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AirMaintenance UPDATE

The Magazine for Aircraft Maintenance Professionals

2019 Recurrent Training Exam

A Top 15 list: the most in-demand spare parts

Transport Canada Approved for R/T

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Good news in Cowtown

WestJet opens YYC Dreamliner maintenance hangar

With an oilpatch in tatters and a recent nasty provincial election that opened new and old wounds, it's understandable that many Albertans are feeling somewhat battle-weary these days. But there was at least some good news in late April as WestJet celebrated the opening of its new Dreamliner maintenance hangar at Calgary International Airport. Member of Parliament Kent Hehr, City of Calgary councillor Jyoti Gondek, Calgary Airport Authority President and CEO Bob Sartor, 1,500 WestJet employees and members of WestJet's executive team attended a ribbon-cutting ceremony.

"The opening of this hangar is another example of how our biggest airline partner, WestJet and the Calgary Airport Authority are working hand-in-hand for the good of the city," said Sartor. "WestJet's investment in its Calgary hub has a direct impact on jobs, the economy and all of the opportunities that come with vital air service connecting travellers to other economies and markets."

WestJet's $50 million investment in the 125,000-square-foot hangar is in addition to the airline's announcement that it will be the first Canadian airline to base its Dreamliner aircraft out of YYC Calgary International Airport. The first three 787 Dreamliner aircraft launched from Calgary on non-stop routes to London, Paris and Dublin on April 28, May 17 and June 1 respectively. Both investments are expected to generate significant economic output and support thousands of direct and indirect jobs in Alberta.

WestJet also recently expanded the list of destinations it serves to 67 with the addition of non-stop Atlanta, Portland and Austin routes from Calgary. WestJet remains the airline with the most destinations, seats and departures out of YYC.

WestJet's hangar accommodates one 787-9 Dreamliner aircraft or up to four 737 aircraft. It increases the airline's campus size to 500,000 square feet or 11 acres. The hangar allows for indoor maintenance on the airline's Dreamliner aircraft and can accommodate up to 130 members of the WestJet technical operations teams with workspace and tools to maintain the company's fleet. ■

Departments

Features

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Upcoming Events

B0105: The Teacher's Aid

Ten tech schools across Canada are on the receiving end of surplus Coast Guard helicopters.

The Government of Canada announced in early May, it will donate surplus Coast Guard assets to colleges and universities across Canada to support their respective aircraft maintenance training programs

The Southern Alberta Institute of Technology (SAIT) in Calgary, Alberta was the first tech school in the country to take receivership of a Coast Guard Messerschmitt-Bölkow-Blohm BO105 helicopter, soon to be followed by nine other educational training institutions that will also receive a donated BO105 helicopter.

The 10 Coast Guard BO105 helicopters were in service in the Canadian Coast Guard for more than 30 years. The first was purchased by the Coast Guard in April 1985, and the last in April of 1988. The helicopter fleet plays an essential part in supporting programs such as ice-breaking, marine communication, aids to navigation, environmental response, waterway protection, conservation and protection, science and support to other government departments as required.

As part of the Coast Guard's Fleet Renewal Plan, the Government of Canada has purchased and deployed 22 new helicopters – 15 light-lift helicopters (Bell 429) and seven medium-lift helicopters (Bell 412EPI).

Altitude East
June 24-26, 2019
St. John's, Newfoundland
www.altitudeeast.com

Saskatchewan Air Show
Moose Jaw, Saskatchewan
July 6-7, 2019
www.saskairshow.ca

EAA AirVenture Oshkosh
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Oshkosh, Wisconsin
www.eaa.org

Quesnel SkyFest
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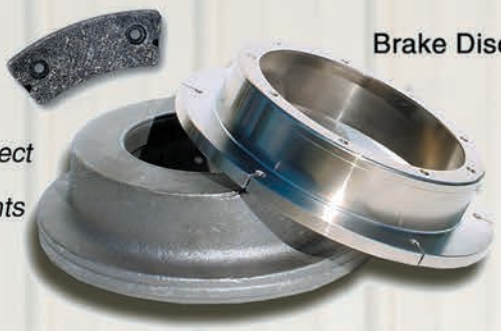

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STCs & new products

Hartzell adds to Top Prop line

Hartzell Propeller has added legacy four-blade structural composite propellers for Beechcraft 1900C and 1900D turboprop aircraft to the company's Top Prop lineup. Lower pricing for each propeller, including polished spinner assembly, is $68,000 for the 1900C and $75,000 for the 1900D. Pricing for the 1900D is the same for both high and low watt de-ice boots. Additional discounts are available to fleet operators directly from Hartzell or one of the company's Recommended Service Facilities.

For information visit www.hartzellprop.com

STC kit has all components for upgrade

Concorde Battery has gained FAA certification for installation of its Platinum Series sealed lead acid batteries to replace original equipment lead acid batteries on Gulfstream models G350 & G450.

STC ST00890DE accommodates the drop-in replacement of RG-380E/46L batteries by way of a battery tray that employs the aircraft original mounting support and hardware. Included in the STC kit are all components required for this upgrade.

For information visit www.concordebattery.com

Corrosion relief for Gulfstream G280 operators

Quiet Technology Aerospace has received STC approval for its sixth airframe-specific carbon fibre engine inlet replacement barrel, which offers a terminating solution for Gulfstream G280 operators over the plaguing issue of engine inlet cowl inner barrel corrosion on the Honeywell HTF7250G engine inlets.

QTA's carbon graphite composite inner barrel comes with a lifetime warranty, assigned to the aircraft's serial number that automatically transfers to any future owner. In addition, the QTA upgraded inlet cowls have lifetime Product Liability Insurance placed via Lloyds of London.

For information visit www.qtaerospace.com

New elastomer is formulated for aerospace

Greene Tweed, a manufacturer of high-performance thermoplastics, composites, seals, and engineered components, has announced the launch of its new Fusion 665, an ultra-low-temperature and chemical-resistant elastomer specifically formulated to meet and exceed the requirements of Aerospace Material Specification (AMS) 7379 and AMS-P-83461. With a temperature range of -70F to 450F, Fusion 665 achieves low-temperature performance without compromising high-temperature performance. Fusion 665 was developed to overcome existing limitations of comparable materials, such as NBR, FKM, or FVMQ (Fluorosilicone). **For information visit** www.gtweed.com

New Anvil shears cut softer materials

The Anvil shears from KNIPEX are designed for cutting a variety of soft material, including rubber, leather and hose, have a cutting capacity for round material up to one inch and can cut flat material up to 1 1/2-inch maximum width. The blade of the Anvil shears is forced against the anvil, which creates an easy and clean cut without damage or deformation on soft materials. Main features for the Anvil shears include a strong, replaceable blade and an opening spring and locking device. The locking device is easy to use and keeps the blades secure when not in use.

For more information visit www.knipex-tools.com

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The PAGE P400K 400 Hz power cable test kit is a comprehensive kit every GSE professional needs. This kit allows for verification of the 400 Hz cable's retention force on each power and control pin, surface temperatures, accurate no-load testing and confirming E&F safety interlock, voltages and phases are correct. **For information visit** www. pageindustries.com

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FLIGHT DECK IMPRESSES SECRET US CUSTOMER

Field Aviation has announced the sale of two EFI-890R flight deck upgrades to an undisclosed US-based customer for their Bombardier Dash 8 aircraft. This sale represents the first two upgrades in the operator's fleet, one being on a Bombardier Dash 8 Series 200 aircraft and the second on a Series 300.

"The obsolescence issues facing the classic Dash 8 airline and special mission operators is significant, and our EFI-890R flight deck upgrade not only solves this problem but provides pilots with consolidated flight guidance and significantly more situational awareness", said Brian Love, Field Aviation's Chief Commercial Officer.

WORLD'S FIRST FLAP-FREE AIRCRAFT TAKES FLIGHT

BAE Systems made aviation history in early May by maneuvering the first aircraft to use supersonically blown air instead of ailerons or other control surfaces. Taking to the skies over Llanbedr Airfield in Gwynedd, northwest Wales; the wing-shaped Magma UAV made use of two new "flap-free" technologies that the company says could one day revolutionize aircraft design. Developed by BAE in collaboration with the University of Manchester and the British government, Magma replaces control surfaces with a simpler "blown air" technology that controls the flow of air over the wings with supersonic puffs of air from the inside.

BOMBARDIER'S DONATION TO CENTENNIAL COLLEGE

In parallel to the opening of Centennial College Downsview Campus Centre for Aerospace and Aviation, Bombardier Commercial Aircraft announced in late April the donation of a CRJ200 aircraft to the Centennial College Aviation Program at its new campus based in Downsview, Ontario.

The CRJ200 is the first one of its kind to grace the Downsview facility hangar; it is also the biggest plane as well as the first-ever commercial aircraft to be received at the site. The aircraft will allow students to have a hands-on experience with CRJ Series technology, and learn on a bigger scale.

KF AEROSPACE INCREASES MAINTENANCE CAPACITY

KF Aerospace rolled out another hangar expansion to augment its maintenance, repair and overhaul capacity at YLW Kelowna. The increased footprint will allow KF to ramp up support for key customers. The new space will add 21,000 square feet to KF's Hangar 1 (South), one of five customer-dedicated hangars at the base. It will bring KF's capacity to a total of 13 concurrent lines of narrow body and regional aircraft maintenance, grow its staffing from 725 to 800 in 2020, and expand the YLW base to a total 370,000 square feet.

In addition to being Canada's largest commercial MRO, KF is the largest private sector employer in Kelowna. KF Aerospace President, Tracy Medve says the project is part of a steady growth program across Canada. "In tandem with the major expansion of our Hamilton base, we are excited to be making additional investments in Kelowna that will help us support our airline partners with world-class maintenance services."

VIH AEROSPACE AWARDED AS9100D CERTIFICATION

Vancouver Island-based VIH Aerospace recently announced receipt of AS9100 Rev D quality management systems certification for its North Saanich facility. The internationally recognized certification is for organizations doing business in the aerospace industry such as manufacturers, contractors, and suppliers. New requirements emphasize the prevention of risk and counterfeit parts. Third party certifying bodies issue certifications. For an organization to maintain AS9100D certification, they will be subjected to annual or regularly scheduled audits where the organization's compliance with the standard is evaluated by the certifying body.

"Attaining the AS9100 Rev D status is a great accomplishment for our company as it allows VIHA to standout in the marketplace as a member of an elite group of companies to hold this level of certification," said VIH Aerospace General Manager Arne Arneson.

REALITY GOGGLES REPLACING PAPER AND RULERS?

Organizers of the MRO Americas maintenance conference have selected the AR-based technology of AerinX among the TOP 10 most promising innovations in the sector. Budapest-based AerinX develops an augmented reality-based system, which promises to make external inspection and related maintenance operations of airplanes and other aircraft simpler, faster and more reliable. The company boasts its technology will become a staple replacement to the current practice of external aircraft inspection using rulers to measure and felt tip pens to mark skin damages.

AIRBUS ADDS AN X-TRA BELUGAXL

As production of BelugaXL aircraft continues to advance as planned, Airbus has decided to "future proof" the company's internal transportation network by adding another next-generation airlifter to the overall fleet. This expansion from the originally-targeted number of five airlifters to a new total of six is meant to ensure the capacity provided by the BelugaXLs: highly modified A330 jetliners tailored to carry large airframe components (within the Airbus production network) that can accommodate a range of potential future scenarios.

"Years from now, we could see situations such as further rate increases for our jetliners or may encounter one of the airlifters being grounded, which would make this 'extra' sixth aircraft an essential part of our transport network," said Bertrand George, head of the BelugaXL program at Airbus.

The no. 1 BelugaXL performed its maiden take-off in July 2018 and will officially enter service later this year. By 2023, the six aircraft are scheduled to be fully operational, replacing Airbus' existing fleet of A300-600ST Super Transporters (also known as Beluga STs).

GULFSTREAM G650ER SHATTERS SPEED RECORD

Gulfstream Aerospace Corporation announced in April that its ultra-long-range Gulfstream G650ER beat a recent competitor speed record while at the same time increasing the distance flown for the farthest business jet flight in history.The G650ER flew from Singapore to Tucson, Arizona, at an average speed of 597 miles per hour over a distance of 8,379 nautical miles. The G650ER's performance beat the previous record by 44 minutes and more than 225 nm, asserting the aircraft's title for flying farther faster than any other jet.

The G650ER departed Singapore's Changi Airport at 4:53 PM local time March 29, crossing the Pacific at an average speed of Mach 0.85 and arriving in Tucson at 5:16 PM local time March 29, with fuel in excess of National Business Aviation Association instrument flight rules reserves. The flight took 15 hours and 23 minutes. ■

Rising insurance costs:

The insurance firm Global Aerospace says aviation insurance claims costs are rising and maintenance practices are a factor in that. Here's why.

Opposite page: The new-generation aircraft engines used in airline applications can cost upwards of $38 million.
Above: One factor driving aviation insurance claims costs higher is advancing technology.

maintenance practices

Pilots, operators, and other aviation stakeholders have observed that aviation insurance claims costs trend upward. Understandably, many ask why that is the case. While there is certainly a "cost of living" component to this increase, it often seems that the rise in claims costs outpaces that index. What, then, is the reason? The answer is that there are multiple factors involved.

One factor driving aviation insurance claims costs higher is advancing technology. For example, some newer aircraft engines have designs that make them more efficient and lighter in weight, but also make them more expensive to repair. In particular, many newer engine compressors are cast as one unit (blades included) and irreparable damage to any area means the entire unit must be replaced at significant cost. Plus, in general, the composite materials used in modern engines are generally more expensive than the traditional materials they replace.

Newer engines are also being built to tighter tolerances. Consequently, it takes less damage to cause an internal engine component to fall beyond repairable limits set by the manufacturer. When this occurs, a full replacement of the damaged component is required.

Above: Newer engines are also being built to tighter tolerances.

The new-generation aircraft engines used in airline applications can cost upwards of $38 million. While extensive repairs may be possible given the high value of the engines, operators are sometimes reluctant to undertake them, preferring to replace the damaged engine instead.

Composite material used in newer aircraft structures is a significant factor in aircraft weight reduction and generally stronger than aluminum. However, damage to a composite structure or component can be difficult to detect, and more costly to repair than aluminum used in most aircraft.

Changing aircraft manufacturing practices affect repairs

Another factor in the upward trend of aircraft insurance claims costs is the impact of changing aircraft manufacturing practices and parts inventory. In order to operate more cost-effectively, many manufacturers today keep very little parts inventory on hand. Many older aircraft are no longer manufactured and replacement parts availability for these aircraft is limited. In these instances, the part may have to be remanufactured at a very high cost. For newer aircraft, if a component

Above: Pratt & Whitney employees work on a PW1100G-JM engine at the Middletown Engine Center in Connecticut.

Above: While extensive repairs may be possible given the high value of engines, operators are sometimes reluctant to undertake them.

part is needed for the repair process, often the part is not in stock and may have to be pulled from the assembly line.

Resolving this dilemma, of course, takes longer than simply obtaining the component from an aircraft manufactures' inventory and sending it to the repair facility. Consequently, an aircraft in need of repair may be out of service longer.

The good news is that manufacturers have been able to adopt this approach largely because improvements in a wide range of areas — from technology to training — have resulted in fewer incidents and less aircraft damage. The bad news, however, is that the reduction in parts availability leads to higher repair costs and greater inconvenience.

The effect of repair preferences

Aviation insurance policies typically state that repairs will be made with components of "like kind and quality." Although this phrase is widely used in aviation and elsewhere, creative arguments have been made about its meaning. In the past, aircraft operators were more accepting of repairing damaged components.

Utilizing new parts during the repair process significantly increases the repair cost when compared with repairing components using methods designed and approved by the Original Equipment Manufacturers' (OEM) engineering department. Aircraft operators also want to minimize the potential for a diminution in aircraft value when they sell their aircraft by utilizing new parts whenever possible.

The limited availability of core exchange pricing for new parts has also increased the cost of repair. Historically, manufacturers would discount the cost of a new part in exchange for receiving the damaged but repairable part. The manufacturer would then repair the damaged part and place it in their refurbished parts inventory.

However, many aircraft manufactures are reluctant to accept core exchanges (especially for new aircraft) since the damaged part they get in return could potentially sit in storage for years after it is repaired, increasing their

Above: Some newer aircraft engines have designs that make them more efficient and lighter in weight, but also make them more expensive to repair.

carrying costs and delaying the return on their investment. Therefore, the availability of certified refurbished parts has become limited.

How the move away from Certified Repair Facilities increases costs

Another factor pushing insurance claims cost higher is the desire by some operators to have the repair performed by the aircraft manufacturer, rather than an MRO (maintenance, repair and overhaul) facility. This in spite of the fact that MRO facilities are fully authorized and qualified to perform the repairs, and might even return the aircraft to service sooner.

However, many owners have concerns that when they are ready to sell the aircraft, a potential buyer would learn that certain repairs were not performed by the manufacturer and could use that as leverage in purchase price negotiations. Thus, many owners opt for a manufacturer repair. Of course, in some instances the manufacturer is the only entity authorized to perform the work.

Above: Technicians make adjustments to a Rolls-Royce Trent 1000 engine on an Air New Zealand.

An ounce of prevention…

As technology continues to advance, it will surely get more expensive to repair a damaged aircraft, and aviation insurance claims costs will continue to be largely outside the control of aircraft owners and operators. However, safe operation of the aircraft is, and will always be, something within their control.

There are many steps that pilots, maintenance personnel, and operators can take to mitigate risk, avoid incidents, and prevent the resulting repair costs. These include proper maintenance. It is critical that aircraft are maintained in accordance with the aircraft manufacturer's recommendations. Airframe or engine failures, especially in flight, can have significant financial ramifications.

Training: Recurrent training for pilots and mechanics is critical to ensure the safety of flight and maintenance operations.

Responsible operation: Weather-related incidents in particular are a major source of expensive repair costs. For example, hail damage and lightning strike repair costs have been known to exceed $1 million in damages and result in lengthy down time to accomplish the repairs and return the aircraft to service.

Ultimately, the time and effort invested in these measures is well spent, as every incident prevented is a claims cost avoided.

(With files from Global Aerospace) ■

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Atlantic AME Association

AME Association 2019 Golf Tournament

The winner of the Putt-to-Win contest is Stephen Oakes. Stephen has won free green fees for our annual AME Association Golf Tournament, which is being played on September 27, 2019, at Granite Springs Golf Club, just outside of Halifax.

Please save this date; invitations will be going out well in advance. Each year, we've been able to surpass the previous year in terms of involvement on all levels: players and corporate sponsorship alike. Be sure to let your fellow industry associates and colleagues know, and perhaps encourage others to 'Like' our Facebook page.

www.atlanticame.ca

Central AME Association

CAMEA Outstanding AME Award

2019 Winner: Brian Deane

Brian Deane started his career in aircraft maintenance in 1980 working for Kubys Aircraft in Kenora, Ontario apprenticing on De Havilland, Cessna, Beechcraft, Norseman and Piper float planes. From Kubys Brian moved to Air Manitoba in Winnipeg where he obtained his Aircraft Maintenance Engineers licence and endorsements on the Douglas DC3, Curtiss Commando C46 and the Hawker Siddeley 748 aircraft.

Brian toured Canada's north as a flight engineer on these aircraft visiting many remote communities in Manitoba, Ontario, Quebec, the Northwest Territories and Nunavut. The most challenging aspect of this was operating and maintaining the C46 aircraft outside during the winter because they were too big to fit in the hangar. While at Air Manitoba, Brian managed the sheet metal shop and later was promoted to a crew chief position maintaining the aircraft.

Brian left Air Manitoba to work at the Manitoba Government Air Service as an AME. There he spent the summers on fires in Manitoba, Ontario and the Territories with the Canadair CL215 aircraft. While at the Air Service he obtained a CL215 endorsement and a Transport Canada S structures licence.

Brian obtained a Certificate in Quality Assurance Management from the University of Manitoba, which lead to a Quality Assurance Manager position with the Manitoba Apprenticeship Branch where he was responsible for the Transport Canada approved Aircraft Maintenance apprenticeship program.

Working closely with Red River College Stevenson Campus eventually lead to becoming the QA Manager for both Apprenticeship and Stevenson Campus. In this position Brian developed accreditation manuals and curriculums for Transport Canada and Canadian Council for Aviation and Aerospace training programs delivered by the college. He also worked closely with Maples Collegiate and Tec Voc Collegiate to implement aircraft maintenance training at those institutes. He volunteered as a lead advisor to Manitoba Education in the development of a provincial aircraft maintenance curriculum to be used as an elective program in provincial high schools

As an active member of the Central AME Association since inception he has served as Vice President. He also volunteered for 10 years with Skills Canada/Skills Manitoba developing the scope of the aircraft maintenance contest and mentoring Manitoba contestants during the event.

Brian retired from the Red River College in January 2013 and established a successful aviation consulting company specializing in Quality Assurance and maintenance training program development and delivery. He has provided services to medium and small aviation companies in Manitoba, Ontario, Saskatchewan and Alberta.

There have been many exciting moments maintaining aircraft and flying around the north but working with apprentices, college students and young high school students, seeing them obtain their dream was the most rewarding part of his career.

(Previously known as the NAASCO Outstanding AME Award. This award recognizes any AME or manager holding an AME licence in Manitoba, Saskatchewan and Northern Ontario that has performed an extraordinary act of service or has shown leadership, dedicated technical service and has been active in nurturing and training other mechanics.)

Manitoba's Annual Aviation Symposium

We're looking forward to next year. Stay tuned for more information as we start planning the 25th Annual Aviation Symposium March 5-6, 2020.

www.camea.ca

AME Association of Ontario

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Skills Competition

The Annual Ontario Technological Skills Competition was held at the Toronto Congress Centre on May 6-7. This event invited all Ontario Post-Secondary College Programs to send the two best students in their area of study to compete to see who would advance to represent Ontario at the Skills Canada National Competition (SCNC).

This event also introduces elementary and high school students to the plethora of technical trades in Ontario, and highlights the college system as a viable alternative to university education. Our AME Association also hosted a Workshop for 100 Grade 7 and 8 senior elementary school students throughout the day on Monday, May 6th, to extol the virtues of a typical day in the life of an AME.

Andrew McTiernan of Fanshawe College's Norton Wolf School of Aviation Technology won the 2019 Aircraft Maintenance Competition in the Skills Ontario program for post-secondary students. He will travel to Halifax, Nova Scotia, at the end of May to represent Ontario at the National Skills Competition.

McTiernan was in tough competition with nine other students from aviation programs across the province, representing the colleges of Algonquin (Ottawa area), Canadore (North Bay area), Centennial (Toronto area), Mohawk (Hamilton), and a second competitor from Fanshawe. Jay Brocke of Canadore College placed second in the competition and Lloyd Smith of Mohawk College came third.

Competing students spent a full working day on four projects: sheet metal, composites, electrical and piston engine. The program was designed to test the knowledge and skills required to maintain and troubleshoot aircraft, aircraft engines and aircraft systems of the candidates and also included an HR interview. The projects were organized by the Aircraft Maintenance Engineers Association of Ontario and led by Louis Anderson, technical chair of the Aircraft Maintenance Competition for the second straight year.

2019 AME Association of Ontario Conference

Our annual conference and trade show will take place September 11-13, 2019 at the Hilton Meadowvale Hotel and Conference Center in Mississauga. The conference committee is excited to be putting together another great show with a variety of technical presentations that will appeal to everyone, no matter their expertise.

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 Friday morning session.

Our own version of the 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. www.ame-ont.com

— *Submitted by Stephen Farnworth*
For the Board of Directors

Western AME Association

Purpose and Objectives

The purpose and objectives of this association are to:

1. Promote and protect the profession of the Aircraft Maintenance Engineer.
2. Develop, maintain and improve representation and consultation with regulatory bodies that affect or may affect the profession of the Aircraft Maintenance Engineer.
3. Represent the views and objectives of the membership of the Association.
4. Promote and develop the knowledge, skill and proficiency of the profession of the Aircraft Maintenance Engineer through education, publication and research.
5. Cooperate and associate with groups, associations and organizations on matters of mutual interest.
6. Promote honorable practices among the membership and between persons in the aviation industry.

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www.pamea.ca

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).

Mission Statement

The Pacific AME Association promotes and protects the professionalism of the AME, while developing, maintaining and improving our relations with regulatory bodies affecting our industry. We represent the views and objectives of our members, while promoting proficiency through educational collaboration with other groups on matters of mutual interest.

CENTRAL OHIO

Central Ohio PAMA

COAGO 2019 registration now open

This year's Central Ohio Aviation Golf Outing will be held September 6th at the Willow Run Golf Course. Registration is now open for Sponsors and Players at the COAGO 2019 site on Bird Ease Pro.

The sight provides secure payment process and directs you to the PayPal website for transaction completion. If you need to pay by other means, please contact us at golf2019@copama.org.

Last year's event entertained 120 golfers and made $8,110 with all proceeds going to the COPAMA Scholarship Fund. Its primary goal is providing help paying for certification testing of new AMTs. Thanks you to all the sponsors, players and volunteers that plan to participate and Willow Run Golf Course and their staff for providing the venue.

AMT s mourn the passing of Terry J. Huff

The Central Ohio Aviation community lost a great AMT when Terry Joseph Huff, 56, passed away on January 20, 2019 after a long and courageous battle with cancer.

Terry graduated from the Columbus Technical Institute Aviation Maintenance Technology program in September of 1983. After graduation, he began his career as an aviation mechanic with Clydesdale Aircraft. In 1993, he continued his career with PDQ Air Service, which later became Airnet II.

In June of 1999, he began adjunct teaching in the evening Columbus State Community College AMT program and continued teaching until August of 2018.

Terry had many interests outside of aviation, including scuba diving, which he enjoyed immensely. He is survived by his wife Josie. Terry will be deeply missed by friends and colleagues.

www.copama.org

SOCAL

PAMA SoCal Chapter

Who we are

The purpose of SoCal PAMA is to promote a high degree of professionalism among aviation maintenance personnel; to foster and improve methods, skills, learning, and achievement in the field of Aviation Maintenance; to conduct local meetings and seminars; to publish, distribute, and disseminate news, technical bulletins, journals, and other appropriate publications dealing with the trade of Aviation Maintenance; to collaborate with other organizations in aviation in the queries of governmental agencies pertaining to maintenance rules and guidelines.

The SoCal Chapter does not solicit dues. Donations are voluntary, appreciated and are used to help offset chapter expenses.

www.socalpama.org

PAMA Dallas – Fort Worth

About us

The DFW Chapter of PAMA is a non-profit association dedicated to promoting professionalism and recognition of the Aviation Maintenance Technician through communication, education, representation and support, for continuous improvement in aviation safety.

Since 1997 we have been coming together for a day of golf and fun in support of our local aspiring Airframe & Powerplant mechanics! Our annual PAMA DFW Golf Classic is a charitable event whose proceeds benefit scholarships for students pursuing a career in Aviation Maintenance at Tarrant County College. The chapter partners the Tarrant County College Foundation to offer a full scholarship to at least one student every year.

However, this goes beyond just the classes leading to the Airframe and Powerplant certificate. The scholarship pays for the tuition, student fees, textbooks, and all of the FAA examinations (written, oral and practicals). These are all accomplished at Tarrant County College Northwest Campus, Aviation Department.

The cost for a full scholarship is approximately $6,500. A selection committee set up by the college chooses the winner of the merit-based scholarships. The scholarship is open to anyone who meets the criteria.

Since the Foundation began administering this scholarship in 2009 we have collected over $97,000 and awarded 16 full scholarships. These successes are possible with the support of our aviation community, so we are always looking for hole sponsors and major raffle donors to support this just cause.

Our mission to educate, train, and provide encouragement to our industry's aviation technicians does not waiver.

www.pamadfw.com

AirMaintenance Update

open book exam 2019

open book exam 2019

AirMaintenance Update is Transport Canada-approved for recurrent training. This is our 14th exam, published annually in our June-July anniversary issue, in accordance with our agreement with Transport Canada. The exam consists of questions based on articles appearing in all six issues from the past year: June-July 2018, Aug.-Sept. 2018, Oct.-Nov. 2018, Dec.-Jan. 2019, Feb.-March 2019, and April-May 2019. You will require all six issues in order to write the exam. If you are missing any issues, call us at (604) 214-9824 or email us at amumag2015@gmail.com, and we will mail them to you at a cost of $7.95 per magazine postpaid.

A 75% pass rate is required in order to qualify for your 16 hours toward RT. The questions in the exam are arranged in order of their appearance in AirMaintenance Update according to issue and individual article. The exam can also be downloaded as an Adobe Acrobat PDF file via our website: www.amumagazine.com. Answers should be printed in the spaces provided and must be drawn directly from the text of the articles in order to be considered correct. All questions requiring a longer answer than the space allowed must be typewritten on a separate sheet of paper. Completed exams should be submitted to: AirMaintenance Update, Unit 7, 11771 Horseshoe Way, Richmond, BC, V7A 4V4. The exam must be postmarked no later than October 31, 2019. We will mark your test and return it along with documentation supporting your submission. We will keep a copy of your written test and results on file for future reference, and a copy will be forwarded to Transport Canada. Once again, good luck to all participants!

Your Contact Information

For a prompt and accurate response to your 2019 Exam answers, please fill in the following information (print clearly)

Name .....

Address .....

.....

.....

Phone .....

Email .....

June - July 2018 (Volume 17/Issue 1)

Improving the Life of Critical Components

Finish the following sentences:

1) Approved and field-tested in the aerospace industry, PVD and PACVD can be used to deposit thin film coatings to ...

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2) One PVD coating, called BALINIT Turbine Pro from Oerlikon Balzers, is specifically geared towards protecting engine compressor blades, vanes or integrated bladed rotors (blisks) from ...

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3) Bearings are another component that suffer from severe and disproportionately distributed ...

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Sort of Made a Bang!

4) A surge from a turbofan engine is the result of instability of ...

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5) In a turbine engine, compression is accomplished aerodynamically as the air passes through ...

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6) When a compressor surge is not recoverable, there will be a single bang and the engine will decelerate to zero power as if ...

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Raising the Bar

7) The single stage centrifugal compressor impeller in the FADEC engines is slightly larger and heavier than the compressor used in ...

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8) The No. 2 bearing in the accident engine was manufactured for Rolls-Royce by Timken and is an ...

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9) Because the compressor rotor acts like a gyroscope, it resists changes in orientation during ...

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10) The No. 2 bearing of this helicopter was manufactured with a tolerance stack-up that made it prone to large ball excursions at manoeuvre rates less than the ...

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Aug. - Sept. 2018 (Volume 17/Issue 2)

A Transition Underway

Finish the following sentences:

1) The three main ingredients in aviation composite materials are ...

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2) Aerospace fibres are carbon fibres which tend to be expensive, but provide ...

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3) Rather than corrode, composites ...

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4) Composites also lose much more structural integrity than aluminum if they are ...

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Innovative Flaw Detection Devices

5) 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 ...

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Raising the Bar

6) The Beechcraft Corporation Model 1900D Airliner Maintenance Manual describes the 1900D as equipped with a retractable ...

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7) During extension and retraction, the nose gear actuator exerts pressure through an aluminum yoke fitting attached to the end of the ...

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8) The Beechcraft Corporation Model 1900D Airliner Maintenance Manual warned against using the wrong grease on the wrong parts, given that some greases ...

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Oct. - Nov. 2018 (Volume 17/Issue 3)

Lightning in the Bottle

Finish the following sentences:

1) Metals and carbon fiber composite materials (CFC) offer a high degree of electric field shielding and some ...

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2) Damage from lightning strikes to non-conducting materials, such as fiberglass and aramid-reinforced composites, can be more severe than ...

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3) Composite materials such as CFCs have lower electrical conductivity than ...

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Seeing Things

4) To ensure safe aircraft takeoffs and landings, one of the most vital areas to inspect for possible fatigue cracking and heat damage is the ...

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Raising the Bar

5) The Navajo Chieftain fuel system consists of fuel cells, engine-driven and emergency fuel pumps, fuel boost pumps, control valves, fuel filters, fuel pressure and fuel flow gauges, fuel drains, and ...

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6) The wing-root fairings were removed to facilitate a visual inspection of the ...

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Dec. - Jan. 2019 (Volume 17/Issue 4)

Silver Wings

Finish the following sentences:

1) Essentially, blended winglets improve airplane performance by ...

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2) The blended winglet provides a transition region between the outboard wing, which is typically designed for a plain tip, and the ...

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3) Induced drag is the part of the airplane drag due to global effects of ...

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4) Any significant reduction in induced drag requires a change in this global flow field to reduce the ...

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Time to Winterize

5) Some carbureted engines, like the O-470 in the Cessna 180 and 182, run markedly better if partial carburetor heat is applied during ...

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Versatile Nature

6) What makes flexible shafts specifically useful is that flexible shafts can bend, but also...

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7) A flexible shaft assembly consists of a rotating shaft (sometimes called a core) with metal end fittings for attachment to ...

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8) In fact, flexible shafts are often the preferred choice in aerospace applications for rotary motion transmission over gearboxes, universal joints, and ...

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Raising the Bar

9) Hydraulic pressure for the anti-skid/power brake system is provided by a hydraulic pump driven by an electric motor that is controlled by a ...

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10) An accumulator is incorporated to maintain system pressure when ...

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11) Power braking action is actuated by the master cylinders that are connected to the top of each rudder pedal and that are commonly referred to as ...

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12) In the event of a hydraulic brake system failure, including a brake pump failure, braking action is only available through the ...

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Feb. - Mar 2019 (Volume 17/Issue 5)

Chrome Components

Finish the following sentences:

1) Physical vapor deposition (PVD) coatings offer many of the same benefits and, in some ways, are superior to ...

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2) Physical vapor deposition describes a variety of vacuum deposition methods that can be used to produce ...

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3) PVD is typically used to coat components at relatively low coating temperatures of ...

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4) Bearings are another component that suffer from severe and disproportionately distributed ...

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Raising the Bar

5) Such an advanced timing of the magnetos leads to pre-ignition or detonation of the combustion gases in the engine and results in high cylinder head temperatures and ...

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6) Chapter 12-78 indicates that the advanced firing position of the number one cylinder may be determined by the use of a timing disc and pointer, Time-Rite piston position indicator, protractor and piston locating gauge, or ...

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7) The engine seemed unusually hot for the brief time that it was run, but because the engine operating temperature and pressures were normal, the hot engine was attributed to ...

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8) The Cessna 207 series service manual, Chapter 12-80, Magneto Check, states: "advanced timing settings in some cases is the result of the erroneous practice of bumping magnetos up in timing in order to reduce ...

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9) The company chose to re-install the timing indicator plate due to its ease of use and ...

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10) The decision to use the magneto timing indicator plate was supported by ...

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April - May 2019 (Volume 17/Issue 6)

Raising The Bar

1) During engine operation, a closed exhaust valve can result in the hot pressurized exhaust gases being forced back into the common induction system through the normal opening of ...

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2) Small glowing carbon deposits in the hot exhaust gases can induce pre-ignition of the fuel/air mixture in the induction system and result in ...

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3) The cylinders are overhauled when the engine is overhauled or when ...

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4) During overhaul, the cylinders are subjected to an inspection, including liquid penetrant inspection of the head area and, in some cases, ultrasonic testing on ...

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5) Some overhaul facilities mark the cylinder skirt with the overhaul date and coding particular to the facility or put a serial number on the valve ear for ...

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6) There are no requirements to track cylinder life or ...

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7) The severe extent of the corrosion, staining, and rub on the fracture surface indicated that the fatigue crack had been present for ...

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8) The failure of the number 2 cylinder exhaust ear prevented the exhaust valve from ...

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9) The hot exhaust gases migrated back into the induction system through the intake valve, causing a disruption in the fuel/air mixture to the remaining cylinders, resulting in ...

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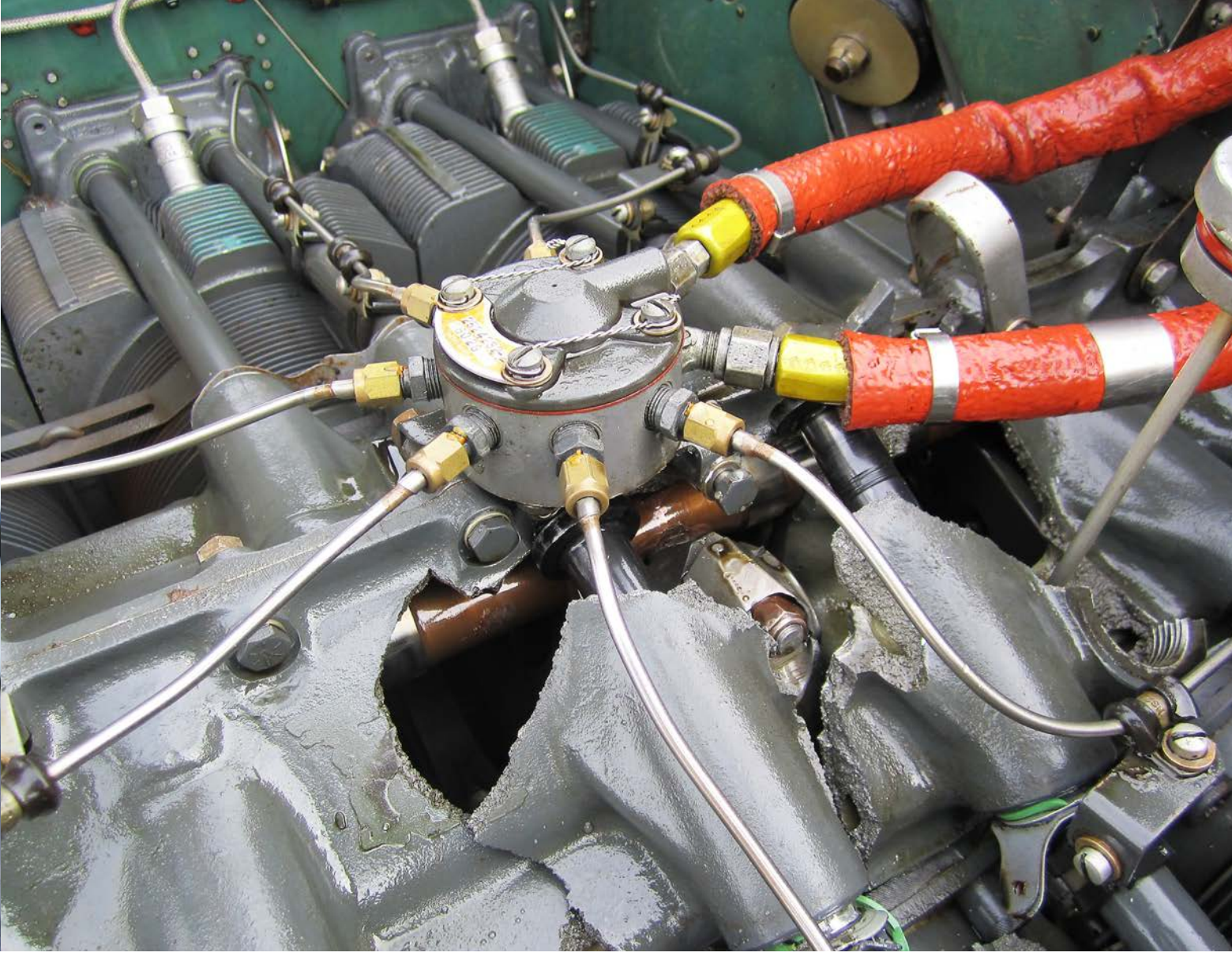
Transport Canada:

The following are selections of Canadian Aviation Service Difficulty Reports originally published as “Feedback” by Transport Canada.



Opposite: Helicopter technology. Above: Avco Lycoming, IO-540-K1B5.

reports and comments

Report: Allison, 250-C47B
Engine outer combustion case cracked fuel nozzle boss

Subject:

During aircraft startup, the pilot noticed high turbine outlet temperature and shut down the engine. The aircraft maintenance engineer discovered that the fuel nozzle boss was separated from the can at weld/radius.

Transport Canada Comments:

Rolls Royce has acknowledged additional instances of potential outer combustion case cracking by issuing Revision 3 to M250-C47 CEB A-72-7002. The latest revision decreases the interval of the repetitive visual inspection for the weld size at the fuel nozzle boss. Be vigilant when inspecting this area. Cracking and separation of the fuel nozzle boss could lead to potential power and performance reduction. Additional Alert Commercial Engine Bulletins have been released to cover the M250-C28, -C30 & -C40 series Roll Royce engines.

Above: 737 8CT.01

Report: Austro Engine, E4-A

Engine failure due to foreign object debris

Subject:

While cruising/descending at 9000 feet, the pilot observed dropping oil pressure and increasing oil temperature. Failure code warnings were also observed. The pilot landed the aircraft, which sustained some minor damage. The lower cowl and underside of the aircraft were contaminated with engine oil.

Transport Canada Comments:

An engine investigation revealed that a foreign object had entered one of the cylinders and damaged the piston. This resulted in the piston cracking and allowing combustion gasses to pressurize the crankcase thereby forcing out the engine oil.

The source of the foreign object was not known however the evidence left behind on the piston indicated that it may have been caused by a piece of lockwire.

It is important for Aircraft Maintenance Engineers to be certain that the areas surrounding critical areas be cleaned of any foreign materials following maintenance activities.

Report: Avco Lycoming, IO-540-K1B5

Connecting rod bushing failure

Subject:

During climb to altitude, the left hand engine sputtered and shutdown. The aircraft returned for landing without further incident. A visual inspection conducted by the pilot revealed a catastrophic failure in the top of the crankcase.

Transport Canada Comments:

The manufacturer, Lycoming, has issued Mandatory Service Bulletin 632B to identify and remove from service certain connecting rods with non-conforming small end bushings.

The Federal Aviation Administration (FAA) has issued Airworthiness Directive 2017-16-11 to mandate the inspections and actions listed in the Lycoming Service Bulletin. Transport Canada urges the report of any related service difficulties found on engines not listed in the models affected section of Mandatory Service Bulletin 632B.

Report: Helicopter Technology Company, equipment

Delamination of main rotor blade abrasion strip

Subject:

During the 100-hour inspection of the main rotor blades, as required by the Helicopter Technology Company Service Notice 2100-8 revision 2, all five blades were found to have delamination of leading edge abrasion strip. All of the blades have a total time since new of 97.2 hours and 2074 torque events. The Main Rotor Blades are being sent back to manufacturer.

Transport Canada Comments:

In the elapsed calendar time since the release of Service Notice 2100-8 revision 2, operators have continued to report delamination or disbonding of the abrasion strip on Helicopter Technology Company Main Rotor Blades.

The service difficulty reports have also indicated that failure to detect the delamination or disbonding when inspecting has resulted in departure of the Abrasion Strip in-flight.

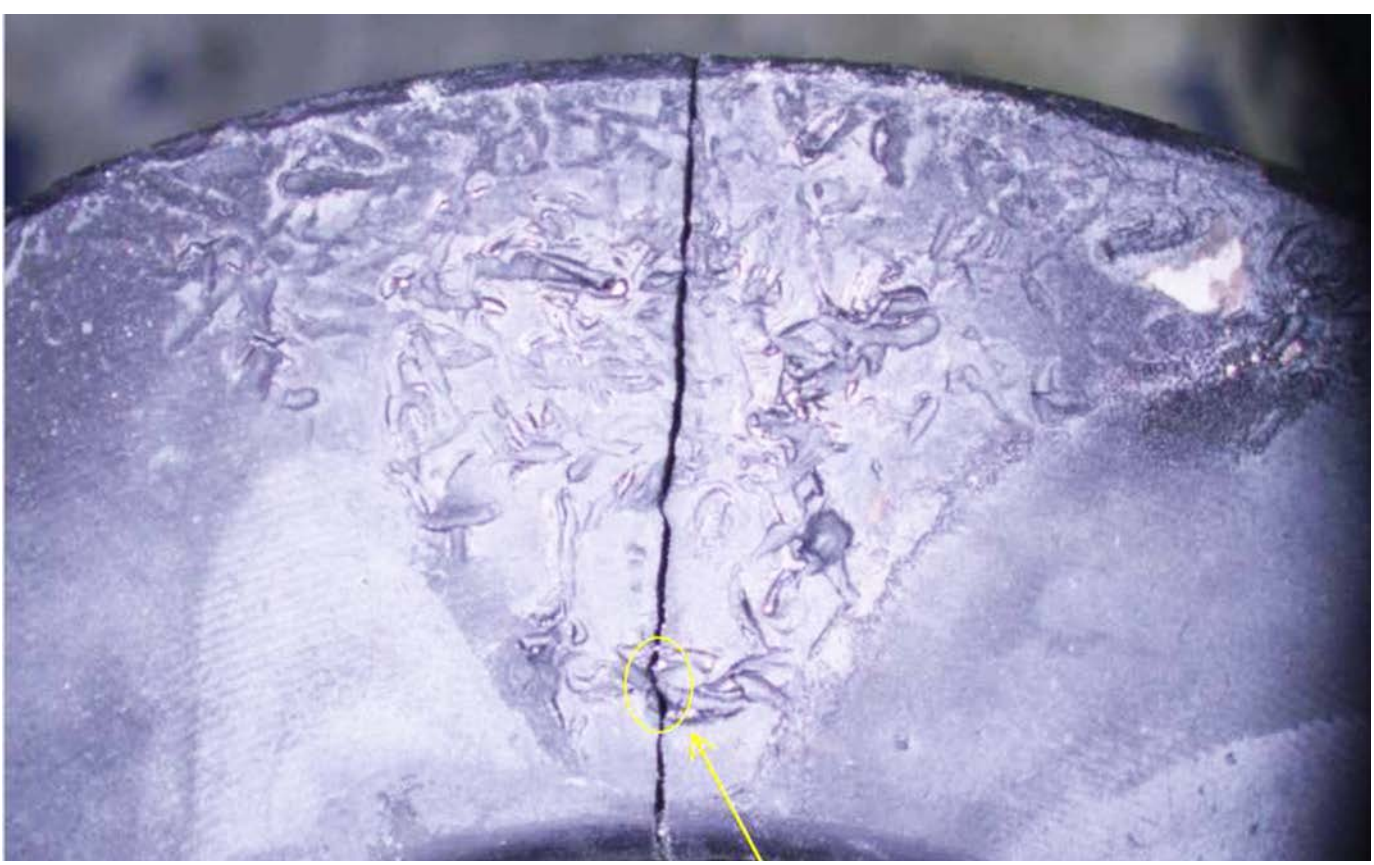
Due to these reports, Service Notice 2100-8R2 was superseded by Mandatory Service Bulletin (MSB) 2100-8R3 dated 29 April 2016.

The MSB revises the frequency and requirements for accomplishing the inspection as well as introduces a modification that will be mandated by a future published Federal Aviation Administration (FAA) Airworthiness Directive.

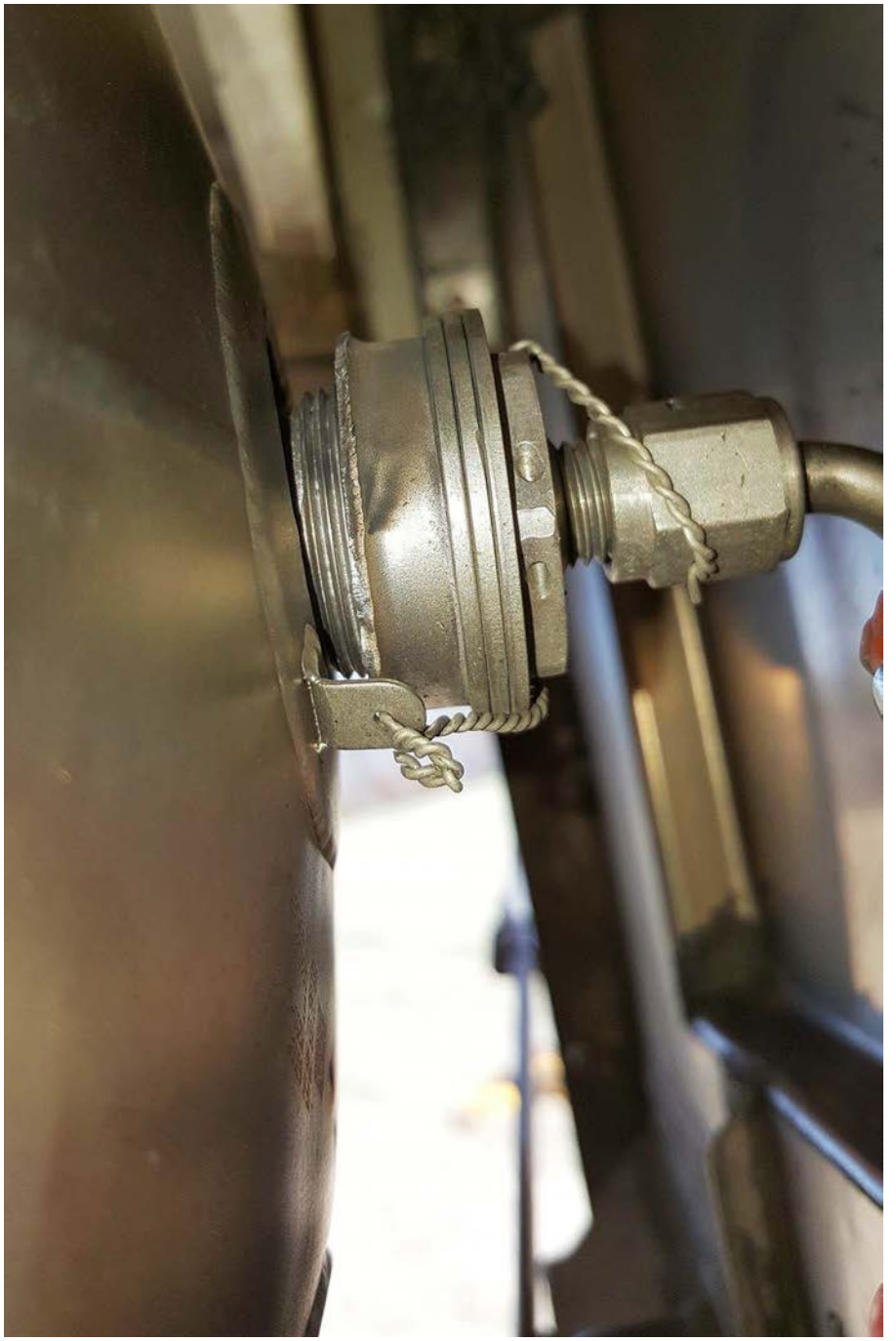
Report: Bell 206B
Cracked aft fuselage frame

Subject:
During a scheduled 100 hour airframe inspection, while looking through the inspection panel of the most-aft section of the airframe, the aircraft maintenance engineer found a suspected crack approximately 6mm long. The crack was discovered in the aft frame near the upper right-hand tail boom attachment fitting, specifically fuselage station 205.0, water line 75.0 at the 2:00 position, when viewed from the rear, looking forward. The crack was in a difficult position to inspect with a magnifying glass because it was nestled behind a reinforcement angle.

A liquid penetrant inspection was performed to confirm the suspected crack. The tail boom was removed and the crack was again confirmed. The liquid penetrant had seeped through from the front side and was visible from the aft side. The frame was paint stripped and the crack was measured to be approximately 33 mm long. The origin of



Above: Austro Engine, E4-A.



Above: Allison, 250-C47B

the crack is unknown, there has been no recent operational incident and it was found on the compression side of the tail boom.

Transport Canada Comments:

As described in this service difficulty report, there was likely no operational incident that can be considered root cause for the frame cracking.

Age and fatigue may have contributed however the original design and/or the outdated "pressed" aft fuselage bulkhead, were the probable cause of why it cracked. Bell Helicopter has released Technical Bulletin TB 206-12-199 Revision A to address this area of concern.

Specifically, part two of the technical bulletin introduces and provides instructions for installation of a new machined aft fuselage bulkhead that is made of thicker material. The new bulkhead is a direct replacement on the 206A/B.

Report: Boeing 737 8CT

Wheel assembly missing/broken tie bolts

Subject:

During the take-off roll, at approximately 120 to 130 knots, the crew reported that they heard a bang followed by a vibration and decided to reject the take-off.

When maintenance arrived at the aircraft, they confirmed that the number 1 and 2 tires had blown and that damage was also found to the wheel halves. The cause of the tire blowout was unknown, but all affected components were changed out and sent to the appropriate vendor for assessment.

> "The number 1 wheel assembly had four sheared tie bolts and all the bolts appeared to be intact on the number 2 wheel assembly.

The number 1 and 2 wheel assembly halves were found still held together by the tie bolts. The number 1 wheel assembly had four sheared tie bolts and all the bolts appeared to be intact on the number 2 wheel assembly.

The wheel fuse plugs on both wheel assemblies were inspected and found to be intact. The aircraft servicing history was reviewed and no abnormal servicing issues were noted since the installation of the wheel and tire assemblies.

All wheel assemblies and the number 1 and 2 brakes were replaced to return the aircraft to service. The service difficulty report (SDR) will be updated with all findings following vendor analysis.

Transport Canada Comments:

Investigation by the shop concluded all the bolts from this event were as follows:

1. All bolts were evaluated and met specifications for hardness, coating and material (H-11 steel) with no indications of a batch or quality issues.

2. The cause of the six fractured bolts was found to be fatigue. Four bolts were found with cracks initiating from the 8th to 9th thread root and two bolts were found with cracks initiating from the under-head radius transition area.

3. No abnormal cause of the fatigue cracking was detected (corrosion, mechanical damage).

4. Overload fractures detected on three of the six bolts were assumed to have occurred during the take-off roll.

5. No indication of bolt stretch was observed. The original equipment manufacturer (OEM) was contacted and reported that they were unaware of any problems with tie bolts in industry. The operator initiated a fleet campaign replacement of all bolts, and limited the bolts to less than the OEM recommended service life, in an effort to prevent these issues. The reduced service life program has worked and reduced the failure frequency. One SDR has been reported since July 2016 where a loose bolt was found during maintenance.

(Feedback is a safety awareness communication with quarterly updates for the aviation community.) ■

Above: Bell 206B

In Great Demand

The aviation IT firm Locatory.com conducted a review of 2018 to determine a Top 15 list of spare parts that were in greatest demand among buyers and sellers. Not surprisingly, wheels and brakes were well at the top of the list.

Every day we see aircraft flying, making thousands of flight hours and transferring millions of passengers worldwide. However, despite seeing all of them in the sky, there are hundreds of aircraft on the ground, having routine checks or special maintenance projects. Due to extremely strict safety and airworthiness regulations, all aviation companies must provide the best service their aircraft can get and as soon as possible. The keywords here are– as soon as possible.

Keeping an aircraft on the ground is without doubt a very serious decision. The longer it stays there, the more money airlines lose. Since most maintenance projects involve having several parts changed, the aircraft spare parts market is understandably inundated with requests. The faster the maintenance company gets the needed parts, the better.

The urgent nature of maintenance business raises an important question: which spare parts are in greatest demand among buyers and sellers.

To answer that question Locatory.com listed out the top 15 spare parts bought most throughout last year. On review, it seems most of the top parts requested were for the most common maintenance operations. The parts changed most are wheels and brakes and so the top 15 consists of almost half of those components. Looking at wheels and brake parts and their numbers, it is obvious the majority belong to the most popular aircraft operational at this time – Boeing 737 CL, Boeing 737 NG and the Airbus A320 family. Only one of these parts, wheel part number 3-1546, belongs to an Airbus A330. According to Airbus Orders and Deliveries information on February 28, 2019, there are only 1,441 operational A330s worldwide in comparison with 8,734 A320s.

Aircraft windows

The other spare parts at the top of the list are windows and their frames. It seems that aircraft windows, being so small, should also be extremely durable. From the perspective of a passenger, this part in particular is not where they want to see cracks or malfunctions. However, the numbers say otherwise. According to Locatory.com data, windows and windshield assemblies are among the top 15 spare parts searched in the platform.

According to some industry insiders, windows are among the most maintained or changed aircraft parts aside from wheels and brakes. There are several reasons behind that but the most common is the malfunction of a heating system installed in the frame. If there are any wiring problems, they have to be changed with the windows too. These components are not separated and must be changed together. The other reason is mainly environmental: problems can be caused by sudden changes in temperature and pressure as aircraft launch from ground to sky. Cracks in the windshield can appear at any time and the glass must then be quickly changed.

Changes in SB and AD

Besides the actual changeable parts used in the process of flying, there are some

Above: The parts changed most are wheels and brakes.

Above: Windows are among the most maintained or changed aircraft parts aside from wheels and brakes.

less prominent components on the list. For example, box relays, aural warning module assemblies, or bleed valves, had to be implemented in accordance to new Service Bulletins (SB) and Airworthiness Directives (AD).

It goes without saying that safety is the highest priority in aviation and due to changing laws and directives there have to be some changes made in all operational aircraft. And that is the main reason these spare parts climbed to the top of the list in 2018.

What will the future bring?

For now, it is very hard to predict what other spare parts will be needed in the near future. However, the parts themselves are one thing. The other is the speed and the time spent for receiving them.

"We understand the market and know how crucial it is for airlines or MRO companies to receive some spare parts as soon as possible," says Dainius Meilunas, CEO at Locatory.com. "Our company does everything we can, we find new IT solutions or create new services so that our clients would spend less time and money and would get the service as soon as possible. I believe, that our know-how, vast experience in the market and being in a worldwide aviation group gives us an upper hand in delivering the best solutions and services to the market players."

Top 15 aircraft spare parts and part numbers in 2018:

01 Battery (PN 2758) Airbus A320 family
02 Aural Warning Module Assembly (PN 69-78214-4) Boeing 737NG
03 Brake Assembly (PN 2606672-4) Boeing 737CL
04 Constant Speed Drive (Safran PN 735511A) Boeing 737CL
05 Wheel Assembly (PN C20626200) Boeing 737NG
06 Wheel Assembly (PN 3-1546) Airbus A330/A340
07 Main Wheel Assembly (PN C20195162) Airbus A320 family
08 Receiver Transmitter TCAS (PN 822-1293-033) Various aircraft i.e. Boeing 737, CRJ200, etc.
09 TCAS/ACAS Antenna (PN 7514081-901) Various aircraft, i.e. Boeing 737, Airbus A320 family, Boeing 757, etc.
10 Valve, Anti-ice (PN 327155-3). Airbus A320 family
11 Windshield Assembly (PN 5-89354-3149) Boeing 727, 737NG/CL
12 Box Relay (PN 005RL05) Airbus aircraft
13 Bleed Valve (PN 6774G010000) Airbus A320 family
14 Brake Assembly (PN C20225510) Airbus A320 family
15 Window (PN 5-89354-3150) Boeing 727, 737NG/CL

(Locatory.com is an aviation IT company primarily acting as an aircraft parts locator.) ■

Excessive VIBRATION

Above: As the aircraft was climbing through 9,000 feet above sea level out of Newark, the No. 4 engine vibration light illuminated.

Turbine blade failure scuttles a flight on the eastern seaboard.

The BAe-146-200 aircraft (C-GRNV), operating as ARN896, was on a scheduled international flight from Newark, New Jersey, to Halifax, Nova Scotia. As the aircraft was climbing through 9,000 feet above sea level (asl)(1) out of Newark, the No. 4 engine vibration light illuminated, and the vibration gauge indicated 3.0 inches per second (ips).

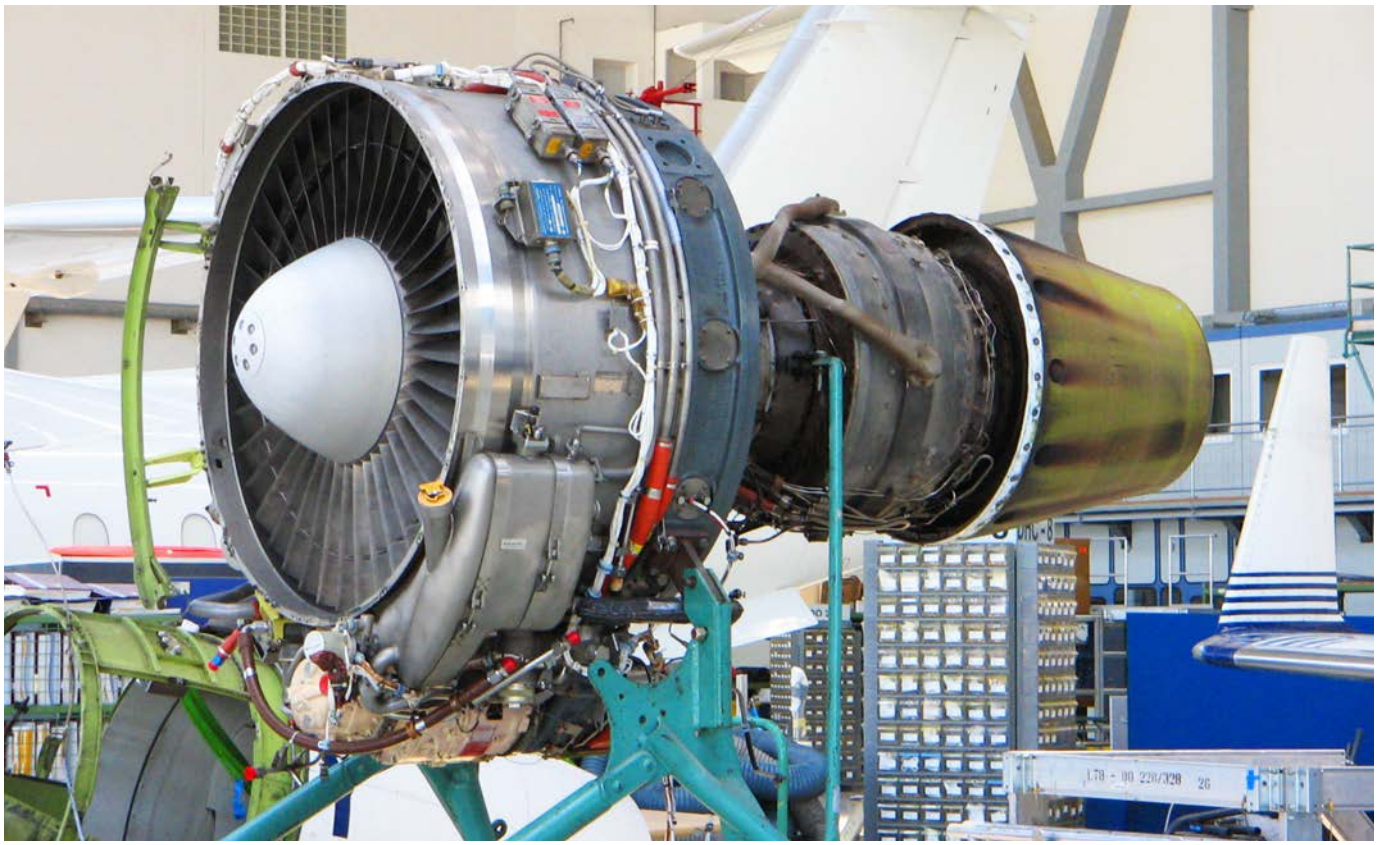
The crew reduced power on the No. 4 engine, and the vibration level decreased to below 1.2 ips. The crew then carried out the engine vibration checklist; however, as the aircraft leveled at flight level 190, the vibration level had increased again above the maximum allowable 1.2 ips. The crew secured the engine as per their procedures.

The crew consulted with company maintenance, dispatch, and operations departments, and the decision was made to continue the flight. The aircraft was landed uneventfully at Halifax with Emergency Response Services (ERS) standing by.

There was no damage to the aircraft other than internal damage to the No. 4 engine.

Engine Examination

A teardown of the No. 4 engine (Lycoming ALF-502R-5, serial number LF-05483A) revealed a fractured third stage turbine blade. This was the third incident of this type involving the same aircraft (C-GRNV) in less than a year. The three incidents involved re-bladed engines, with the last repair prior to the failure being their modification according to Service Bulletin (SB) ALF 72- 270R1.



Above: A teardown of the No. 4 engine revealed a fractured third stage turbine blade.

The third stage turbine disc and shaft were sent to the TSB Engineering Branch for failure analyses and to determine possible commonality in the three failures (LP 03/95 refers). Failure analyses of the two previous third stage turbine blade failures were also carried out at the TSB Engineering Branch; the findings are contained in Engineering Reports LP 31/94 and LP 89/94.

Third Stage Turbine Blade

One of the blades from the third stage disc had separated approximately 12 millimetres above the platform. The second blade clockwise from the broken blade had its tip shroud knocked off. The damage to other blades consisted of chipped trailing edges near the blade tips. Visual and liquid penetrant inspections were performed on all blades in search of cracks in the same general area as the fracture occurred; no cracks were detected. To facilitate a detailed examination using optical and scanning electron microscopy, the broken blade and two neighbouring blades were removed from the disc. The fractured blade bore the identification 2079, which corresponds to the heat lot number.

The blade had broken in a chordwise manner 12mm outboard of the platform, and the fracture surface was more or less perpendicular to the longitudinal blade axis. There were two distinct regions visible on the fracture. The first region extended approximately 10 mm from the leading edge and appeared flatter and brighter than the rest of the fracture. Right

Above: A teardown of the No. 4 engine revealed a fractured third stage turbine blade.

at the leading edge, there was a very small region, which reflected light differently. When viewed from the side, a "V" type notch was discernible. This kind of fracture topography is consistent with Stage I and II fatigue crack propagation. The darker appearing fracture beyond the 10mm zone reflects the rapid final separation.

Scanning electron microscope examination confirmed the Stage I fatigue crack propagation characterized by pronounced crystallographic facets. Isolated pockets of microporosity were also detected in the Stage I fatigue crack region. Further into the fracture, Stage II fatigue crack propagation, with its typical beach marks and striations, became prevalent. Successive grinding and polishing into the origin disclosed no presence of large metallurgical discontinuities; however, scattered microporosity was intercepted within the origin region on the third polish. The microporosity was so small that it would undoubtedly have met the manufacturer's acceptance criteria.

The microstructure of the failed blade was typical of the cast nickel base superalloy. Comparison of the microstructure of the failed blade with that of the two neighbouring blades did not disclose any metallurgical deviations. Similarly, hardness readings taken on the longitudinal

sections of the failed blade and two neighbouring blades were practically identical. Energy dispersive X-ray analysis of the blade material verified that the alloy conformed to the manufacturer's specification for M3617R.

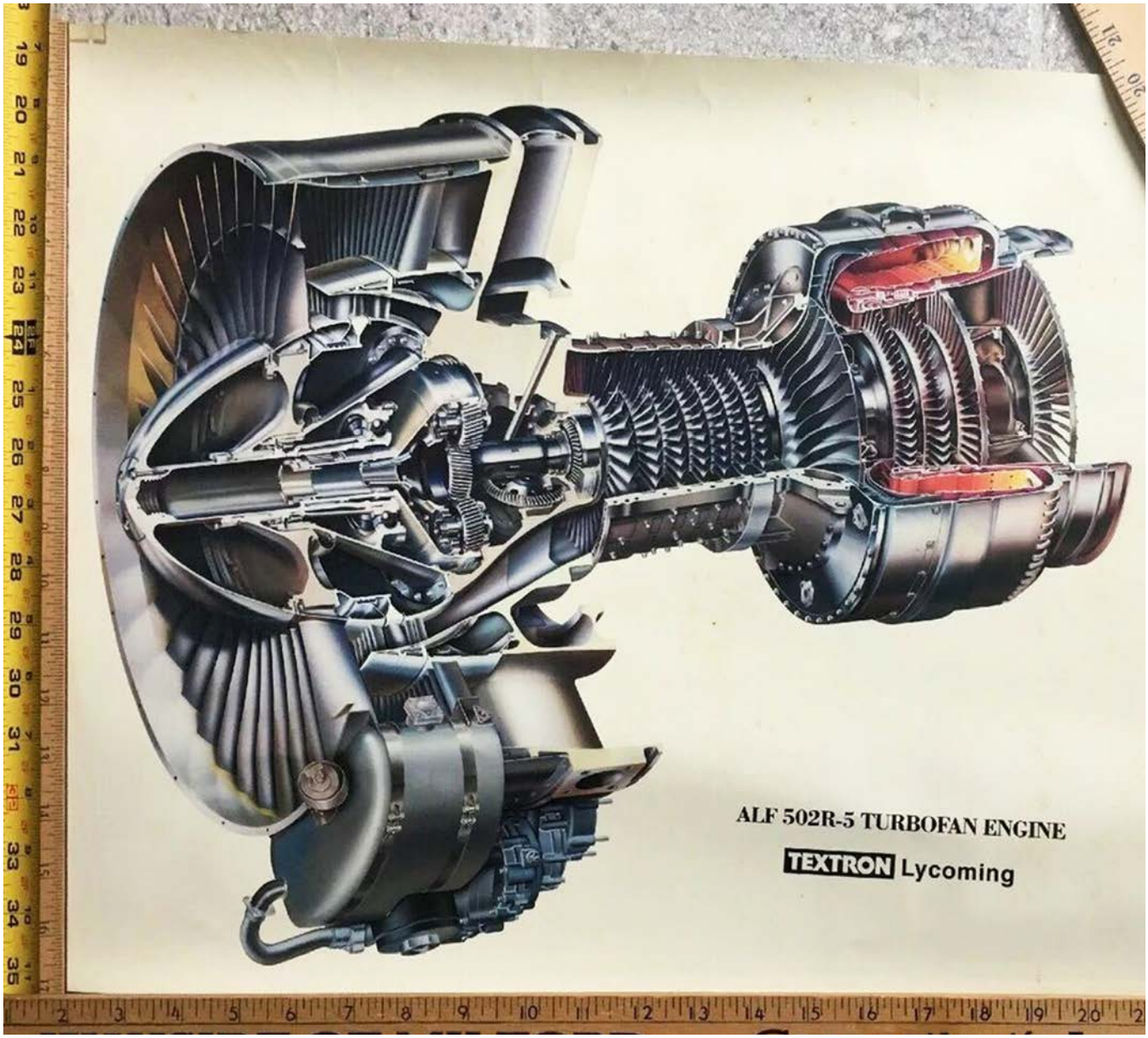
The third stage turbine assembly had been modified to carry out SB ALF 72-270R1. The modification involved machining a redesigned blade root slot profile that alleviates disc broach slot cracking. An insert replaces the material removed by this modification. In other words, the blade roots retain the original configuration. All blades, including the failed one, were sitting firmly in their respective slots, and the tip shroud gaps were checked by the operator and found to be within limits. The blades had accumulated 4,103 hours and 3,836 cycles between the time of the modification and the time of the failure.

. . . The third stage turbine blade problems first appeared in 1991 (Air Wisconsin); since then, there have been four more occurrences (one at Air BC, three at Air Nova). All turbine blade failures involved re-bladed engines and were contained. Allied Signal indicated that the lower-than-desired life after re-blade resulted from re-blading the turbine wheel at overhaul with used blades . . .

Previous Third Stage Turbine Blade Failures

Following concerns expressed by operators, Transport Canada invited Allied Signal (formerly Textron Lycoming) to give a briefing about the ALF 502 series engines' in-service difficulties. The meeting was held on 19 January 1995 in Ottawa.

The third stage turbine blade failure problems first appeared in 1991 (Air Wisconsin); since then, there have been four more occurrences (one at Air BC, three at Air Nova). All turbine blade failures involved re-bladed engines and were contained. Allied Signal indicated that the lower-than-desired life after re-blade resulted from re-blading the turbine wheel at overhaul with used blades. The used blades met replacement specification at the time of installation; however, following its investigation into the blade failures, the engine manufacturer determined that the tip shroud gaps between neighbouring blades were excessive. The excessive tip shroud gaps were caused by in-service wear of the high spots on the fretted shroud surfaces of the used blades. The manufacturer concluded that the excessive gaps resulted in reduced damping and led to high-cycle fatigue failure.



Above: Following concerns expressed by operators, Transport Canada invited Allied Signal, formerly Textron Lycoming, to give a briefing about the ALF 502 series engines' in-service difficulties.

Failure Analysis - Third Stage Turbine Blade

This third stage blade failure bears a striking resemblance to the failure investigated the previous year (LP 89/94). In that occurrence, as in this case, Stage I and II fatigue cracking were detected, with no particular material deficiency at the initiation site. In the present case, there was some scattered microporosity present at the origin.

It is believed, however, that the microporosity merely served to locate the crack origin, rather than cause it. The respective blades came from the same supplier but had different heat lot numbers, so the problem does not seem to be batch related. There was no obvious connection between the modification to the third stage turbine disc and the development of this failure. The first of the three third-stage blade failures on this aircraft was discussed in Engineering Branch Report LP 31/94. In that case, the blade failed through the platform by fatigue, which established itself in an area of clustered porosity judged to be in excess of the manufacturer's acceptance criteria. Therefore, no connecting link has been established between the first failure and the two that followed.

In this occurrence, the third stage blade failed as a result of an overload extension of a high-cycle fatigue crack, which originated near the blade's leading edge.

It is possible that re-blading with used blades resulted in excessive tip shroud gaps between neighbouring blades, which then resulted in reduced damping and the high cycle fatigue cracking.

No. 4 Engine In-Flight Shutdown

The No. 4 engine turbine blade failures were contained and caused vibration to exceed the allowable 1.2 ips. The excessive vibration prompted the flight crew to carry out a precautionary in-flight shutdown of the No. 4 engine according to procedure.

Findings

1. The third stage blade (engine S/N LF-05483A) failed as a result of an overload extension of a fatigue crack which originated near the blade's leading edge. With the exception of scattered microporosity intercepted in the Stage I fatigue region, no other material deficiencies or damage were in evidence to explain the failure initiation mechanism.
2. The third stage blade material is considered to be in compliance with the chemical composition and porosity limits as per manufacturers' specification M3617.
3. There does not appear to be any connection between the modifications carried out on the third stage turbine disc and the development of the failure.
4. The third stage failure closely resembles a failure investigated last year (LP 89/94). While the failure mechanism was identical, it was not possible to find a common underlying cause.
5. All previous occurrences of third stage turbine blade failure involved re-bladed engines, with the blades failing in high-

cycle fatigue. It is possible that the lower-than-desired life after re-blade resulted from re-blading the turbine wheel at overhaul with used blades, with excessive tip shroud gaps between neighbouring blades.

6. The No. 4 engine turbine blade failure was contained and caused vibration to exceed the allowable 1.2 ips.

7. The excessive vibration prompted the flight crew to carry out a precautionary shutdown of the No. 4 engine as per procedure.

Causes

A third stage turbine blade failed, causing excessive vibration, which prompted the flight crew to carry out a precautionary shutdown of the No. 4 engine. The third stage blade failed as a result of the overload extension of a high-cycle fatigue crack, which originated near the blade's leading edge.

Action Taken

Allied Signal is developing shroud reconditioning procedures to alleviate the problem. Transport Canada is monitoring Canadian and other operators who use the ALF 502 engines for in-flight shutdown rates and engine reliability.

(This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board, consisting of Chairperson John W. Stants, and members Zita Brunet and Maurice Harquail, authorized the release of this report on 08 January 1996.) ■

Aviation Services

Aviation Services

Aviation Services

Banking on Growth

Centennial College has begun a new era with the opening of its Downsview Campus Centre for Aerospace and Aviation.

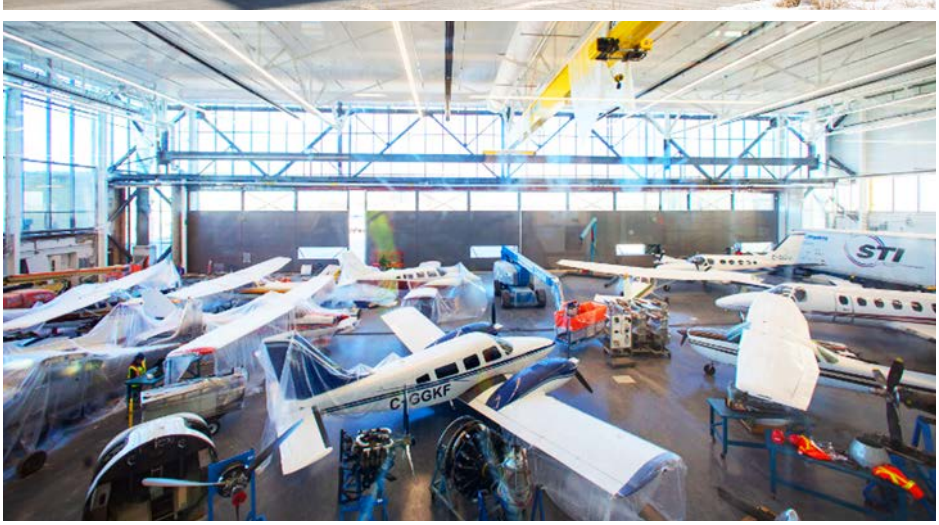
Viewed from space, it's a dark field in the middle of a brilliant city. For decades Torontonians skirted around the periphery of Downsview Park with little awareness of what the land encompasses. But in late April Centennial College formally opened its Downsview Campus Centre for Aerospace and Aviation, an education and training facility that represents the first stage in an ambitious plan to recast the former military airbase as Ontario's aerospace hub to help propel Canada's aviation industry and bolster its leadership position in a competitive global sector.

The four-acre campus is the new home of Centennial's aerospace technology program located on the historic site of de Havilland of Canada, an indelible part of Canada's aviation heritage. The $72-million project repurposes the de Havilland building with selective demolition and new construction to create 12,700 square metres of instruction space, including classrooms, labs and workshops, two aircraft hangars, offices, a library and food service under one roof.

The Ontario government contributed $25.8 million towards the project, while Ottawa granted $18.4 million in Strategic Investment Funds; the college and its partners and donors funded the remainder. Centennial moved its aircraft and avionics technicians from its Ashtonbee Campus in Scarborough in early January. The much larger teaching space will allow enrolment to grow from 300 to more than 900 students, as aerospace graduates are in high demand across Canada and around the world.

Centennial counts Bombardier Aerospace as a key partner by helping to prepare its workforce with new skills required in the assembly and maintenance of the next generation of aircraft. With Bombardier's donation of a Canadian-made CRJ200, students have the opportunity to work on current technology and gain the key skills to transition into the workforce. The campus is set to anchor an aerospace hub that will incubate innovation and attract new investments from a growing global industry worth $838 billion annually.

The aim of Downsview Aerospace Innovation and Research (DAIR) consortium and its partners is to develop new technologies through collaborative research and innovation, aid in workforce training and skills development, and participate in supply-chain development. DAIR partners include Centennial College, the University of Toronto Institute for Aerospace Studies, Ryerson University, York University, Bombardier, Pratt & Whitney Canada, Honeywell, Collins Aerospace, Safran Landing Systems, MDA Corp., Siemens, Mitsubishi Heavy Industries Canada Aerospace, Canadensys Aerospace and FlightSafety International. ■



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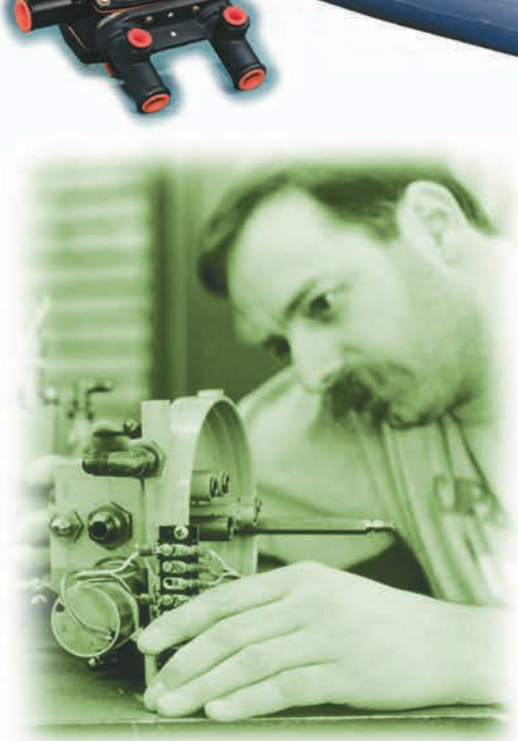

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