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The Magazine for Aircraft Maintenance Professionals

UPDATE

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Well underway: the transition to composite airframes

Selected Highlights: NBAA 2018

PAMA and AME news

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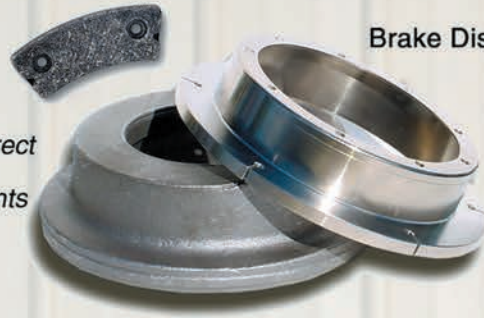
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On Relative Value

Citing teething problems with new engine technologies, aircraft delivery backlogs and an impending surge of engines coming off-wing for maintenance, the London/Dublin-based aviation consultancy firm IBA now poses this one question: are engine values artificially high?

In the past year, the industry has seen the CFM LEAP-1B enter into service on the Boeing 737 Max while the new Pratt & Whitney PW1000G has been plagued with early launch problems resulting in an emergency Airworthiness Directive in December. Orders look strong for the A320neo, which stand at just over 5,750 and B737Max at 4,230, and it is worth noting that the A320ceo and 737NG still have considerable order books to fulfill. The single-aisle market is still dominated by the A320 and 737 families making them the most sought after assets in the market with stable market values.

The twin-aisle market is currently dominated by the Airbus A330ceo and the Boeing 777, with airframes active and an order backlog. Last year IBA saw the 787-10 enter service with the Trent 1000-TEN engine and in the coming months IBA expect more deliveries of these aircraft. The order book for the Boeing 787-10 is currently 168 aircraft with 45 aircraft coming with the Trent 1000-TEN fitted and further 25 unconfirmed.

The latest engines containing the most up-to-date technology retain the greatest value in single-aisle and twin-aisle aircraft and with maiden flights fast approaching the A330 and Boeing replacement aircraft, the 777X, will bring their Rolls Royce Trent 7000 and General Electric GE9X engine counterparts. Unlike the single-aisle market, these are rather more susceptible to value changes as once a secondary market has been established the fleet to replace is far less. When these engines are new, however, they track close to list price unless the host aircraft performs under par. IBA expects to see the GE9X start certificate testing in 2018 and this is expected to last until 2019.

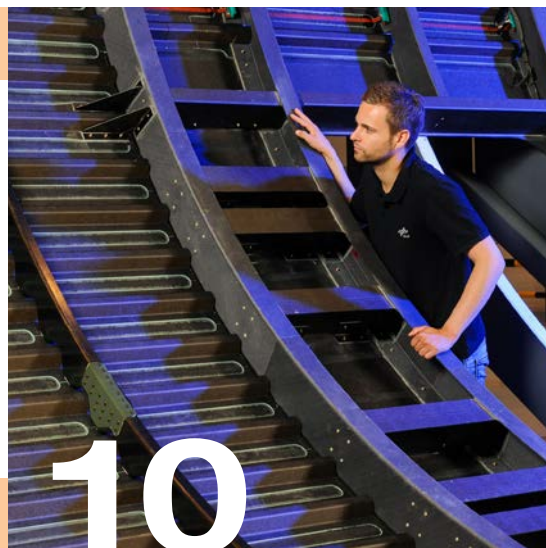
The CFM56-5B/-7B and the V2500-A5 engines are still experiencing frequent trades and stable values, with demand expected to grow as more engines are removed for maintenance. Limited availability of spare parts could mean longer downtime during maintenance compounded by a longer wait and higher pricing for those parts. ■

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Upcoming Events

Mega expansion scheduled for YVR



During the month of June, Vancouver International Airport (YVR) broke ground on a number of capital construction projects to enhance the airport experience and improve YVR's competitive position as a world-class connecting hub. The projects are part of YVR's multi-year expansion plans that will see the airport complete 75 major projects, totaling \$9.1 billion over the next 20 years.

Vancouver Airport Authority President and CEO Craig Richmond was joined by British Columbia Premier John Horgan; Ken Hardie, Member of Parliament for Fleetwood-Port Kells; and Fiona Famulak, President of the Vancouver Regional Construction Association to celebrate the groundbreaking of YVR's construction projects. They include building one of the largest GeoExchange systems in Canada, significant terminal expansions, new parking options and improved vehicle rental facilities.

YVR is one of the fastest-growing airports in North America. It welcomed a record 24.2 million passengers in 2017 and is forecasting 32 million passengers by 2022. About 327,000 tonnes of cargo are expected to move through the airport by 2020. These newest construction projects will improve the speed with which people and goods move through YVR, and provide passengers with a wide range of compelling offerings and amenities.

YVR plays a significant role in the local, provincial and national economy—creating jobs and driving business activity. The airport supports 24,000 jobs on Sea Island and more than 100,000 jobs across British Columbia. YVR's operations—together with tourism and cargo—contribute more than \$16 billion in total economic output, \$8.4 billion in GDP and \$1.4 billion in government revenue across British Columbia. Each new flight through YVR creates hundreds of jobs and con-

tributes millions of dollars in economic benefit to the province.

The expansion projects will have significant economic and employment benefits in the region. By the end of 2018, construction activities at YVR will create nearly 2,500 full-time construction jobs on Sea Island and hundreds more off-site. Much of the work will be done in the province, offering a significant number of jobs for British Columbians.

YVR's multi-year expansion plans are made possible by its unique, not-for-profit operating model. YVR receives no government funding and all profits generated at YVR are reinvested back into the airport for the benefit of its customers, partners and communities.

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STCs & new products

New sealant dispenser is battery operated

PPG has introduced a battery-powered sealant-dispensing tool that eliminates the need for hoses and a compressed-air supply. The PPG Semco model 1250 tool is designed for applying sealants, adhesives, potting compounds and other materials packaged in a variety of PPG Semco cartridges or PPG SEMKIT packages that are used for multicomponent materials. It features nine dispensing speeds that give the operator the ability to select the best rate for each task and sealant viscosities.



For information visit www.ppgaerospace.com

Composite blades offer noise reduction

The new AMT-206-1 composite tail rotor blade distributed by Dakota Air Parts is a direct replacement for Bell 206A and 206B series helicopter tail rotor blades. This product has a non-symmetrical airfoil section and incorporates a swept tip. It is primarily fabricated from carbon fibre and Kevlar continuous fibres suspended in an epoxy matrix and is fitted with a nickel abrasion strip on the leading edge. The abrasion strip is bonded on using a urethane adhesive. The AMT-206-1 composite tail rotor blades offer a 30 percent cost advantage with twice the life over the standard 206 tail rotor blades. For information visit www.dakotaairparts.com



Heavy-duty grinders reduce vibration

Walter Surface Technologies has introduced the Ironman and Ironman PS grinders featuring 1,750 watts of power, six-inch wheel capacity, a QUICK-R instant release function, and the Walter Stabilizer that reduces vibration and extends the life and productivity of abrasives by up to 30 percent. The Ironman PS offers the same durability and performance as the Ironman, but with added safety features: a "deadman" switch and mechanical brake stop grinding wheels from turning within two seconds of relieving the trigger. For more information visit www.walter.com



TapGuide features a v-groove design

Big Gator Tools has introduced its V-TapGuide to accurately guide hand-tapped threads on the inside of a hole to accept a machine screw or bolt. It starts every hole straight, helping prevent tap breakage and increase the tap life. The tap guide can also be used to restore an internal thread that has been damaged or to cut a new, larger thread in the case of severe damage or stripping. Its 90-degree "v-groove" design runs through the entire guide and is found on the bottom of the guide allowing users to drill on round or cornered material. The bottom also features a flat base to allow users to work on flat surfaces. For information visit www.biggatortools.com



Digital gauges measure pressures over 500 psi

Newbow Aerospace has launched a range of digital tire pressure checking gauges and digital strut service tools. The gauges are calibrated to an accuracy of +/-0.4 percent FS allowing optimum aircraft tire pressure settings to be achieved. Capable of measuring pressures in excess of 500 psi, the digital tire pressure gauge is compatible with all make and model aircraft as well as all OEM tires. The digital strut service tool is capable of exceeding pressures of 5,000 psi at an accuracy of 0.4 percent FS, allowing all aircraft make and model strut and accumulators to be serviced. For more information visit www.newbowaerospace.com



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HARTZELL TRAILBLAZER PROP RECEIVES STC



Hartzell Propeller's carbon fibre composite two-blade Trailblazer prop has received a Supplemental Type Certificate (STC) for American Champion Aircraft's Super Decathlon aerobatic tandem two-seat tail dragger. Offered as a new aircraft option by American Champion, the 76-inch diameter Hartzell Trailblazer is also available under Hartzell's Top Prop program for retrofitting on the Super Decathlon fleet, which is capable of aerobatic stresses between +6g and -5g. The Trailblazer's light weight and the composite materials result in a smooth operation designed for the ultimate in aerobatic performance in conjunction with Lycoming AEIO-360-H1A and -H1B 180 horsepower engines with inverted fuel and oiling systems.

PRATT & WHITNEY TESTS 3D PARTS FOR ENGINES



Pratt & Whitney has announced its participation in an industry team developing and testing additively manufactured (3D printed) turbomachinery components, including the first additively manufactured rotating part for Pratt & Whitney development programs.

The team includes Norsk Titanium, the Notre Dame Turbomachinery Laboratory (NDTL) and TURBOCAM International. The jointly managed team is currently exploring the applicability of Norsk Titanium's Rapid Plasma Deposition (RPD) material to turbomachinery applications. As part of this effort, the Notre Dame Turbomachinery Laboratory will test an additively manufactured, integrally bladed rotor (IBR) produced to meet the applicable quality specifications used in Pratt & Whitney's current turbomachinery products. TURBOCAM International will machine the initial test IBR. Pratt & Whitney is expected to test the part at the Notre Dame Turbomachinery Laboratory in the second half of 2018.

BOMBARDIER DEBUTS NEW ATMOSPHERE CABIN



In mid-July, Bombardier Commercial Aircraft unveiled the interior of its first CRJ Series aircraft with the new ATMOSPHERE cabin design on the opening day of the Farnborough International Air Show in the United Kingdom. Bombardier showcased the new cabin alongside launch operator Delta Air Lines and supplier Zodiac Aerospace during its air show inauguration event.

The ATMOSPHERE cabin is comprised of larger passenger living space, wheel-first roller bag capability, more spacious lavatory, increased cabin connectivity options, all integrated in a contemporary design and material choices. The ATMOSPHERE cabin design allows each passenger to carry and store an "oversized" roller bag within the aircraft cabin bins, which minimizes the need to check bags at the counter or the gate.

HYDROPHOBIC COATING TECH NOW IN TRIALS



GKN Aerospace has developed a new hydrophobic coating for cockpit windows that is said to significantly enhance resistance to surface abrasion. The technology is being flight trialed in the United States and is now undergoing performance assessment with Airbus on its flight-test aircraft. Preliminary test results show that the new surface treatment could be added to the range of available solutions for ice and rain protection.

The new GKN Aerospace technology is a permanent solution that only needs to be applied once in the lifetime of a window. By contrast, the hydrophobic technologies currently available in the market today provide only a temporary solution that requires repeat applications every six to eight months, dependent on flight hours and conditions.

FIRST BELUGA XL EMERGES FOR MAIDEN FLIGHT



The first Airbus BelugaXL took off July 19th from Blagnac in Toulouse for its maiden flight over southwestern France. The aircraft is the first of five BelugaXL

to enter into service later in 2019 and to gradually replace the BelugaST transporters. The BelugaXL was launched in November 2014 to address the transport and ramp-up capacity requirements for Airbus beyond 2019. The new oversize air transporters are based on the A330-200 Freighter, with a large re-use of existing components and equipment.

PPG SHOP-TRIALS UV-CURED AEROSPACE SEALANTS



In early July PPG announced it has begun qualification and shop trials for a family of aerospace sealants that are cured on demand using ultraviolet (UV) light, allowing for substantial reductions in process time, waste and costs while increasing efficiency.

Based on PPG PERMAPOL polymer technology and known in the industry as sealants cured on demand (SCOD), these proprietary sealants cure in seconds with the simple application of UV light, rather than hours or even days required for traditional-cure products. These new sealants are fuel-resistant, offer low shrinkage, are highly flexible and exhibit excellent physical properties.

PPG SCOD products are undergoing evaluation for qualification to the new SAE Aerospace Material Specification (AMS) 3102 written for UV-cured sealants. Several aircraft manufacturers have begun or will soon begin the evaluation and approval process for these products. Traditionally, aircraft industry sealants are supplied as chemically cured, two-component materials that can take hours to cure once applied. While this curing process takes place, many assembly operations in the area must be suspended to not disturb the uncured sealant, often limiting production rates and flight-line maintenance. Mixed sealants also have a limited working time in which to be ap-

plied, leading to expired sealant being discarded and money wasted. PPG's new family of UV-cured aerospace sealants can help solve these challenges.

PPG is developing a comprehensive SCOD product line for fillet and butt joint sealing over the entire aircraft, from wing tip to wing tip and nose to tail. The sealants can be provided in either a one- or two-component form. The two-component form allows applicators the option of either curing the sealant chemically in the classic manner or instantly with UV light. While existing two-component materials have limited pot lives, PPG SCOD products will be supplied frozen and can be stored in a freezer for months.

SAFRAN GROUND-TESTS HYBRID PROPULSION SYSTEM

Safran has passed a major milestone in its hybrid electric propulsion roadmap with the first ground test of a distributed propulsion system in July at a Safran Helicopter Engines test facility near Pau-Pyrénées Airport, in France.

In a distributed hybrid electric propulsion system for aircraft, a turbo-generator (a gas turbine driving an electrical generator) is coupled to a bank of batteries. This system powers multiple electric motors turning propellers to provide propulsion. The power is efficiently distributed by a new-generation power management system, and the motors are controlled by a fully-integrated smart

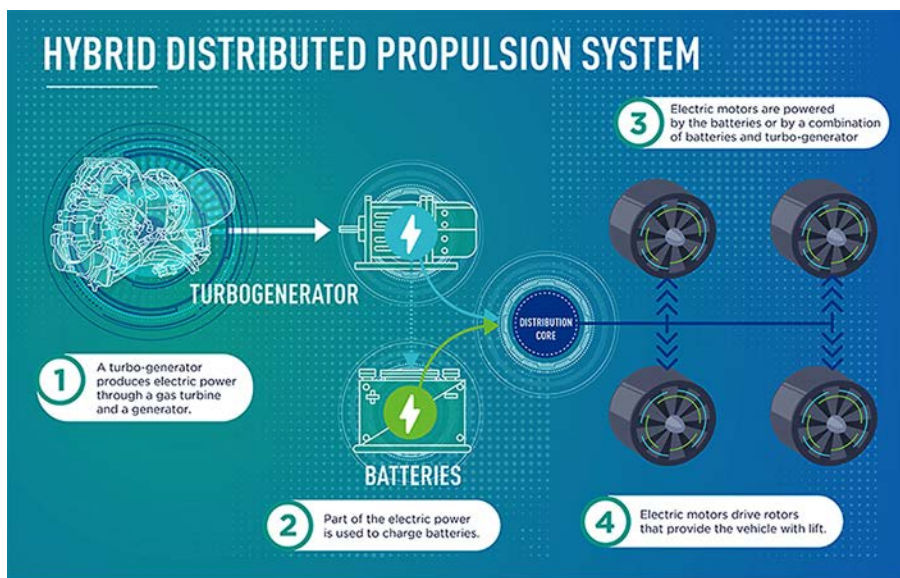
power electronics assembly. Several operating modes were tested and validated during this first series of tests, with the electric motors powered only by batteries or by a combination of batteries and turbo-generator. The system generated 100 kW of electrical power.

Hybrid propulsion systems should contribute to the emergence of new VTOL (vertical takeoff and landing) and STOL (short takeoff and landing) aircraft, by enhancing their flight capabilities and expanding their range of missions. Safran's hybrid electric propulsion roadmap is focused on bringing these technologies to the market by 2025.

AIRBUS FORECASTS \$4.6-TRILLION MARKET

Airbus' new Global Services Forecast recently predicted a US\$4.6 trillion worldwide market for commercial aircraft services from 2018 to 2037. The new analysis is based on a three-way market segmentation, respectively focusing on the aircraft, the airline operation, and the passenger experience.

Aircraft-focused lifecycle services represent the largest segment of growth and include maintenance, spares pool access, tooling, technical training and system upgrades which are needed to keep the airlines aircraft flying. This market represents a cumulative value of \$2.2 trillion over the 20-year period, from \$76 billion in 2018 to more than \$160 billion per annum by 2037. ■





A transition underway:

BY R. ERIC JONES

The transition to composite airframes is now well underway. Does this mean the end is in sight for aluminum? Not necessarily.



Opposite: A component of the Airbus A310 is fed through a high-tech loom where strands of carbon fibre are braided together. **Above:** By building the composite fuselage sections as full barrels with integrated stringers, Boeing reduced the number of parts on the 787, improving overall aerodynamic performance.

the composite question

Aviation and Aerospace technology is a funny thing. Frequently, the newest and most innovative technologies seem much like fashion. For instance, a brand or style of jean becomes fashionable for a time and then simply disappears. Look at jeans over the years, rolled up legs, bellbottoms, button-fly, stone washed, and the eponymous, skinny jean.

Many aviation and aerospace technologies also pinnacle and then fade away, or are improved upon. Avionics, the gauges in the cockpit that translate performance and navigation data to the crew, have morphed greatly over time. Older air-

craft utilized simple direct reading needle gauges, then LED (Light Emitting Diode) backlit gauges, and flight management computers with Apple Macintosh style interfaces. Now most avionics are cathode ray tubes (CRTs, almost HD televisions), driven by display electronic units that gather complex data and flash them upon a multi-function display screen.

However, the same metaphor cannot be said of aircraft structures. Aluminum structured aircraft have stood the test of time and remained relevant for over 90 years. Sure, the sophistication in the metallurgy has improved, but aluminum designed aircraft seem an amazingly resilient technology.



Above: Used extensively in the Airbus 350 XWB family, carbon-fibre reinforced plastic is lighter than aluminum and stronger than iron.

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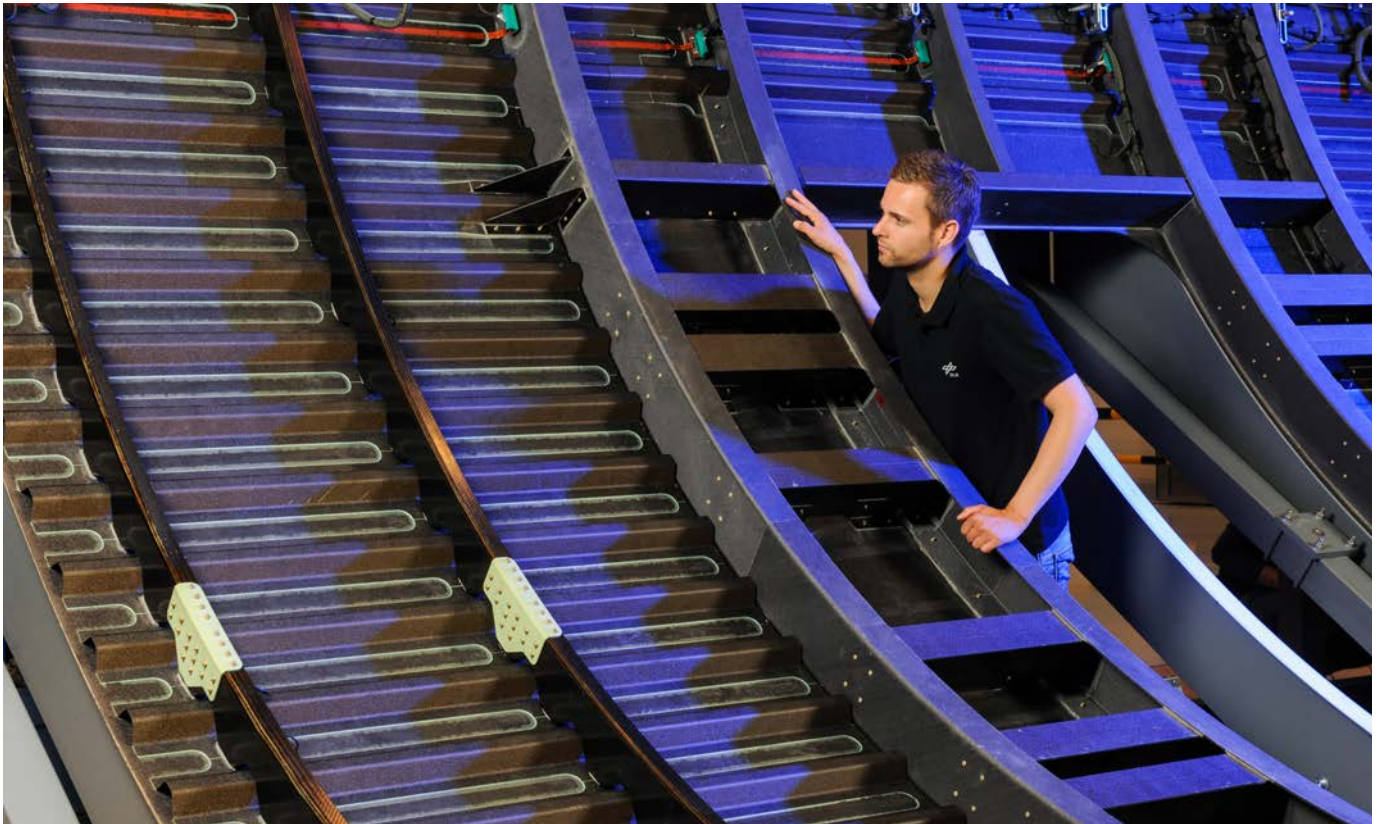
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Above: Components made of carbon fibre teinforced polymers are increasingly being used to make aircraft lighter, more comfortable and more economical.

Once a niche technology and a favourite of maverick designer Burt Rutan (Scaled Composites), Composite structures have taken over aviation and aerospace in a profound manner. This leaves aluminum a dying technology. Why? What is it about composites that make them the giant killer, the newest structural material to take down aluminum's 90-year reign?

If you're looking for a simple definition of composite structures, here is a simple explanation, "Composites are formed by combining materials together to form an overall structure that is better than the sum of the individual components." Simple right? However, this definition hardly explains its pervasive use on the newest aircraft, arguably starting with the Boeing 787. Boeing had traditionally resisted the temptation to commit to composite technology for years, but with the 787 the company did a 180, and embraced composites.

In contrast Airbus had utilized composites in the past, primarily mating larger flight surfaces such as the vertical stabilizer, wings, or horizontal stabilizers

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Above: Boeing Composite Manufacturing Center begins fabricating 787 vertical fin. Below: Boeing performs destructive testing on a full-scale composite wing box of the 787 Dreamliner, the first Boeing all-composite wing box ever built.



to aluminum fuselages. In 2013, they released an all composite fuselage and wing design in the A-350.

But for a more in depth understanding of composites, and their structural applications, I spoke with Dr. Peng Hao Wang, a Graduate of Purdue University in Aviation Composite Technologies. Dr. Wang has written a text on the subject called, Structural Composites: Advanced Composites in Aviation, published by AVOTEK.

Dr. Wang is also an Adjunct Faculty member at Lewis University, teaching lab and lecture courses on the subject. He was gracious enough to take some time out to answer questions that would hopefully help clarify my questions. My first question was obvious: what makes composite technology so much better than aluminum when it comes to aircraft construction? Dr. Wang replied that “composite materials, specifically carbon fibre composites, have a better weight to strength ratio than aluminum.”

This means a significantly lighter airplane is flying through the air, one that saves commercial airlines more money in overall fuel burn. But if these airplanes are so much lighter, I wondered, don't they sacrifice structural integrity which aluminum has so successfully provided? No; composites are lighter, yet the strength of carbon fibre is significant.

In fact, “Composites provide twice the strength and half the weight of aluminum,” said Dr. Wang.

The three main ingredients in aviation composite materials are resin, fibres, and heat pressure. Different fibres allow for different characteristics such as heat resistance, durability, and flexibility. Primarily three types of fibres are used, glass (i.e.fibreglass), carbon, and Kevlar (a Dupont brand name) or aramid.

The crucial ingredient according to Dr. Wang is, “resin.” Resin, the amount of heat, and the type of fibres are crucial in determining what type of application the composites will be best suited. Aerospace fibres are carbon fibres which tend to be expensive, but provide maximum strength. Dr. Wang believes aramid is the toughest fibre, “but handling and fabrication of the material is difficult. i.e. difficult to machine and aramid composite absorbs moisture.” Dr. Wang also sees future potential in, “organic fibres,” rather than synthetic.

However, composites are not a perfect replacement for aluminum aircraft construction. Aluminum has always been susceptible to corrosion, yet if properly maintained, will last decades. Composite materials have similar problems, but rather than corrode, composites erode over time. Constant wind resistance over the composite structure will erode like sand from a rock.

Furthermore, ultraviolet light will degrade the material when not painted or maintained properly. Composites also lose more structural integrity than aluminum if they are hit with blunt force. If a baggage tug accidentally bumped into the side of a composite fuselage, it is more difficult to detect any damage on the aircraft. The trauma can also take more “overall strength” away from the structural integrity than aluminum.

Aluminum is still used in conjunction with composites to prevent erosion. For example, the leading edge of the wing on the 787 was mated with aluminum. With a similar number



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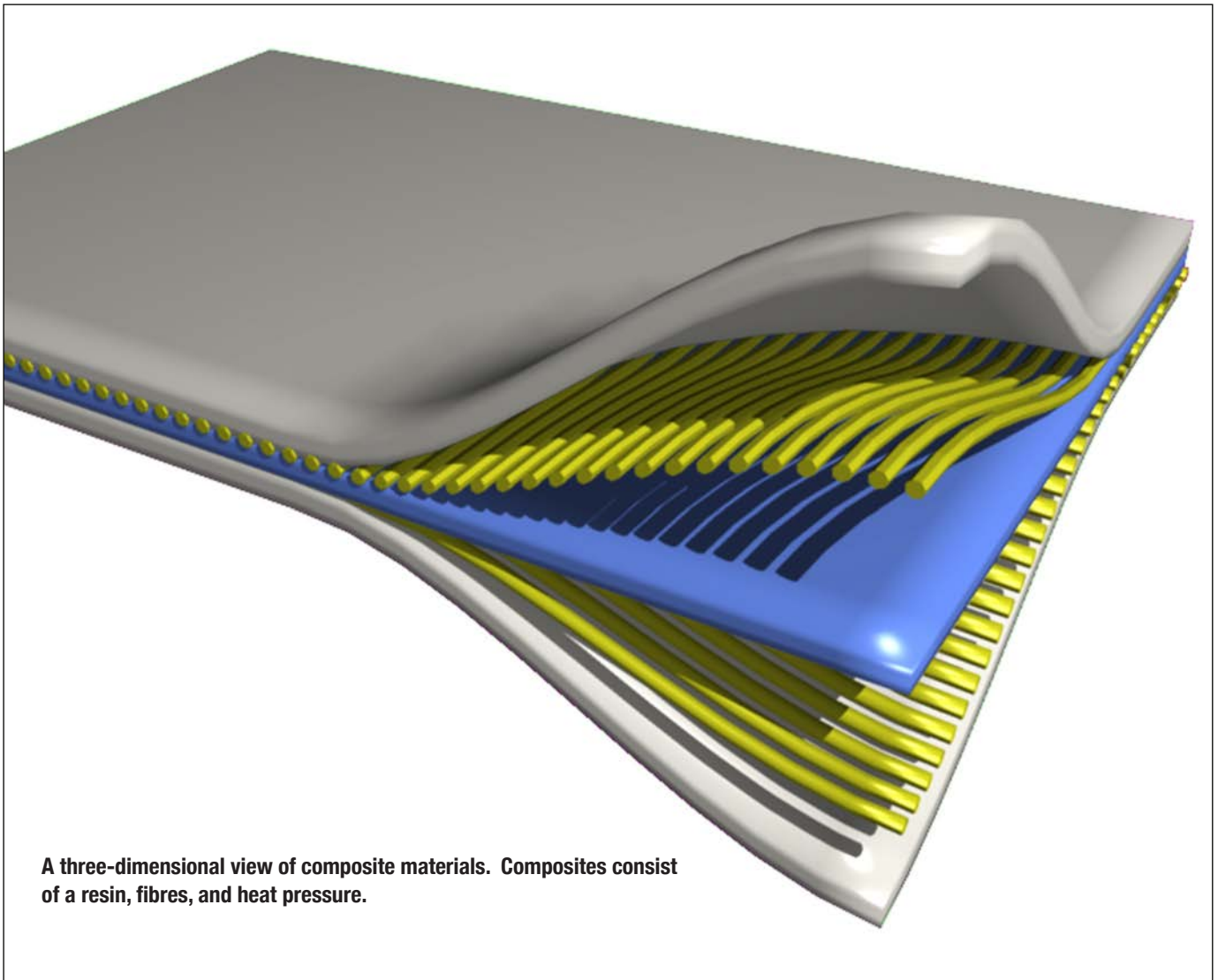


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of disadvantages doesn't it seem logical that aluminum should continue to be utilized over composites?

Dr. Wang disagrees. "The real advantage of composites over any existing technological aircraft building material is that it can make complex shapes with minimal parts."

A traditional aluminum wing has hundreds of thousands of parts to construct it, attach it to the fuselage, etc. But the 787 wing was literally, "one single manufactured composite piece, albeit a large one." That made it virtually unbreakable.

During static wing loading tests, the Boeing 787 composite wing was repeatedly stretched and pulled to evaluate for fatigue and load resistance. Every aircraft certification requires this rigorous testing procedure. During the test, the wings on the 787 were flexed upward approximately 25 feet, which equates to 150 percent of the most extreme forces the airplane is ever expected to encounter during normal operation. It passed with incredible results; it could not be broken. In fact the wing could practically clap over the fuselage. In 2008, Boeing had to isolate one specific section of the wing and apply incredible load factors just to get the wing to break for FAA approval. The durability and single piece construction make

composites incredibly effective for aviation construction. Dr. Wang feels, "That to prove the durability of composites, aircraft manufacturers are actually over-engineering them, and that slowly composites will supplant aluminum designs."

So it seems that composites will continue to be utilized in aircraft design and construction. As the manufacturing processes improve, damage detection, and repair methods become safer, the proliferation of composites will continue. This hardly seems a death sentence for aluminum structures. In fact, it seems both technologies are enjoying a happy marriage on current and new aviation designs. However, it is just a matter of time until safety, economics, efficiency, and public perception eventually move aluminum completely out of aircraft construction.

History tells us that at some point in the future, composites will also be rendered obsolete, moved out of the way by some new organic structural system perhaps. I just hope skinny jeans are long gone before composites are. ■

(R. Eric Jones is an Assistant Professor of Aviation and Transportation Studies at Lewis University in Romeoville, Illinois.)

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Aviation's big event:

The industry's single most important event is scheduled to return in October. Here are just a few of the planned activities . . .



Opposite: The indoor static display area will feature several light aircraft. **Above:** Aircraft of all sizes and for all missions, ranging from single-engine piston aircraft to large intercontinental business jets and rotorcraft, may be seen at the outdoor static display.

NBAA – BACE 2018

The 2018 National Business Aviation Association (NBAA) Business Aviation Convention & Exhibition (NBAA-BACE), set for October 16-18 in Orlando, Florida offers more exhibits, more aircraft on static display and more opportunities for education and networking than any other show in the business aviation industry. This is the year's most significant media event for the business aviation industry, bringing together business leaders, government officials, manufacturers, corporate aviation department personnel and all manner of people involved in nearly all aspects of business aviation.

Education Sessions: Workforce Issues, New Technologies

With more than 50 education sessions planned, there's a session to meet the needs and interests of all attendees.

"We have a great line-up of education sessions planned," said Tyler Austin, NBAA manager, professional development. "NBAA-BACE attendees will learn about important issues facing business aviation right now, and also find out what is on the horizon in terms of innovation and how those future developments will affect the industry?"



Above: The Innovation Zone also will host sessions shining a light on the young professionals changing the face of the industry.

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Above: With more than 50 education sessions planned, there's a session to meet the needs and interests of all attendees.

There will be Professional Development Program courses, pre and post-convention seminars, M&O sessions and more taking place October 14 - 20, with the main education sessions set for the three days of the show, October 16-18 at the Orange County Convention Center (OCCC) in Orlando.

Education tracks include: operations, human resources, business management and leadership.

The Innovation Zone has annually been the area where hot industry topics are discussed, and this year is no different. For example, a session looking at how remote-piloted VTOL aircraft will co-exist with business aircraft operations will challenge attendees to imagine the impact these technologies will have on our industry.

“With our forward-thinking sessions, presenters will examine current research and development efforts, identify technical challenges, and speculate on a timeline for viability in the marketplace,” Austin said. “Technologies such as electric propulsion and artificial intelligence are converging, and these sessions will provide valuable information to help the industry determine how they will affect operations and the next generations of business aircraft.”

The Innovation Zone also will host sessions shining a light on the young professionals changing the face of the industry. Panel discussions will look at practical strategies for developing young talent, as well as how the industry must attract the next generation of employees while also reaching younger customers.

Static Displays: Focus on Business Aircraft

NBAA-BACE organizers report strong manufacturer interest for exhibiting a wide array of aircraft at the show's two expansive static display areas.

“This year promises to offer one of the largest and most diverse lineups of business aircraft we've ever seen at NBAA-BACE,” said Joe Hart, NBAA director for static displays and regional forums. “While most exhibitors locked in their spaces early, there are still a few prime locations at both static display areas available for manufacturers, aircraft resellers and service providers.”

NBAA-BACE will feature approximately 110 fixed-wing aircraft displayed between the main outdoor static display at Orlando Executive Airport (ORL) and the indoor static display on the OCCC exhibit floor.



Above: Bertrand Piccard will appear as a keynote speaker. Below: One of the many static displays on view at NBAA-BACE 2018.

Aircraft of all sizes and for all missions, ranging from single-engine piston aircraft to large intercontinental business jets and rotorcraft, may be seen at the outdoor static display. Attendees will be able to closely examine this wide array of aircraft from manufacturers including Airbus, Bell Helicopter, Boeing, Bombardier, Dassault Falcon, Gulfstream and more, with convenient shuttles running between the airport and the OCCC during show hours.

At the convention center, the indoor static display area will feature several light aircraft, including piston singles, light

turboprops and helicopters, frequently utilized by owner-operators for a wide variety of business aviation purposes.

Keynote Speaker: Bertrand Piccard

The NBAA has announced that Solar Impulse Project Chair Bertrand Piccard will be among the speakers at the Day Two Keynote at this year's NBAA-BACE.

Piccard is an internationally recognized aviation innovator who piloted Solar Impulse 2, the first airplane to fly around



the world without a drop of fuel. He also recently launched the World Alliance for Efficient Solutions, whose goal is selecting 1,000 solutions that would protect the environment in a profitable way.

These solutions are to be offered to world decision makers at COP24; the 24th session of the United Nations Framework Convention on Climate Change Conference of the Parties (COP 24), which is scheduled for December 3-14 in Katowice, Slaskie, Poland. The World Alliance also hopes to encourage these leaders to adopt more ambitious environmental targets and energy policies.

“Bertrand Piccard pushes the boundaries of the possible with his pioneering spirit,” said Chris Strong, NBAA senior vice president of conventions and membership. “That pioneering spirit is among the hallmarks of the business aviation industry, and we know convention attendees will be inspired by his personal story and perspectives about what is possible in aviation and beyond.”

The Solar Impulse project was created to demonstrate the abilities of renewable energies and promote energy savings. The Solar Impulse Efficient Solution label seeks to bridge the gap between ecology and economy, bringing together protection of the environment and financial viability to show that these solutions are not expensive fixes to problems, but rather opportunities for clean economic growth.

The Solar Impulse 2 solar-powered aircraft departed from Abu Dhabi in the United Arab Emirates, traversed Asia, then

completed its longest leg from Japan to Hawaii. On that leg, the aircraft’s batteries sustained substantial damage that required repair, but the flight eventually continued from Hawaii to California, across the U.S., over the Atlantic Ocean to Spain and back to its starting point in Abu Dhabi. Solar Impulse 2 completed its 26,000-mile round-the-world mission, July 2016.

Sessions: Maintenance and the Small Department

One of many educational seminars, this Monday, October 15th session will focus on how the small department keeps its planes in the air and pilots and passengers safe. A discussion regarding Minimal Equipment Lists that will provide an overview on how to use them, and when to use them will be the focal point for the first part of this session. Additionally, the session will address what documentation the department must maintain and what must be on the aircraft. Maintenance may be arguably the most taken for granted piece of the operation until something goes wrong.

NBAA-BACE is a three-day business event for the aviation industry. Full registration for NBAA-BACE provides access to indoor exhibits at the Orange County Convention Center, the static display of aircraft at Orlando Executive Airport and education sessions for all three days of the show.

Visit www.nbaa.org for registration details. ■

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Western AME Association



President's Message

The Western AME Association is pleased to announce we have confirmed the date and time of the next symposium and trade-show. You can find us at the Coast Plaza in Calgary on March 20-22, 2019 with the theme "The AME, Guardian of the Vested Interest."

And interests are high. Passenger travel in Alberta is at an all time high, with peak travel season consistently seeing over two million passengers a month and growing. Two new airlines were launched in the province this month while existing airlines are seeing record passenger load, and record profits.

This is consistent with other provincial economic indices. New motor vehicle sales are the highest they have been in years, while receipts from retail trade have never been higher. Meanwhile, despite the slowdown in the oil and gas sector, there have never been more people working in Alberta than there are today. Of particular note is the former Premier Brad Wall of Saskatchewan, who after making a political career out of deriding the policies of Alberta has quit politics to migrate to Alberta (which has overtaken Saskatchewan as the prairie province with lowest unemployment) to take a position in the private sector. Welcome to Wild Rose Country, Brad.

Although operators tended to see maintenance as a cost, not a revenue generator, we still promoted the important aspects of our job: professionalism, skill, and especially keeper of the flying public safety. But now we are looking at maintenance rather than as a financial burden, but as a financial safeguard. With complex and ever changing systems, new technologies, increased demand, combined with the need for streamlined operations and tight margins, a skilled AME is invaluable.

Consequently, investment in AMEs is also invaluable. Whether maintaining fleets or performing third party maintenance, the return on investment in AME training is a safe bet. For this, WAMEA looks forward to working with our friends in industry to find ways to collaborate in initiatives to get more knowledge capital on the market now and in the future.

To get the conversation going, contact WAMEA to inquire about becoming a member or corporate member. Hope to see everyone in the spring, and until then, have a great summer from everyone at WAMEA!

— Jarrah Elhalabi
President, WAMEA

AEA Canada Connect Conference

The annual AEA Canada Connect Conference is a two-day event that personally connects general aviation industry professionals. Formerly known as the AEA Regional Meetings, the AEA Connect conferences have grown beyond simply receiving regulatory updates and technical training via a classroom-style lecture — attendees are now more engaged than ever in the educational environment with interactive discussions and analysis. Avionics repair stations, manufacturers, regulators and educators show an increasing desire to come together, network and personally conduct serious business — they want to connect in person.

Where: Sheraton Cavalier Calgary Hotel, Calgary, Alberta
When: September 6-7, 2018

ATAC Canadian Aviation Conference & Tradeshow

The Canadian Aviation Conference and Tradeshow has been the national gathering for operators, suppliers to the industry, and government stakeholders involved in commercial aviation and flight training in Canada for over 80 years!

Where: Westin Bayshore Hotel, Vancouver, BC
When: November 13-15, 2018

www.wamea.com

Pacific AME Association



About us

PAMEA is a non-profit association comprised of aircraft maintenance engineers, aircraft maintenance personnel and aviation industry corporate members.

PAMEA is an active member of the Canadian Federation of AME Associations (CFAMEA).

www.pamea.ca
pamea@telus.net



Central AME Association



Red River College acquires Stevenson Aviation Campus

The Province of Manitoba is helping Red River College (RRC) reach new heights in aviation and aeronautics training by supporting the college's acquisition of its successful Stevenson Aviation Campus, announced Education and Training Minister Ian Wishart.

"Our government recognizes the leadership shown by Red River College in the purchase of its campus property, where it provides essential training for Manitobans in a skilled and high-demand industry," said Wishart. "This is a fiscally responsible plan that will help ensure many more people can pursue a career in aeronautics and learn in an exceptional environment with industry leaders and experts."

The Manitoba government enabled the purchase of the Stevenson Aviation Campus by approving RRC's plan to borrow up to \$8 million to acquire the previously leased facility. RRC requires government approval to borrow, as set out by The Red River College Act. By purchasing the campus from its landlord, Hubert Kleysen, RRC will save nearly \$1 million over the term of the mortgage and will have greater flexibility to grow and adapt its renowned aviation and aeronautics programs.

"Red River College works shoulder-to-shoulder with industry to deliver cutting-edge training at our Stevenson Campus, and to provide students with the job-ready skills they need to compete here at home, and on a national and global stage," said Paul Vogt, RRC president and CEO. "By acquiring our campus – with the support of the provincial government – we will continue to provide strong workforce training for Manitoba's aerospace and aviation sector, which is one of the largest in Canada. This move will make us more agile and ensure that we are successful for generations to come."

est in Canada. This move will make us more agile and ensure that we are successful for generations to come."

RRC's Stevenson Aviation Campus offers diploma programs for aircraft maintenance engineers, aerospace manufacturing technicians and gas turbine engine repair. Each year, RRC trains about 400 students in these programs, boasting high graduation rates in the 80 to 90 per cent range.

"Boeing Canada Winnipeg is proud of our diverse, talented, and innovative workforce, many of whom are graduates of Red River College and were trained at the Stevenson Campuses," said Kim Westenskow, GM, Boeing Canada Winnipeg. "As one of the largest aerospace composite manufacturers in Canada, our partnership and collaboration with the college has been imperative in advancing our role in the global aerospace industry. We are proud to celebrate this important milestone with you today, and a bright future ahead."

The campus, located on the west side of Winnipeg James Armstrong Richardson International Airport, also offers specialized training for individuals already working in the industry to help them meet certification requirements and continually upgrade their skills and knowledge. All programs are developed with industry partners and follow federal aerospace guidelines.

Over 5,000 people are directly employed by the aerospace and aviation sector in Manitoba. Aerospace manufacturing, repair and overhaul, training and related services contribute \$1.9 billion to Manitoba's economy every year. The province is home to the third-largest aerospace sector in Canada.

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2018 AME Conference & Trade Show

Our annual conference and trade show will take place November 7-9, 2018 at the Hilton Meadowvale Hotel and Conference Center in Mississauga. The conference committee is hard at work with planning and preparations. Wednesday will feature a Transport Canada session for Ministers Delegate training and in the later part of the day the exhibitors will have access to set up their booths and displays.

Thursday will see an intensive program with keynote speakers and presentations from several international maintenance organizations. On Thursday starting at 4:30 pm, there will be an "Industry Social" in the exhibit hall. This is a perfect opportunity to mingle and meet with exhibitors and peers. Friday will continue with more specialized sessions for all interests and operators. The Annual General Meeting of

the AME Association of Ontario is tentatively scheduled for a morning session.

The very popular Skills Competition will be returning. Join us to watch the industry's leading certified aircraft maintenance technicians, engineers and students compete in several challenging skills tests. Watch as they compete with current and future maintenance professionals who will test combined abilities against their peers. The purpose is to raise awareness of the training and skills needed to provide safe and airworthy aircraft worldwide! Check our web site for up-to-date information on the sessions as well as links to register and special hotel rates. <https://ame-ont.com/>

— Submitted by Stephen Farnworth for the Board of Directors



News from the Rock

Hello fellow AMEs, apprentices, corporate members and students. It's newsletter time again and an opportunity to update things on this end of the province. The big news recently is the 2018 Atlantic Region Aircraft Maintenance Conference which was held at the Westin Hotel in Halifax, Nova Scotia April 18-20, 2018.

This year's conference was the 40th annual conference and there was an excellent turnout of delegates and displayers. There was an excellent technical program with some very interesting technical speakers. The technical program was approved by Transport Canada as meeting the requirements of recurrent training as per CARS 573.06. The Meet and Greet on Wednesday evening was well attended and enjoyed by those in attendance. It was an opportunity to renew old acquaintances and make new ones.

A vital part of every conference is the Awards Banquet and Awards ceremony. The three awards and two bursaries were presented to the following recipients:

- Earl Blakney / Aviall Canada Ltd. Award - presented to the outstanding A.M.E. was awarded to Terry Hutchings of Universal Helicopters (Nfld.) Ltd.
- Roger Richard Memorial Award - presented to the retired A.M.E. who has distinguished himself / herself during their aviation career was awarded to Duke Quinlan of Goose Bay, Labrador.
- Newfoundland Government Air Services Memorial Award - presented to an individual / company which has supported the A.M.E. Association (Atlantic) Inc. and / or Atlantic Region Aircraft Maintenance Conference was awarded to Gerald Mallon of Halifax, Nova Scotia.

The two bursaries awarded by the A.M.E. Association (Atlantic) Inc. were awarded to the following:

- Robyn Currie - Nova Scotia Community College
 - Amanda McGrath - College of the North Atlantic
- Congratulations to all the award recipients.

Anneke and her team are to be commended for an excellent job. Although I was unable to attend due to medical reasons, I really missed the conference and I thank you for the get-well wishes. I am looking forward to Moncton next year and St. John's in 2020. Contract negotiations have already begun and the tentative dates are April 22 -24, 2020. There is nothing like planning well in advance.

The HPIAM Course scheduled for Wednesday, April 18, 2018 had to be cancelled due to an injury to instructor, Norbert Belliveau. The course will be rescheduled at a later date (to be announced). We wish Norbert a speedy recovery.

I spoke with Bob Whittle, Base Engineer Training Officer at Cougar Helicopters Inc., and he informs me that operations are extremely busy supporting and servicing the offshore drill rigs and production platforms. There are eight Sikorsky S-92As fulfilling the requirements

of the offshore contracts. Bob Parady has retired as Director of Maintenance, and his position has been filled by Morris Kendell. We wish Bob a happy retirement and best wishes to Morris in his new position.

My next contact was with Maintenance Supervisor Tim Sheppard at the Canadian Coast Guard Helicopter Section. The engineering staff of Bob Quinton, Brian Osmond, Dan Ennis, Steve Williams and Matt Kelly are extremely busy with the introduction of the new Bell 429 and Bell 412 aircraft. These aircraft are soon due for their first annual inspection, which requires an extensive workload. They recently hired Matt Kelly to bolster the maintenance staff. Welcome aboard Matt! Crews are busy preparing for Arctic operations. Have a safe operating season.

I spoke next with Keith Parsons of the Transport Canada District office. Keith and his team of inspectors are busy completing audits and inspections on operators around Newfoundland and Labrador. The workload has increased dramatically to the point where they had to hire another inspector. Carson Goodyear has been hired to fill the position. Good luck Carson.

Jason Simms is the base engineer at Universal Helicopters (Nfld.) Ltd., maintaining a Bell 407 on the Newfoundland and Labrador government contract. He also maintains a Bell 407 owned by Quinlan Bros. Fisheries. The Bell 407 on the government contract is primarily air ambulance but is also used for fire fighting and search and rescue duties. Operations have been really slow due to weather and high winds but things should increase soon with summer just around the corner.

My next contact was with Newfoundland Government Air Services and I spoke with Maintenance Supervisor Jeff Pollett. Jeff and his crew of engineers, (Ralph Roberts, Dave Walsh, Peter Snow and Chris Morris) operate out of the old Cougar Helicopters hanger. They maintain the Beech King Air 350 air ambulance aircraft and with the fire season rapidly approaching, a Canadair CL 415 will be stationed in St. John's for the fire season. The aircraft is due to arrive in the next few weeks. Crews will be out of the Gander base.

Moving away from the airport, you can find GasTops in the Donavan's Industrial Park. I spoke with Shawn Churchill (Calibration Specialist) and he informs me that they are busy and they do oil analysis, tool calibration and other specialized tasks for companies such as Cougar, Provincial Airlines Ltd., Provincial Aerospace Ltd., Canadian Coast Guard and other companies that require their expertise. They also do work for the oil industry.

Another company found in the Donavan's Industrial Park is Pro-Arc Fabricating Ltd. I spoke to owner/operator Elwood White. He does a lot of welding repairs for companies such as Air Canada Jazz, Provincial Airlines, Provincial Aerospace, and Universal Helicopters. He also

does work for Buffalo Airways, Manitoba Government Air Services and other firms out west. Keep up the good work.

My next contact was with Provincial Airlines Ltd. where I spoke with Robert Glasgow, Production Manager. Maintenance crews are very busy maintaining the fleet of DH Dash 8s, Beech 1900Ds, DH Twin Otters and a Metro. PAL operate 4 Dash 8 – 100s, 5 Dash 8 – 300s, 9 DH Twin Otters (flying under the Air Borealis banner) and a Metro doing medevacs and cargo operations. P.A.L. now has 2 Beech 1900Ds, one based in Halifax and 1 based in Montreal on the Blanc Sablon run.

The company is renting hanger space at Dorval airport.

A report from Provincial Aerospace was unavailable but some recent news was the acquisition of the Moncton Flight College by PAL and their parent company in Winnipeg.

This concludes my report. Until next time have a safe flying season.
— *Mel Crewe*

www.atlanticame.ca

PAMA SoCal Chapter



April 2018 Meeting Wrap

The SoCal Chapter thanks Mr. Mike Broderick, Product Applications and all at Trace Worldwide for their time and expert technical presentation on “Mechanics, Pilots and Safety in Maintenance” and HRD

Aero Systems for hosting the elegant dinner on April 10th at the 94th Aero Squadron Restaurant in Van Nuys, California.

www.socalpama.org

Central Ohio PAMA



About Us

COPAMA is an affiliated chapter of the Professional Aviation Maintenance Association (PAMA) a national association of aviation maintenance technicians. Membership requirements in COPAMA are simple. You must have an interest in aviation maintenance. Our membership includes Aviation Maintenance Technicians (AMTs) from the airline, corporate and general aviation communities as well as pilots, vendors, students and companies, all with the goal of aviation safety.

Some of the opportunities of membership in our organization are:

1. Monthly meetings with presentations — many approved for IA renewal and FAA, AMT Awards
2. A forum for discussing current aviation events
3. An opportunity for AMTs to network with other professionals

4. Opportunities for students to shadow technicians on the job; take tours and discuss the aviation maintenance profession
5. Scholarships for students of the Aviation Maintenance Technology Programs
6. Social gathering opportunities such as the Central Ohio Aviation Golf Outing (COAGO) and the Holiday Dinner
7. District Science Day and Youth Aviation Adventures participation and sponsorship

Be a content contributor!

If you know of any upcoming events, pass us an email including some basic information and we'll post it here for other members to view.

www.copama.org

If you'd like to contribute your professional association's newsletter to AirMaintenance Update, contact our editor, John Campbell via email at: amu.editor@gmail.com

Eddy current testing Simplified



Above: This tech is looking for abnormalities and cracks on and around an aircraft part using an eddy current.

Innovative flaw detection devices can streamline the testing of a wide variety of aircraft parts while easing lift-off and operation.

In aircraft maintenance and repair, eddy current devices have long been used to nondestructively test (NDT) wheels, struts, propellers, airframes, hubs, engine components and other parts for flaws such as cracks, fatigue or corrosion in a variety of metals such as aluminum and steel alloys.

This traditionally involves multiple eddy current test instruments to address the full scope of work, which can involve inspecting surfaces, welds, tubing, and bolt holes.

“When it comes to metal fatigue testing, there are a number of different ways to test the materials,” says Beau Klingbeil, General Manager of Eclipse Aero-

space Inc.’s Chicago service center, which provides complete servicing of the manufacturer’s twin-engine, single pilot jet line of aircraft. “Eddy current is the least expensive, least invasive way of doing those tests so we typically end up using it on a weekly basis.”

While meter type instruments are traditionally limited to aluminum airframe inspection with a set frequency and probe type, more sophisticated impedance plane units that can be set to a variety of frequencies allow for testing in a much wider range of applications. However, these versatile tools can be quite complicated to use – almost too complicated – even for those with some training.



Above: This nondestructive inspection technician is performing an eddy current test to check for problems that may compromise the aircraft's structural integrity.

Fortunately, for busy Airframe and/or Powerplant (A&P) mechanics that do not specialize in NDT testing, yet are responsible for a breadth of repairs, streamlined testing using sophisticated impedance plane devices is now possible. These devices can provide very accurate test results and dramatically simplify operation while utilizing a wide range of probe types.

Simplifying Lift-Off and Operation

All-digital eddy current instruments, utilizing incremental push button adjustment instead of rotational knobs, are common in aviation repair. However, operating the devices can be complex to the point that mechanics unfamiliar with their peculiarities are often forced to pull out the manual to set up and use them.

This is particularly true when it comes to lift-off, which is required at the start of eddy current testing to offset any surface abnormalities or hand movement that could distort accuracy of the measured material. During lift-off with

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Above: A specialist at a non-destructive inspection shop uses an eddy current to search for defects in an aircraft part. An eddy current is the outer ring of a magnetic current

such instruments, mechanics typically end up pressing buttons and waiting for the computer processor to rotate through the set-up process, which can be agonizingly slow.

“With most digital eddy current units, you push buttons to incrementally set a variety of different parameters,” says Klingbeil, who is an A&P mechanic and Level 2 certified in eddy current testing. “You have to constantly go back and forth to adjust things like the single amplitude, phase angle, and vertical/horizontal position.”

Instead, Klingbeil found a better alternative by turning to an impedance plane eddy current instrument by Centurion NDT (www.centurionndt.com), a Streamwood, Illinois based manufacturer of portable eddy current and ultrasonic equipment.

“I can step up for an eddy current test in minutes and be ready to go with the NDT-1100,” says Klingbeil. “The portable unit is very easy to use and performs a variety of tests.”

The instrument, which is about the size of an iPad with an LCD screen, will locate surface and near-surface defects and conductivity changes in magnetic and non-magnetic materials, and can cover about 85 percent of the applications for eddy current testing that might be performed. This includes crack detection; sorting classes of materials according to hardness alloy, carbon content, tensile strength, and grain structure; as

well as measuring coating thickness, sheet thickness, and the relative conductivity of critical materials.

Unlike traditional all-digital units, the instrument has an automatic balance/null feature that substantially reduces set-up time for manual operation. By moving the probe and turning a phase control knob on the front panel, lift-off can be completed in seconds.

According to Klingbeil, the unit is very easy to use at lift-off and during operation, which tends to eliminate common errors of adjustment that can otherwise occur.

“For me, the reason it’s so easy to use is that you just enter the frequency with a push button, and then turn knobs to fine tune everything else,” he says. “Because of how easy it is to use, I don’t deal with a lot of false indications. It eliminates most of those.”

In regards to ease of use, he adds, “When you’re adjusting things like the single amplitude, the phase angle and even the vertical and horizontal position, you don’t use a push button that functions very incrementally. Instead, you can fine tune it exceptionally well and accurately with knobs.”

Since mechanics often must deal with a full range of testing from the airframe to the wheels, it is also important to select an eddy current instrument that accommodates a large array of probe and coil types.



Above: Eddy testing has found a crack inside an aircraft part. An eddy is an electric current in a conducting material that can show cracks unseen to the human eye.

In the case of Eclipse Aerospace's Chicago service center, Klingbeil stocks about a half dozen probes from Centurion NDT.

The manufacturer of portable eddy current and ultrasonic instrumentation makes a wide variety of probes and coils. Digital frequency selection, probe drive and impedance adjustments allow the operator to optimize system performance for whichever probes or coils are selected.

According to Klingbeil, the Chicago service center utilizes two pencil probe testers with different frequencies, two probes for wheel specific testing, and two bolt hole probes to test different types of wheels.

"The pencil probe testers have different angles because some areas we have to NDT are hard to reach," says Klingbeil. "One pencil probe tester is straight, one is angled 90 degrees to improve reach."


Among the most specialized probes are those utilized to detect heat damage along the wheel bead seat, the critical area where the rubber edge of a tire contacts the wheel.

In this regard, Centurion NDT offers an extensive library of wheel bead seat probes, which accommodate the variety of wheels manufactured for the industry.

To improve accuracy and ease eddy current testing of the wheel bead seat,

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the company also offers a wheel turntable accessory. Instead of manually turning the probe around the wheel, which can lead to less reliable test results, the motorized turntable provides a constant rotational speed specific to the diameter size of the wheel half. With greater consistency, even the smallest cracks are more clearly visible on the screen, without the more erratic results common to manual methods.

Overall, Klingbeil recommends such simplified, versatile eddy current test units to other A&P mechanics at fixed base operators and major haulers alike.

"I'm an airframe & power plant mechanic, so NDT is not my primary job; it's something I've certified along the way," says Klingbeil.

He adds, "If you're a novice learning how to do NDT, it's a good unit because of the simplicity and accuracy. You could use it at a service center platform or in the field for mobile response.

"This will do everything that other units will, but is a lot faster and more portable." ■



The Colour of Grease



Proper and timely lubrication of moving parts is the most basic of maintenance procedures. That doesn't mean things can't go wrong.

On 12 July 2016, an Air Georgian Limited Beechcraft 1900D (serial number UE-330, registration C-GORF) was operating as Air Canada Express flight GGN7212 from Lethbridge Airport, Alberta, to Calgary International Airport, Alberta, with two crew members and 15 passengers on board. When the landing gear was selected down for the approach into Calgary, the flight crew observed that there was no gear-safe indication for the nose landing gear. The flight circled east of Calgary for about an hour while the pilots attempted to rectify the problem. An emergency was declared. The aircraft

landed at 0720 Mountain Daylight Time, during daylight hours, with the nose gear in a partially extended position. No fire occurred, and there were no injuries.

History of the flight

Air Georgian Limited (Air Georgian) flight 7212 (GGN7212) was a scheduled Air Canada Express flight from Lethbridge Airport (CYQL), Alberta, to Calgary International Airport (CYYC), Alberta, on 12 July 2016. The flight was operated using a Beechcraft 1900D, registration C-GORF, with 15 passengers

(including one infant) and two pilots on board. The first officer was the pilot flying and occupied the right-hand seat; the captain was the pilot not flying and occupied the left-hand seat.

GGN7212 departed CYQL at 0531 and climbed to the flight-planned altitude of 11,000 feet above sea level (ASL). The flight progressed normally into CYYC until 0610, when the flight crew selected the landing gear down. When the landing gear began to extend, a grinding, banging noise was audible. When the landing gear extension sequence stopped, the flight crew observed one green down indicator light for each of the main landing gears, but no green indicator light for the nose landing gear. The in-transit light in the landing gear handle was extinguished.

The flight crew requested radar vectors in order to perform the appropriate checklist and to cycle the landing gear. They observed the same indication as before. At 0640, they performed a flyby of the control tower. The personnel in the tower observed that the nose landing gear was not in the fully extended position. The nose landing gear was trailing about 20 to 30 degrees below the horizontal retracted position.

At 0650, GGN7212 entered a holding pattern east of the airport at 8,000 feet ASL. The flight crew was in contact with Air Georgian maintenance, and troubleshooting continued. The landing gear was cycled again, both hydraulically and manually, with no change in the indication. A Calgary Police Service aircraft was in the area and its crew offered to look at the aircraft. They communicated that the nose landing gear was in a trailing position, but they could not see any fluid leaks.

At 0700, GGN7212 had 800 pounds of fuel remaining, and it was decided to land the aircraft. The flight crew and Air Georgian management discussed considerations of what to do with a partially extended nose landing gear. It was decided that a normal landing configuration would be used and that the nose would be lowered to the runway surface as smoothly as possible.

The flight crew requested vectors for the visual approach to Runway 35R at 0705 and declared an emergency. A few

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minutes later, they requested that airport rescue and firefighting vehicles be put in position. At this time, the captain took over pilot-flying duties from the first officer. At 0710, the captain briefed the passengers on the landing and asked them to review the emergency exits and brace position on the briefing card. He also stated that no one was to get up and exit the aircraft until instructed to do so by the flight crew.

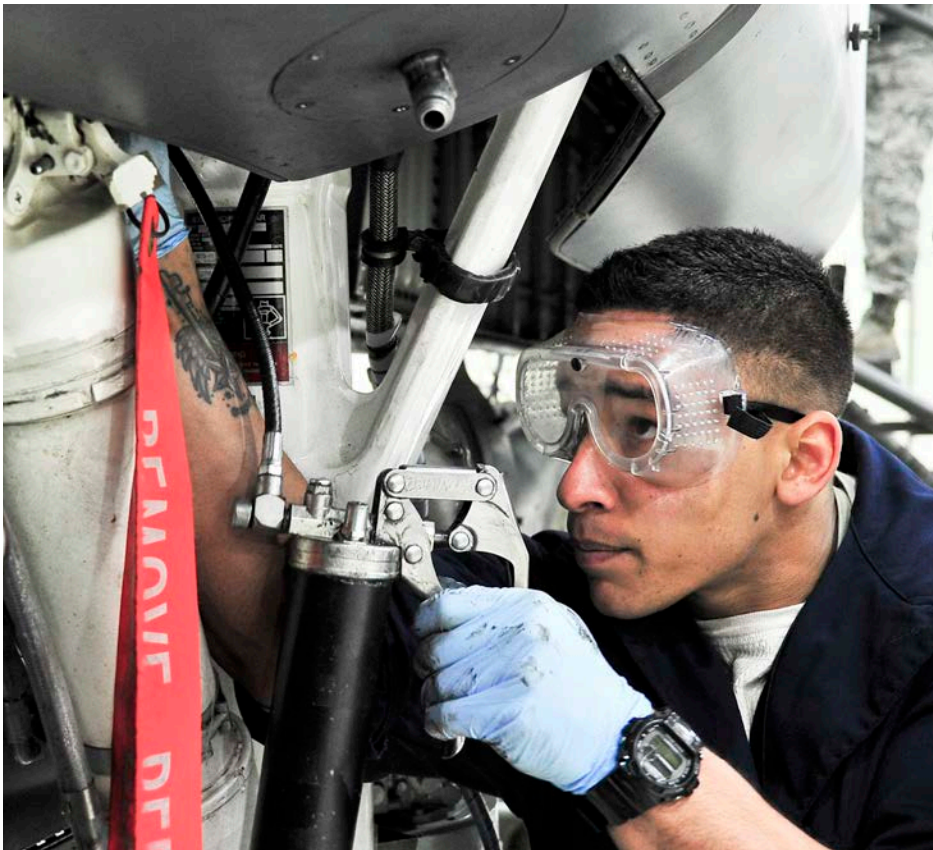
At 0717, GGN7212 was on final approach to Runway 35R and was switched from the control tower frequency to the emergency frequency. A few minutes later, at about 300 feet above ground level (AGL), the captain instructed the passengers to brace. At 0720, GGN7212 touched down on the main landing gear. The first officer feathered both propellers, placed both engine condition levers in the fuel cut-off position, and pulled both FIRE PULL/T handles. About 20 seconds later, the nose touched the runway. The aircraft slid on its nose for another 20 seconds before coming to a stop 6950 feet from the runway threshold. Emergency vehicles reached the aircraft

in 30 seconds, and all passengers and crew deplaned within one minute.

Some smoke and fumes were present in the cabin due to the nose scraping along the runway, but there was no fire. The actions of the flight crew resulted in minimal damage to the aircraft and no injuries to the passengers. Damage to the aircraft was limited to the nose landing gear components, the nose gear door and gear light, as well as two propeller tips on each side of the aircraft that contacted the runway.

Landing gear description

The Beechcraft Corporation Model 1900D Airliner Maintenance Manual describes the 1900D as equipped with a retractable tricycle landing-gear system. The nose and main landing-gear assemblies are extended and retracted by a hydraulic system consisting primarily of an actuator located in each wheel well, a hydraulic power pack located in the left wing, and hydraulic plumbing. During extension and retraction, the nose gear actuator exerts pressure through



an aluminum yoke fitting attached to the end of the actuator piston. This yoke is attached to the middle of the upper and lower drag braces, and causes the drag braces, when folding or unfolding, to extend or retract the nose gear. The yoke is attached and pivots through the braces by means of a pivot/stop bolt, part number 114-820107-1.

Nose landing gear actuator yoke

The failure of the retract-and-extend mechanism of the nose landing gear was initiated by a yoke lubrication problem. The bolt with part number 114-820107-1 on the occurrence aircraft was not lubricated as required. The yoke should turn freely around the yoke's pivot/stop bolt; however, the occurrence yoke's pivot/stop bolt was seized in the yoke due to deteriorated grease and corrosion for two reasons:

First, the deteriorated grease did not provide lubrication. Second, insufficient lubrication allowed the penetration of moisture between the bolt and the bore surface, causing corrosion on both surfaces. The bolt seizure resulted in abnormal loading on the yoke's pivot/stop bolt and the actuator clevis during retraction and extension of the nose landing gear. This led to fatigue cracking and failure of the yoke's pivot/stop bolt ends.

From 31 August to the end of September 2016, the operator examined the condition of nose landing gears in its fleet and found five more Beechcraft 1900D aircraft with non-airworthy nose landing gear yoke pivot/stop bolts, as well as several other nose landing gear bolts.

Lubrication and inspection processes

The investigation examined the processes for lubrication and inspection of the nose landing gear. The lubrication task process at Air Georgian was the same for the lubrication schedule; a bolt inspection; a detailed inspection; and a lubrication following aircraft cleaning.

Above: The nose landing gear pivot-stop bolt was not properly lubricated because maintenance personnel were not adequately trained on lubrication and the use of equipment.

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Technicians and AMEs would reference the applicable sections of the Beechcraft Corporation Model 1900D Airliner Maintenance Manual to determine which bolts and parts needed lubrication and which grease was required to complete the task. A table of greases was provided to ensure that the technician or AME used the correct grease. Some senior maintenance personnel reported that the task required the technician to do the following:

1. Wipe away the old grease.
2. Attach the tube of the grease gun to the bolt nipple and manually squeeze the grease gun handle until sufficient grease is expressed.
3. Monitor for old grease seeping from all applicable seams of the bolt, indicating that the bolt is lubricated and serviceable.
4. Monitor for new grease seeping from all applicable bolt seams, indicating that new grease is successfully expressed and has penetrated all relevant areas.
5. Wipe away excess grease as necessary.

Some senior maintenance personnel reported that bolt lubrication deficiencies could be monitored during the lubrication task by performing step three, above. If no old grease was seen being expelled, or if it was not possible for the new grease to enter the lubrication point in step two, this could indicate that the bolt or part was dry and/or blocked with old, hardened grease, and therefore unserviceable. The defect would then be recorded and actioned on an additional work card.

Inspection tasks

As part of the periodic bolt inspection and detailed inspection, technicians and AMEs were required to perform the lubrication. Technicians and AMEs were then required to test the pivot/stop bolt (and others) for free rotation to determine whether the bolt was sufficiently lubricated and serviceable. This required technicians and AMEs to dismantle the bolt and use their fingers to freely rotate it. If any inspection discrepancies were found, technicians and AMEs were required to “determine the cause and replace parts as necessary.” If any new parts were required, an additional work card was to be completed. The lubrication schedule, bolt inspection, and detailed inspection were signed off as part of the aircraft maintenance release by an appropriately authorized AME who was an Aircraft Certification Authority (ACA).

Air Georgian lubrication and inspection maintenance schedule

Air Georgian maintenance personnel were required to lubricate and inspect the occurrence bolt on the nose landing gear at times specified in the Beechcraft Corporation Model 1900D Airliner Maintenance Manual.

When greasing the pivot/stop bolt, a technician is required to grease other bolts on the nose landing gear as part of the same schedule; some of these bolts have different grease requirements. The lubrication schedule referenced a specific table of greases for each bolt or set of bolts to ensure that the

technician used the correct grease. The Beechcraft Corporation Model 1900D Airliner Maintenance Manual warned against using the wrong grease on the wrong parts, given that some greases wash off easily and some cause corrosion.

The technician was required to source the correct grease from either the hangar grease cabinet or a pre-loaded grease gun. The Calgary sub-base had transparent grease guns to provide a visual indication of which grease was in which grease gun. In addition, the two primary greases for the Beechcraft 1900, the only aircraft type serviced in Calgary, were of contrasting colours.

The Toronto maintenance main base was responsible for two aircraft types and multiple grease types of varying colours. The Toronto maintenance base did not have transparent grease guns, and it was not possible to view the actual grease cartridge that had been loaded inside. It is not possible to determine the grease type by squeezing out the grease, as many types of grease are the same colour.

It was observed that not all grease guns had been loaded with the grease type matching the label on the gun. The investigation determined that this was not uncommon at Air Georgian. To reduce the risk that the wrong grease was used, a technician on one crew had been assigned the specific task of checking grease guns, and technicians in general were told by the Toronto base senior maintenance staff to remove cartridges before each use to make sure the gun contained the correct grease. These additional requirements and procedures were not documented in any Air Georgian manuals.

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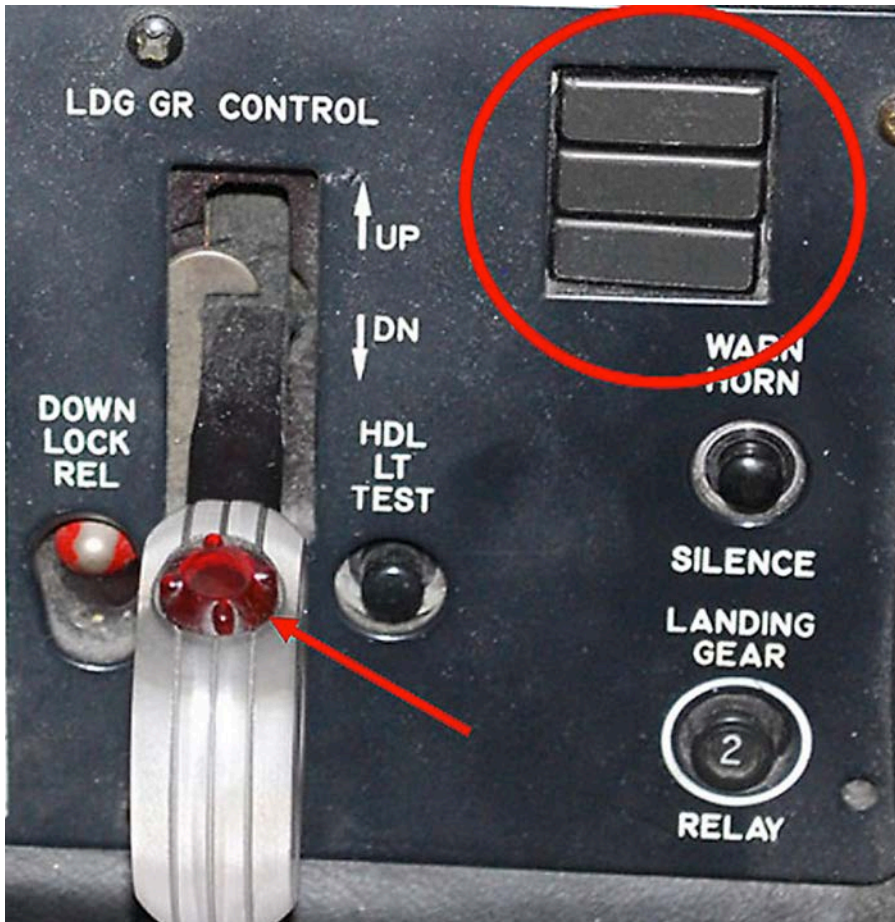
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Above: Beechcraft 1900D gear-down indicator lights (circled in red) and landing gear control handle (arrow).

The process of removing and checking the grease cartridges prior to each use added to the workload in Toronto.

Some personnel commented on the difficulty and inconvenience of the grease guns, as usability varied. Some of the grease guns required much more force than others to express the required grease and some leaked grease when in use. The Air Georgian Maintenance Procedures Manual, under Material Control, has instructions to identify unserviceable equipment with a tag and place in quarantine or leave on the hangar floor if equipment or material is large. There were no unserviceable grease guns observed in quarantine.

Operating environment

The pivot/stop bolt is located three-quarters of the way up the nose landing gear, nearly inside the wheel well. However, some other bolts requiring servicing are

located at the top of the nose landing gear, up inside the wheel well. Difficult access and shadows made the physical and visual aspects of the inspection and lubrication tasks more challenging, and supplemental lighting was required to perform the task.

Workload and tasking

At the time of the occurrence, Air Georgian had recently procured more CRJ-200s, increasing the number of aircraft within the fleet. It was not uncommon for a shift to experience high workload, which could include a combination of scheduled and unscheduled tasks on the Beechcraft 1900D and the CRJ-200. Unscheduled aircraft serviceability issues often took priority and scheduled tasks were deferred.

Examples taken from the Air Georgian computer-tracking program indicated multiple task-extended entries,

primarily due to workload and personnel shortage.

There was no standardized practice or procedure for transitioning between a deferred task and a new task. Technicians had a varied approach to task progress tracking. Some would initial each step, some would initial each section, and some checked off each page as a whole. If a scheduled task was interrupted and temporarily suspended, for example when a technician was halfway through lubricating the nose-wheel gear, it was not always possible to determine what had been done when the technician returned or a new technician took over the task.

Analysis

There was no indication that Air Georgian's flight operations contributed to this incident. This analysis focuses on the maintenance and organizational factors that contributed to the incident, as well as on the Transport Canada (TC) regulatory oversight program.

The investigation could not determine the exact errors that contributed to the lubrication deficiencies, although an examination of the lubrication and inspection tasks made it possible to determine the likely errors. An examination of maintenance conditions also made it possible to determine the likely contributors to these errors.

Lubrication performance

The failure of the retract-and-extend mechanism of the nose landing gear was initiated by a yoke lubrication problem. The lack of lubrication caused the pivot/stop bolt in the nose landing gear yoke to seize and break, which eventually prevented the nose landing gear from fully extending.

The investigation conducted an analysis outlining the steps that should typically be performed to ensure effective lubrication and avoid errors. To complete these steps effectively, Air Georgian would have needed several defences in place. If any of these defences were deficient, the probability of error at one or more steps would be increased.

If maintenance personnel do not

correctly perform maintenance procedures as required in maintenance schedules, there is a risk that the safety of flight will be compromised.

At Air Georgian's Toronto main base, there were pre-loaded, labeled grease guns that did not necessarily contain the grease type matching the label on the gun. This occurred so frequently that there was an informal practice whereby technicians would remove the cartridge before each use to make sure the gun contained the correct grease. This equipment issue could have contributed to errors for example by increasing the probability of selecting the wrong grease. The technician or aircraft maintenance engineer (AME) may not have been able to detect the error, given that many types of grease are the same colour.

If there is no documented procedure for correctly loading, labeling, and servicing grease guns, or if grease guns are not correctly loaded and labeled, or serviceable and usable, there is a risk of inadequate lubrication that can lead to component failure.

Transport Canada activities after the occurrence

Following the occurrence, TC conducted two surveillance activities at the Toronto/Lester B. Pearson International Airport (CYYZ) ramp and identified deficiencies related to parts of the aircraft other than those involved in the nose landing gear lubrication. A follow-up ramp inspection addressed only those deficiencies.

A ramp inspection of an Air Georgian Beechcraft 1900D aircraft in Calgary was also conducted. Despite the known lubrication issues concerning the nose landing gear lubrication, TC personnel did not examine those areas of the aircraft. Only aircraft documents were verified.

TC conducted another PI on 14 February 2017, and concluded that all areas were acceptable and that the maintenance process at Air Georgian met the regulatory requirements. The TSB was unable to obtain detailed training records for the personnel involved, and the summary sheets provided to the TSB lacked sufficient detail to assess the level of training of Air Georgian maintenance personnel. The investigation was unable to determine whether the training records supplied to the TSB differed from those made available to TC.

Findings as to causes and contributing factors

1. The lack of lubrication caused the pivot/stop bolt in the nose landing gear yoke to seize and break, which eventually prevented the nose landing gear from fully extending.
2. The nose landing gear pivot/stop bolt was not properly lubricated because maintenance personnel were not adequately trained on lubrication and the use of equipment.
3. Air Georgian's safety management system (SMS) was ineffective at identifying and correcting improper and unsafe maintenance practices relating to nose landing gear lubrication tasks.

4. Air Georgian's quality control program contributed to ineffective lubrication activities going undetected for an extended period of time prior to the occurrence.

5. Transport Canada's surveillance of Air Georgian focused primarily on its SMS rather than regulatory compliance. As a result, ineffective lubrication processes went undetected in the process inspection and two program validation inspections prior to the occurrence.

Findings as to risk

1. If maintenance personnel do not correctly perform maintenance procedures as required in maintenance schedules, there is a risk that the safety of flight will be compromised.
2. If there is no documented procedure for correctly loading, labeling and servicing grease guns, or if grease guns are not correctly loaded and labeled, or serviceable and usable, there is a risk of inadequate lubrication that can lead to component failure.
3. If there are no documented procedures or standard practices to manage task interruptions safely and effectively, there is a risk of task-related error that could compromise the airworthiness of an aircraft.
4. If maintenance organization training programs do not provide personnel with appropriate training that reflects their responsibilities, there is a risk that variable on-the-job performance will compromise the validity of a maintenance release.



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5. If maintenance personnel responsible for training are not provided with the necessary skills to teach, demonstrate, and validate competencies, there is a risk of variable on-the-job performance and task-related error that could jeopardize the airworthiness of an aircraft.

6. If supervision practices in an approved maintenance organization do not ensure that maintenance tasks have been completed in accordance with required procedures, there is a risk that task-related errors will remain undetected, jeopardizing the airworthiness of an aircraft.

7. If maintenance training documentation does not contain detailed and standardized information on course content, there is a risk of variability in training outcomes.

8. If maintenance training records do not exist, or are not accurate or up to date, there is a risk that maintenance personnel will perform tasks that they are not qualified or authorized to perform, thus jeopardizing the airworthiness of an aircraft.

9. If maintenance issues are not reported through an operator's safety-reporting system, there is a risk that maintenance hazards will not be identified and mitigated.

10. If quality assurance programs are ineffective, there is a risk that opportunities to detect problems will be lost and deficiencies will persist.

11. If Transport Canada does not adopt a balanced approach that combines inspections for compliance with audits of safety management systems, there is a risk that improper maintenance practices will not be identified, which may lead to incidents and accidents.

Safety action taken

Air Georgian has taken the following safety actions as a result of this occurrence:

1. In September 2016, a fleet campaign was carried out to address the greasing and bolt issue. Many bolts, including the pivot/stop bolts, were found to need replacement and servicing.

2. As a result of this fleet campaign, Air Georgian advised Transport Canada that an additional inspection item has been added into the company's maintenance tracking system, reducing the bolt inspection interval from 1200 hours to 600 hours.

3. In January 2017, Air Georgian hired a manager for maintenance training.

4. Human-factors training on distraction covers the need to track and document steps in the workflow. In August 2017, Air Georgian launched a communication and awareness campaign called "Flag It, Tag It and Snag It!"

(These are excerpts from the report written by the Transportation Safety Board of Canada following its investigation into this occurrence. The Board authorized the release of this report on 25 April 2018. It was officially released on 29 May 2018.) ■

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Is BlackFly a realistic glimpse into the very near future of “three-dimensional transportation” or merely a novel gizmo with no actual hope of making the mass market? At the very least, the electric ultralight has Transport Canada’s cooperation.

In early July the Warkworth, Ontario-based “aero vehicle” firm OPENER, Inc revealed its BlackFly; which the company calls “the world’s first ultralight all-electric fixed-wing extreme short/vertical take-off and landing (ESTOL/VTOL) aircraft.” BlackFly is a single-seat Personal Aerial Vehicle (PAV) designed and built for a new world of three-dimensional transportation. BlackFly has simple controls requiring no special skills to master and operate safely. Though BlackFly has full amphibious capabilities, it is primarily designed to easily operate from small grassy areas and travel distances of up to 40 miles at a speed of 72 mph.

“OPENER is re-energizing the art of flight with a safe and affordable flying vehicle that can free its operators from the everyday restrictions of ground transportation,” said Marcus Leng, CEO. “We will offer competitive pricing in an endeavour to democratize three-dimensional personal transportation. Safety has been our primary driving goal in the development of this new technology. BlackFly operators will be required to complete company-mandated vehicle familiarization and operator training. In Canada, ultralight pilot licences are also required.”

The OPENER team has spent the last nine years in stealth mode, designing, developing, and testing new innovative technologies, which have now evolved into the zero-emission BlackFly vehicles. Fault-tolerant design and triple modular redundancy reside at the core of these vehicles. Eight propulsion systems, spread across two wings, provide for multiple-failure security. Years of continuous testing, combined with 1,400 flights and 12,000 miles flown, form the bedrock of OPENER’s development program.

After working collaboratively with Transport Canada for several years, OPENER received permission on July 6th to operate BlackFly as a Basic Ultralight Aircraft. OPENER hopes to continue to collaborate with Transport Canada to safely and progressively expand the use and operating profile of these vehicles. The company’s long-term vision is to integrate these vehicles into a rural/urban commuting network, which would



be powered by renewable energy sources requiring only a fraction of the transportation energy used currently.

Some of the BlackFly’s other features include 30-minute charging, low noise signature, and an automatic return-to-home button, with an option for a ballistic parachute.

OPENER began operations on October 5th, 2011, with the first manned flight of a fixed wing all-electric VTOL aircraft. This event prompted the formation of a stealth company with the sole purpose of pursuing the development of this new technology. In September of 2014, the company reorganized as OPENER and relocated the majority of its operations to Silicon Valley in California. ■

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