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The Magazine for Aircraft Maintenance Professionals

UPDATE



Transport Canada Approved for R/T

A large photograph of a white aircraft engine on a tarmac, with other aircraft and airport buildings in the background. The engine is the central focus, with its intake and exhaust visible.

Off the ground:
**Bombardier delivers
C Series to SWISS**

The legend continues:
the Harvard II

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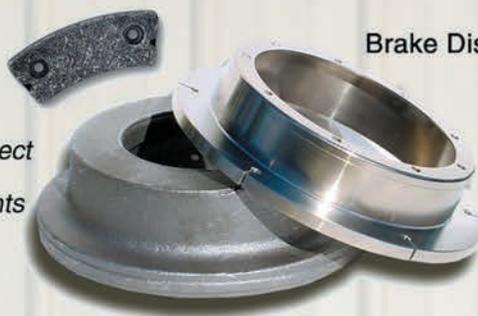
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Still, the world's fastest man



Eldon Joersz and George Morgan return from their record-setting flight in July of 1976.

Like an indestructible bar of Mcintosh toffee, there are some things that simply last and last. An incredible record set by Eldon Joersz is one of them. It was on July 28, 1976 that Joersz officially became the fastest man in the world when he flew his US Air Force Blackbird plane at an astonishing 3,529.56 kmh (2,194 mph) at an altitude of 80,600 feet. Flying with George Morgan as reconnaissance systems officer, Joersz covered almost one kilometre per second, flying at Mach 3.3 above Edwards Air Force Base.

Their craft was the legendary SR-71 Lockheed Blackbird, a long-range strategic reconnaissance aircraft in service from 1966 to 1998. Only 32 were ever built, and only 135 pilots ever qualified to fly one.

Speaking from his home near Dallas, Joersz said: "The visionary for these records was Wing Commander John Storrie, and the other guy was Jim Sullivan, the SR-71 pilot that flew New York to London in one hour, 54 minutes in 1974."

In 1976 the decision was made by Storrie and Sullivan to set the world absolute speed record. Flying three times faster than sound and with an engine temperature approaching 427 Celsius, Joersz and Morgan flew 25 kilometres. Once through the box, they had to turn and complete another run at the same altitude. An average of the two speeds was taken, and that was the record speed.

"After the second time, control said, 'Unofficially, the record is 2,194 mph.' They knew what it was right away," said Joersz.

Inside the cockpit they were elated—although a little disappointed they hadn't gone even faster. "Our informal goal between the two of us was for 2,200 mph. So actually, we were quietly a little disappointed that we'd missed it by seven mph!"

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Upcoming Events

RCAF Snowbirds are Georgia-bound



Canucks looking for a road trip in the fall might want to take catch up with the Royal Canadian Air Force Snowbirds, who are scheduled as the headliner act at Georgia's inaugural Wings Over Golden Isles, October 8-9, to be staged at the Brunswick Golden Isles Airport. The family event will also include performances by world class performers including the US SOCOM Para-Commandos, Rob Holland, Patty Wagstaff, Buck Roetman, Bill Braack's Smoke-N-Thunder jet car, Kent Pietsch, Scott Yoak's Quicksilver P-51D Mustang and the GA-based Sky Soldiers cobra team.

Wings Over Golden Isles will cap off the first day of flying with a concert headlined by Southern Rock Recording Artists .38 Special. Local North Georgia favorites Angie Lynn Carter and Scott Thompson are the opening acts for the concert. A show of fireworks will close the day of activities and set the stage for more air show demonstrations on Sunday.

CANADA

Abbotsford International Air Show

August 12 – 14, 2016
Abbotsford, British Columbia
www.abbotsfordairshow.com

Airshow Atlantic

August 20 – 21, 2016
Miramichi, New Brunswick
www.airshowatlantic.ca

Rotary Charity Air Show

August 31, 2016
Brantford, Ontario
www.rotarycharityairshow.ca

Val-d'Or Air Show

September 10 – 11, 2016
Val-d'Or, Quebec
www.arvo.qc.ca

UNITED STATES

Thunder Over Michigan

August 20 – 21, 2016
Ypsilanti, Michigan
www.yankeearmuseum.org

Airshow of the Cascades

August 26 – 27, 2016
Madras, Oregon
www.cascadeairshow.com

Boeing SeaFair

June 15 – August 21, 2016
Seattle, Washington
www.seafair.com

New York Air Show

September 3 – 4, 2016
Newburgh, New York
www.airshowny.com

Cleveland International Air Show

September 3 – 5, 2016
Cleveland, Ohio
www.clevelandairshow.com

NAS Oceana Air Show

September 9 – 11, 2016
Virginia Beach, Virginia
www.oceanaairshow.com

California International Air Show

September 24 – 25, 2016
Salinas, California
www.salinasairshow.com

Red Bull Air Race

October 1 – 2, 2016
Indianapolis, Indiana
www.redbullairrace.com

If you have any upcoming events you'd like to see listed, contact AMU's editor, John Campbell, at: amu.editor@gmail.com

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STCs & new products

Hydraulic-operated wind pin from Schweiss

Schweiss Doors now offers a hydraulic-operated wind pin designed for hydraulic doors. The hydraulic-operated wind pin rises out of the floor socket and the door automatically opens, eliminating the task of the door operator having to walk back and forth to the centre of the door and manually engage or disengage the wind pin. This operation is performed through the push of one button but there is a fully automatic remote control available, which allows operators to drive their vehicle, airplane or tractor up to the hydraulic door and open the door without leaving the seat of their vehicle. **For more information visit** www.SchweissDoors.com



GearWrench expands air impact line

GearWrench announced a three-member expansion of its 81 Series air impact wrench line. All three models feature a twin-hammer impact mechanism that is said to operate at reduced sound levels due to the efficiency of its muffler. The new wrenches come with a two-year warranty and include 3/8-, 1/2-, and 3/4-inch drives.



For information visit www.gearwrench.com

AVS-SYS introduces new range of composite parts

AVS-SYS Ltd. has introduced a new range of ultra-lightweight composite parts and components for aircraft, including specialist aerospace ducting. The new products are said to be up to 40 percent lighter than equivalent parts currently in use, and that this weight saving is delivered without any loss in fit, form or function. The maker of this product says that in a narrow body aircraft, use of the new ducts in the air distribution system would save up to 60 kilograms in weight. **For information visit** www.avs-sys.com



Enhanced sliding cockpit windows selected

Airbus has selected **PPG** enhanced-design sliding cockpit windows for installation in an A320neo airplane. After the aircraft is delivered, PPG will work with Airbus and the Federal Aviation Administration (FAA) to gain Parts Manufacturer Approval (PMA) to sell windows directly to airlines as replacements in the aftermarket in place of the current design. Operators can request PPG's new-design sliding cockpit windows, as well as its latest-design windshields and aft fixed cockpit windows, for installation in new aircraft of the Airbus A320 family. **For more information visit** www.ppgaerospace.com



Hyperion LED position anti-collision lights unveiled

KAD Aerospace Inc. and Whelen Engineering Company have unveiled the new 90777 Hyperion/Orion LED position/anti-collision light and the new Hyperion/Orion STC for Beechcraft King Air and 1900C aircraft. Benefits of the all-new 90777 LED light are said to include long-life performance, a five-year warranty and less weight, while being 30 percent brighter with a 70 percent reduction in power consumption. Lights are available with or without recognition lights.



For more information visit www.kadexaero.com

Release granted approval by Textron Aviation

Cleaning Systems Inc. has announced that its cleaning product called Release has been approved for use on all Textron Aviation models including Beechcraft, Cessna, and Hawker. Release is a multi-surface cleaning product that is said to safely remove carbon, dirt, oil, and grease from all surfaces on the exterior and interior of the aircraft. The biodegradable Release product is safe to use on both painted and unpainted surfaces of the aircraft, and rinses freely in both hard and soft water environments leaving behind no residue.



For more information visit www.cleaningsystemsinc.com

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NEW COMPOSITE PROP COMING FOR SUPERVAN 900



Hartzell Propeller and airplane modifier Texas Turbine Conversions announced in July that they are collaborating on a Supplemental Type Certificate for a new four-blade composite swept propeller for single-engine Supersport 900 aircraft. The propeller STC is expected fourth quarter 2016. Performance expectations are high for the 110-inch diameter propeller, which is said to be 60 pounds lighter than the prop it replaces.

“The combination of the 900 SHP Honeywell TPE331 engine and optional new four-blade composite propeller from Hartzell on the Supersport 900, flat out gets after it,” said Texas Turbine Conversions President Bobby Bishop. “The Supersport 900’s new lighter weight Hartzell prop helps the airplane distance itself even further from any possible competitors as the world’s best performing Cessna Caravan.”

BIG CROWD FOR HALL OF FAME CEREMONY



At a ceremony held June 9, at the Canada Aviation and Space Museum in Ottawa, four new members were inducted into Canada’s Aviation Hall of Fame. The

additional members bring to 224 the number of inductees named since the Hall was formed in 1973.

The annual event is growing in popularity, with this year’s ceremony attracting a significant increase in attendance. More than 400 people were on hand to witness this year’s class of inductees — Frederick James Carmichael, Kathleen Carol Fox, William Ross Lennox and Beverley Strahan Shenstone — being welcomed into the Hall. The Royal Canadian Naval Air Branch (1945-1968) was presented with the Belt of Orion Award for Excellence. Major-General J.C. Madower was the evening’s guest speaker.

“It speaks to the significance of aviation in Canada that our event is attracting more and more guests every year,” said outgoing Chairman of the Hall Tom Appleton, who steps down after serving six years on the Board of Directors and five of those as Chairman.

Canada’s Aviation Hall of Fame is located in the hangar at the Reynolds-Alberta Museum in Wetaskiwin, Alberta, south of Edmonton. The Hall was founded in 1973, and its inductees have led extraordinary lives as military and civilian pilots, doctors, scientists, inventors, engineers, astronauts and entrepreneurs.

BC SPECIALIST TO SEND SIKORSKYS TO NORWAY



VIH Aerospace, a Victoria, BC-area provider of helicopter maintenance, manufacturing, repair and overhaul services; and a specialist in designing Supplemental Type Certified solutions for the Sikorsky S-92 helicopter, is in the process of delivering two Sikorsky S-92 helicopters to a leading offshore oil and gas

operator, in response to the grounding of the Airbus H225 helicopters pending the investigation of a fatal H225 helicopter crash of the coast of Norway on April 29, 2016. The aircraft identified for quick maintenance and modifications turnaround by VIH expert engineers have required greatly differing work scopes in order to meet the compressed delivery timeline required by the operator.

“The initial S-92 helicopter, which was recently delivered, represented the lesser of the two work scopes; requiring a Service Life Extension Program, as well as performance of all scheduled inspections, a thorough inspection of all avionics and electrical systems, completion of and/or ensuring all required Airworthiness Directives were addressed, and a variety of detailed airframe repairs were carried out,” said Jeff Norie, Director of Maintenance for VIH Aerospace, adding that the second S-92 helicopter has required a more detailed workscope, which also included the SLEP.

Additionally, in order to prepare the helicopter for its upcoming deployment, VIH Aerospace’s engineers performed a full conversion from VIP configuration to a Search & Rescue and passenger carrier configuration.

“This was a very labour-intensive and technically specialized project, one that included de-modifying the S-92 and then re-modifying it with mission equipment specific to a SAR role,” said Norie.

Added to this was integration of Supplemental Type Certified equipment such as VIH Aerospace’s Auxiliary Fuel Tank system and SAR console, as well as extensive structural modifications and a complete paint strip and custom paint application.

AEROSPACE INDUSTRY R&D TOPS IN COUNTRY

A joint annual report released in early July by the Aerospace Industries Association of Canada (AIAC) and Innovation, Science and Economic Development Canada (ISED) suggests that the aerospace industry is Canada’s most

innovative manufacturing sector, leading manufacturers in R&D investment and posting nearly 30 percent of the sector's R&D investments in 2015.

In addition to its innovation leadership, Canadian aerospace is strongly integrated into global supply chains and remains a major player in the international aerospace market.

Key findings in the 2015 State of the Canadian Aerospace Industry report include that Canada's aerospace industry contributed more than \$28B to GDP and 211,000 jobs to the Canadian economy in 2015, and that Canadian aerospace manufacturing was the number one R&D investor across manufacturing industries and was, in fact, over five times as R&D intensive as the manufacturing sector average.

HIGH DEMAND FUELS AIRBUS EXPANSION



As part of Airbus Helicopters Canada's international Repair and Overhaul operations, it has expanded its Support and Services department at their main facility in Fort Erie, Ontario. The now 5,000-square-foot space is an increase of 65 percent for the company's Repair and Overhaul department.

"It is our main priority to keep our customers' aircraft operating at peak performance," said Romain Trapp, President of Airbus Helicopters Canada. "With this expansion, we will increase the efficiency of our Repair and Overhaul capabilities, resulting in faster turn-around-time when an aircraft requires service."

The company says that the expansion of its Repair and Overhaul department is a direct result of the high demand for service from customers both domestically and internationally. Five years ago

there was a dramatic increase in AS350/H125 aircraft sales worldwide. With 300 to 600 flight hours per year, many of these aircraft are coming due for overhaul. Today, there are currently 522 AS350/H125's flying in Canada.

Part of the newly expanded facility is the creation of additional Repair & Overhaul workstations as well as, the hiring of new full-time employees to assist with the high demand. Airbus Helicopters Canada is considered an International Centre of Excellence for light aircraft.

AVCORP AND UBC PURSUE PARTNERSHIP



Avcorp Industries and the University of British Columbia have agreed to explore the establishment of a Learning Factory for Advanced Composites at UBC's Okanagan campus. The two parties, represented by Avcorp CEO Peter George and UBC Deputy Vice-Chancellor and Principal Deborah Buszard, signed an MOU in July at the Farnborough International Airshow in the United Kingdom. "Avcorp Industries is committed to exploring the establishment of an industry-first Learning Factory which will push the boundaries of advanced composite manufacturing as well as provide new levels of research and training," said Peter George, CEO of the Avcorp Industries Group. "We are looking forward to working with the UBC-based Composites Research Network in an initial focus on aerospace applications of composite materials and optimized manufacturing processes."

Avcorp Industries is a leading supplier of integrated composite and metallic aerostructures, based in Delta, BC.

SOME LIGHT AT END OF THE TUNNEL SAYS LOCKHEED



In early June of this year, the Lockheed Martin Corporation released statements that suggest the company is seeing some

encouraging signs in the commercial helicopter market after last year's slump in demand from oil and gas companies as the sector grappled with a collapse in oil prices.

Nathalie Previte, vice president of sales and marketing for Sikorsky, a unit of Lockheed, told news agency Reuters that she expected flat demand for commercial helicopters this year, with analysts forecasting a return to growth in 2017. Ms. Previte said Sikorsky had expected a sharp drop in flight hours in the sector in 2015, given a number of contract cancellations, but that flight hours actually rose by one percent in the year ended December 2015.

In addition, she said Sikorsky had won several tenders in the sector this year, including two deals in Norway, one in Asia and several others that she could not identify due to security concerns. However, Ms. Previte cautioned against reading too much into the positive news given residual issues in that market, including large excess capacities. ■



Bombardier C Series:

Bombardier's C Series is a family of narrow-body, twin-engine, medium-range jets targeted to compete against airliners such as the Embraer E195-E2 and Boeing's 737. While the C Series has been a controversial program in the home market, this summer has been important for Bombardier as the CS300 received initial type certification, and the CS100 was delivered to SWISS Air as the first aircraft in almost 30 years designed to serve the 100- to 150-seat segment. Here, we look back at some milestones in the program.



Above left: First flight of second CS300 Flight Test aircraft.

Above right: Take off of a Bombardier C Series aircraft, delivered to SWISS Air.

finally off the ground

At the end of June, Bombardier announced the delivery of the first C Series aircraft to launch operator Swiss International Air Lines as SWISS and Bombardier employees gathered alongside government representatives, suppliers and media for what was clearly a proud occasion for all. The CS program had been dogged by controversy in Canada, and even as late as October of last year, a pending sale of the new jets to Airbus had fallen apart, with provincial and federal levels of government purportedly stepping in with offers of bailout money. But those were more troubled days. The delivery date of June 29 was intended as a festive occasion marked by words of encouragement for everyone involved as

the first CS100 aircraft was scheduled to enter service on July 15th, with its maiden commercial flight taking passengers from Zurich to Paris-Charles de Gaulle.

“A new aircraft program like the C Series aircraft comes around once in a lifetime, and it’s a proud achievement that belongs to many,” said Rob Dewar, Vice President, C Series Aircraft Program, Bombardier Commercial Aircraft.

“This first delivery is the culmination of hard work, collaboration and dedication by thousands of employees, partners and suppliers, and I’m thrilled to applaud them today as we celebrate the delivery of the first CS100 aircraft to our valued customer: SWISS.”



Above: Bombardier C Series aircraft touches down in Zurich, June 17th.

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SWISS, which will gradually replace its Avro RJ100 fleet with the C Series aircraft, also struck a positive note:

“SWISS is proud to be the first airline to take title of the C Series — the world’s newest, innovative and technologically advanced aircraft,” said Thomas Klühr, Chief Executive Officer, SWISS. “The aircraft performed exceptionally well during its acceptance flight, as expected. Along with the CS300 aircraft that we’ve also ordered, the C Series fleet will allow us to tailor our capacity to demand on European routes while providing an excellent travel experience. We congratulate Bombardier and our own SWISS teams on this milestone delivery as we now turn our focus to the CS100 aircraft’s entry into service.”

The SWISS-operated CS100 aircraft will fly to Manchester, Prague and Budapest with other destinations such as Warsaw, Brussels, Nice, Stuttgart, Hanover, Milan, Florence and Bucharest being added.

The start of revenue service comes at a time when Bombardier says it is seeing increased momentum for the C Series aircraft. During the Farnborough International Airshow in mid July, Bombardier confirmed orders for 127 C Series aircraft in the first half of 2016. “We believe that we will continue to attract many more orders in the 100- to 150-seat market as more airlines begin to crave the freedom to match travel demand with the new, right-sized C Series aircraft,” said a Bombardier press release, which went on to boast that the “C Series aircraft’s state-of-the-art fusion of performance and technology sets it well apart from other aircraft in its class.”



Above: Bombardier C Series interior.

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Above: Bombardier C Series flight deck.

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Also announced at Farnborough was that Transport Canada has awarded type certification to the CS300 aircraft and that delivery of this larger model to launch customer airBaltic remains on track for the fourth quarter of 2016. So, with all that running in the background, here is a good point to look at the timeline of the C Series aircraft that will take to the skies with Pratt & Whitney PurePower PW1500G engines, 19-inch-wide seats, and the largest windows in the single-aisle market. Below is some background on the development of the C Series aircraft:

2004: Bombardier Aerospace employed a dedicated multi-disciplinary team to evaluate the feasibility and begin the development of a new-generation commercial aircraft.

2007: Bombardier and Pratt & Whitney (P&W) reach an agreement on commercial and technical terms to provide exclusive power for the C Series aircraft with P&W's Geared Turbofan engine, now branded the PurePower engine.



At a post- news conference photo op, June 17, 2016, from left: Fred Cromer, president of Bombardier Commercial Aircraft; Jennifer MacIntyre, ambassador of Canada to Switzerland; Ernst Stocker, president of the Zurich Government Council and head of the Department of Finance; SWISS CEO Harry Hohmeister.

2009: Bombardier Aerospace celebrates the groundbreaking of the first C Series aircraft building in Québec. Located at Mirabel, 45 minutes north of Montréal, the Complete Integrated Aircraft Systems Test Area (CIASTA) is a high-tech testing and systems-proving facility that will house a virtual C Series test aircraft. CIASTA will test aircraft systems for reliability and functionality one year before the first prototype aircraft flies.

2010: A foundation stone-laying ceremony held in Shenyang, China marks the start of construction of the facility that will build the fuselage for the C Series mainline commercial jetliner. The 226,042 square-foot (21,000 square-metre) facility will be operated by Shenyang Aircraft Corporation (SAC), a subsidiary of the state-owned aviation industrial entity, China Aviation Industry Corporation (AVIC). SAC is a key supplier in Bombardier's C Series aircraft program.

2010: Bombardier announces that testing of the C Series aircraft's composite demonstrator wing is under way at Bombardier's Belfast facility, which is responsible for the design, development and manufacture of the advanced composite wings for the C Series aircraft. The composite wing represents an innovative leap forward in aviation design and technology.

2011: Bombardier announces that the installation of the systems rigs at the CIASTA was progressing on schedule. CIASTA integrates flight control systems, avionics, hydraulics,

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electrical and environmental control systems prior to the C Series aircraft's first flight.

2012: Bombardier announces that the first set of systems tests and simulations for the C Series aircraft, including those on the engine and electrical system, had started in its systems integration rig known as "Aircraft 0."

2012: Bombardier conducts virtual flights with Aircraft 0.

2012: Bombardier says the assembly of the test airframe for its all-new C Series aircraft is well underway.

2012: The cockpit and all fuselage sections for the C Series aircraft's first flight test vehicle (FTV1) arrive at Mirabel, and assembly of FTV1 progresses.

2013: The major components and systems, namely the wings, cockpit, horizontal/vertical stabilizers, all fuselage sections and the engines for FTV1 are mated on site at Mirabel.

2013: Bombardier Aerospace and Pratt & Whitney announce that Pratt & Whitney achieved Transport Canada type certification of its first PurePower Geared Turbofan engine—the PW1500G.

2013: The first full powering on of the main electrical distribution system on FTV1 is completed. Additionally, Bombardier confirms that the wing down-bending static test was successfully concluded on the Complete Airframe Static Test (CAST) article.

2013: With the integration of the C Series aircraft's auxiliary power unit and Pratt & Whitney's PurePower Geared Turbofan PW1500G engines on FTV1 running smoothly, the aircraft's key systems can now be tested.

2013: Bombardier celebrates the C Series aircraft's successful first flight during which FTV1 reached an altitude of 12,500 feet (3,810 metres) and an air speed of 230 knots (426 kmh). In-flight tests included flap and landing gear retractions and extensions; in-flight maneuvers that included a simulated landing; and early validation of the flight control system.

2015: Following an inspection of the aircraft and a review of all the associated build documentation, Transport Canada inspectors issue the flight permit that allowed the first CS300 flight test vehicle to join the flight test program.

2015: The maiden flight of the CS300 airliner, during which it reaches an altitude of 41,000 feet (12,500 metres) and a speed of 255 knots (470 kmh).

2015: Bombardier announces that, based on flight tests results, its all-new CS100 and CS300 aircraft were exceeding their original targets for fuel burn, payload, range and airfield performance. In addition, the C Series aircraft were on track to meet noise performance targets, making them the quietest commercial jets in production. The C Series aircraft's maximum range was confirmed to be up to 3,300 NM (6,112 km), some 350 NM (648 km) more than originally targeted.

2015: In December, the CS100 receives its Transport Canada Type Certification following a testing program that included more than 3,000 flight test hours.

2016: The European Aviation Safety Agency (EASA) and the Federal Aviation Administration (FAA) award Type Validation to the CS100.

As of this writing, Bombardier had booked orders and commitments for 803 C Series aircraft, which include firm orders for 325. *(With Bombardier Aerospace files.)* ■

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ONTARIO

In 2015 the Ontario AME Conference was held in four locations and sponsored by Air Canada, Air Transat, Jazz Aviation and WestJet. In 2016, the AME Conference and the AME Association of Ontario have joined forces to present: Ontario 2016 AME Conference “The Future of the Profession.” This event runs September 27-29, with the host venue being the Hilton Meadowvale Resort and Conference Centre in Mississauga. Members are advised to reserve before September 1 to receive the special Ontario AME Conference rate.

The symposium is held annually and is a perfect opportunity to take in networking opportunities, participate in training sessions and meet vendors. The primary objective of the workshop is to provide new information and training to industry personnel. CARs part v, standard 573.06 states “pursuant to subsection 573.06(1) of the CARs, an AMO certificate holder shall ensure that all staff with technical responsibilities are provided appropriate training in technical, regulatory and human factors issues related to the work for which they are responsible.” (Transport Canada may accept this as approved training depending on your company requirements.)

This forum also provides an opportunity to meet new people in the field and greet old friends—as well as putting faces to the names of

the people that regulate the aviation world. The commitment and initiative of the AME workshop committee is very commendable and we would like to take this opportunity to extend our deepest gratitude and appreciation to each volunteer. In addition, a special thank you is extended to all those individuals and organizations that provide contributions to the symposium. This event is not possible without the hard work, dedication and support of those individuals and organizations.

As the annual Symposium and Workshops are to be held Wednesday and Thursday, the exhibitors will set up Tuesday evening. This is a change from previous years when our workshop was held Thursday and Friday. The workshop committee expects that by moving the operations forward by one day it will be more convenient for exhibitors, speakers and attendees. Hopefully the conclusion of the workshop on a Thursday will ease the congestion and frustration of the Friday afternoon rush. Again this year we will be having two days filled with educational sessions as well as a full house of displays from industries supporting aircraft maintenance.

Visit www.ame-ont.com for all the details.

PACIFIC

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
email: pamea@telus.net

ATLANTIC

Atlantic AME Association



President's Notes

I hope you enjoyed this year's ARAMC conference in Moncton. Jacques Richard and his team put on an excellent conference. The displays had representatives from all sectors of the aviation industry and the technical sessions had a lot of substance. One of these presentations was especially interesting for me due to my involvement in avionics and aircraft wiring in general. The subject of 'Aging Wires' presented by Don O'Leary from the Nova Scotia Community College NSCC got my full attention. The subject matter was supported

with examples and events such the SWISSAIR 111 accident in Peggy's Cove where he was personally involved in the investigation process and other events. I have attended a few sessions at various conferences and this was the best by far. Thank you Don and well done conference organizers. I don't want to leave the impression that the other technical sessions were not good; this one was specific to my field of work. This is always a very difficult task for the conference organizers to find subject matters that is of interest to everybody. Our association has members from the air carriers, commuters, flight training, charter, small helicopters, large helicopters, small AMOs, large AMOs, private AME and

Aviation service industry. You can see that the task of finding a subject that is of interest for everybody is difficult and makes it a challenge for the person in charge of an ARAMC.

If you have something in mind that you would like to see a technical session on, contact Mel Crewe and he can incorporate that into his 2017 conference in St. John's.

A disturbing observation for me was the way that Transport Canada has viewed this conference. Funding was cut by the Political sector of the TC department due to election promises on the budget and the Regional Office had no choice other than to keep the inspectors in their offices. The AME Association and Chairman Jacques Richard worked out a compromise by letting the TC Staff attend the conference without any registration fee. This made possible the attendance of TC inspectors and staff and we also had Keith Whalen, Associate Director Operations attend and interact with attendees. I'm not alone in stating that the ARAMC conference is an excellent venue to bring members of the Aviation industry together and interact with the Regulator and discuss issues and find a solution face to face. Our Industry is the safest means of Transportation and this has been accomplished through working together and sorting out pending issues before they become a problem, or worse, an accident. Communication is essential and we provide an excellent place to do this, the ARAMC.

— Uli Huber, President, AME Association (Atlantic)

News from the Rock

By Mel Crewe

Hello fellow AMEs, apprentices, students, and corporate sponsors. It is newsletter time once again and an opportunity to bring you all up to date with happenings on this end of the Rock. The 38th annual Atlantic Region Aircraft Maintenance Conference was held in Moncton, New Brunswick, from April 6–8, 2016, at the Delta Beausejour. The theme of this year's conference was "Professionalism and Quality – A Higher Standard." As delegates began arriving, they availed of the opportunity to register on Wednesday and prepare for the Meet and Greet as displays began to set up their booths. The Meet and Greet is an opportunity to renew old acquaintances, make new ones, and catch up on the scuttlebutt since last year. Complemented by some delicious hors d'oeuvres and beverages, it was a lovely evening of relaxation.

On Thursday morning, delegates had the opportunity once again to register and the Display Area was opened to the delegates. The official opening was at 0800 hours, with Mr. Bernard LeBlanc, Manag-

ing Director, Greater Moncton Int'l Airport, presenting the Opening Remarks. After a complete day of technical presentations, the A.M.E. Association (Atlantic) Inc. held their annual General Meeting. The meeting was well attended, and it was one of the most informative sessions in quite some time, due in great part to the news from Transport Canada that they were going to cut spending and their participation in seminars and safety meetings. The directive to cancel participation in conferences and Regional Aviation Safety Council meetings came from the Minister's office in Ottawa. Although restricted by Transport, some inspectors attended the technical sessions on their own accord. The A.M.E. Association (Atlantic) Inc. Board of Directors meeting was held immediately following the annual meeting with Mr. Uli Huber, President, presiding.

The Awards Banquet was held Thursday evening in the Shediac Ballroom. Mr. Alan Chaulk was the Master of Ceremonies and kept everyone entertained. Following a delicious meal, it was time for the Awards presentations. This year's Awards winners are to be congratulated for their achievements. This year the winners are: Earl Blakney Aviall Canada Ltd. Award; Dana Ladd; Roger Richard Memorial Award; David Alston; Newfoundland Government Air Services Memorial Award; Brenda Huber; A.M.E. Association Bursary Award; Mitch Mendosa, College of the North Atlantic, Gander campus; and A.M.E. Association Bursary Award; Andre Robichaud, Nova Scotia Community College. Another award was presented to James Power—the induction into the Canadian AME Hall of Fame Award. Congratulations to all the award winners.

After the presentation of awards, there was some hilarious entertainment by comedian Francois Weber. His comedy and utilization of some members of the audience was fantastic and hilarious. Good choice! On Friday morning, it was back to the daily routine, technical sessions and visits to the Display Area. The closing ceremony was held at 3:00 p.m., with yours truly giving the closing remarks and encouraging delegates to make their plans for ARAMC 2017 to be held at the Delta St. John's Hotel and Conference Centre, from April 26-28, 2017. Following the closing remarks, critique draws were held with some beautiful prizes being handed out to the lucky individuals. Congratulations to the critique draw winners.

I would like to congratulate Jacques Richard and his committee for organizing and presenting a fantastic show and I think the content was very beneficial to those in attendance.

www.atlanticame.ca

Western AME Association

About Our Association

The Western AME Association is one of five similar associations across Canada, and is run by a volunteer group of AMEs who are elected by the member AMEs to the Board of Directors. The membership is comprised of AMEs, non-licensed personnel working in the industry, students and apprentices as well as corporate members. A separate committee, under the auspices of the association, runs an annual

symposium/workshop. This workshop is a two-day event that features speakers on a variety of related topics, as well as an industry tradeshow with over 50 booths from various companies, suppliers, manufacturers and other organizations. Attendance at this and our various other smaller workshops may be counted towards the recurrent training requirements required by Transport Canada.

www.wamea.com





Central AME Association



Central AME NASCO Award (Outstanding AME)

Congratulations to Gary Polinuk of Selkirk, Manitoba's Riverside Aircraft Maintenance Ltd. who is the 2016 NASCO Award winner. Gary has been involved with aircraft for over 40 years as he grew up in the family business. He started with his private pilot licence in 1978 and then received his commercial pilot licence in 1981. Business was expanding and there was a need to have an AME on site, so Gary obtained his AME licence in 1983. A Structures licence followed in 1993. Riverside Aircraft Maintenance was formed in February 2000 with Gary as the owner and president. A strong reputation exists due to the hard work and high standards that Gary expects and models himself.

In the community, Gary is a member of the Rotary Club of Selkirk, the Selkirk Biz and the Canadian Federation of Independent Business. Gary is very community minded and supports many organizations such as STARS Air Rescue, Selkirk Steelers, Selkirk Junior B, Kids Fishing for a Cure, The Dream Factory, Rotary Lobsterfest, and the Selkirk Curling Club. Gary also supports this symposium each year with prizes and/or monetary donations.

When Gary can get away from the hangar, you can find him in a curling rink, on a beach in the Caribbean or flying up north to the cabin with his wife Michele. Gary plans to keep working in aviation for many years ahead!

www.camea.ca

CENTRAL

PAMA SoCal Chapter



February 2016 Meeting Wrap

Notification of Final Flight

On July 8, 2016 our friend Bill Meyer passed away. Bill was a top notch Aviation Maintenance Professional that will be missed by all. Bill worked as the Director of Maintenance for Land Air Sea Leasing. As well, he was team member at Garret Aviation and Airesearch Aviation during his career. He was a Member of PAMA National and also served on the PAMA National Board of Directors. Bill was also a member of the Southern California Chapter of PAMA since its beginning days.

April 2016 Meeting Wrap

The SoCal Chapter thanks Mike Broderick, Product Applications and all at Trace Worldwide for their time and generosity in hosting the April 2016 Chapter dinner meeting and excellent technical presentation on "Turbine Engine Hygiene" at the 94th Aero Squadron Restaurant in Van Nuys, California. To learn more about how Trace Worldwide can improve and extend the life your turbine engines, contact Mike at rotordoc1223@icloud.com or visit www.traceww.com.

www.socalpama.org

SOCAL

Central Ohio PAMA



www.copama.org

Golf Outing

It's time again to register for this fall's Central Ohio Aviation Golf Outing on Friday September 9 at Kyber Run Golf Course. This will be the 14th year for the event co-hosted by COPAMA and the Professional Pilots Association (PPA). Sponsor emails are being sent and the July Newsletter will officially notify those on our email list.

We'll use the Bird Ease Pro website for Player and Sponsor registration and hope you'll visit to learn more about the event, location and sign up to play! The course fills quickly so don't wait to claim your spot in the fun and festivities! Hope to see you there!

FAA Airman Knowledge Testing Center

Columbus State Community College's Testing and Talent Assessment Center would like to announce that they are a FAA Airman Knowledge Testing Center (FAA LAS#43201) through PSI/Lasergrade offering most of the written testing for FAA Airman Knowledge Tests. (At this time they are unable to test for the Inspection Authorization). To schedule a test please contact PSI/Lasergrade at www.lasergrade.com or 800-211-2754. CSCC Testing and Talent Center at 614-287-5750 or act1@csc.edu The Testing and Talent Center is located on the second floor of the Workforce Development (WD223) Building, 315 Cleveland Ave., Columbus OH 43215.

CENTRAL OHIO

PAMA Dallas – Fort Worth



DFW

About Us

The DFW Chapter of PAMA is a non-profit association dedicated to promoting professionalism and the recognition of the Aviation

Maintenance Technician through communication, education, representation and support, for continuous improvement in aviation safety.

email: curtislandrum@charter.net

www.pamadfw.com



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the Harvard REBORN



The Canadian Forces Flying Training School in Moose Jaw, Saskatchewan unveiled a very special aircraft in July.

In honour of the British Commonwealth Air Training Plan (BCATP), 2 Canadian Flying Training School (2 CFFTS) received their newly painted CT-156 Harvard II at 15 Wing Moose Jaw on June 17th. Flown on its maiden voyage by Commandant 2 CFFTS, Lieutenant Colonel David Smith, the commemorative CT-156 Harvard II 156120 touched down in Moose Jaw after a short acceptance test flight and ferry flight from a paint facility in Prince Albert, Saskatchewan.

Through the diligent efforts of many, and in cooperation with NATO Flying Training in Canada (NFTC)

program partner, CAE, the aircraft has been painted in a yellow WWII BCATP paint scheme to commemorate the BCATP. The aircraft is painted to resemble an aircraft flown by Pilot Officer John Gillespie Magee, Jr, the famed author of “High Flight.” Pilot Officer Magee completed his wings training on BCATP Harvards, in June 1941 as a student on No. 2 Service Flying Training School, RCAF Station Uplands (Ottawa). “High Flight” is now considered to be the poem of the Air Force and is commonly read during Battle of Britain commemorations and graduation ceremonies.

“It was a privilege to receive the commemorative BCATP Harvard II and return it home to the skies above Moose Jaw,” said Lieutenant Colonel Smith. “I am extremely proud of the efforts of all members of our team both within 2 CFFTS and our industry partner, CAE. The monumental focus of effort symbolized by Canada’s contribution of the BCATP to the Second World War continues today, albeit on a much smaller scale with the NATO Flying Training in Canada program. It reminds us of what we can accomplish when we all work towards a common goal!”

To echo that sentiment Mike Greenley, Vice President and General Manager of CAE Canada responded by saying, “CAE is delighted to have had the opportunity to collaborate with the RCAF and 2 Canadian Forces Flying Training School on the BCATP commemorative CT-156 Harvard II paint scheme. The proud history of military flying training in Canada, and specifically Saskatchewan, is certainly worth celebrating. [We] look forward to telling the BCATP story alongside our DND partners during



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This year, the RCAF is commemorating the British Commonwealth Air Training Plan, one of the largest air training programs the world has ever seen, and marking the 75th anniversary of the establishment of the 400-series squadrons.



The Harvard II is painted to resemble an aircraft flown by Pilot Officer John Gillespie Magee, Jr, the famed author of “High Flight.”

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this important commemorative year. A big thanks to Plane Perfection in Prince Albert, Saskatchewan, who painted the aircraft; we are ecstatic with how everything turned out.”

The commemorative Harvard II is more than an impressive looking aircraft as it has also returned to its flying rotation within the training program. Current student pilots will once again have the honour of flying a yellow Harvard during their training, just like the pilots that came before them 75 years ago.

This year, the RCAF is commemorating the British Commonwealth Air Training Plan, one of the largest air training programs the world has ever seen, and marking the 75th anniversary

of the establishment of the 400-series squadrons, which continue to serve Canada and Canadians to this day.

2 CFFTS, as the principal host unit of the NFTC Program, currently operates the CT-156 Harvard II in both the primary and advanced fast-jet training role as part of 15 Wing Moose Jaw. Graduates of the Harvard II basic training program are assigned to Fast-Jet, Helicopter, or Multi-Engine advanced training with advanced Fast-Jet candidates remaining in Moose Jaw before progressing on the CT-155 Hawk and eventually, the CF-18 Hornet. The commemorative Harvard II will be available for viewings at the Abbotsford, Toronto and London Airshows. ■



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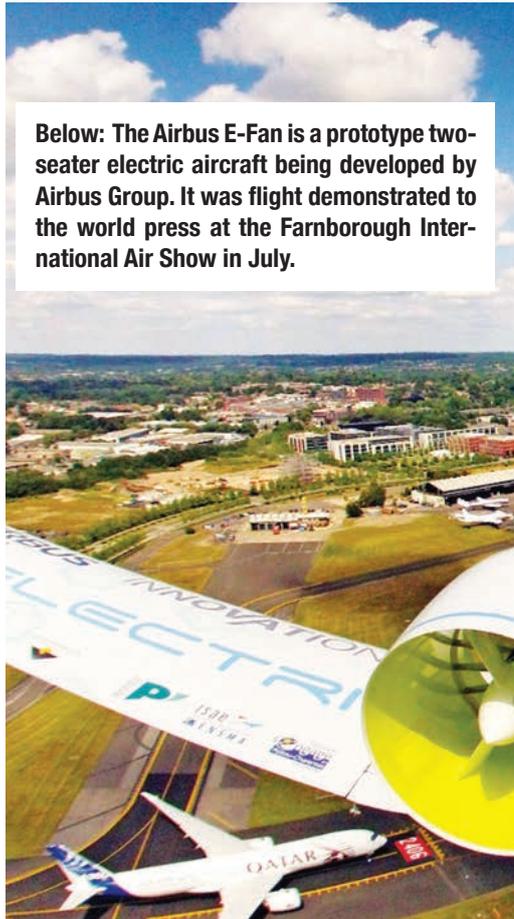
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Through the diligent efforts of many, and in cooperation with NATO Flying Training in Canada (NFTC) program partner, CAE, the aircraft has been painted in a yellow Second World War British Commonwealth Air Training Plan paint scheme to commemorate the Plan.

A staggering \$100 billion US in fresh orders went down at this year's Farnborough International Air Show.



Below: The Airbus E-Fan is a prototype two-seater electric aircraft being developed by Airbus Group. It was flight demonstrated to the world press at the Farnborough International Air Show in July.



Show of strength

It's often called the world's most important air show, and it's not hard to see why. At the close of the 2016 Farnborough International Airshow exhibition that ran July 11-17, organizers confirmed that the show had recorded orders and options to the value of US\$123.9 billion, defying industry expectations. Farnborough International's order tracker recorded a total of 856 aircraft valued at US\$93.98, 1407 engines valued at US\$22.7 billion and a variety of other business deals totaling £7.2 billion.

As the trade day drew to a close, the Farnborough International Airshow welcomed over 6,000 young people to the show for its STEM outreach program Futures Day. Star of the show was British Army Air Corps officer, European Space Agency astronaut and International Space Station crewmember Tim Peake who made his first public appearance since returning from the ISS in early June.

Starting the proceedings on a high note, the global aerospace trade event was opened by both



Stunt teams from around the world strut their stuff at the Farnborough International Air Show. This is Rich Goodwin Aerobatic's Pitts S2S Muscle Biplane in action.

Prime Minister, David Cameron, MP and Virgin Atlantic boss Richard Branson who welcomed senior aerospace executives, military officials and international government representatives at the official opening ceremony with a fly past by the F-35 Joint Strike Fighter flanked by the Red Arrows.

Notable deals over the week included Virgin Atlantic, concluding its purchase for 12 Airbus A350-1000, and the UK Government, confirming the purchase of 50 Apache Helicopters and 9 Boeing P-8 Poseidon aircraft. Topping the order chart was AirAsia which signed up for 100 Airbus A321neos.

While adverse weather drew business to a close early on Monday, the halls remained busy throughout the week. Visitor numbers from Monday to Thursday have average at 20,000 per day and there have been high levels of networking and engagement with a host of briefings, seminars and company presentations taking place.

Speaking at the close of the week, Farnborough International Chief Executive, Shaun Ormrod said, "The extreme



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British astronaut Tim Peake was on hand to help open Farnborough 2016.

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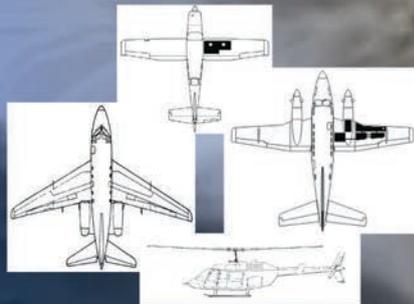
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weather bought us some additional challenges this week, but it doesn't seem to have stopped our exhibitors and visitors doing business. The halls have been busy all week, which is really encouraging for the supply chain industry. With these orders adding to the already large backlog, it looks like the aerospace industry is going to be busy for some years to come."

Commercial Director, Amanda Stainer further added, "It's been a really successful show for our exhibitors. Our marketing suite has been busy and we have already taken a considerable number of re-bookings for the 2018 show. The Meet-the-Buyer program went well, with over 1,700 meetings taking place, as did the military delegations and civil and commercial delegations program, which had representation from over 60 countries."



A Trent high-bypass turbofan engine on display at the Rolls-Royce booth highlights how far the company has come since its iconic Merlin V-12 piston powerplants of the 1930s.

Farnborough is a biennial showcase for the world of aviation, combining a major trade exhibition for the aerospace and defence industries with a public airshow. The first four days (Monday to Thursday) are dedicated exclusively to the business and trade aspects of aviation, with the final three days open to the public.

The airshow is an important event in the international aerospace and defence industry calendar, providing an opportunity to demonstrate civilian and military aircraft to potential customers and investors. The show is also used for the announcement of new developments and orders. ■

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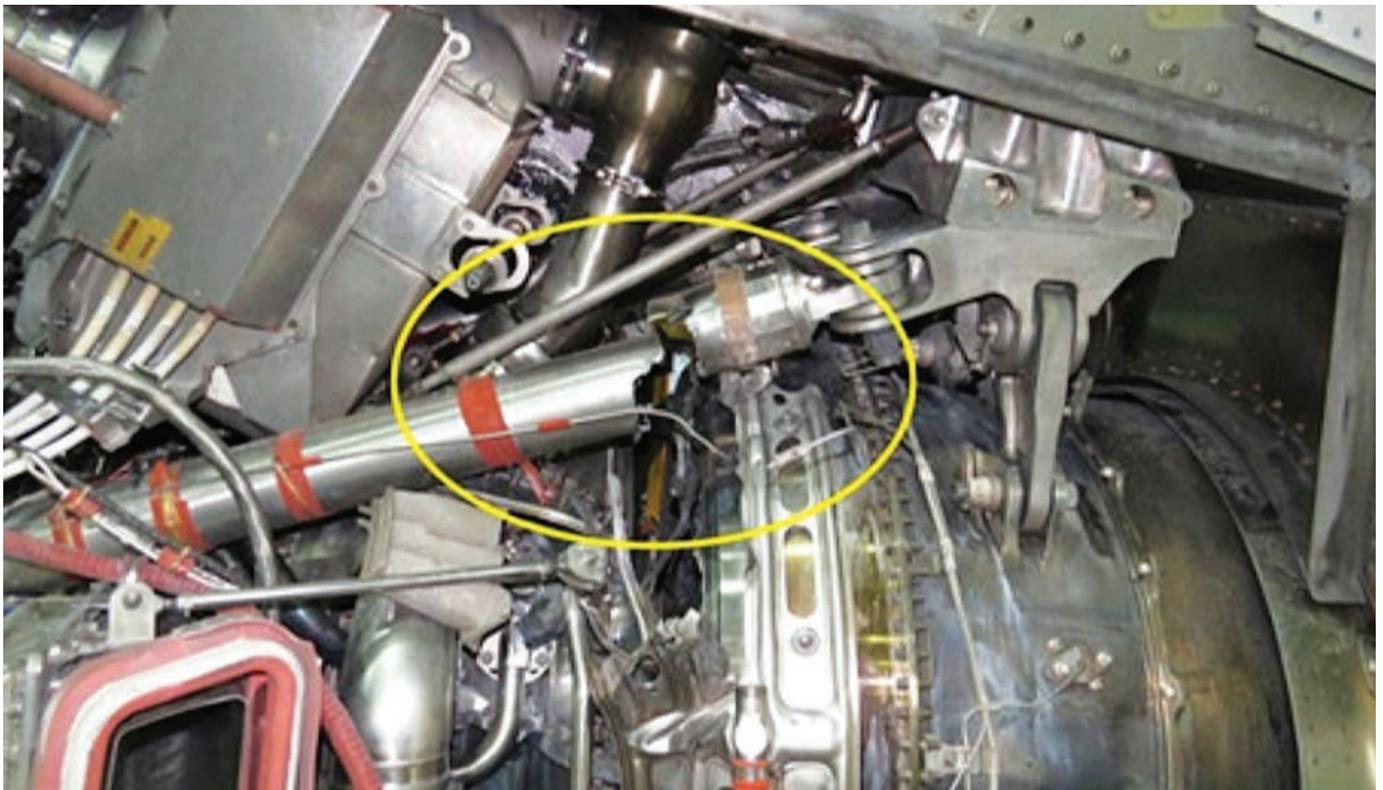
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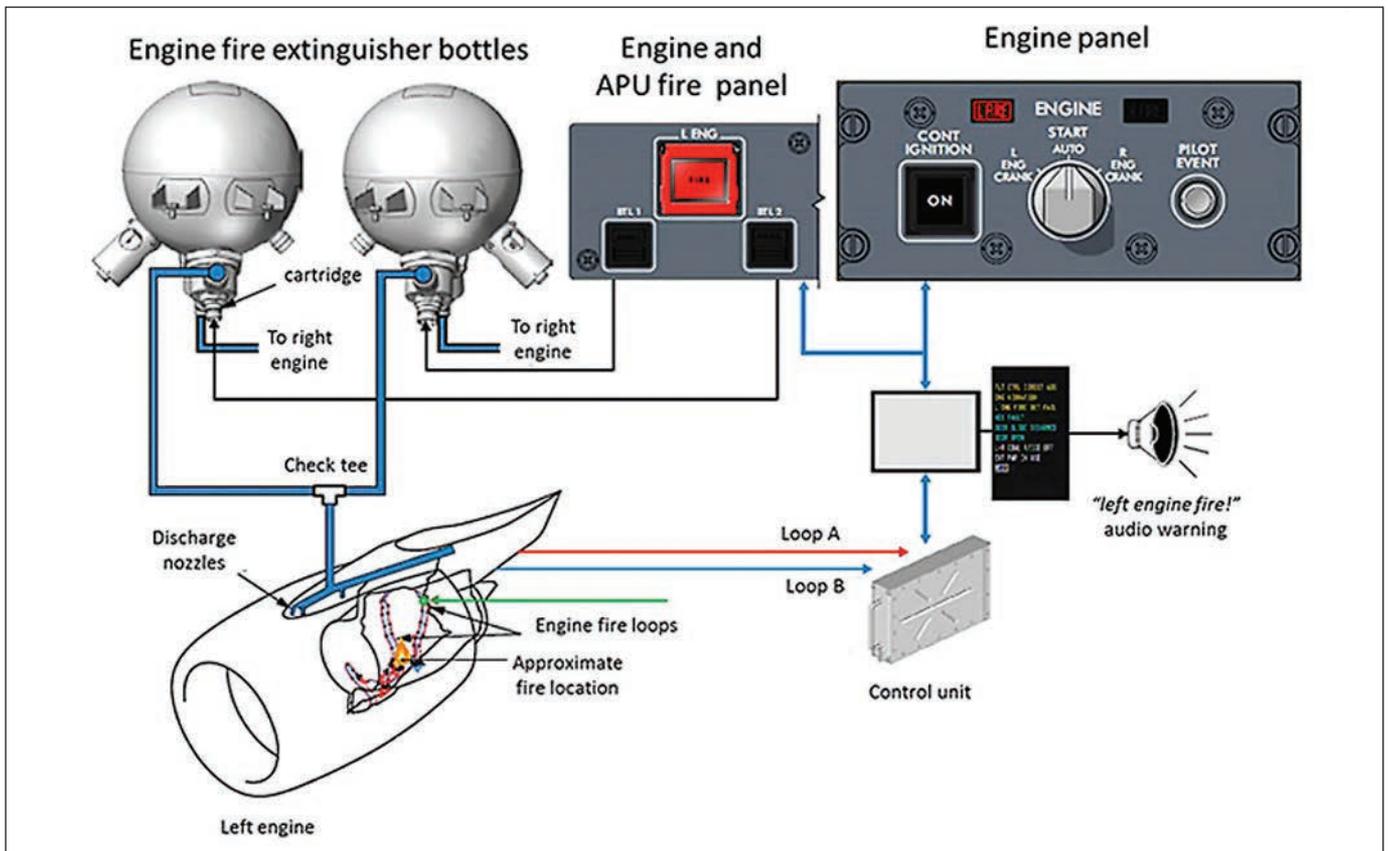


A flawed cool-down procedure ends in flames during ground runs at Mirabel Airport.

On May 29, 2014, a Bombardier C series CS100 (C-FBCS) with two pilots and four test engineers on board was conducting engine ground runs at the Montréal International (Mirabel) Airport, Quebec. During the test, at 1837 Eastern Daylight Time, the left engine (Pratt & Whitney Canada model PW1524G) experienced a sudden power loss caused by an uncontained turbine rotor failure. After having been advised of smoke and fire from the engine, the crew immediately secured the engine and declared an emergency. All personnel on board evacuated the aircraft. Bombardier ground personnel successfully extinguished the fire. There were no

injuries, but the engine and aircraft sustained substantial damage.

On the day of the occurrence Bombardier and Pratt & Whitney planned to conduct engine ground runs on a Bombardier CS100 aircraft, (referred to as Flight Test Vehicle 1/FTV1) in two distinct phases. The first phase was to run the right engine at various predetermined power settings in order for Pratt & Whitney engineering personnel to gather cabin air samples. This sampling was part of an ongoing effort to isolate the cause of an oil smell in the cabin and cockpit that was first noticed in early November 2013.



Above: Schematic of engine fire extinguishing system.

The second phase was to run the left engine, also at various predetermined power settings, in order to leak-check an oil pump assembly that had been replaced the previous evening as part of an effort to troubleshoot an oil consumption issue. This second phase was to be conducted in two parts. The first part of the engine ground run would be carried out with the thrust reverser doors open, then the engine would be shut down and the thrust reverser doors would be closed and secured. The engine would then be restarted for the second part of the engine ground run.

The plan called for two Bombardier test pilots to be at the aircraft's controls in the cockpit, while two test engineers (one from Bombardier, the other from Pratt & Whitney) carried out monitoring duties in the cabin. Two additional Pratt & Whitney engineers, also in the cabin, would conduct air sampling. Once an agreement had been reached on the test plan, the crew proceeded to the aircraft at 1400.

The aircraft was parked on Road 408 at the Mirabel Airport. An enclosed trailer that Bombardier uses to support engine ground runs was parked nearby. It contained various pieces of support and servicing equipment and tools, including wheeled fire extinguishers. There were two Bombardier aircraft maintenance engineers on standby in a nearby van, and two avionics technicians on the left side of the aircraft, one of whom communicated with the cockpit crew through the aircraft's built-in intercom system. Two additional aircraft maintenance engineers and a Pratt & Whitney engineer stood on the left side of the aircraft, forward of the wing tip.

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Above: Left inboard thrust reverser cowl damage.

After the flight crew completed their pre-run checklists, the right engine was started at 1514. The required tests and air sampling were carried out uneventfully and were completed at around 1700. The right engine was kept idling as a replacement Bombardier flight test engineer boarded the aircraft at 1718 to relieve the one on board, whose work shift had ended, and the passenger door was closed.

At 1723:56, dry motoring of the left engine was carried out for one minute and 38 seconds, and the engine was then left to spool down. For the next 11 minutes and 51 seconds, maintenance ground technicians ascertained that no leakage was found from the replaced oil pump assembly on the left engine. At 1738:20, the left engine was started and kept idling for seven minutes and 53 seconds before being shut down. While keeping the right engine at idle, the ground crew again checked for oil leaks and closed the thrust reverser doors on the left engine. No leak was found. At 1807:40, the left engine was restarted for an idle run of six minutes and one second. At 1814:27, the power level of the left engine was increased to 60 percent N1 according to the test plan, and kept at that setting for 15 minutes and eight seconds. At 1831:15, the left engine power level N1 was increased to 74 percent, where it stabilized at 1832:02. After the left engine had been running at that power setting for five minutes and 45 seconds, an explosion occurred in the left engine, which began to spool down. At 1837:52, upon seeing the explosion, two Bombardier ground crew exited the van parked nearby and ran toward the trailer parked on the right and aft of the aircraft, which contained the wheeled fire extinguishers. In the meantime, the ground crew technician advised the flight crew, through the intercom, that there had been an explosion.

The cockpit crew received no fire warning indication but did receive ENG VIBRATION, L ENG FIRE DET FAIL, and FIRE SYSTEM FAULT warnings on the screen

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of the engine indication and crew alerting system (EICAS). Once informed by the ground crew that there was fire on top of the left wing, the pilot-in-command (PIC) secured the left engine and shut down the right engine but did not discharge any fire bottles. The PIC ordered the co-pilot to arm the evacuation slides and to call for firefighting coverage, then used the intercom system to order the other occupants to evacuate through the right front door. The co-pilot called the airport's radio frequency to request aircraft rescue and firefighting (ARFF) assistance. He also ordered to "leave everything" and repeated this order, as some occupants were initially carrying personal equipment to the front right door. At 1838:25, the PIC requested confirmation from the ground crew that there was a fire and was again informed that there was fire and smoke over the left wing.

At 1838:58, the right front door's emergency evacuation slide was armed, and the door was immediately opened. Once the slide was deployed, all of the aircraft's occupants immediately began to evacuate. The PIC switched off the electric power in the aircraft and subsequently evacuated the aircraft last.

At 1840:15, the first fire extinguisher (containing carbon dioxide) was discharged on the burning engine by Bombardier personnel. The second fire extinguisher (containing dry chemical) was also discharged and extinguished the fire. ARFF personnel arrived on scene at 1842:20. At 1845:17, ARFF vehicles dispensed the first spray of fire suppressant foam and water on the engine and wing. At 1851, ARFF personnel officially declared the fire extinguished. At 2041, the aircraft was towed back to the Bombardier hangar and quarantined for the investigation.

Initial inspection revealed that the left engine sustained an uncontained failure in the low-pressure turbine's first stage area, and that debris from the engine caused damage to the airframe as well as lighter damage to the wing's lower surfaces, wing-to-fuselage fairing panels, wing leading edge slats, flap fairings, landing gear door panels and actuating mechanisms, landing gear strut and braces, and fuel inerting equipment.

Analysis

The flight crew was qualified and certified to conduct engine ground runs. Analysis focused on the engine cool-down procedure and the factors that led to the uncontained failure of the engine. From its initial release until the issuance of the engine's type certificate by TC, the Pratt & Whitney PW1500G installation and operating manual specified a 10-minute cooling period before shut-down in order to minimize the potential for oil coking in the main engine bearing

compartments and to mitigate a bowed rotor start condition. This cooling period was determined based on the results of testing carried out on development engines and demonstrated compliance with the PW1500G's certification basis.

The predicted temperature environment of the No. 4 bearing compartment, where the oil supply tube resides was evaluated in 2009 during engine development and certification, using a thermal analysis model, according to current engineering practices. The operational and normal soak-back temperatures that

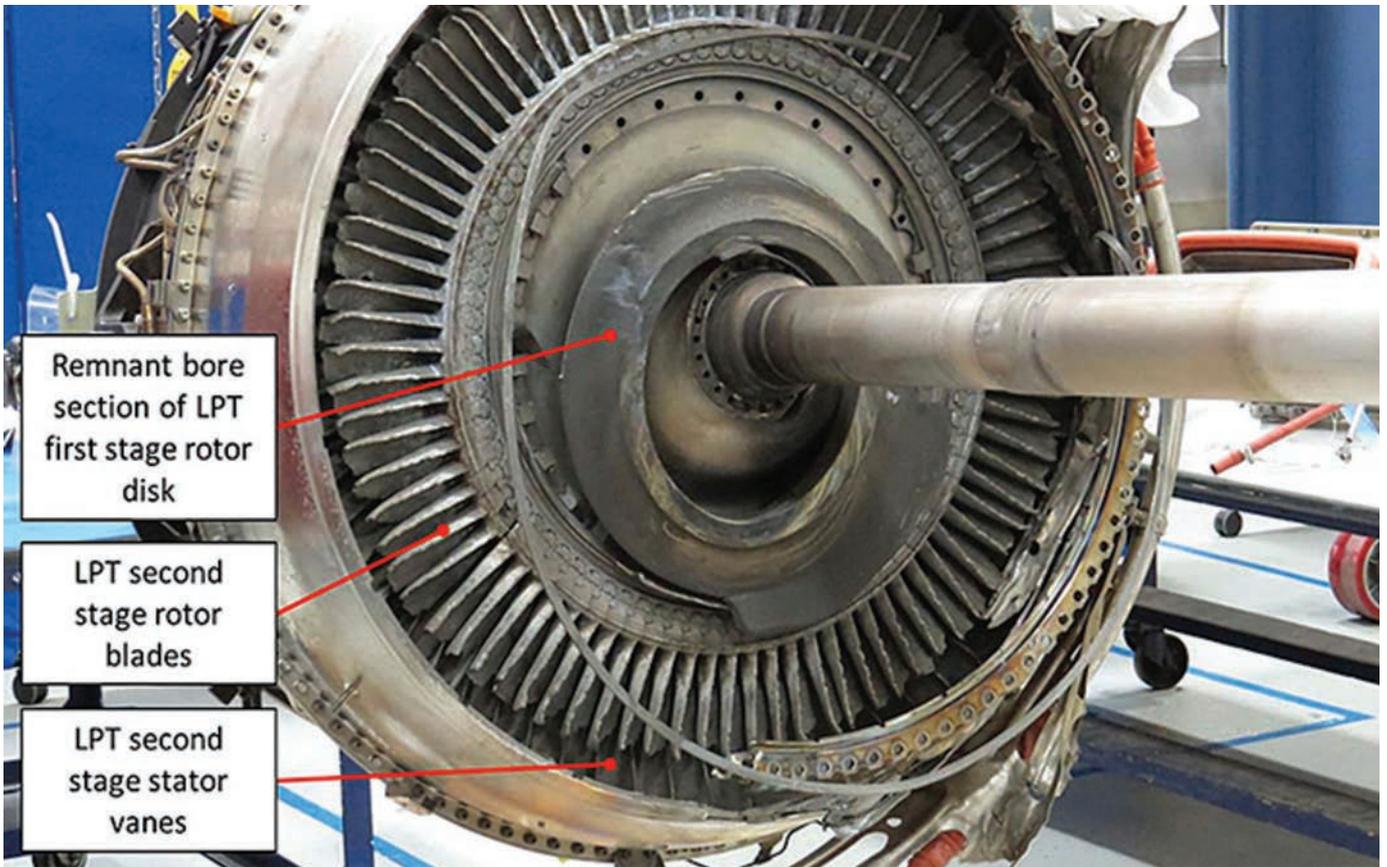
The advertisement features a collection of power tools against a blue background with a faint pattern of tools. The tools are labeled as follows:

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Below the tools is the USATCO logo, which consists of a globe with an airplane silhouette and the text "NY USATCO CA" and "U.S. Air Tool Co." Below the logo is the slogan "Serving the aerospace & metal working industries since 1951!". At the bottom, there are four small images showing hands using various tools on metal parts.

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Remnant bore section of LPT first stage rotor disk

LPT second stage rotor blades

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Above: Front face of the low-pressure turbine.

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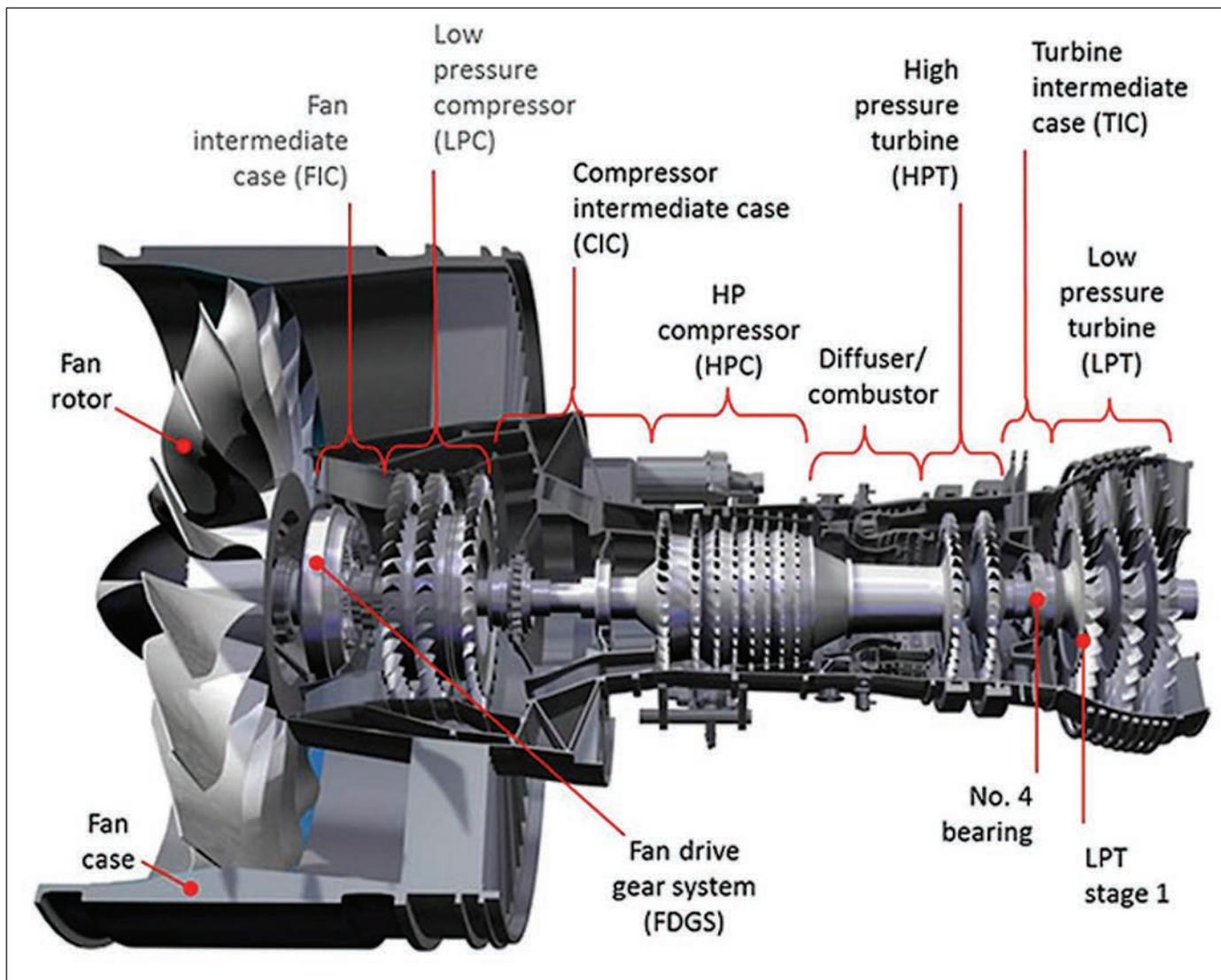
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Above: Cutaway view of PW 1500 series engine.

the No. 4 bearing oil feed tube's Teflon C-seal was expected to encounter in service were predicted to be below 500F. The effect of a hot shutdown was not considered at the time because the operating instructions required a 10-minute cool-down period before shutdown, which would have prevented the Teflon C-seal from being exposed to temperatures exceeding its design thermal limits of 500F. After the occurrence, the thermal environment in the No. 4 bearing compartment was reassessed using a current-generation three-dimensional thermal analysis model. This more accurate model confirmed that the Teflon C-seal could be exposed to temperatures greater than 640F during a hot engine shutdown.

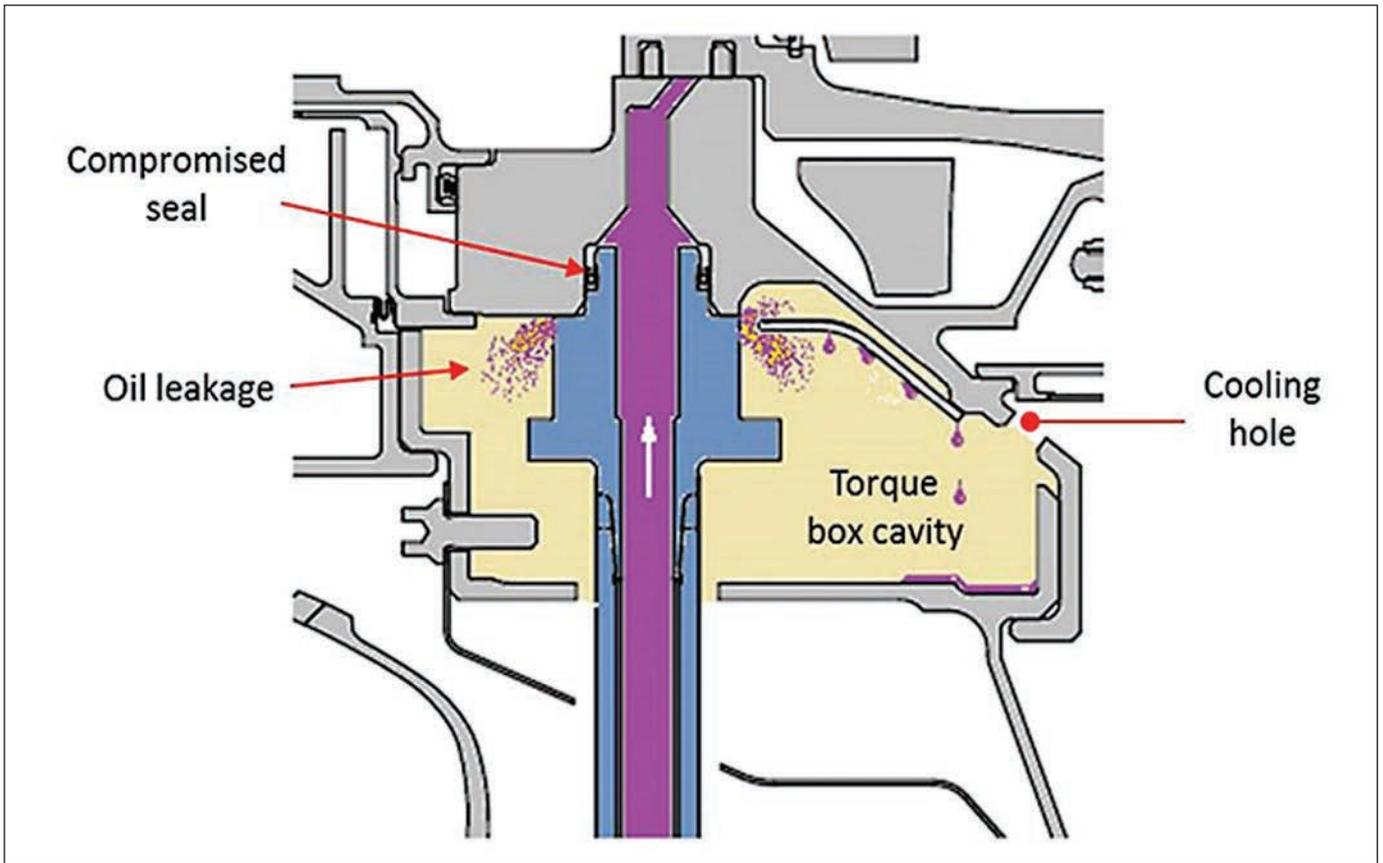
The detrimental effect of heat soaking sustained during hot shutdowns on the bearing compartment tubes' Teflon C-seals was not foreseen by Pratt & Whitney during the development of Restriction and/or Special Instructions (RSI) No. F-500-001-71-011.

Between the original issuance of the RSI in July 2013 and the occurrence in May 2014, seven shutdowns with a cool-down period of less than five minutes took place on

the occurrence engine. Bombardier believed all of these hot shutdowns were in accordance with section 3.c. (original version) or 2.c. (rev.A) of the RSI, since the engine would not be restarted within eight hours following the shutdown. One of those hot shutdowns, on May 26, 2014, was not in accordance with section 2.c. (rev.A) of the RSI because the engine was restarted before expiration of the eight-hour wait period (specifically, the restart occurred approximately 50 minutes after shutdown) and the indicated exhaust gas temperature at the time of the restart was above 90 C (specifically, 99 C).

In the absence of any indication in the RSI of potential damage to the engine when applying the mitigation technique, the RSI section 3.c. (original version) or 2.c. (rev.A), as written, was interpreted by Bombardier as an alternative equal to the other shutdown options contained in the RSI.

Therefore, applying the mitigation technique in section 3.c. of RSI No. F-500-001-71-0011 (or section 2.c. of rev.A), instead of those in sections 3.a. or 3.b. (or sections 2.a. or 2.b. of rev.A), led to the heat soaking on the No. 4 bearing oil feed tube's Teflon C-seal.



Above: Cutaway view of oil leakage in torque box.

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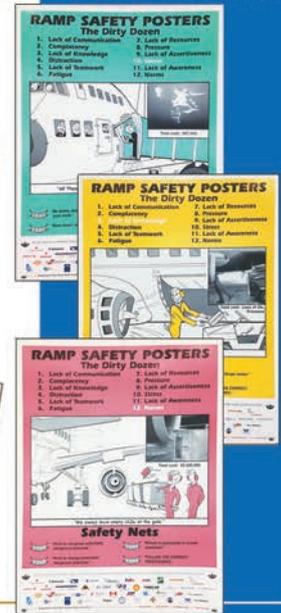
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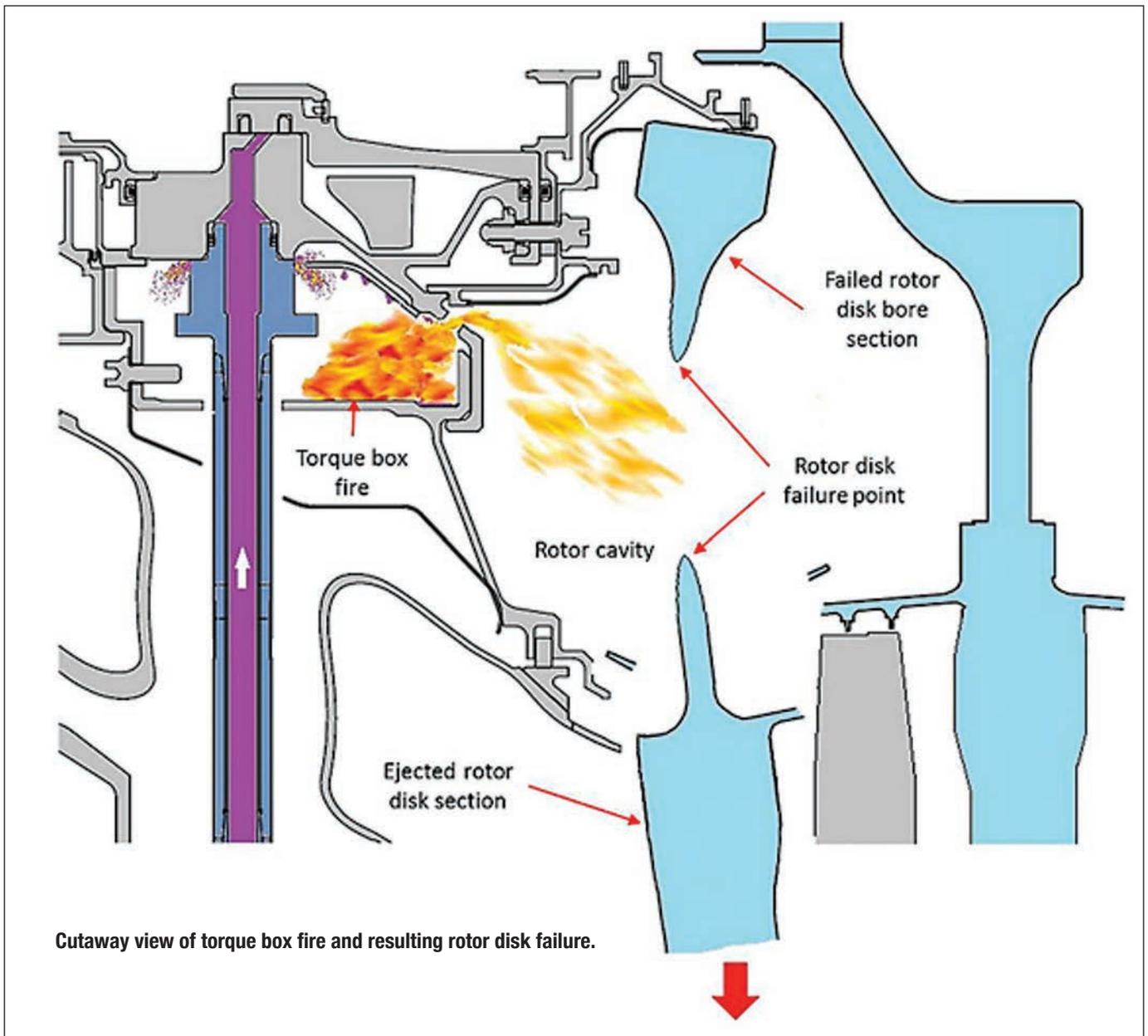
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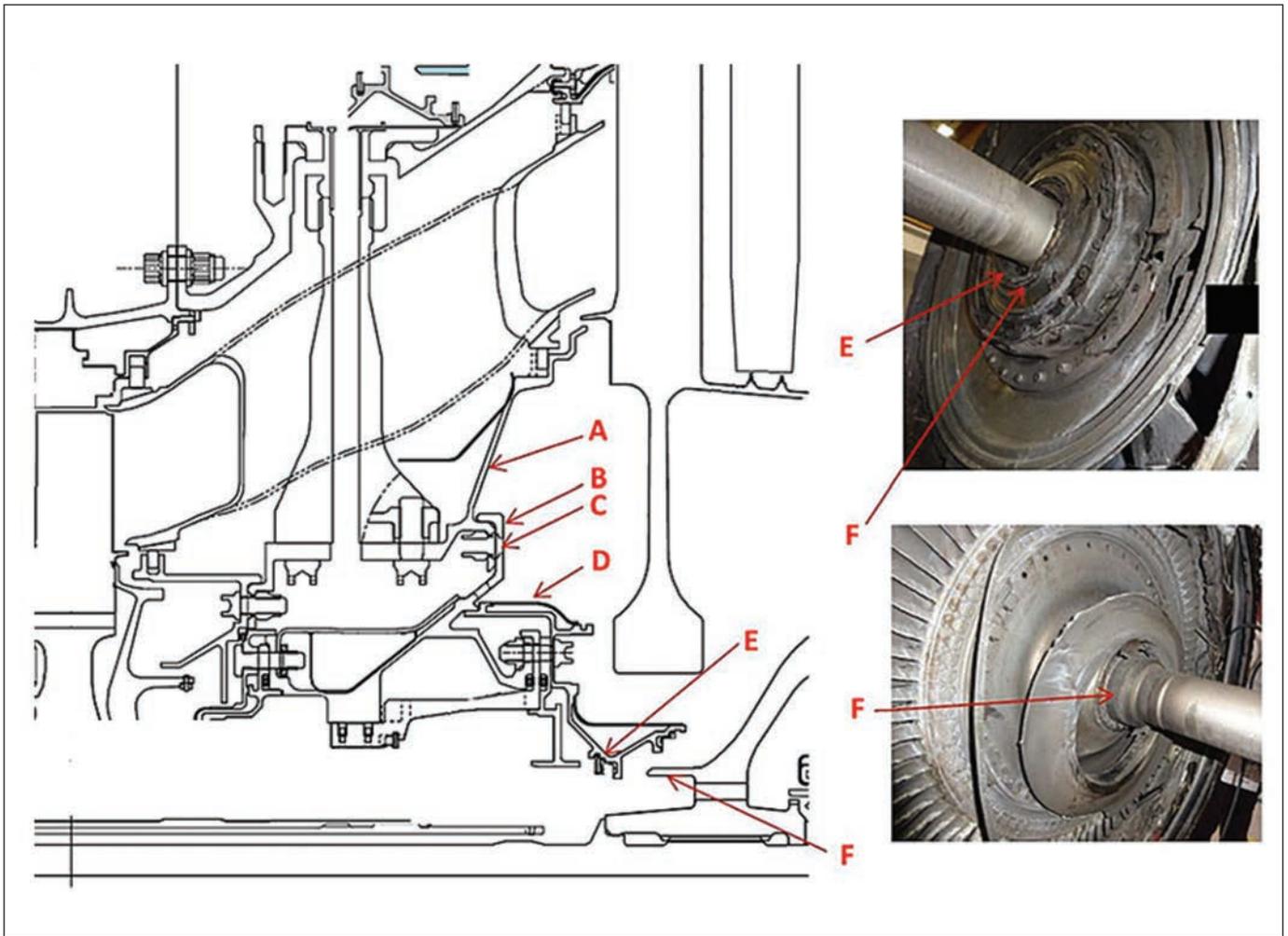
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Testing of the occurrence Teflon C-seal's material revealed that its composition conformed to specifications. However, examination of the seal showed that its diameter and axial dimensions had been altered, and testing confirmed that the material began exhibiting quantifiable changes when exposed to temperatures above 550 F, with permanent deformation beginning at 608 F. It could not be determined whether the heat damage to the Teflon C-seal was the cumulative result of several hot shutdowns or the sole result of the hot shutdown following the May 21 engine ground runs. The high oil consumption first noticed on May 26, 2014 was likely the first apparent sign of severe oil leakage from the Teflon C-seal; however, the exact cause of the oil consumption had not yet been determined. It is also possible that an oil fire may have been present, perhaps sporadically, in the bearing cavity during the May 26, 2014 engine ground run and that the disk integrity had begun to be compromised. Testing demonstrated that,

once the seal was compromised, oil leaked into the turbine intermediate case (TIC) and was drawn into the turbine rotor's cooling air stream. It is most likely that, sometime during the 74 percent N1 segment of the engine ground run, the temperature in the torque box reached the auto-ignition point of the oil, which generated a fire. This scenario is supported by the occurrence engine's teardown and subsequent laboratory analysis, which revealed the presence of soot and signs of burning in the torque box, clearly indicating that combustion had been taking place in the vicinity of the feed tube's mounting flange.

Rub-induced sparking and hot-surface ignition were also considered, but no sign of rubbing was found and analysis of hot-surface ignition concluded that it was highly unlikely to be the cause. Consequently, it was concluded that the air/oil mixture auto-ignited. The location and severity of thermal damage patterns on the TIC aft wall on the rotor cavity side



Above: Cutaway view of thermal distress areas on the aft face of the turbine intermediate case.

were indicative of intense combustion between the TIC aft wall and the first stage rotor disk of the low-pressure turbine 1 (LPT1).

The effect of the oil fire on the forward face of the LPT1 caused the rotor disk to be exposed to elevated temperatures, causing a softening of the disk material to the point where it failed in tensile overload. This was confirmed by laboratory analysis of a section of recovered rotor debris.

One or more hot shutdowns caused heat soaking, which allowed the oil feed tube's Teflon C-seal in the No. 4 bearing to fail, which in turn allowed engine oil to merge with the turbine rotor's cooling air stream. This air/oil mixture encountered ambient temperatures that were above its auto-ignition point, and the ensuing combustion heated the LPT rotor to the point of failure. The failure of the LPT rotor was uncontained and resulted in major damage to the engine, nacelle, and wing.

Safety action taken

Following the occurrence, Bombardier grounded the C Series test aircraft fleet until the cause of the occurrence could be clearly established. Once the cause of the occurrence was as-

certained, Pratt & Whitney proposed a plan to return to flight, which included a revised cool-down procedure, increasing the pre-shutdown cooling period to 20 minutes and requiring notification to Pratt & Whitney when there is a hot shutdown; the addition of a metallic face seal in addition to the Teflon C-seal on the No. 4 bearing oil feed tube mounting flange; a change in the material of the mounting bolts of the No. 4 bearing oil feed tube flange to enable higher torque on bolts; the installation of thermocouples to permit real-time monitoring of the low-pressure turbine (LPT) cavity temperature; operational restrictions to limit the oil seal temperature to 500 F; post-flight daily oil consumption monitoring; operational restrictions in high outside air temperatures; increased daily borescope inspections. These measures were implemented on an interim basis in order to return to flight-testing. Production engines will feature an enhanced design configuration for the oil supply tube and cooling airflow that will physically separate the turbine rotor cooling airflow from the bearing compartment to eliminate the possibility of recurrence.

(This report concludes the Transportation Safety Board's investigation. The Board authorized the release of this report on 20 April 2016. It was officially released on July 05, 2016.) ■

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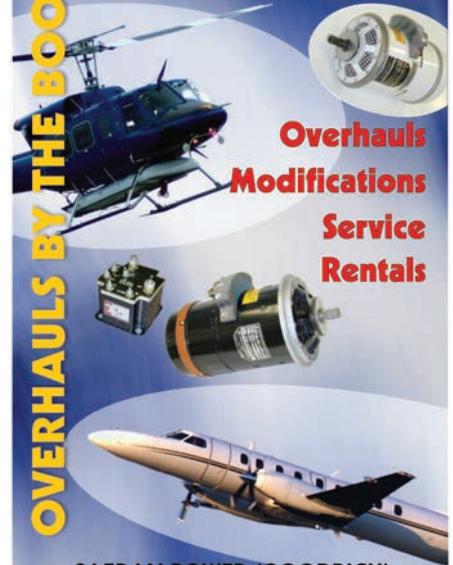
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The Northern Lights Foundation has honoured a group of women who've distinguished themselves and their industry.

Each year, the Northern Lights Award Foundation (NLAF) bestows the Elsie MacGill Northern Lights Award to honour outstanding Canadian women who have made a significant contribution in their field and who continue to lay the groundwork for and attract other women to enter or excel in these industries. And in early June, NLAF board members announced the names of seven winners of this prestigious aviation and aerospace award. The 2016 list of winners includes:

Pioneer Award: Rosella Bjornson, who was the foremost first officer on a jet and is a trailblazer for women in aviation. She received her pilot's licence at 17 and earned her commercial and instructor rating while attending the University of Calgary. She became the first female first officer when Transair hired her in 1973, and the first jet qualified female airline pilot in North America. She was grounded in 1979 due to her first pregnancy, and worked with Transport Canada after her second pregnancy in 1984 to help create new policy for this vital issue. In 1990 she became the first female captain with a major airline in Canada (Canadian).

Flight Operations/Maintenance Award: Brigadier General Lise Bourgon, who is a highly respected maritime helicopter pilot with over 220 hours flying the Sea King. She has been a pioneer of gender integration. She was the first female LtCol pilot commanding officer of an operational squadron, first female colonel wing commander, and the first female commander of joint task force-Iraq in Kuwait commanding over 600 CAF personnel. She has worked on issues affecting women in the CAF and wrote her staff college thesis on retention and work-life balance. She has multiple degrees, the latest a Master of Public Administration.

Government/Military Award: Dr. Sylvie Béland, an internationally recognized aerospace and space scientist whose work has contributed to new technologies to the Canadarm2 and the International Space Station. She is the first woman aerospace R&D director at the National Research Council in charge of the largest laboratory in the country with a staff of 100. She has held a number of senior positions at the Canadian Space Agency and served a five-year term as Counselor on Space and Commercial Affairs at the Canadian Embassy in Paris. She also acted as a Permanent Delegate of Canada to the European Space Agency. She is now the NRC co-champion on the National Women In Science and Technology Committee.

Business Award: Jolene Mahody, EVP and CFO for Chorus Aviation is a Chartered Accountant and has received her Fellow of Chartered Accountant designation, which is awarded for outstanding career and community achievements. She

joined Air Nova in 1992 and has had an impressive and varied career track that has seen her take on increasingly senior roles. Jolene played a key role in the merger of four regional airlines into what eventually became Jazz Aviation LP, a successful IPO in 2006 and the evolution of Chorus.

Education Award: Dr. Catherine Mavriplis, who completed a Masters and a PhD in Aeronautics at Massachusetts Institute of Technology before pursuing post-doctoral studies in computational mathematics and aerospace engineering at Princeton. She is a licenced professional engineer in the state of Virginia and in Ontario. She has been a member of the faculty at the University of Ottawa since 2008. In 2011, she was selected as the NSERC/Pratt and Whitney Canada Chair for Women in Science and Engineering, the first woman from aviation and aerospace to be selected as one of the national champions for women in science and aerospace.

Rising Star Award 1: Holly Johnson who has a Bachelor of Applied Science in mechanical engineering from the University of Toronto. She joined MDA as a student and has worked on the Canadarm program including performing the pre-mission simulation of the Canadarm robotic operations with the International Space Station. She was the lead systems engineer on the neurosurgical medical robotic (neuroarm2) transferring the technology of space to provide hands-free surgical imaging. She is also a Private Pilot.

Rising Star Award 2: Navreet Saini who graduated from Ryerson University's aerospace engineering program in 2012, accepted an avionics engineering position with Bell Helicopter and has transferred to the Flight Test Experimental department. She has done internships with the Ryerson Institute Aerospace Design and Innovation, and with Bombardier. She worked on the ramp at the Brampton Flying Club during school and completed her pilot's licence and night rating. Her goal is to work in the human factors and aviation sector.

The Foundation's award program, the Elsie MacGill Northern Lights (EMNL) Award, is named after aviation pioneer and human rights advocate Elsie Gregory MacGill. The world's first female aircraft designer, MacGill graduated from the University of Toronto's electrical engineering program in 1927 and later became pivotal in the design and production of the Hawker Hurricane in Canada during the Second World War. During her career, MacGill was appointed to the Canadian Royal Commission on the Status of Women, and was made an Officer of the Order of Canada.

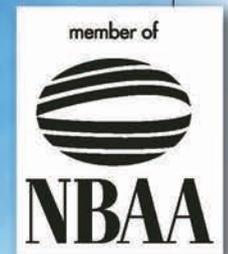
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