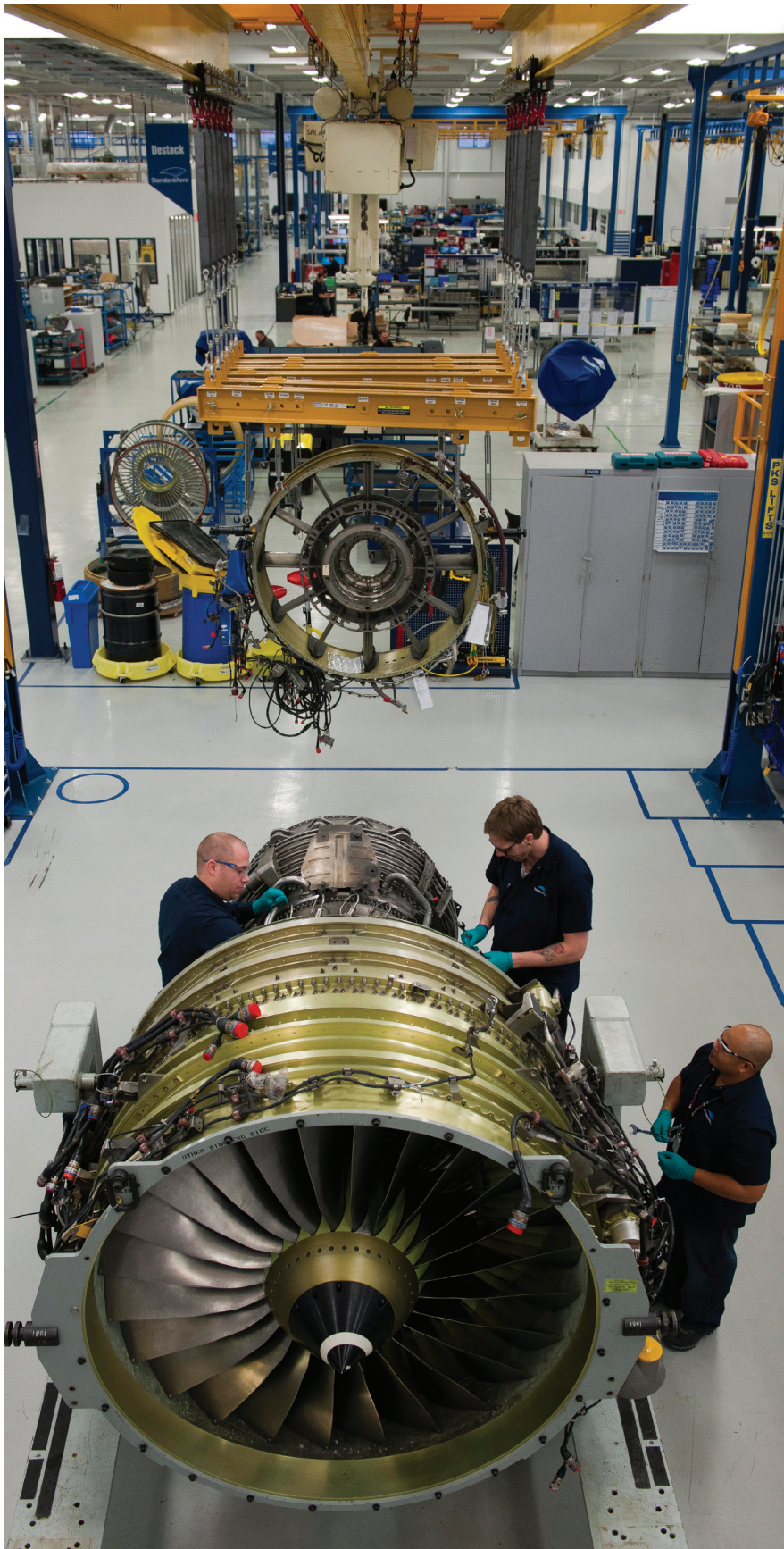
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StandardAero's capacity has grown in the last two years. It acquired high-thrust test cell capability at Kelly Aviation Center in San Antonio. The company has also nearly doubled component repair capacity, including engine component repair, in Cincinnati. StandardAero image.

commercial engine shop visits were made at GE and its JVs in 2017, a number he expects will grow by about 5 percent a year through the end of the decade. "It's a large fleet with some 36,000 engines, and it's a young fleet. Approximately two-thirds of the fleet has one shop visit or less, so there is a lot of activity to come as the fleet continues to grow." GE's services backlog is more than \$160 billion.

GE is investing in its Lafayette (Ind.) Engine Facility, which will offer LEAP overhauls, as well as in its Malaysian facility, which will expand LEAP capacity. It's also expanding on-wing support (OWS) capabilities worldwide, including a new base in Dubai and facilities in Brazil and South Korea. GE has more than 300 technicians globally and expects that to grow to nearly 500 by 2020, Dwyer says.

Pratt & Whitney is expanding its geared turbofan (GTF) MRO network. Pratt, in addition to MTU (now in a JV with LHT) and Japanese Aero Engines Corp., is partnering with Delta TechOps, says Paul Finkelstein, director of marketing. In April P&W also announced that Turbine Controls, StandardAero, TWIN MRO, ACMT, and Lewis & Saunders are the first third-party suppliers to join the GTF repair network. The GTF, which incorporates 40 percent more sensors than the V2500, can generate about 4 million data points per engine per flight.

In the last year Pratt has received more than 2,000 new GTF orders and commitments from 22 customers. In addition, the V2500 – with a fleet of more than 7,000 in service -- will continue to be in high demand for the next decade or more, he says. And PW2000-powered 757s are "in very high demand in the used aircraft marketplace."

Golden Opportunity

"In the next few years newer-generation engine MRO requirements will displace the capacity currently allocated to previous-generation engine MRO workload, most notably at OEM shops," says Peter Turner, president of StandardAero's Airlines & Fleets division.

"Our discussions with OEMs in general indicate that they do not prefer to invest in brick and mortar to support engine MRO workload and hence need to outsource engines to make way for the newer variants," he adds. "Therefore, we anticipate the OEMs will come to their trusted partners, such as StandardAero, to provide capacity to handle this growing workload." He stresses, however, that "our corporate strategy is not to compete with OEMs... "



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Hirth Expands Support

Hirth Engines, the German manufacturer of engines for ultralights, experimental aircraft, and drones, is expanding aftermarket support in areas such as “just-in-time parts,” updated maintenance manuals, and an updated Web page to help its many international customers find the right parts, says Peter Lietz, head of international sales and service. The company also is “actively searching for partners to provide local first-level support in their local area, time zone, and language.”

Hirth is registering growth in the UAV sector and the spare parts/replenishment segment, Lietz says. An example is Hirth’s support of Airflite, an Australian MRO which has partnered with Hirth’s new parent company, UMS SKELDAR, the UAV joint venture between Sweden’s Saab and UMS AERO of Switzerland.

Airflite has been contracted to maintain UMS SKELDAR’s V-200 unmanned helicopter, along with the UAV’s Hirth 3504HF, a two-cylinder, in-line, two-stroke, liquid-cooled derivative of Hirth’s 3503 E/V engine. Hirth will help Airflite to develop 3504HF maintenance schedules.

Hirth UAV customers can interface with its Florida-based partner, UAV Propulsion Tech, which ships engines back to Germany for repair and test. Or customers with organic capability can perform MRO on site or in theater, supported by OEM training, manuals, and optional in-person technical support.

Another partnership involves U.S. distributor, Recreational Power Engineering, which provides in-house engine maintenance and overhaul in the sport light and experimental aircraft sector.



“We are currently seeing slot capacity constraints worldwide,” MTU’s Koppers says. This, he explains, is the result of new-generation engines entering shops earlier



Peter Turner
President, StandardAero Airlines & Fleets Division

than planned, continued high demand for current-generation engines, and sustained demand for mature engines, such as the CF6-80C2, which are being flown longer or

even revived – in some cases resulting in an immediate need for MRO services, from smaller worksopes to heavy maintenance.

Asia

“The Asian region ... produces around a quarter of all shop visits and is expected to make up around 35 percent of world demand by 2027, Koppers says. Within that region China is the largest single MRO market – both in shop visit volume and revenues, he says. By 2027 over 40 percent of all Asian shop visits – approximately 1,400 visits or more – will be generated from the Chinese market, most of them generated by narrow-body engines, he predicts.

MTU Maintenance Zhuhai, “the largest narrow-body shop in Asia,” is increasing capacity by 50 percent – from 300 to 450 shop visits annually by 2021, he says. Although this JV with China Southern relies on the Chinese partner for baseload, “around two-thirds of shop visits come from independent business around the globe.”

Convergence Dividends

LHT “absolutely” sees the convergence of new and old engine demand as an opportunity, Wilken says. All players will be challenged in preparing for new engines while supporting current and mature engine

types, as they “tend to fly longer than predicted,” he says. “Market capacity is not expected to grow faster than MRO demand for the next five years,” he adds.

LHT and MTU have partnered on EME Aero, a GTF JV in Poland. Expected to open in 2020, the facility has a planned annual capacity of over 400 shop visits, Koppers says. LHT has also established a partnership with GE, XEOS, to service GENx-2b and later the GE9X engines. LHT is a member of OEM networks “in all major future engine types,” Wilken says.

He estimates that the number of shop visits for the CFM56-5B/-7B and V2500 engines will increase by about 5 percent per year from 2018 to 2023, when demand is expected to peak. Within this group the -7Bs, as the sole engine option for the B737NGs, will increase in visits by 9 percent per year, Wilken says, while V2500 visits will grow at a more modest 2 percent per year until 2023. He expects overhaul demand for new engine types to start growing quickly in the mid-2020s, but until then these powerplants are expected to involve smaller worksopes.

MTU expects its commercial maintenance business – with revenues expressed in U.S. dollars -- to increase by “mid-teen percentages” in 2018, Koppers says. The MRO expects growth in

CFM56-7 and -5B shop visit volumes in the neighborhood of 20 to 30 percent for this and next year.

MTU Maintenance is expanding capacity at all locations, Koppers says. "By 2027 around 50 percent more capacity will have been added." In Hannover it's planning additional buildings to increase shop space. And it is expanding a logistics center in Berlin. MTU Maintenance Canada introduced V2500 capabilities in late 2017 and may add CF6-80C2 capacity as well.

StandardAero's capacity has mushroomed in the last two years. It acquired high-thrust test cell capability at Kelly Aviation Center in San Antonio, followed by the RB211-535E4 award from Rolls-Royce. This designates StandardAero as the OEM's "end-of-life engine maintenance service partner for these engines," expected to remain in airline service until 2040, Turner says.

The company has nearly doubled component repair capacity – including engine component repair – in Cincinnati. Turner predicts further consolidation within engine component repair, "given how fragmented the space is."

"We also still have capacity available for incremental engine programs, and we're in the final stages of industrializing a second large facility in Winnipeg to accommodate



AAR provides full engine management solutions including support programs, overhaul management, and engine exchange/sales/leasing/ plus access to parts through its global supply chain and repair facilities. AAR image.

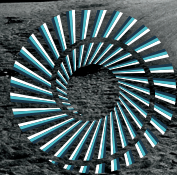
... requirements from GE and operators of CFM56 and CF34 engines, as well as distributing cycle 2 repair work around our increasing, specialized piece part ... repair division."

AAR also enjoys new as well as legacy engine business. A recent power-by-the-hour (PBH) agreement with Air Malta, for example, involves nose-to-tail support of

A320neos, including airframe, APU, and engine LRUs plus on-site inventory.

Aero Norway sees convergence as "an opportunity since some of the engine MRO shops will need to deal with the new-generation engines at an early phase due to some startup problems with the new-generation engines."

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AAR provides full engine management solutions including support programs, overhaul management, and engine exchange/sales/leasing/ plus access to parts through its global supply chain and repair facilities.

It's been working with several large operators and MROs "on used content maximization ... to reduce their cost/available seat miles [CASM] during engine shop visits," Glover says. This is a trend in both mature and current engine fleets, he says.

"We anticipate some customers will want to continue their CASM reduction and cash smoothing," Glover says. "AAR recently signed a large multiyear mature engine CPH [cost per hour] program and structured a flight-hour solution for the same customer." AAR forecasts and holds the inventory, its "MRO partner overhauls the engines, and the operator enjoys cost predictability for their operations."

Customization

MTU sees airlines "moving away from fly-by-hour [FBH] contract[s] ... as engines mature, and increasingly desiring individualized solutions and worksopes," Koppers says. "We pride ourselves on our customized worksopes, as well as our solutions for

mature engines." FBH contracts are very common for newer-generation engines, however, as a way of reducing risk, he adds.

LHT's Wilken also perceives a trend towards "highly customized engine MRO solutions," exploiting potential savings. "The demand for standard, non-optimized engine MRO offerings is declining as airlines increasingly want to carve out additional savings."

Tailored worksopes are typically used in support of older-generation engines, Glover agrees, where work is performed on engine modules. Further repair options are available at the piece part level. Targeted repairs preserve the engine's efficiency, time on-wing, and performance. "An example would be a repair or overhaul on a CF6-80C2 engine [that] would focus on a core restoration, say every 3,500 cycles, but the LPT [low pressure turbine] and fan may be repaired every other shop visit."

Some of AAR's recent bespoke engine management/engine material management programs use tailored worksopes, material management, and engine spares provisioning. AAR also has "partnered with engine and component MROs who understand used content, designated engineering representative [DER repairs], PMA use, and the need for differentiated repair schemes for individual engines."

Used content also helps to "bring some predictability to some of the engine maintenance costs" in maturing engines. "This pro-active approach has become common practice over the last few years," Glover adds.

MTU also supports used serviceable material (USM). The CFM56 and V2500 engines are exciting to observe, Koppers says, as the installed fleet is large and the newer variants – such as the CFM56-7 and V2500-A5 – still have their shop visit peaks ahead of them. But as these engines mature, MRO costs will increase due to need for heavier shop visits and material replacement.

In fact, many will be retired over the next 10 years, which will increase supply of spare engines and USM. "We find developments like this particularly interesting, as our mature engines program is perfect for such fleets." And more material in the market means that the options within this program will be even more flexible and cost-effective, he says.

"We're looking forward to supporting operators ... through ... customized builds, green-time lease in or out, and teardown and remarketing of parts." High shop visit demand is also boosting demand for spare engines, as provided by MTU Maintenance Lease Services, he says. **AM**

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An insider's guide to business jet cabin upgrades.

By Dale Smith



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T

alk to any major aircraft broker and they'll tell you that today's market for pre-owned

business jets is the best it's been in at least a decade. And it's especially evident in the mid- to large-cabin aircraft types.

"There are a lot of used aircraft changing hands now and the prices are right," explained Matt Spain, Senior Completions and Paint Representative for Duncan Aviation. "For example, you can buy a (Bombardier) Global for eight million dollars and then spend another five million on upgrades and have an airplane that's the equivalent of a new one costing \$35 million."

That's just the kind of large-scale project Stevens Aviation recently completed for a broker/customer.

"It came in as a ex-Flight Inspection Mission bird that was owned by the Japanese government and we converted it over to a corporate/executive aircraft," stated Tim Briscoe, Interiors Manger for Stevens Aviation, Inc. "It had been used by the Japanese government for a variety of surveillance and special missions activities." See after image left, across the spread.

Briscoe explained that a U.S.-based broker had purchased the aircraft and wanted to reconfigure it prior to resale. But, as you can well imagine, the broker wanted the job done at a high quality, while controlling their initial investment.

"Once we learned what the broker wanted to do with the airplane, we did some research and actually found four different Global Express interiors in 'boxes'," he said. "The ones we chose come from Colorado. Actually, there was one full- and one partial interior boxed up. The full interior was from an airplane that was damaged in a hangar incident, but the interior was in perfect condition because it was out of the airplane at the time. It's amazing what you can find out there when you start looking around."

"The interior was relatively complete. We reconfigured it to the customer's design. Ultimately, we had to do a lot of engineering to get all the final detailing and fitting, including re-engineering the various mounting brackets we needed," Briscoe said. "The whole project including the interior and avionics upgrades, took right at seven-months to complete. It turned out really nice."



Stevens Aviation converted this former Japanese government-owned special missions aircraft into an elegant bizjet. The project took seven months.

Stevens Aviation has posted a pair of videos on the conversion on their YouTube channel at: https://youtu.be/d2hh_UjAwqw.

Everything Old Is New Again

Of course, when it comes to cabin refurbishing project the Stevens Aviation example is pretty-much the "Everest" of interior work. But that doesn't mean there isn't a plethora of opportunities to help bring new life to an aging airframe's cabin.

MROs across the U.S., in particular are seeing the demand for interior work at a five-year high, especially as owner/operators rush to comply with the FAA's pending ADS-B mandate deadline of January 01, 2020.

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Elliott Aviation says clients are taking advantage of downtime when putting aircraft in the hangar for meeting the ADS-B mandate. Operators are utilizing the opportunity to upgrade their aircraft to the newest designs and materials, and at the same time, they are trying to maximize resale value.

“Our activity level is very strong right now,” Meghan Welch, director of Paint and Interior Sales, Elliott Aviation, said. “A lot of that has to do with the ADS-B mandate. When people are putting their airplanes down for ADS-B they are wanting to maximize the downtime and do other things – maintenance, interior, paint – they want to get as much done on the aircraft

as they can.”

With regards to the scope of interior projects, Ms. Welch said that across the board customers are looking to upgrade their interiors to the “latest and greatest” designs and materials.

“They want their own personal design touches in the airplanes and they want the highest quality in materials and

workmanship,” she said. “The typical customer is spending a lot of time on the design portion of the process to make sure the fit, form and function is exactly what they want, which is efficient and very sophisticated.”

Ms. Welch also explained that while owners want their own “style,” they are paying more attention to the design and styling cues found in the new factory aircraft. That way they are not only upgrading their aircraft to the newest standards, they are hopefully maximizing the resale value.

With regards to colors and fabrics, she said that the trend is for rich contrasts in carpeting and seats: darker, patterned carpeting, lighter upholstery and dark veneers, especially for U.S.-based customers.

And while subtle fabric and upholstery colors are “in” for some owners, others want their aircraft’s interior to be as individualized as they are.

“In general, we’re seeing a lot more specific requests for unique materials, advanced items and detailed finishes,” Adam Bruce, Completions and Paint representative for Duncan Aviation said. “International customers, in particular, all seem to want some sort of intricate artwork or design on the bulkheads. They also want to include some interesting colored cabin lighting system now.”

To that end, one trend that is particularly “hot” right now is LED lighting systems.

“Lighting is as important in the aircraft as it is in their homes and offices now. The right lighting can create the ideal ambiance in-flight and they want that,” Ms. Welch said. “Actually Elliott Aviation’s



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On the previous page, Elliott Aviation's before and after of a redo on a Falcon 2000. Above is their refresh of a Challenger 300. Meghan Welch, director of Paint and Interior Sales at Elliott says customers are spending time on the design process to make sure the fit, form and function is exactly what they want, which is an efficient and very sophisticated interior with their own personal design touches. Elliott Aviation images.

sister company, Elliott Technologies is developing our own series of LED lighting called RGB Prizm.”

“With the RGB Prizm LEDs you can actually control the temperature of the lighting to fit the ambiance you want for the situation,” she said. “If you’re watching a movie it’s one tone. If you want to relax you can adjust the lighting to a bluer tone. You can adjust the red, green and blue settings to fit your need.”

Andrew Evans, Elliott Aviation’s director of Marketing explained that the Prizm cabin lighting system introduces a number of features to enhance the cabin’s environment including the ability for upwash, downwash, window lighting, cup holder lighting lower accents. The system can be controlled by the existing CMS or the embedded Wi-Fi Prizm app.

Thanks to their small size and extremely low power requirements, LED are also finding their way into other unique cabin lighting options. Spain said that Duncan Aviation has seen an increase in customers asking about putting twinkling, fiber-optic ‘starlight’ patterns in the headliners of their aircraft.

“You see it on the commercial side and it’s now translating over to the private side,” he said. “We recently did it in the lavatory headliner in a Falcon 7X. It’s pretty neat. It won’t be long until we see it in the entire cabin.”

Gotta’ Fly with WiFi

While there are a lot of variations between the level of interior upgrade, materials, fabrics, colors, lighting options and so forth, when it comes to spec’ing out a cabin refurb project, one upgrade that’s becoming a must-have is Wi-Fi connectivity.

“Pretty much every customer wants the same experience they have at home or in the office,” Spain said. “It has to have Wi-Fi – until they see the price. It varies a lot. So we need to know what level of service the customer wants in the cabin before we provide a quote. Do they want to just send texts and emails or do they want streaming video all the time?”

“Some customers aren’t ready to install the Wi-Fi hardware or antenna, but they want to provision the aircraft with the wiring while the seats and all are out of the aircraft,” Bruce said. “We don’t recommend doing that. Technology is changing too fast. You may find something that will require you to remove the interior again anyway and if you provision now you are just wasting money.”

No matter what the scope of the project, deciding early on

exactly what the customer wants and needs is a key part of achieving a successful end product.

“We make sure we do all the due-diligence during the design process to educate the customer as to what all their options are and then design the final solution to their specific needs and wants,” Ms. Welch said. “You never want a customer saying, ‘Oh, I wish I would have known about that...’ You want them to say, ‘I’m so glad I did that...’ That’s a critical part of our job – making sure they have everything they want when it’s done.”

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Duncan Aviation says they are seeing more specific requests for unique materials, and detailed finishes. International customers, in particular, have been asking for intricate artwork or a design on the bulkheads. Duncan is also seeing special lighting requests and has seen an increase in customers asking about putting "twinkling, fiber-optic 'starlight' patterns" in the headliners. Duncan images.

air dampers, lighting fixtures, wiring – pretty much everything," he said. "The owner probably had to spend an additional \$30 thousand over the original estimate on all that extra work and equipment."

While not as routine as issues caused by poor maintenance and/or corrosion, another common interior upgrade request that can open up its own set of problems is a customer wanting to change the seating configuration. But, there's a lot more to it than moving a few seats around.

"We are currently delivering a Hawker and its owner wanted to remove the side-facing divan seating and put in a couple more cabin seats," Ms. Welch said. "Every floorplan reconfiguration takes engineering time to understand what we can and cannot do with each particular aircraft before we turn it over to our fabrication team."

"Re-arranging cabin seating is more challenging in today's aircraft than it has been in the past," Spain explained. "Take an older Challenger 604 for example, the airframe is certified as a 9g and all of its seats are dynamically certified for a 9g load during a crash. The FAA changed the expectations for newer aircraft to meet higher 16g requirements per (FAR) 25.562, which came out in 1989."

"So, all new aircraft fall under that requirement. The Global Express is one of those aircraft. Early serial number aircraft were equipped with 16g cabin seats but the 16g side-facing divan had not been developed yet," he said. "So the divans in those early aircraft were 9g and could not be occupied during taxi, takeoff or landing."

Spain said that now that the 16g divan has been approved,

Is It a Plane or Pandora's Box?

While no two cabin refurbishing projects are the same, one thing that all MROs share is the mystery of what really lies beneath the carpet and behind the sidewalls?

"One of the biggest challenges we face is the actual age and condition of the aircraft itself. We never know what shape the aircraft is really in until we start to take it apart," Briscoe said.

"For example, we recently did a project on a Citation 650 that was so corroded it was amazing."

"It was so bad, we had to literally cut all of the materials out of the cabin and ending up having to replace all of the air vents,

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Of course, regardless of the interior, the end goal of any upgrade is a fully functional business tool that is ready to fly. Stevens Aviation image.

customers are wanting to replace the old divan with the new model. Its not a simple bolt-in solution though.

“Some of the earlier Global Express’s – serial number 9113 and below – have floor beams that are not strong enough to support the 16g certified divans. The upgrade to the new seats require modifications to the floor beams to handle the new loads.

Spain also said that it’s not just the style of seating that can be a certification issue. The new 16g requirements also have parameters regarding how the upholstery stitching, tucks and bolsters are designed.

“With an 9g seat, you can do all that with no limitations,” he said. “With a 16g seat you may not be able to do any of what the customer wants. There are a lot of restrictions regarding design and fabrication and it’s a lot to keep up with and explain to the customer. They don’t like to hear they can’t do something.”

“Those are big hurdles on the certification side when it comes to cabin changes: What parts and materials are allowed in what airframes today?” Bruce added. “We have a lot of limitations now and they become a big area of education for our customers especially if they buy an airplane without really knowing much about it.”

“In many instances, there is only so much we can accomplish on some models to meet requirements without incurring

costs that are just through the roof,” he said. “And, in some cases we can’t do it for any price.”

What We Have Here is a Failure to Communicate

While there are a lot of gremlins that can spring up and create havoc in any interior upgrade project, two of the most common – choosing the wrong MRO, and inadequate time allotment – are both rather easily avoided, if the customer understands that early on.

The two factors that usually lead to a customer choosing “the wrong MRO” are price and location. Both of which are pretty obvious. The problem is, like most things in life, the lowest price is not always equate to getting the best quality of work.

Ms. Welch said that the best first step a customer can make is to go visit the facility and to see examples of the level and quality of work they are doing.

“Whether it’s paint or interior work, it’s important to see examples of recent work and to talk to past customers to find out what their experiences were with the shop,” she said. “Where they happy with the project overall? Did they have any problems? Things like that.”

“It takes time to find the right facility that works best for your type of aircraft, schedule and budget,” Ms. Welch said. “We have people who end up coming back to us who were unhappy with the

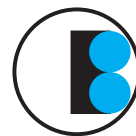
work another shop did. It can be very costly for us to fix another shop’s mistakes. Fortunately, a lot of these situations can be avoided by doing thorough pre-project homework.”

When it comes to meeting schedules, Briscoe said that thorough involvement by the owner’s DOM and the owner themselves is critical at the beginning and throughout the project. Because things are always popping up, someone with decision-making authority needs to be available, because waiting for answers just costs time and money.

Speaking of costing time and money, one thing that all MROs agree on is the problems caused by last-minute changes. Sure, it happens, but the sooner the shop knows a change is coming, the better for everyone involved.

“It can be seemingly simple things,” Briscoe said. “We can get most of the way through a project and the owner suddenly decides they want to redo the metal plating in the cabin. That doesn’t seem like much until you consider it impacts every department in our facility. Someone has to go collect all the individual metal pieces and then make sure they get sent back to the right department once they’re done.”

“When it comes to upgrading a cabin, nothing is as simple as it sounds,” he said. “Sometimes you can’t avoid problems, but most of the time you can.” **AM**



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RouteSync Streamlines Departures for Airlines

In a visit to the KLM Operations Control Center, Aviation Maintenance Magazine editor-in-chief Joy Finnegan spoke with Boeing and KLM to learn about the RouteSync process and how it is working for the airline.

BY JOY FINNEGAN, EDITOR-IN-CHIEF

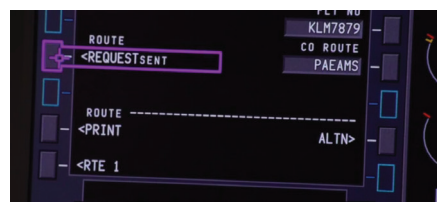


Boeing has introduced a new tool called RouteSync that eliminates manual pre-flight processes for airlines by automating flight planning and performance data entry with the airplane's Flight Management System (FMS) computer. RouteSync is now helping streamline the pre-flight process by saving airlines valuable time before takeoff. With the push of a few buttons, the service

allows pilots to instantly upload the flight plan and performance data. By eliminating the task of manually typing in the information, pilots save between three to five minutes on domestic flights and up to 15 minutes for international travel.

Pilots can now simply enter the departure, destination and flight number in to the FMS. Then by hitting the request button, the flight plan is automatically loaded into the computer versus having to manually enter the flight plan. On long haul flights this can save time during one of the busiest and most stressful periods in the preflight departure process. Eliminating the manual entry also reduces the possibility of human error while entering long, complicated routings.

During trials, Boeing estimated that using RouteSync eliminated between three to 15 minutes of pre-flight operational time spent entering data. This allows pilots to focus on other mission critical tasks. Boeing



Automatic uploading of routes can save precious minutes and reduce errors in the preflight phase.

worked with airline partner KLM during the development.

During the test period, KLM says it saved between 200-335 hours during a six-week flight trial period, through automated data entry by uplinking

4,021 flight plans. Boeing touts that "RouteSync promotes on-time departures through automation" and is a strong new addition to their digital product portfolio.

"RouteSync saves me somewhere between five and ten minutes on average," says Robert Schuringa, first officer and instructor/examiner on the B777 for KLM Royal Dutch Airlines. "It gives me more time and helps speed up the process to ensure an on-time departure."

"We are now able to turn an aircraft a lot faster," says Jim Hamilton, RouteSync project manager at Boeing. "The old school way was to print out the route from dispatch, if there was a change in the flight plan. When there was a change, you had to send it out to the ground station and they would print it out and carry it out to the pilot. Then the pilot enters all the information in. So, with this, we are automating this process. We are looking at how do we make the disruption recovery go faster," he says, in the case of last minute changes due to weather reroutes or other operationally needed changes. "In the past, we were heavily relying on voice and paper communications. Enroute, the challenge we are facing is ever more congestion in the airspace,



Robert Schuringa, first officer and instructor/examiner on the B777 for KLM shows how pilots can check their routes using their iPads prior to preflight.

weather, and other operational factors. So how do you exchange an updated flight plan or the final performance data between the operations center, where optimization can be carried out, and get that info out to the pilot who has to make the final decision [about the route, fuel load, etc.]?"

Schuringa says in the old process, prior to the flight, the preparations for each flight were conducted where things like optimum routing, weather, Notams, the technical status of the aircraft and other factors are considered, and then sent to the crew center. "There, we had printers printing the flight plan with all the airways and waypoints and we had to physically type it in during the preflight onboard the aircraft. The new procedure is, we have all this information on the iPad and we can check if we agree with the routing and final fuel based on those factors I mentioned." Then the crew can accept the route and performance data on the iPad and it is stored on the server at the KLM Operations Control Center. "Later, we can access it from the airplane via ACARS. So now, when we arrive at the aircraft, we don't have to put in all the airways and performance data anymore," Schuringa says. "The whole route can be accessed directly from the server. We simply put in the flight number and the city pair, like AMS-JFK, and the ACARS sends the request to the server. It will then send back the complete routing and upload it directly into the FMS." At this point it can be dual verified by the crew prior to executing it. "Thereby you save approximately five to ten minutes of programming and that time can be used for other preflight preparations," he adds. Additionally, Schuringa says, when flying parallel tracks over the ocean crews used to have to manually put in all the waypoints using lat/long positions and a typing error could occur. RouteSync eliminates those possible errors.

Hamilton says another benefit is that the system can help detect any synchronization issues between databases. The service will upload the flight route, weather conditions and other performance data into the FMS. RouteSync includes new features like route validation. It will also insert or remove discontinuities in the flight plan. If there's an error, the service won't upload the information and will send an advisory to the pilot and the airline, Hamilton says. The service is available for Boeing planes and other commercial aircraft. KLM has been using the service for a year. "It worked perfectly, from day one," Schuringa says. **AVI**

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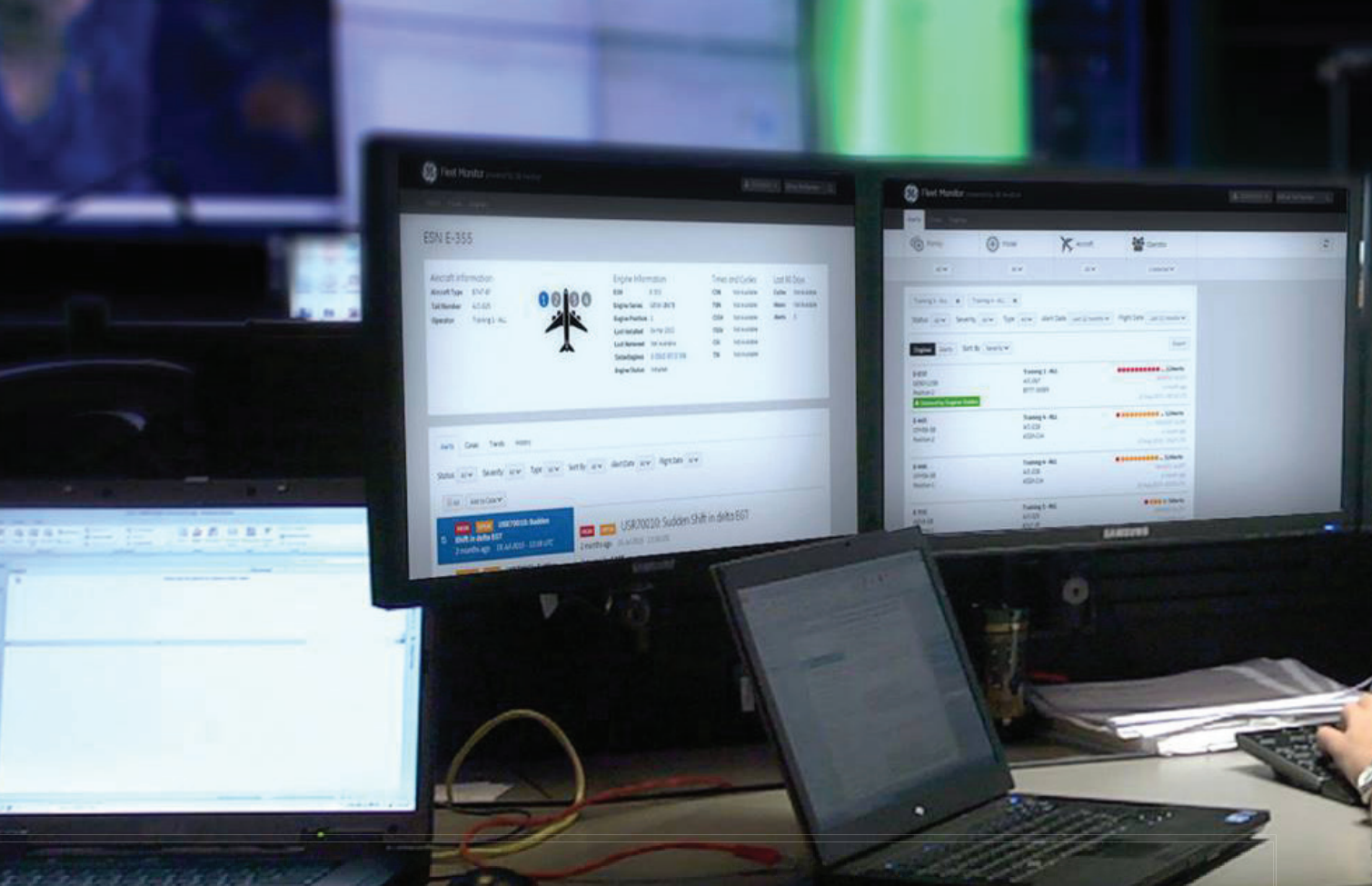
sat down with Matt Mruk, director, business development for aerospace and government at PROTO, to learn more about the company, their products and what differentiates them from other tool makers on the market.

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Matt Mruk, Director, Business Development, PROTO Industrial Tools

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Big Data Analytics: From Infant to Adolescent

By Charlotte Adams

Big data analytics is expanding from engines to all of aviation, as players gear up to compete in an arena viewed as critical to aftermarket success.

But the technology is still evolving and not everybody is sold. "The majority of ... players still are exploring ways to benefit from big data ... that go beyond simple visualization of aircraft system health," says Diogenis Papiomytis, director of commercial aviation for market analyst, Frost & Sullivan. (See market sidebar.)

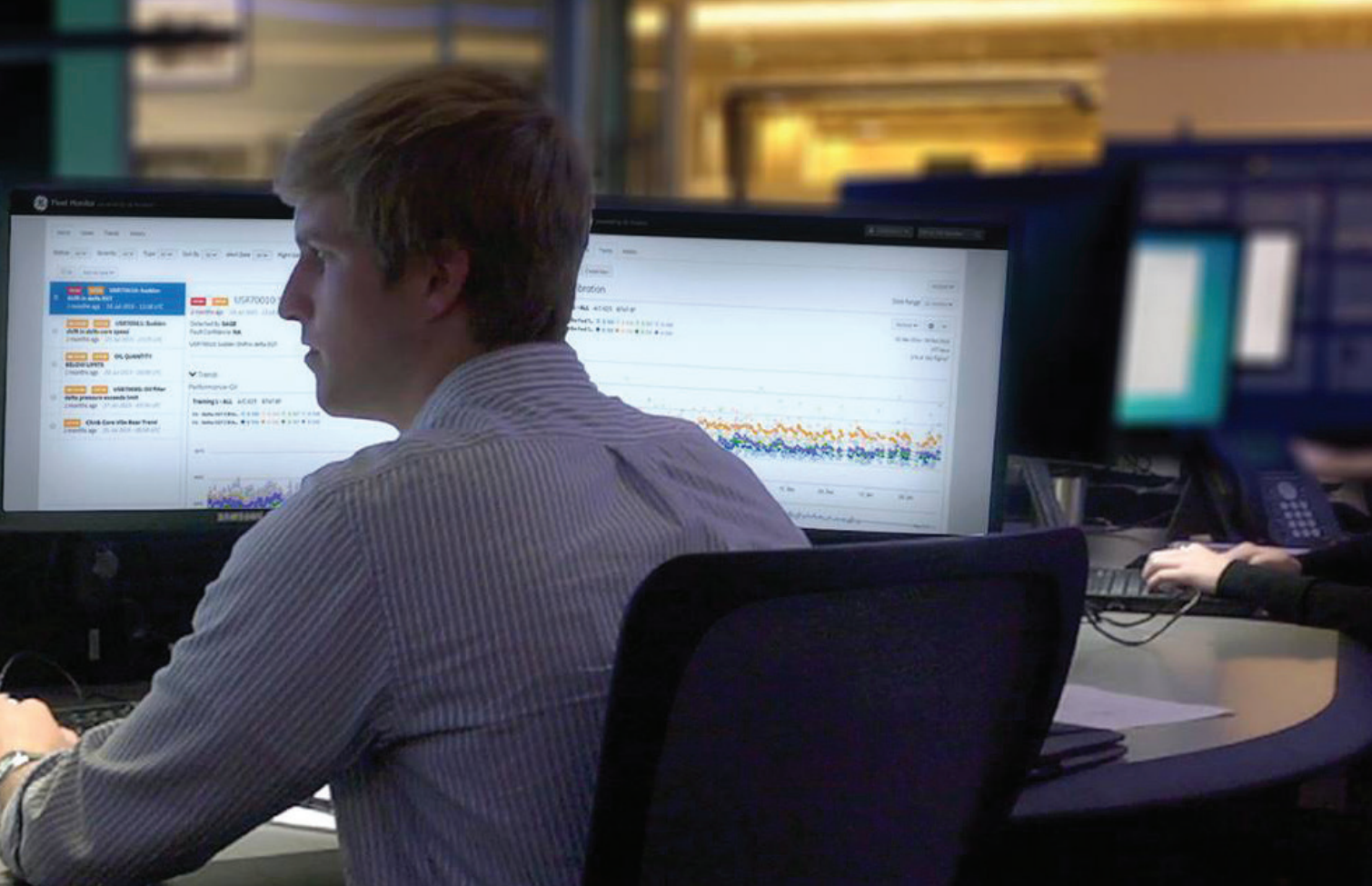
Boeing Global Services (BGS) agrees, at least with the first point. At a recent BGS conference only about 25 percent of its customers said they were satisfied or highly satisfied with the results of their current analytics projects, says Ken Sain, the unit's vice president of digital aviation and analytics. BGS sees this skepticism as an opportunity for it to drive value through Boeing AnalytX, as it terms its analytics efforts.

Big data plus tools and platforms are necessary but not sufficient to meet customer needs, Sain says. Engineering insight, real-time applications, integration/automation, and prognostics/optimization are also essential, he contends. These six

interrelated and mutually reinforcing elements make up the company's "analytics ecosystem."

State of the Art

"The emphasis in the industry currently is on generating sufficiently sized data sets, generating a statistical baseline in order to be able to... [detect] trends over time or any exceedances," says Friedhelm Kappei, head of industrial engineering with MTU Maintenance. "We believe the majority of monitoring programs are in the diagnostic phase and capable of some prescription though the aim of all providers is, of course, to enter the predictive sphere as soon as possible," he adds.



GE Aviation continues to refine and expand its concept of “digital twins,” digital replicas of engines that allow systems to be modeled and analyzed. “By creating a digital twin, we’re able to gather and analyze more data from engines,” explains Jon Dunsdon, chief technology officer with the Digital Solutions business. “This process allows us to get a clearer idea of how an engine will respond for better predictability.” GE image.

There’s “still some hesitation” regarding prescriptive maintenance, adds Steve Sword, principal business development manager for commercial systems with Rockwell Collins. The avionics company is working with Airbus to launch a new on-board server/router for Airbus’ SkyWise analytics platform.

Airlines get concerned about the risk of no-fault-found, he says. Sword thinks carriers are looking for “advisory intelligence so that their maintenance teams can make decisions.”

AFI KLM E&M

AFI KLM E&M recently added an inventory feature to its Prognos platform, which already includes functionality for aircraft, engines, and auxiliary power units (APUs). “Predictive maintenance and big data are at the heart of our strategy,” says Rodolphe Parisot, the MRO’s vice president for digital and innovation.

Parisot cites some tangible results. The MRO “is now capable of predicting a failure 10 to 20 days [in advance],” he says. And for the last 50 removals done following a Prognos alert, “100 percent of the removed parts or systems have been confirmed faulty by the OEM.”

“Big data is expected to transform the industry by enabling proactive, predictive analysis, as opposed to the reactive analysis we have seen to this point,” MTU’s Kappei says. “We are reaching a point where developments could be called ‘prescriptive,’ in that data gathered from operations” – relating to the region used, engine derating, and engine performance, for example – “are connected and help to forecast remaining on-wing time and optimal engine removal points.”

Boeing Perspective

An example of how Boeing’s ecosystem works is an application upgrade that grew out of a consulting project with an airline customer to look at increasing the efficiency and reducing the cost of preventative maintenance



Ken Sain, Vice President of Digital Aviation and Analytics, Boeing Global Services

checks of flight control surfaces. An overnight maintenance check might involve 30 hours of work for a mechanic team.

The project looked at finding a way – using predictive analytics – to focus inspections on the subset of the fleet that had “a higher probability of having an issue,” Sain says.

The project involved machine learning – training a computer to look for things that might indicate a problem. Boeing examined almost 130 parameters at 8 Hz – 8 times per second – over 60,000 flight hours, resulting in some 220 billion data samples, he says.

The company then worked to “identify candidate features that might be precursors ... of a potential problem.” It also looked at “truth data” – what has been found in actual inspections – and traced back to figure out the signatures of a potential problem.

Boeing was able to determine – with 95 percent accuracy – where there was likely to be a problem, Sain says. The computer flagged a potential issue in five cases, he says, “and we confirmed – through direct measurement – that in all five cases [the carrier] needed to take preventative action.” The solution is prescriptive as well as predictive, he says, in that it indicates

certain aircraft should be inspected.

Boeing is involved in engine maintenance management, as well, with its Engine Fleet Planning And Costing (EFPAC) application. As of late spring 2018, EFPAC had 11 customers including engine “total-care OEMs,” with more than 6,500 engines enrolled and generating some 10-20 percent savings in engine maintenance costs, according to the company.

One customer, KLM, was able to cut out five engine visits, Boeing says. Although the airline has only had the software for two years, it had already projected maintenance visits, using other means. When the carrier used EFPAC to assess its planning, it was able to optimize the service visit schedule, reducing the number of planned visits by five.

Right Data

Having the right data is equally important. MTU’s engine trend monitoring (ETM) system, for example, currently works with smaller, more specific data sets culled directly from operations, Kappei explains, adding that the company is closely monitoring industry developments.

New features include: remaining on-wing time prediction, based on performance parameters such as exhaust gas temperature (EGT) margin; automatic diagnosis to identify the root cause of a trend shift; and a “quick fleet analysis tool” to review on-wing deterioration per engine serial number and “shop visit effects.”

ETM can be used across multiple engine platforms. “We can ... monitor a customer’s GE90 and V2500 fleet with the same tool,” something that is unusual in the industry, he says.

Shop visits also generate data concerning workscope, hardware condition, repair, scrap rates, build-up, and test runs, Kappei says. When this information is combined with ETM information, the two data streams enhance MTU’s knowledge across the lifecycle so that areas such as scrap rates, module deterioration, and removal dates, become more predictable.

Customers who have been using MTU’s ETM system for a number of engine runs have benefitted from the identification of data patterns unique to them that help in planning shop visits, logistics, and fleet management, leading to parts savings and shorter turn times, he says.

Real-Time?

AFI KLM E&M’s Parisot predicts that analytics eventually will become real-time. As of today, however, the focus is on “real-time-enhanced troubleshooting.” Among



“Predictive maintenance and big data are at the heart of our strategy,” says Rodolphe Parisot, AFI KLM E&M’s vice president for digital and innovation. AFI KLM E&M images.



AFI KLM E&M’s Parisot predicts that analytics eventually will become real-time. As of today, however, the focus is on real-time-enhanced troubleshooting.

the challenges are “efficient and cheap, real-time connectivity and improving communication between the aircraft and the ground.”

Engine trend monitoring traditionally aims to identify long-term trend changes, MTU’s Kappei says. For this purpose the aircraft transmits single-snapshot reports in different flight modes, which produces only a small volume of data (about 10 KB per report). Newer developments use continuous data from the whole flight, which includes snapshots from each second. Although this data is still below

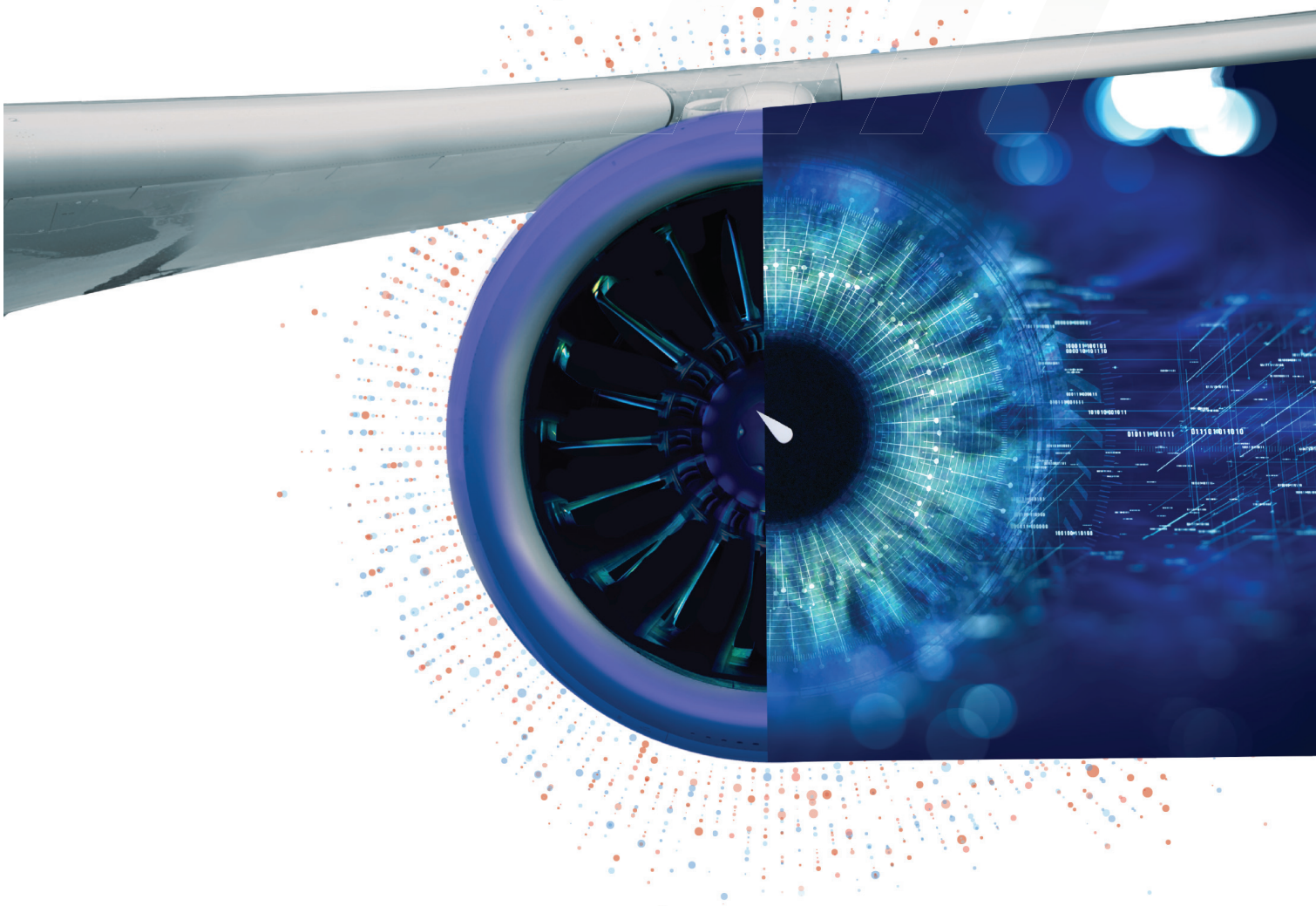
1 GB, it exceeds current in-flight data transmission capabilities and therefore is downloaded via a wireless quick access recorder (WQAR) after arrival.

Currently, most engines produce data snapshots at various points in flight, such as take-off, climb, and cruise, adds Jayesh Shanbhag, executive, services digital leader for GE Aviation. These snapshots can include up to 1,000 different measurement parameters and can range in size from 50-200 MB of data per flight, depending on flight time.

Another challenge is that not all aircraft



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employ the same data format, transmission capabilities, and frequencies, Kappei points out. They are equipped by different hardware and software manufacturers and run hardware and software at different upgrade levels. "These factors require highly flexible databases, data processing, and analysis."

It is also too expensive at this time to transmit data for the whole flight in real time via ACARS although new technologies might help to reduce the costs to a level that makes real-time transmission a reality, he says.

EngineWise

Last year Pratt & Whitney launched EngineWise, a platform that includes "data analytics and real-time intelligence to help predict and prevent operational disruptions before they occur," the company says. It has announced EngineWise agreements in connection with aircraft orders involving the selection of the P&W geared turbofan (GTF).

EngineWise has also added new data analytic capabilities for V2500 engines – via the eFAST "data ecosystem" -- thanks to an Airbus A321 STC that allows installation of a device that can access, store, and transmit information. The ecosystem includes a "highly secured acquisition, storage and transmission infrastructure that is capable of accessing and recording

aircraft and engine full-flight data, generating reports based on recorded data, and offloading data and reports to a remote ground station upon landing," says Paul Finklestein, director of marketing. One of the key benefits of this system is the flexibility and control the operator has in sharing access to its data with other parties, he adds. "In the near future, we aim to deploy eFAST across additional platforms."

The hardware component of eFAST includes a "small avionic device that can reside anywhere on the aircraft, but is commonly found in the avionics bay," Finklestein says. The system has access to 100,000 engine and aircraft parameters and is capable of recording 6,000 parameters on a continuous basis, he says. eFAST provides customers advanced configuration management options without requiring physical access to the aircraft. Data can be sent via Wi-Fi, cellular, or ACARS, allowing customers to better manage the cost of data transmission.

EngineWise promises "cradle to grave product knowledge – the ability to anticipate, prevent, and proactively prescribe to create a planned environment for ourselves and our customers, by having ... all critical data at our fingertips," says Karine Lavoie-Tremblay, associate director for engine business intelligence.

"We capture an enormous amount of data to analyze," she says, but what is



Karine Lavoie-Tremblay, Associate Director Engine Business Intelligence, Pratt & Whitney

more imperative is to focus on the most important data that helps improve overall reliability."

Real-time data transmission and analytics are performed today and are critical for maintaining flight safety, she says. But adding more of these capabilities needs to be balanced with the availability of technologies, operational cost, safety, and the ability to react.

She sees "three technical shifts" enabling the expansion of digital capabilities: global enterprise systems; fast, high-volume

Analytics Market From 30,000 Feet

The big data applications/artificial intelligence (AI) market today is probably "just a fraction" of the estimated \$400 million market for MRO automation software, says Diogenis Papiomytis, director of commercial aviation for market analyst, Frost & Sullivan. But he "would not be surprised" if big data/AI revenues surpass the value of automation software by 2030.

Part of the challenge is that the market is very fragmented, he says. Large information technology integrators like IBM, Microsoft, and SAP have cloud platforms and analytics solutions. And GE, Airbus, and Boeing, as well as large MROs, have solutions.

But the biggest hurdle is that "almost 90 percent of data generated by an aircraft goes unused," he says. "No one today knows exactly how to leverage big data. Suppliers are testing solutions, but it's still early days.

AI Key

"Big data analytics is still in its adolescence," Papiomytis asserts. Analytics will only be mature enough once AI is added to the mix. "AI will be the engine of analytics in the future," he predicts.

Because AI's still young, making the business case for it can be challenging. But, as with all new technologies, "you need to make the breakthrough investment before you can measure the benefits," says Gary Vickers, managing director of Aerogility, which offers a set of Web-based tools using AI. He asserts that "there is already enough evidence from big data analytics and AI-based applications to make this investment compelling."

To date more emphasis has been placed on generating big data through sensors and enabling real-time, air-to-ground communications vs. on how to use the data, Papiomytis contends.

"Once you have workable solutions that can reduce the costs and increase the predictability of maintenance/flight scheduling, you can then assess improvements from the use of new, real-time data sets. Until then, real-time data will be used mainly in visualization exercises," such as "dash boarding" and condition health monitoring.

Bottom line: "Analytics and AI still have a long way to go to bring real cost savings to airlines," Papiomytis says.



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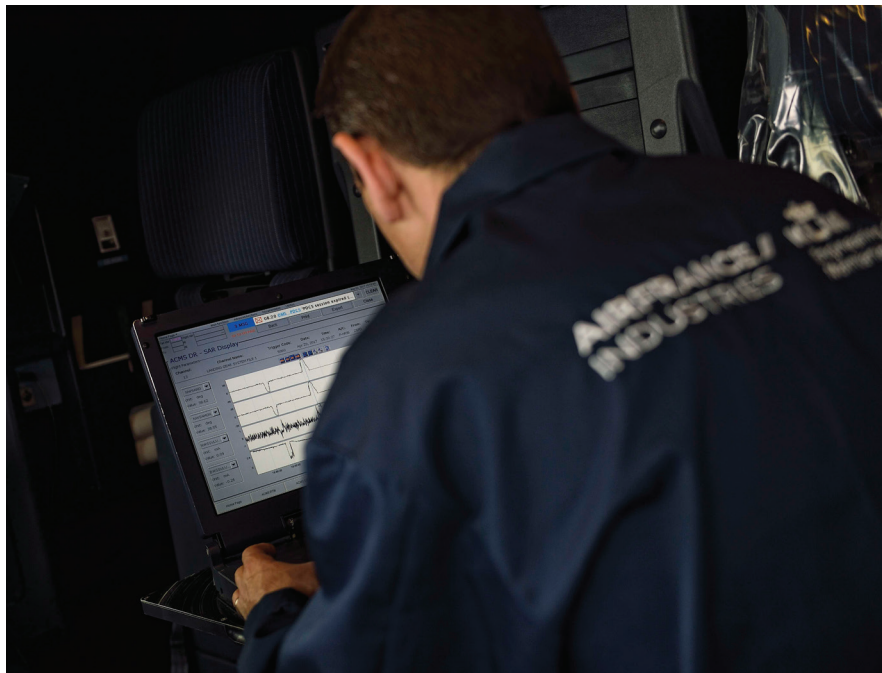
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Boeing is using "truth data" – what has been found in actual inspections – to trace back and determine the signatures of a potential problem. Boeing image.



AFI KLM E&M recently added an inventory feature to its Prognos platform, which already includes functionality for aircraft, engines, and auxiliary power units (APUs). AFI KLM E&M image.

processing; and the ability to aggregate asynchronous data."

General Electric

GE Aviation continues to refine and expand its concept of "digital twins," digital replicas of engines that allow systems to be modeled and analyzed. "By creating a digital twin, we're able to gather and analyze more data from engines," explains Jon Dunsdon, chief technology officer with the Digital Solutions business. "This process allows us to get a clearer idea of how an engine will respond for better predictability."

GE has applied the concept to improve engine availability and fuel efficiency. It can model the overall health of the engine and can "create an analytic model of the health ... specific to that engine because you're getting the actual data off that engine."

Digital twinning also can move actions from unscheduled to scheduled maintenance, reduce the inspection burden, and increase flight efficiency.

More specifically, creating a digital twin helps airlines fly the aircraft better, Dunsdon says. The approach can provide insights on the most efficient way to climb. "You don't want to climb too aggressively and deteriorate the engine," he says. Or you can look at "things like taxi[ing] on one engine, when you operate the APU... ."

The company has "continued to expand on these time-series models," incorporating maintenance and operational data "to bring more context and fidelity ... and have another step change in our results."

We continue to use data analytics to drive more accurate, prognostic fleet monitoring, says Bill Dwyer, general manager services marketing. "Our Fleet Support facility monitors some 36,000 engines, and processes more than 100 million records per year." Moreover, the OEM's digital capability "enables us to analyze that data to issue about 14,000 customer notifications per year with 90 percent accuracy," he adds. "That's an incredible productivity driver for our customers, because we're giving them advance notice of issues, enabling them to proactively schedule maintenance and to avoid costly operational disruptions."

Rockwell Collins and SkyWise

Airbus is working to get more data off its airplanes, partnering with Rockwell Collins to get the avionics company's latest server/router on its A320s as both a forward-fit and retrofit.

FOMAX – for flight operations and maintenance exchanger – combines

GE Aviation's Accelerator in Washington, D. C. Launches to Drive Efficiency

In October GE Aviation's opened an Accelerator to provide a place in the D.C., Virginia and Maryland area for hands-on collaboration with federal and defense customers to achieve mission-critical outcomes. The accelerator is an innovation space focused on using data and analytics with idea generation, incubation, and development for products and services.

GE Aviation Chief Digital Officer John Mansfield officially opened the accelerator with Colin Parris, vice president of Software Research at GE's Global Research Center and Tony Mathis, GE Aviation president of Military Systems. Technology partners participating in the event included Microsoft, Teradata, Hewlett Packard Enterprise, Intel, CACI, and VION.

"GE Aviation's Accelerator in Washington, D.C. is home to software developers, architects, data scientists and domain experts with specific backgrounds in analytics, maintenance, and engines," said Mansfield. "Building on the strong partnership we have with our customers will allow us to continue to share both our physics and digital-based capabilities, improving their asset availability, efficiency and operations."

Through the partnership, data scientists, domain experts, software developers, and solution architects from GE will work together with federal and defense customers to distill some of the 10 billion data points produced by the defense sector annually into solutions that can achieve condition-based maintenance and connect disparate data sources.

"GE Aviation's Accelerator is where digital and physical technologies come together in powerful ways to improve industrial operations of all kinds," said Parris.

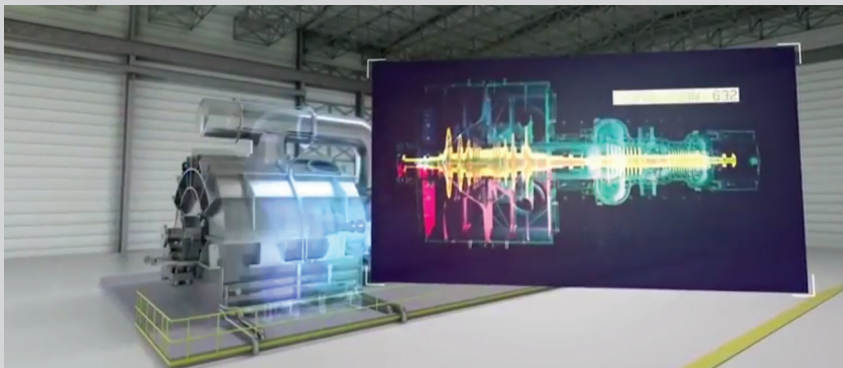
"We're combining data, AI and our deep industry domain expertise into digital twins that provide unique insights and solutions to drive better mission-based outcomes for the military and for industry."

"Digital transformation is a strategic imperative for aviation to stay competitive in today's ever-changing world," said Mathis. "We're partnering with customers to bring real and tangible outcomes leading to increased readiness, affordability, mission effectiveness and operator safety."

GE Aviation's Accelerator is located at the Warner Building, 1299 Pennsylvania Avenue, NW, 9th floor, Washington, D.C. The collaboration space is comprised of data scientists, engineers and UI/UX designers in the Delaware/Maryland/Virginia area.

GE Aviation's Accelerator in Washington, D.C., is their second collaboration space in the United States. The first one is in Austin, Texas, the headquarters of the Digital Solutions business. GE has similar spaces in Dubai and Munich.

GE Aviation says more than 300 unique airlines, OEMs and business jet operators covering more than 10,000 aircraft are GE Aviation's Digital Solutions customers for services such as flight and fuel analytics, navigation services, operations management, and planning and recovery.



maintenance and flight operations functions in a single box, says Rockwell Collins' Sword.

Capable of uploading up to 12 GB per day, FOMAX provides two air-to-ground channels – a direct connection to Airbus' SkyWise analytics platform, hosted in the Airbus cloud, and a direct connection to the airline, via two 4G cellular radios. There is also broadband satellite connectivity, but

this is used primarily for flight operations, he says. "At this point there is no real-time parameter streaming in flight."

The way the box is being configured, it's going to collect significantly less data up front, Sword says, because the amount of data it collects is driven by what you can do on the ground. "Until the algorithms can make sense of that much data, there's [no] point in collecting it and

downloading it."

The promise of Skywise is predictive, Sword says. If it detects an anomaly, it suggests to the operator that there is some root cause worth investigating. He cites Airbus' public statement that in early trials with launch customers SkyWise was able to demonstrate a 30 percent reduction in operational interruptions, using predictive analytics. **AM**

Expanding with Flying Colours

BY JOY FINNEGAN, EDITOR-IN-CHIEF



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Flying Colours will be adding more than 140,000 square feet to its North American footprint as it continues an ambitious expansion and embarks on its largest infrastructure growth to date.

Plans are currently being finalized for the groundbreaking of a brand-new hangar by the end of fall 2018 at the Peterborough,

Ontario, Canada facility. The company says the additional hangar, the fourth at Flying Colours Peterborough headquarters, is needed to provide additional capacity for completions, refurb and heavy maintenance work on large jet airframes.

The purpose-built hangar will be divided into three distinct zones. A new 40,000-square-foot, climate controlled, state-of-the-art paint shop will be added, supplementing the two existing dedicated paint shops. Large enough to accommodate business jets up to Global 7500, Boeing Business Jet or Airbus A220 (formerly known as the Bombardier C-Series) size airframes it will fulfill the higher volume of paint jobs passing through the facility. A second area of 40,000 square feet has been designed to enable heavy maintenance and/or interior work on up to four Global 6000-size aircraft to take place simultaneously. Two higher levels will be used for new customer offices, a second dedicated design-center at the facility, storage and general office space. The total office space will cover more than 20,000 square feet bringing the hangar footprint to more than 100,000 square feet in total when it opens in mid-2019.

At the company's Chesterfield, St. Louis, Mo. Facility, a fifth hangar will be inaugurated on December 1st. The 30,000-square-foot area will be large enough to handle up to three large-jet maintenance, avionics upgrades and interior projects at once, including Bombardier Global and larger Gulfstream models. The additional capacity dove tails with the expanded interiors and cabinetry workshop that opened in January of this year. Together the shops will support the multiple aircraft projects being undertaken at the facility. A further 18,000



Dave Stewart, VP Operations and General Manager, is the driving force behind Flying Colours' continuous improvement efforts.

square feet of customer lounges, office space, and storage area will form the second floor.

On a recent visit to that Chesterfield, Mo. site, Aviation Maintenance had the chance to meet with Dave Stewart, VP operations and general manager and Kevin Kliethermes, director of sales, to learn how the company is handling their growth. Stewart, formerly with Toyota Motors, brings a fervent love of lean and a deep understanding of the Toyota management philosophy. He had never been in aviation in any capacity before coming on board with Flying Colours.

"Was I brought here to bring lean to the company? Probably. We've come a long way. We have a long way to go." Part of the philosophy, Stewart says, is that even though Toyota has been



Dave Stewart and Kevin Kliethermes, director of sales for the company, check out corrosion found after opening up an aircraft for other work.

embracing lean culture for decades, they are still working towards improvement.

Some of the ideas Stewart has been touting since coming on board are direct from the Toyota playbook such as individual responsibility for roles, continuous improvement, eliminating waste, stopping to fix problems, getting it right the first time and using visual cues so no problems are hidden. When he first came on board, Stewart says there weren't clear goals as far as meeting schedules was concerned. "We now have a scheduling and planning department that is tied into our material planning so we get our kits out to production when we need them. It is a very linked-together process from the day we find out about a project until the day it delivers. Now we put a lot of emphasis into our scheduling to be able to handle it," Stewart says.

Flying Colours says this expansion, their largest investment to date, has been driven by the need for increased capacity due to growth in the business aviation sector. The company sees an active pre-owned market driving a rise in refurbishment demand, and heavy maintenance checks for more models coming due. Connectivity is also stimulating more avionics upgrades across numerous platforms, as well as the upcoming ADS-B Out mandate. More than 100 employees will be hired across the two sites.

"We were literally running out of space to deliver all the services that our clients were requesting, so took the decision to increase our footprint significantly at both of our North American sites," says Sean Gillespie, EVP, Flying Colours. "The business aviation sector is more buoyant than it has been for some time and with our Bombardier ASF status, our breadth of experience working on numerous different aircraft types, and the fact that we can offer a multitude of skills under one roof, so reducing aircraft downtime, is making us very attractive to a wider range of customers."

The Peterborough facility recently re-delivered its one hundredth major retrofit of a Bombardier Challenger model.

The Bombardier Challenger 604, delivered in the first week of October 2018, underwent a major overhaul of the cabin, avionics, connectivity and fuselage.

The private owner also took the opportunity to update cabin-connectivity with the Gogo AVANCE L3 air-to-ground connectivity system installed to provide WiFi access for voice, email, web browsing, moving maps, and a selection of movies and TV programs across the North American region. Passengers will also enjoy inflight entertainment courtesy of the Rockwell Collins Venue system with new monitors installed at the front and aft of the cabin.

The flight deck was also treated to a major overhaul with Rockwell Collins' Future Airspace Navigation System (FANS) 1/A installed combined with installation of ADS-B Out tracking equipment, for which Flying Colours holds the STC on Challenger 604 types.

As we tour the facility, Stewart peppers everything he says about the work flow at the company with Toyota process improvement phrases: just-in-time sourcing, kaizen circles, gemba walks, plan do check act (PDCA), etc. For instance, he says they have implemented kaizen or quality circle meetings for every department once a week where any quality issue can be addressed. Kaizen is the Japanese word for improvement. "Some issues are ongoing for months others are able to be taken care of today," he says. Stewart says they do regular risk assessments from the beginning of a project's intake through the delivery phase, in every department.

He explains that just-in-time sourcing was invented not to save money, but because the original company didn't have any money when Toyota first started building cars. "They only had enough money to buy a limited amount of parts. As soon as those cars went out the door, they got more money to buy parts and that was the beginning of just-in-time," Stewart says.



Sean Gillespie, EVP, Flying Colours, says they need to expand to meet recent growth in the bizav sector and demand for refurbs and avionics upgrades.

The company implemented gemba walks. Gemba means "the actual place." The purpose is to get managers and leaders out from behind their desks to see the actual work process right at the place it is happening. It also encourages managers to engage with employees, see the work process and talk about areas for continuous improvement. "We have our senior leadership take gemba walks. They go to the floor and see what is happening, boots on ground, to understand what the condition is," he says.

But he stresses what is happening at the company is in its infancy. "With continuous improvement, you could work on it for a hundred years and never be finished," Stewart says. "Every time you reach your ideal situation, you have to raise the bar, so you have another goal to reach for." **AM**



Accepting Foreign Airworthiness Directives – A More Dramatic Change Than It Might Appear

Congress has passed a new FAA Reauthorization Act. The law authorizes FAA expenditures but it is also used as a vehicle for changing substantive law, as well. This year's law includes a provision that could pose a thorny issue for Americans, in that it offers an opportunity for the FAA to potentially side-step traditional rulemaking processes in favor of acceptance of foreign rules.

The specific provision at issue is found in Section 242 of the FAA Reauthorization Act. That provision allows the FAA to inter into bilateral agreements under which the FAA would accept foreign Airworthiness Directives. As with any other FAA Reauthorization provision, the devil is in the details, and how the FAA implements this provision through its regulatory structure will be vitally important.

Under current law and regulations, Airworthiness Directives are regulations, and as such they are subject to the due process requirements spelled out in the Administrative Procedures Act (APA). This means that under normal circumstances, an Airworthiness Directive cannot be issued by the FAA unless the FAA first publishes the proposal in the Federal Register, seeks comments from the public, considers those comments, and then publishes a final rule version of the Airworthiness Directive.

The FAA is the aviation safety authority in the United States. Other nations have their own aviation safety authorities. The United States has bilateral aviation safety agreements which facilitate trade in civil aviation products and articles. Often, the philosophical essence of those agreements involves an agreement among the aviation safety authorities to rely on the findings of the other in certain limited circumstances, in order to facilitate both commerce and safety.

One purpose of these sorts of agreements is to make the process of acceptance of products and articles more efficient, for both safety and commercial reasons. So historically, the bilateral agreement have largely dealt with reliance by one authority on the findings of another. Examples of this include streamlining of the process for issuing a type certificate, acceptance of aircraft parts approvals, acceptance of export airworthiness approvals, and acceptance of local oversight of repair stations as the basis for renewing foreign repair station certificates.

Section 242 will permit the FAA, as the United State's aviation safety authority, to circumvent normal process in order to more rapidly implement a foreign Airworthiness Directive through acceptance of that foreign Airworthiness Directive. This is quite a departure from the traditional scope and reach of bilateral agreements because this clause now permits the United States to accept foreign rulemaking as the basis for United States' rulemaking. This could be a positive thing for safety (as it could make the process of publishing important safety information more efficient) but it could also open a door to mischief by circumventing norms of due process. I will explain what I mean by "mischief," but first allow me to discuss the norms of the bilateral process so you understand why this is a big step.

The foundation of any bilateral aviation safety agreement is a finding by the regulatory authorities that they have each (1) investigated the aviation safety system of the other authority, and (2) found that the other system yield sufficiently similar results that the first authority can rely on certain (described) findings of the

second authority. This provides a foundation for "trust" between the government authorities that might allow them to rely, in part, on certain technical findings made by the other authority.

For example, the United States and the European Union have investigated each others' airworthiness systems, and found that they typically come to the same conclusions when posed with the same data. They do so through very similar (but not identical) mechanisms.

Within the scope of international airworthiness affairs, there are several terms used to describe an authority's reliance on a foreign authority's work, including: "approval," "validation," and "acceptance."

Where there is no (relevant) agreement between the FAA and a trading partner, there is no deference to the aviation authority of that trading partner. This means that something that is approved by the foreign authority must be subject to a fresh review if it is offered to the FAA for a similar approval.

But when we enter into a bilateral agreement that is based on a level of trust between the authorities, the authorities can use validation and acceptance. Validation happens when the FAA and a foreign authority identify the similarities in the results of their systems, and then move to a relationship where they can each accept certain findings of the other's system. Because of this acceptance, the second (usually the 'importing') authority does not have to duplicate the analysis performed by the first authority (often known as the 'exporting authority'). This means that they merely have to validate the findings of the other authority in the technical areas where there are differences (how this works in practice is a little different from how it is supposed to work in theory). So, for example, when Airbus designs a new aircraft and gets it type certificated in the European Union, the FAA can accept some of the findings from the European Union, and only needs to check the engineering in certain technical areas that require validation. If the design is approved by the FAA in the validation areas, then the FAA can make a finding that the aircraft design meets the FAA's regulations and the FAA can issue a U.S. type certificate to Airbus. This is meant to cut down on duplicative engineering review work by the authorities.

Acceptance, though, reflects the ultimate level of trust among authorities. Acceptance means that the importing authority accepts the approvals of the exporting authority, and does not need to review them before doing so. As an example, most countries have historically accepted FAA aircraft parts approvals in their bilaterals (like PMA and TSOA). Until recently, the United States has not directly accepted foreign approvals; today, though, the FAA accepts Canadian and European TSOAs (based on a lengthy process of trust-building and harmonization among the authorities) and also accepts certain parts approvals from countries like China.

The term "acceptance" is well understood in the context of bilateral relationships among aviation authorities. The connotation is that we accept without a need to make any further showing.

While this level of trust among authorities has been implemented in the past around the certificates and approvals issued by one, and then trusted by the other, Section 242 brings this process to a new level. Because Airworthiness Directives are regulations, Section 242 allows

the FAA to enter into a bilateral agreement in which we trust the regulations promulgated by a foreign authority to serve as the basis for regulations that will be promulgated in the United States.

This certainly has some potential for positive safety impact. Recently, Southwest Airlines had a CFM56-7B fan blade failure. The FAA had issued a proposed Airworthiness Directive on this engine (and its fan blade) but it had not yet finalized the Airworthiness Directive process. The European Aviation Safety Agency (EASA), on the other hand, had already issued a final Airworthiness Directive addressing this issue. One could argue that if the FAA had been allowed to reissue the EASA Airworthiness Directive, instead of going through the norms of due process, then it might have prevented the failure by getting the Airworthiness Directive out more rapidly.

But there is equal potential for mischief. One of the reasons for the processes defined for rules in the Administrative Procedures Act (APA) is that regulators do not always see the problems in their own rules. This is not because they are stupid – this is because they are human and they are subject to the limits of human experience and creativity. When you open up a rulemaking project to scrutiny by the whole world, you have a chance of recognizing flaws and unintended consequences that the rule-writers did not notice. In the context of FAA regulations, proposed rules can have non-safety impacts. These non-safety impacts can be adverse impacts, and in many cases there is a better way to achieve the desired safety result. Regulators do not always recognize these non-safety impacts. The process defined by the Administrative Procedures Act allows the aviation community to point out those unintended consequences and to propose a better way to approach the problems and achieve the desired safety result.

Many years ago, I was involved in an Airworthiness Directive project. The proposed airworthiness directive claimed that

there were safety problems with a particular crankshaft, and that it must be replaced with a different crankshaft. Repair stations complained that the engine manufacturer was using the Airworthiness Directive to ‘capture’ the maintenance market in way that was unfair. This “unfair capture” argument was less relevant to the FAA than safety concerns, but it did motivate some repair stations to invest in studying the issue. So we started to look at the safety allegations and the data surrounding the populations of crankshafthts. When we investigated the data, it turned out that the data showed that the new crankshafts had a higher incidence of failure than the older one it replaced– not a lower one! The proposed Airworthiness Directive would have reduced safety! In response to this data, the FAA withdrew the proposed Airworthiness Directive. This is part of the reason that the FAA invites the public to participate in rulemaking activities: in order to supplement the FAA’s resources and help the government reach the right decision for safety.

The potential problem with Section 242 of this year’s FAA Reauthorization Act is that if it is interpreted to circumvent the Administrative Procedures Act, then it could remove the opportunity for Americans to learn of a proposed U.S. Airworthiness Directive, review the proposal, and offer helpful criticisms and improvements before that proposed Airworthiness Directive becomes a regulation. A court might say that the law cannot be read that way (because both laws apply), but a court also might rule that Section 242 was intended to circumvent the APA. Ultimately, whether the law is implemented in a way that closes off the rights of interested persons to participate will depend, in part, on the FAA’s decisions about how they choose to implement the authority offered by Congress (as well as the language of the biateral agreements used to implement this authority). **AVM**



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A handwritten signature in black ink, appearing to read "Johann C. Bordais".

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