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# AirMaintenance

The Magazine for Aircraft Maintenance Professionals

# UPDATE



Transport Canada Approved for R/T

## PMA vs OEM

can PMA parts compete  
with the OEM aftermarket?

## NBAA 2016



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## Bell steps up for the ladies



For some of the world's largest regional airlines — those with more than 400 aircraft, averaging around 2,000 daily flights — female aviation mechanics have increased from one percent to today's almost 10 percent, although this is not true across the industry. For some companies, according to the FAA, women make up around 4.10 percent, previous one percent for male-dominated careers. But Bell Helicopter tried to address the workplace imbalance this fall when it bestowed Women in Aviation International an \$8,000 grant which provided instructional materials as a hands-on teaching activity for girls ages eight to 16 during a youth outreach program called International Girls in Aviation Day on September 24th.

"We are delighted with this grant, which will enable us to present another fascinating segment of aviation to the girls," said WAI president Dr. Peggy Chabrian. "With this grant, Bell Helicopter has created future helicopter pilots, designers, and engineers. We thank them for joining with us to plant the seeds for this exciting facet of the aviation industry."

On International Girls in Aviation Day, WAI chapters around the world host their own one-day event to attract more young women to the aviation and aerospace communities. This program is an outgrowth of the successful Girls in Aviation Day events held since 2012 during the annual International Women in Aviation Conference.

"In addition, this Bell Helicopter grant makes it possible to provide our chapters with low- and no-cost teaching materials that they will use on Girls in Aviation Day. We will now be able to provide a DVD on helicopter careers produced by the Helicopter Association International, as well as an all-new hands-on rotary-wing activity," added Dr. Chabrian. ■

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### AirMaintenance Update

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# Upcoming Events

## Red Bull series returns to Vegas



Eleven years since it was officially launched, the Red Bull Air Race World Championship has become renowned as the fastest and most exhilarating motorsport series on the planet. Devised by the Red Bull sports think-tank, the initial goal was to create the most advanced aerial challenge the world had ever seen; what they got far exceeded their original expectations. The Red Bull Air Race series quickly became a visual spectacle unlike any other. A combination of high speed, low altitude and extreme maneuverability makes the sport accessible only to the world's most exceptional pilots.

The specially designed aerial race-tracks used are the result of extensive research and evaluation. The unique inflatable pylons, which form the Air Gates, were first developed in 2002 and have evolved year-on-year into the sophisticated design currently used. They are constructed to be robust and safe in the event of a pylon hit, and can be repaired and re-inflated within minutes.

For the final race of the 2016 season, the glitz and glamour of Las Vegas welcomes back the Red Bull Air Race to the Las Vegas Motor Speedway for the third consecutive year, with shows scheduled for October 15-16. Known as the city that never stops performing, the neon lights and non-stop party atmosphere will make Las Vegas an electrifying final stop on the 2016 calendar.



### UNITED STATES

#### Embry-Riddle University Wings and Waves Air Show

October 8 – 9, 2016  
Daytona Beach, Florida  
[www.erau.edu](http://www.erau.edu)

#### Red Bull Air Race

October 1 – 2, 2016  
Indianapolis, Indiana  
[www.redbullairrace.com](http://www.redbullairrace.com)

#### Wings over Houston Airshow

October 21 – 23, 2016  
Houston, Texas  
[www.wingsoverhouston.com](http://www.wingsoverhouston.com)

#### Airline Engineering & Maintenance: North America

October 26 – 27, 2016  
Charlotte, North Carolina  
[www.airlineengineering-northamerica.com](http://www.airlineengineering-northamerica.com)

#### MRO Latin America

January 25 – 26, 2017  
Cancun, Mexico  
[www.mrolatinamerica.aviationweek.com](http://www.mrolatinamerica.aviationweek.com)

#### Aero-Engines Americas

February 2 – 3, 2017  
San Antonio, Texas  
[www.aeroenginesusa.com](http://www.aeroenginesusa.com)

#### MRO Americas

April 25 – 27, 2017  
Orange County Convention Center  
Orlando, Florida  
[www.mroamericas.aviationweek.com](http://www.mroamericas.aviationweek.com)

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

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# NBAA 2016

If you haven't yet made plans for the 2016 NBAA Business Aviation Convention & Exhibition (NBAA-BACE), better get cracking.

As one of North America's largest trade shows, it's often been called the aviation industry's biggest and best event of the year.

From November 1 to 3 in Orlando, NBAA-BACE will feature more than 1,100 exhibits at the Orange County Convention Center, as well as about 100 aircraft on two static displays. The show's 27,000 attendees are also invited to attend any of the 50 education sessions covering topics of interest to all industry professionals.

Why is NBAA's convention a can't-miss event of the year? "So many different kinds of aviation companies come out, from small aircraft parts people all the way through interior designs of business jets and things that I normally don't get to

see and experience," said one attendee. Other attendees said the ability to meet current and potential customers in person, and see the latest aviation products and services, were two of the main reasons they attended NBAA-BACE.

## NBAA-BACE Quick Facts

- **When and where:** November 1-3, 2016, Orlando, Florida
- **Online registration:** NBAA Member \$285, Non-Member \$485
- **Onsite registration:** NBAA Member \$385, Non-Member \$585

# STCs & new products

## Push-button two-chuck driver from WORX

The new WORX 20V MaxLithium Switchdriver has a rotating head equipped with two quarter-inch chucks that can be loaded with different combinations of drill or driver bits. This allows the user to drill a pilot hole, for example, and then quickly rotate the head to switch chucks and sink the screw with a driver bit. Switchdriver's two quarter-inch chucks rotate 180 degrees clockwise or counterclockwise with the push of a red button located just above the trigger. **For more information visit [www.worx.com](http://www.worx.com)**



## AMISOIL grease gun kit makes greasing easier

AMSOIL has introduced a grease gun kit to its line of synthetic grease. It includes two grease-distribution options (flexible hose and rigid pipe). The pistol-grip design and rigid pipe allow one-handed grease application, while the flexible hose eases access to hard-to-reach locations. Two head ports allow for increased flexibility and comfort, while the plastic tip cover protects against contamination from debris. An easy-to-use plunger makes the job of greasing equipment easier. **For information visit [www.amsoil.com](http://www.amsoil.com)**



## Five-blade option upgrade for Turbine Evolution

Hartzell's composite 82.5-inch diameter five-blade propeller is available as an optional performance upgrade in place of the four-blade Hartzell aluminum propeller that is standard equipment on the Turbine Evolution.



In addition to new aircraft kits, the new carbon fibre propeller is available as an upgrade for the 65 Turbine Evolutions flying today. Even though the new propeller has one more blade, it is 3.5 pounds lighter than the standard propeller including spinner and de-ice.

**For information visit [www.hartzellprop.com](http://www.hartzellprop.com)**

## Three-tool wire repair kit available from Xuron

Xuron Corporation has introduced a wiring assembly and wire repair tool kit that includes three tools used for the majority of wiring tasks during assembly and field service operations, regardless of industry. Featuring soft rubber handgrips and a Light Touch return spring, these ergonomic tools include a wire cutter, slitter, and adjustable stripper-cutter. The Xuron TK2300 Wire Technician Tool Kit includes the Model 2175 Maxi-Shear Flush Cutter for soft wire up to 12 AWG, the Model 440 High Precision Shear for slitting coaxial cable jacketing, and the Model 501 thumb adjustable wire stripper-cutter for wires from 10 to 26 AWG. **For more information visit [www.xuron.com](http://www.xuron.com)**



## L.S. Starett introduces calipers with extended range

The L.S. Starrett Company now offers extended range lightweight caliper models up to 40 inches (1016mm). No. 799 calipers feature zero at any position, inch/mm conversion, and easy access to a long-life battery. The 24-inch and 40-inch extended range calipers offer 1/2-inch high readout on the LCD display, automatic shutoff after 30 minutes of inactivity, a preset/hold feature, and the ability to set minimum and maximum limits.



**For more information visit [www.starrett.com](http://www.starrett.com)**

## Inspection unit provides 14X magnification

Titan Tool Supply's Ion 4.3 Inspection Magnifier provides magnification up to 14X and offers on-screen measurements using an integrated XY dimensioning grid with cursor functions. It is capable of recording and tracing 100 date-stamped images for accurate quality-control records. Its liquid lens technology provides a wide focus range, fast response time, excellent optical quality and low power consumption. The Ion 4.3 functions as a mobile inspection tool suitable for areas having poor lighting and difficult access.

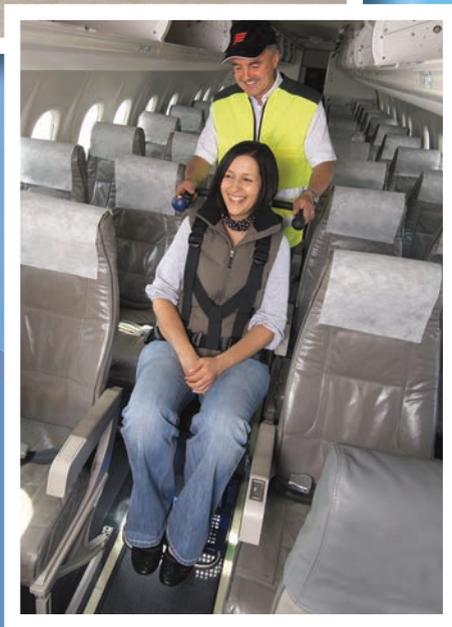
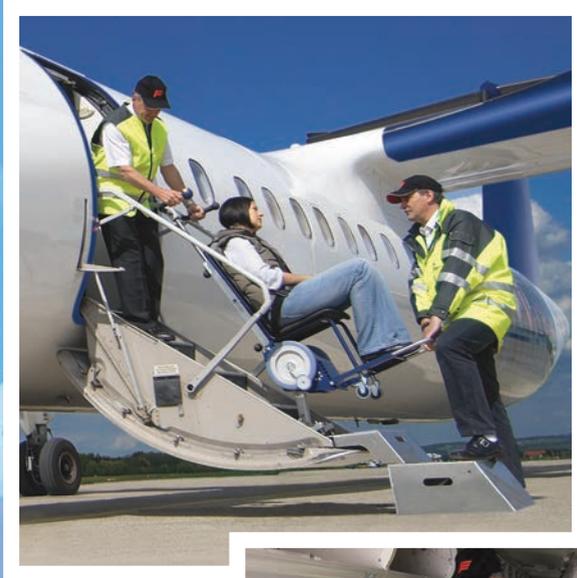


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## MAJOR STEP FOR ANTI-VIBRATION SYSTEM



The North Carolina-based LORD Corporation has announced product qualification for their Improved Vibration Control System (IVCS) for the Boeing H-47 Chinook helicopter. Under contract with Boeing since September 2013, LORD has completed all program milestones and has received final qualification approval for the system that controls steady state and transient vibration. According to Stuart Hartwell, business development manager for LORD Global Aerospace & Defense, this qualification milestone for the twin-engine tandem rotor heavy-lift helicopter represents a major step in bringing significant weight savings to the H-47 platform.

The IVCS technology uses accelerometers that measure aircraft vibration levels. A centralized computer processes these signals through a software algorithm that interprets the data and sends commands to force generators located under the pilot seats. These force generators create “anti-vibration” that stops the progression of vibration due to the main rotor, and creates a more comfortable vibration environment for the aircrew. The LORD product is a direct/drop-in replacement for the previously used passive tuned vibration absorber.

## BAE STUDYING ON AVRO RJ FREIGHTER

The United Kingdom’s BAE Systems Regional Aircraft is working towards the possible launch of a passenger-to-freighter conversion program for the Avro RJ jetliner and is seeking customer feedback to help assess market potential.

Building on the experience gained in the BAe 146QT (Quiet Trader) freighter of which around 30 aircraft were produced, the business has spent the past year assessing the suitability of the newer-build Avro RJ as a freighter. This work has created a full OEM-designed specification for the freighter, which is now being offered to the market. The principal variant for conversion would be the RJ100 aircraft, and typically such aircraft can be bought for between US \$1-1.5 million while the freighter kit and conversion would cost between US\$ 2.2 and 2.8 million. Availability would be from the end of 2017.



The Avro RJ Freighter, which can carry up to 14 tonnes of cargo, fits the gap between the seven-tonne freight capacity of current large turboprops and the 18 tonnes of the bigger Boeing 737 Classic freighter conversions.

## GRAND CHEROKEE HEAD-TO-HEAD AGAINST TWISTER

Motorsport fans and gearheads around the planet have at least one thing in common: they just love apples and oranges matchups such as motorcycles versus sportscar on a fast track. Recently, it was Jeep’s turn to answer the eternal question when the company pitted its 6.4L V8 HEMI Grand Cherokee SRT against

a Silence SA1100 Twister plane. The venue was the 1.8-mile Blyton Park Driving Centre circuit in Lincolnshire, England where both car and plane reach speeds in excess of 140 mph. The Jeep versus plane challenge was inspired by the origins of the HEMI engine, which was first developed for the Republic P-47 Thunderbolt fighter aircraft. While the Grand Cherokee SRT tackled the racetrack, the Twister plane navigated around seven-metre high pylons, as they both attempted to reach the chequered flag first.



Capable of reaching zero to 62 mph in less than five seconds, the Grand Cherokee SRT delivers a factory-spec 461 hp and features technologies like launch control, Selec-Trac transmission and air-cooled six-piston Brembo brake calipers which have a claimed stopping distance of 116 feet from 60 to zero mph. The Grand Cherokee SRT was driven by Ed Morris — the youngest-ever British driver to compete at Le Mans 24 hour, while the Silence SA1100 Twister plane was flown by Peter Wells, a specialist aerobatic pilot with over 25 years of flying experience.

## CYCLONE FLEET STILL IN DELAYED MODE



The CBC has reported that this country’s air force is now projecting it will be 2025

before its CH-148 Cyclone helicopter fleet is fully up to speed with all of the aircraft, pilots and ground crew needed for deployments—both at home and overseas. The date for Full Operational Capability (FOC) will be almost 21 years after Paul Martin's Liberal government signed a contract with U.S. defence giant Sikorsky Aircraft to deliver 28 state-of-the-art maritime helicopters. It will also be seven years after the last of the vintage CH-124 Sea King choppers is scheduled to retire after flying for over five decades.

## COMPOSITE SKYCRANE ROTOR BLADES IN FLIGHT



Erickson Incorporated and Helicopter Transport Services have announced the first flight of its composite main rotor blades for the S-64 Aircrane and CH-54 Skycrane. Flight-testing will continue for several months and certification is expected later this year. The new rotor blades are expected to significantly increase aircraft performance at high elevations and temperatures as well as increase fuel efficiency, reduce manufacturing costs and maintenance costs. The rotor blade simply bolts onto the existing rotor heads of the CH54B/S64F and requires a minor main rotor head modification for the CH54A/S64E. The blade program was kicked-off by Erickson and HTS in 2010, with the design being finalized in 2013. Last year, Erickson designed and completed the construction of a 12,000 square foot composite manufacturing facility in Medford, Oregon where the blades are now produced.

## CERTIFICATION SOUGHT FOR ADVENT EABS

Advent Aircraft Systems has launched certification on the Pilatus PC-12 of its lightweight anti-skid braking system (Advent eABS). Once certification is

complete, the PC-12 would be added as an additional model to Advent's existing STC for the system on the Eclipse EA500/550 and the King Air B300/300C series aircraft.



Advent eABS benefits for the PC-12 operator are said to include improved braking in all runway conditions without the risk of flat spotted or blown tires, an alternative to the use of reverse thrust to reduce prop erosion and the risk of FOD ingestion; and the ability to confidently apply the brakes immediately after touchdown or in situations where hard braking is desired, such as a rejected takeoff. All models of the PC-12 are eligible for eABS installation, provided the aircraft is equipped with a WAAS enabled GPS, such as the Honeywell Apex, Garmin or IS&S WAAS GPS products. The eABS is 27 pounds installed, and comes with all required installation hardware included. Downtime is minimal and requires no changes to the existing PC-12 brake system.

## AIRWORTHINESS ENGINEERING GRAD PROGRAM FIRST IN U.S.



Northrop Grumman Corporation and Embry-Riddle Aeronautical University have joined forces to develop the United State's first airworthiness engineering graduate study program. Significant growth in Northrop Grumman's aeronautics business drove the development

of this specialized technical curriculum designed to meet the anticipated needs of the company's government, military, civil and commercial space customers. Students who pass the Embry-Riddle program will earn a Certificate of Study in Airworthiness Engineering (CSAE). The graduate certificate program is scheduled to launch in January 2017. The Certificate of Study in Airworthiness Engineering will be administered by Embry-Riddle's College of Engineering in Daytona Beach, Florida.

## BRANDON TO TORONTO FLIGHT REMOVED



In a move that will sadden many Manitobans, WestJet has announced it will no longer be offering direct service between Brandon and Toronto. The run was removed from WestJet's schedule as of September 26 because demand for seats had not met expectations, the company said. The four-times-a-week flights began at the end of June to test response to the route. WestJet then announced in July that it would offer the service on a year-round basis starting late August. People who have booked flights on the route will be contacted by WestJet to make

alternate travel arrangements or to offer refunds. WestJet will continue to operate a midday Brandon-Calgary flight seven days a week. It's also bringing back an early morning departure and late-night return option for the route three times a week, beginning October 23rd. ■



# *Can PMA parts* compete

It's not a new argument, but perhaps one worth revisiting: parts Manufacturer Approval (PMA) replacement parts, their comparable quality and cost savings, versus the Original Equipment Manufacturer (OEM).



**Above left:** There is a constant industry push-pull between PMA providers and OEM giants such as Honeywell.  
**Above right:** In addition to providing high quality parts, PMA suppliers can offer major advantages over OEM counterparts.

# in the OEM aftermarket ?

**W**hen it comes to replacement parts, the large Original Equipment Manufacturers would prefer to have a monopoly on the aftermarket business. But as with any industry, the presence of alternative aftermarket products of comparable, or even better, quality drives down prices. For the aviation industry, this competition comes from smaller independent Maintenance, Repair and Overhaul shops (MROs) as well as Parts Manufacturer Approval outfits. In response, OEMs attempt to retain as much of the aftermarket as possible by marketing its parts as the highest quality, most reliable parts available, through warranty and contracts

with air carriers and leasing companies, and now through new bundling strategies designed to lock out alternative suppliers. According to Tom Wolfe of FAA-certified MRO component repair facility AeroKool Aviation—a company that specializes in environmental control systems, air cycle machines, valves and heat exchangers—the OEMs have a vested interest in discouraging the use of third party repair stations and PMA part providers.

“The OEMs invest heavily in product development on the front end and hope to recoup some of that investment in aftermarket programs,” says Wolfe.



Technicians at Texas Pneumatic Systems are specialists in the repair and overhaul of pneumatic and fuel components for aircraft manufactured by Boeing, Airbus, Embraer, Bombardier, ATR, Bell, AgustaWestland and many others.

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Techniques designed to keep the repair and part replacement business in-house include contractual agreements that specify the use of OEM replacement parts only.

OEMs may also employ repair "bundling" strategies for complete packages of repair for entire systems—and even other parts of the aircraft—under a single, blended rate. This makes it difficult for the air carrier to get information on individual part costs to evaluate if switching to a PMA part might be advantageous.

"The aviation industry benefits from the competition, which drives down prices for the airlines," says Wolfe. "There is no competition when the OEM is the only option in the market"

That being the case, PMA parts are still at a disadvantage when compared to OEM parts and not because of price or quality, but rather a lack of education about alternate options.

Parts Manufacturer Approval is, of course, an authorization granted by the Federal Aviation Administration (FAA) to a manufacturer of aircraft parts. PMA



**The staff at FAA-certified MRO component repair facility AeroKool Aviation, which is a company that specializes in environmental control systems, air cycle machines, valves and heat exchangers.**

parts must pass the same rigorous quality and testing requirements as OEM parts, but are often significantly lower in price.

The perception and adoption of PMA parts can vary based on geography, the category of customer (air carrier, leasing company, parts broker, independent MRO), and in some cases, simply the familiarity and confidence of the customer with the quality of these alternatives.

In North America, the majority of air carriers already accept PMA parts. However, in Europe, Asia and developing countries there remains a perception that OEM parts are higher quality and more reliable.

“There is a perception in some parts of the world, which I believe is changing,

that PMA parts may be inferior in quality and design robustness to OEM parts, but as has been proven many times, PMA parts meet the requirement of being equal to, or better, than the OEM,” says John Grimshaw of Triumph Accessory Services, Wellington, a Part 145 Repair Station.

As for other segments of the industry, aircraft leasing companies largely continue to specify in lease agreements that only OEM replacement parts may be used. For parts brokers and distributors, the decision to use OEM or PMA parts is often driven by the customer so they offer both options.

According to Grimshaw, independent MROs tend to specialize in specific components or sub-systems. For Triumph Accessory Services, that means

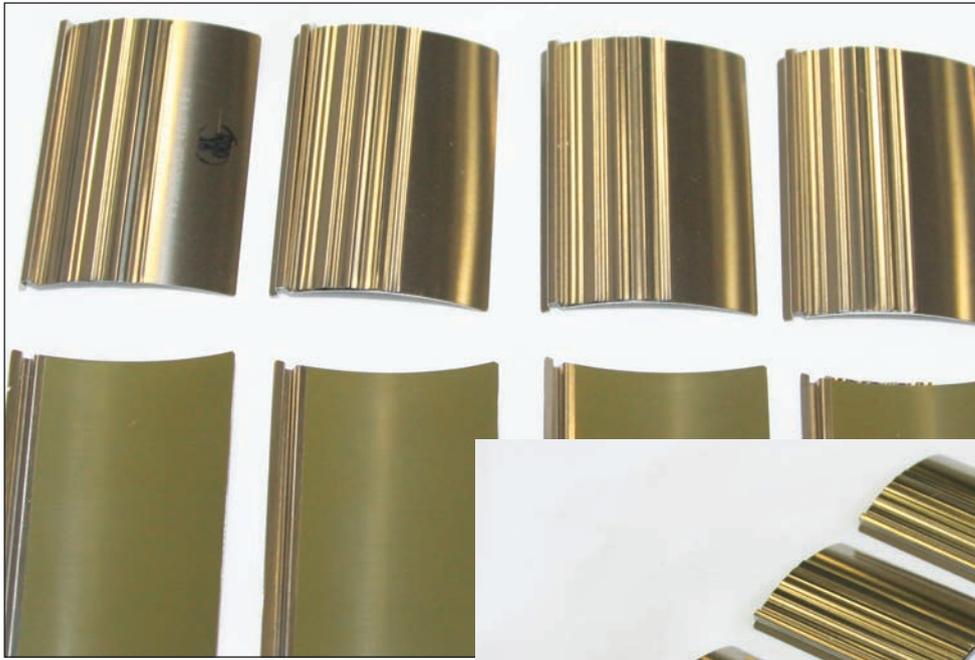
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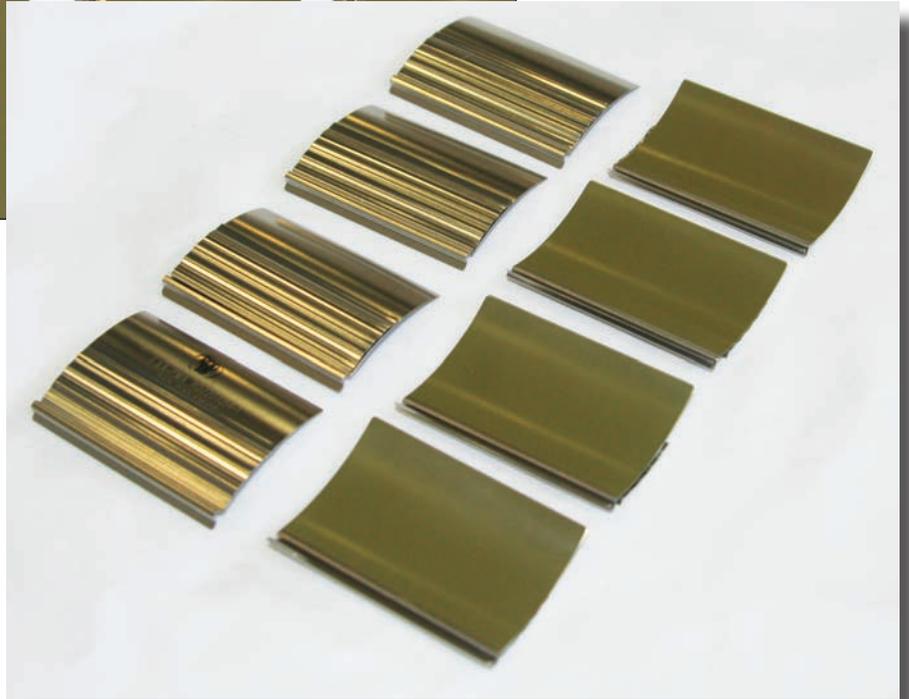


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**Left: R&D Dynamics' foil bearings were designed and developed by the same person who first pioneered the technology for air cycle machines while working at Honeywell and Hamilton Sundstrand decades ago.**

**Below: An air cycle machine uses sophisticated foil air bearings, like these from R&D Dynamics, that conform to the shape of a mating rotating shaft.**



electrical generators, hydraulic pumps, pneumatic valves, air cycle machines, various types of actuators, and power generation and transmission equipment.

The bulk of the work comes from air carriers that no longer perform in-house repairs, from parts brokers and distributors that need components tested, repaired and overhauled to resell, and from freight carriers converting passenger aircraft.

OEM repair shops, on the other hand, can offer a broader portfolio of parts. In addition, they can offer air carriers parts at below-catalogue rates, while the MRO often must pay full price. Therefore, to compete effectively, third party repair shops often promote the use of PMA parts.

Rich Simmons, Operations Manager at Texas Pneumatic Systems (TPS), a third party MRO that specializes in pneumatic, fuel and hydraulic components, concurs.

"If a customer is looking for a cost effective solution, we want to be able to offer them the PMA parts because they are less expensive than the OEM," says Simmons. "For our service, we would be remiss if we didn't offer that."

### **Environmental control systems**

A prime example of the push-pull between OEM and PMA provider can be found in the maintenance and repair of

Environmental Control Systems used in most military and commercial aircraft. Environmental Control Systems (ECS) provide air supply, cooling & heating and cabin pressurization for the crew and passengers. Major OEMs such as Honeywell, United Technologies Corporation Aerospace Systems (UTAS), and Liebherr dominate the market.

A key component in these systems is the Air Cycle Machine (ACM). To produce cool air without the uses of a refrigerant such as Freon, this high-speed rotating machine utilizes sophisticated foil air bearings that conform to the shape of a mating rotating shaft. Most commercial and military aircraft today utilize ACMs with this type of bearing.

However, at 30,000 to 45,000 rpms even well manufactured foil bearings

can fail or wear out from constant use over time. When this occurs, the ACM may fail to operate in-flight. More serious failures or imbalances of the rotating elements can also cause ancillary damage to other components in the air conditioning pack.

Although common, less-sophisticated PMA parts may be available from many sources, some—like foil-air bearings—may only be available from a few. Finding a qualified PMA provider is not difficult. Sources include the FAA's web site, Inventory Locator Service (ILS), trade shows and even through the company's own advertising and marketing efforts.

Among those currently listed is R&D Dynamics ([rddynamics.com](http://rddynamics.com)), a producer and supplier of high quality,

FAA approved foil air/gas bearings and other PMA parts for most models of ACMs. At its facility in Bloomfield, Connecticut, each foil air bearing is developed using exacting design and manufacturing processes that are similar to OEM methods and inspected prior to shipment using stringent FAA quality inspection systems.

Any concerns over the quality of these sophisticated PMA parts quickly vanish when engineering personnel learn more about the company. Established in 1990, the company's founder, Dr. Giri Agrawal, pioneered the design and development of high speed rotating machines supported on foil air/gas bearings for air cycle machines in the 1970s and '80s while working at Honeywell and Hamilton Sundstrand.

"One of the benefits that R&D Dynamics has is that the founder was a key driver in the development of foil-air bearing technology," says Wolfe of AeroKool Aviation. "When Hamilton-Sundstrand first developed it, he was the leader of the team of engineers that developed this technology."

As Chief Project Engineer at Hamilton Sundstrand, Agrawal received the George Mead Medal, the highest technical award from the parent company United Technologies Corporation. He was also cited as the "Father" of the Hamilton Sundstrand Air Bearing Program.

"When you are looking at PMA parts and you're looking at options at how you can be more competitive with the OEMs, when you see that type of pedigree and credentials, you understand that this company is different from other PMA companies," adds Wolfe.

However, Texas Pneumatic Systems' Simmons is quick to add that the reputation of the PMA provider only gets the company's foot in the door. Although he was also impressed with Agrawal's background, he says that what ultimately keeps the customer engaged over time boils down to quality and price. It is for these reasons that Texas Pneumatic Systems has purchased foil air bearings from R&D Dynamics for the past 15 years.

"Reputation gets us moving, but reputation won't keep us a customer," explains Simmons. "The proof is still in the pudding; when we use the product, do we get the life out of it that we get out of the OEM part? Do we have more or less warranty returns?"

In addition to providing a high quality part, working with smaller PMA suppliers instead of large OEMs can have other advantages as well. Because of their focused expertise, many of these companies can offer OEM-level technical support and are agile and small enough to respond quickly to any situations that arise. This includes expediting delivery of parts when necessary.

"With a PMA parts manufacturer like R&D, there is a willingness to make adjustments in the supply chain, the delivery schedule or if there is a hiccup of any kind, they are able to jump right on to it and get the fix completed with the main guys making the decisions," says Grimshaw of Triumph Accessory Services, Wellington.

"You don't have huge conglomerate and multi-layered management where things are slow to get done, with an agile PMA manufacturer it can get done overnight," he adds. ■



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The National Business Aviation Association has issued a report that calls for renewed emphasis on pre-takeoff flight-control checks. Here's why.



# THE DEVIL is in the Details

In mid-September the National Business Aviation Association (NBAA) issued a report, regarding a fatal 2014 Gulfstream G-IV accident at Hanscom Field Airport in Bedford, Massachusetts, which calls for a renewed emphasis on the importance of compliance with the pre-takeoff flight-control checks required by aircraft manufacturers. Following the Bedford accident, the National Transportation Safety Board (NTSB) determined that the crew did not per-

form a flight-control check prior to takeoff, and was therefore unaware that the aircraft's gust lock was engaged, preventing a successful takeoff. The aircraft was destroyed in the resulting accident, and seven people lost their lives.

The Bedford event prompted the NTSB to recommend that NBAA lead an industry-wide, collaborative study to measure the extent of non-compliance with before-takeoff flight checks. That effort resulted in

the report NBAA issued in September, titled “Business Aviation Compliance with Manufacturer-Required Flight Control Checks Before Takeoff?”

The study, which analyzes 143,756 business aviation flights made between January 1, 2013 and December 31, 2015, found that an average of 15 percent of those flights began with a partial flight control check, and two percent began without a full, valid check. The report defined a valid flight check as the stop-to-stop deflection of all flight controls specified by a manufacturer’s aircraft flight manual.

Referring to the oversight by the flight crew in the 2014 Bedford accident, and citing the data compiled by the NBAA report team on broader compliance with before-takeoff flight checks, association President and CEO Ed Bolen stated, in an Executive Summary accompanying NBAA’s report: “As perplexing as it is that a highly experienced crew could attempt a takeoff with the gust lock engaged, the data also reveals similar challenges across a variety of aircraft and operators. This report should further raise awareness within the business aviation community that complacency and lack of procedural discipline have no place in our profession.”

Among the report’s recommendations, NBAA urged operators to establish flight-data monitoring programs (one-percent of operators currently have such programs in place), and to participate in a formal data-sharing program similar to an existing, successful government-industry program known as the Aviation Safety Information Analysis and Sharing System (ASIAS), which focuses on the root causes of accidents,

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in order to most effectively prevent their recurrence. The study also urged manufacturers to provide clearer requirements for pre-departure flight-control checks.

### NBAA Report

On May 31, 2014, a Gulfstream G-IV was destroyed after a rejected takeoff and runway excursion at Laurence G. Hanscom Field in Bedford, Massachusetts. The two pilots, a flight attendant and the four passengers were fatally injured. The NTSB investigation determined that the

rust lock was engaged, locking the flight controls and preventing a successful takeoff. It was also discovered that the crew had not conducted a flight-control check prior to takeoff, which would have revealed that the flight controls were locked. The NTSB investigation discovered that the flight crew had neglected to perform complete flight-control checks on 98 percent of the previous 175 takeoffs in the airplane.

In its final report on the accident, the NTSB made several recommendations, including recommendation num-

ber A-15-034, to the National Business Aviation Association.

“Work with existing business aviation flight operational quality assurance groups, such as the Corporate Flight Operations Quality Assurance Centerline Steering Committee, to analyze existing data for noncompliance with manufacturer required routine flight-control checks before takeoff and provide the results of this analysis to your members as part of your data-driven safety agenda for business aviation.”

In response to this recommendation, the NBAA formed a project team to address the issue of noncompliance with manufacturer-required routine flight-control checks before takeoff. The team was made up of business aviation Flight Operations Quality Assurance (FOQA) groups and associated vendors, NBAA staff, members of the NBAA Safety Committee, industry safety leaders and relevant safety experts.

### Methodology

The project team was divided into two working groups, a data group and a report group. The data group was tasked with obtaining and aggregating de-identified data from business aviation FOQA programs to determine the compliance with manufacturer-required routine flight-control checks before takeoff. The report group was tasked with analyzing the data provided by the data group, then organizing and writing this report to address the NTSB recommendation. The project team wanted to capture business aircraft noncompliance rates for control checks before takeoff, including trends prior to and after the Bedford accident. To accomplish this, the team looked at flights occurring between January 1, 2013, and December 31, 2015.

**The following definitions were used in the organization and analysis of the data:**

- Routine flight-control checks before takeoff: The required movement of any control surface designated as manufacturer-required to be checked prior to takeoff. These included ailerons, rudder, elevator and spoilers (if equipped).
- Full deflection: A control surface

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**Above: Flight crew in the process of intense flight deck check.**

movement beyond a minimum expected deflection. The analysis of the data included calculating the rigging tolerances and sensor accuracy for each surface to determine what minimum value was equivalent to a full deflection.

- Valid flight-control check: A full deflection control surface movement in each direction (i.e., stop to stop) was required to satisfy the requirement of a valid flight-control check on that surface (e.g., ailerons had to have full deflection up and down to be considered a valid check).

**Using the definitions above, routine flight-control checks before takeoff were classified as follows:**

- Normal flight-control check before takeoff: A flight-control check before takeoff in which a valid flight-control check was conducted on all control surfaces required to be checked. This was classified as a normal event.
- Partial flight-control check before takeoff: A flight-control check before takeoff in which at least one, but not all, of the required control surfaces did not have a valid control check conducted. This was classified as a caution event.
- No flight-control check before takeoff: A flight-control check before takeoff in which there was no valid flight-control check of any of the control surfaces that were required to be checked. This was classified as warning event.

Noncompliant flight-control check before takeoff: A flight-control check before takeoff in which at least one of the required control surfaces did not have a valid control check conducted (i.e., a caution or a warning event).

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2013-2015 Flight Control Checks Before Takeoff Noncompliance



Figure 1

2013-2015 Flight Control Checks Before Takeoff: Caution and Warning Event Percentages

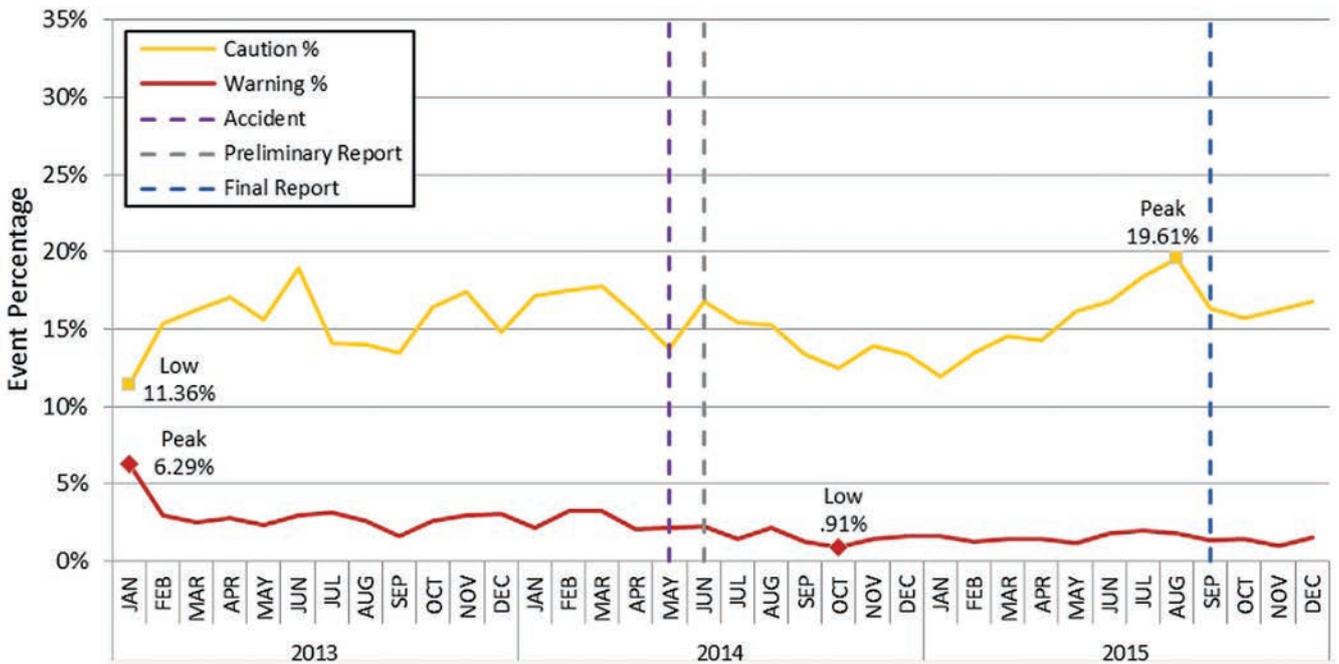


Figure 2

## Data

The data used in this report is based on 143,756 flights conducted by 379 business aircraft representing over 30 different types of aircraft. These flights were conducted over the three-year period between January 1, 2013, and December 31, 2015. **Figure 1** (opposite page, top) shows the number and percentages of noncompliant flight-control checks before takeoff for each month over the three-year period.

**Figure 2** (opposite page, below) shows the percentages of warning and caution events for each month over the three-year period. It also indicates the accident date, subsequent dates of the preliminary accident report and the final accident report.

The data shows that out of 143,756 flights conducted during the 2013 to 2015 time period, flight crews conducted a partial flight-control check before takeoff (caution event) during 22,458 flights (15.62 percent). There was no flight-control check before takeoff (warning event) conducted on 2,923 flights (2.03 percent). For the three-year period covering 2013, 2014 and 2015, the overall noncompliance rate for manufacturer-required routine flight-control checks before takeoff was 17.66 percent, reflecting 25,381 events (Figure 1).

Caution events averaged 15.62 percent, with a low of 11.36 percent in Jan. 2013 and a high of 19.61 percent in August 2015 (Figure 2). Warning events averaged 2.03 percent with a high of 6.29 percent in January 2013 and a low of 0.91

percent in October 2014 (Figure 2). The average non-compliance rate was 17.66 percent, with a high of 21.99 in June 2013 and a low of 13.35 percent in October 2014 (Figure 1).

The project team sought to answer two additional questions:

1. Would the noncompliance rate of control checks before takeoff change after the release of the NTSB preliminary report that indicated the accident crew did not perform a routine flight-control check before takeoff?
2. Would the noncompliance rate of control checks before takeoff change after the release of the final NTSB report?

In the month prior to the final accident report issuance, there was a noticeable drop in caution events followed by a gradual increase again to 17.66 percent noncompliance rate – the average for the 2013 to 2015 period – by December 2015.

The noncompliance rate for warning events reached its low of 0.91 percent approximately five months after the accident occurred and returned to the average warning noncompliance rate of 2.03 percent by the end of December 2015, three months after the final accident report was issued.

The average warning event percentage prior to the accident was 2.80 percent (Figure 2). After the accident on May 31, 2014, and the release of the preliminary report on June 13, 2014, the average warning event rate was reduced to 1.47 percent, a drop of 50 percent. That may indicate there was a positive reaction to the preliminary report finding that the

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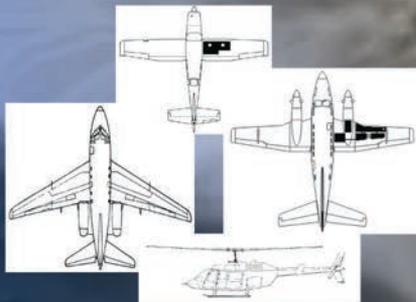
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Bedford crew did not perform any flight-control check before takeoff. The caution events are more variable, and there is not a significant difference in caution event rates between pre- and post-accident percentages.

The noncompliance rate (Figure 1) exhibits some minor month-to-month variation, but overall the data indicates minimal effect of the accident report on crew actions in regard to compliance with the manufacturer-required routine normal flight-control checks before takeoff. In fact, the average noncompliance rate from January 2013 to the release of the final accident report in September 2015 was 17.66 percent and the rate from October 2015 to December 2015 was 17.58 percent.

The overall noncompliance rate of 17.66 percent is very disturbing, and indicates that despite the post-accident reduction in the rate of warning events, there is still a significant challenge concerning noncompliance with manufacturer-required routine flight-control checks before takeoff.

It is troubling to find that nearly 18 of every 100 business aircraft flights included in the data were not in compliance with manufacturer-required routine flight-control checks before takeoff, and that two of those 100 flights conducted no flight-control check before takeoff at all.

## Conclusions

The tragic Gulfstream G-IV accident at Bedford, Massachusetts, on May 31, 2014, provided ample stimulus to probe deeper into business aviation procedural noncompliance. This report specifically highlights the rates at which aircrews are not performing manufacturer-required, checklist-directed flight-control checks before takeoff. As confirmed by the FOQA data over the three-year period, there was a consistent trend of incomplete or neglected manufacturer-required flight control checks before takeoff.

As perplexing as it is that a highly experienced crew could attempt a takeoff with the gust lock engaged, it is equally disturbing that the data highlights a lack of professional

discipline among some crews in not accomplishing manufacturer-directed checklists – particularly safety-of-flight critical items.

The NTSB was prudent in directing a recommendation to the NBAA to conduct a data-driven approach regarding compliance with mandatory flight control checks before takeoff.

This report to the NBAA membership is not only intended to provide closure action to the NTSB recommendation, but also to raise awareness to the broader business aviation community that complacency and lack of procedural discipline have no place in our profession.

## Recommendations

### Business Aircraft Operators

- Ensure you have a standard operating procedure (SOP) addressing manufacturer-required flight-control checks before takeoff.
- Establish a flight data-monitoring program (currently only one percent of business aircraft operators have one) to enhance safety assurance of your flight department's safety management system.
- Participate in data sharing of flight data monitoring information in a formal data-sharing program (e.g., Aviation Safety Information Analysis and Sharing System [ASIAS]).

### Business Aircraft Aircrews

- Conduct flight-control checks before takeoff in accordance with manufacturers' AFM/POH Part 142 Training Centers.
- Emphasize the importance of, and specific procedures for, manufacturer-required routine flight-control checks before takeoff.

### Business Aircraft Manufacturers

- Provide aircraft operators clear requirements and procedures for flight-control checks before takeoff (the project team noted a variance in how flight-control checks before takeoff are described across OEMs and models). ■

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# AME Association of Ontario

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## CFAMEA Annual General Meeting

The annual general meeting of CFAMEA (Canadian Federation of AME Associations) is scheduled for the middle of October. This year the meeting is taking place in Ottawa so that delegates can meet with Transport Canada representatives. Last year we tele-conferenced as TC was unable to meet in person with the association representatives due to budget restraints; so it was decided to bring this year's meeting to TC headquarters. The AME Association board of directors is of the opinion that a new direction is called for to make CFAMEA truly effective. At the AGM we will be proposing a new vision for our national organization. The proposal would result in a stronger and more effective national organization that would augment our regional associations. We look forward to working with our fellow AME associations for a new concept to our alliance.

## A Nation Soars Trilogy

I am looking forward to this fall's debut of the television series "A Nation Soars." The three parts of A Nation Soars — Drawn to Victory, Wings of Courage and Flight Path of Heroes — were created to commemorate the centennial anniversary of Canada's role in the First World War. They explore how aviation changed the course of the First World War, such as its vital part in Canada's nation-defining victory

at Vimy Ridge, and highlight the lesser-known, distinctly Canadian aspects of the war.

As part of the Wings of Courage episode, a group of aviation experts and six young Air Cadets constructed two replica First World War biplanes. Not only are the planes a highlight of the Wings of Courage initiative, the inclusion of the cadets, aged 16 to 19, on the build site serves as a poignant reminder of how young the men were who fought in the Great War. In the summer of 2017, the two biplane replicas will join four others on a coast-to-coast flying roadshow. Each stop will be a weekend event hosted by a specific aviation museum and promoted to the local community.

There is a website with information about the various elements of each episode of the trilogy. The Wings of Courage site also features information on the replica biplane build and links to a suite of free educational materials. (<http://www.wings-of-courage.ca/>)

Drawn to Victory, the first documentary in the trilogy, premieres on CPAC on Sunday, October 30th, 9 p.m. (ET). The Wings of Courage documentary is narrated by Dan Aykroyd and tells the stories behind the heroism of five notable Canadian pilots and the technological improvement of aviation during the First World War; it premieres on CPAC Sunday, November 6th, 9 p.m. (ET).

— Submitted by Stephen Farnworth for the Board of Directors  
 Visit [www.ame-ont.com](http://www.ame-ont.com) for all the details.

## 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 AME Association



### Objectives and By-Laws of AME Association Atlantic

To provide a forum of AMEs elected by AMEs or AMEs voluntarily offering to serve on such a body, to act as a vehicle to represent the views and objectives of the AME Association (Atlantic) Inc. at any level required to preserve or alter as the case may deem necessary, the rights, privileges and legislation of AMEs as a whole.

### By-Laws

#### Membership

Regular Membership: All voting members of the Association must currently hold an AME license in any category, or a non-licensed aviation maintenance technician, technologist or individual meeting a recognized aviation trade standard (CGBS, Mil Standard, CAMC, SCA) or holding a position named in a MCM, MPM, ATO.

## Student Membership

Student membership is available at a reduced rate and this specified membership can only be renewed over a six year period. Student members are non-voting members. Student members attaining AME licenses may become full voting members by paying the difference between student membership fees and regular fees.

## Corporate Membership

A corporate member is any corporation supporting the objectives of the association, and which is actively involved in the aviation industry in the Atlantic Region.

01. A representative of a Corporate member shall have the right to attend all meetings but no Corporate member shall be entitled to vote or hold office in the Association.

02. Membership is limited to AMEs, students and corporations in good standing with dues paid to date. Lapsed membership may be reinstated with the payment of annual dues.

03. The Association's President shall call executive meetings as are deemed necessary. Normal notice of meetings will be thirty days. Emergency meetings will be called as required.

04. Executive decisions can only be made with a quorum of 5 members of the executive, one of which must be the President or Vice-President.

05. An annual meeting of the general membership will be held normally, to coincide with the Atlantic Region Aircraft Maintenance Conference.

06. All committee chairmen will report to the general membership at the annual general meeting.

07. An election of executive officers will be held annually at the general meeting. In the event that an elected committee chairman resigns, for

whatever reason prior to the expiry of his term, the President shall appoint another elected director to fill this position for the remainder of the resignee's term.

08. The executive committee will be comprised of a maximum of eight (8) and a minimum of six (6) directors who will manage the affairs of the Association.

09. Half of the executive will be elected at each annual general meeting. All nominations must be accompanied by one signature of a member in good standing. Elections will follow the nominations. Nomination forms must have the nominee's signature of acceptance or the acceptance can be verified by phone call by the nominator.

10. If a serving member of the executive is nominated to another position of the executive, he shall tender his resignation upon accepting the nomination.

11. Elections will be by secret ballot.

12. Members serving on the executive should be prepared to offer their services for two years, and attend executive and other meetings as required.

13. The president will not be a voting member, with the exception of a tie breaking vote.

14. An agenda will be required for the general meeting for discussion and action on items proposed during the year, and will be mailed thirty days in advance.

15. Membership fees (regular, student and corporate) will be established on an annual basis by the members at the AGM.

16. Any amendments to the AME Association Objectives and By-laws will be approved by the general membership at the AGM.

[www.atlanticame.ca](http://www.atlanticame.ca)

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# Western AME Association



## Input required for national AME meeting

CFAMEA (Canadian Federation of Aircraft Maintenance Engineers Associations) will be holding its Annual General Meeting on October 16-17. A representative from the WAMEA Board of Directors will be in attendance. Please provide any ideas or concerns you may have that can be brought forward at the meeting or to Transport Canada.

Submit your input by emailing [info@wamea.com](mailto:info@wamea.com)

## Max Ward Aviation Maintenance Award nominations now open

The Max Ward Aviation Maintenance Award is dedicated to the exemplary pioneer spirit, commitment, dedication and overall contribution to high standards of aviation maintenance and the unique special attitudes required to successfully meet and overcome all challenges. Know a candidate who fits this description? Submit a nomination form to the WAMEA office. The form can be found online at: [www.wamea.com](http://www.wamea.com)

Nominations must be received no later than 5 p.m. on Friday, February 17, 2017. Please submit nominations to:  
Western AME Association: [info@wamea.com](mailto:info@wamea.com)  
P.O. Box 21101, Edmonton, AB T6R 2V4 ; Fax: (780) 413-0076

## 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 topics, as well as an industry tradeshow with over 50 booths from various companies, suppliers, manufacturers and other organizations. Attendance at this and other workshops may be counted towards TC Canada's recurrent training requirements.

[www.wamea.com](http://www.wamea.com)



## Central AME Association



### Manitoba Aviation Symposium 2017

The Manitoba Aviation Symposium 2017 is scheduled for Wednesday, March 1st - Thursday, March 2nd, 2017 and will be staged at the Victoria Inn, 1808 Wellington Avenue in Winnipeg, Manitoba. CAMEA and the Manitoba Aviation Council will host this event. For more details and a complete schedule visit [www.camea.ca](http://www.camea.ca)

### About CAMEA

The Central Aircraft Maintenance Engineer Association is an organization dedicated to maintaining and enhancing the standards, rights and privileges of all AME members in the central region of Canada.

Our chapter is one of six similar associations across Canada who collectively supports the national body CFAMEA (Canadian Federation of Aircraft Maintenance Engineers Association). Our organization works with Transport Canada in the formulation of new rules and regulations and provides a collective viewpoint for all AMEs.

CAMEA is a not-for-profit organization run by a volunteer group of AMEs. We elect members of our organization to be part of our Board of Directors. Members of CAMEA are comprised of AMEs, AME apprentices, students, non-licensed persons working in the industry and corporate members.

[www.camea.ca](http://www.camea.ca)

## PAMA SoCal Chapter



### William J. Meyer: A Celebration of Life (1947 – 2016)

On July 8, 2016 our friend Bill Meyer passed away. Bill was a top notch Aviation Maintenance Professional that will be missed by all. William J. Meyer, son of Thomas and Anne Meyer was born May 18th, 1947 in California and passed away on the morning of July 8th. Left on Earth to cherish his memory are his wife, Doris Meyer, his two siblings, Andy Meyer and Francine Freedman, his two daughters, Christa Ennis and Laura Ramirez and his four grandchildren, Erin Ennis, Ashley Ennis, Brooklyn Ramirez and Jesse Ramirez. Bill attended Pomona Catholic High School and graduated in 1965.

He enlisted in the Air Force immediately after high school. This was the beginning of his passion for planes! Bill was in the USAF for five years, 1966-71 and he was part of the 50th Maintenance Squadron in Hahn, Germany. Bill worked on the Mach 2.5 General Dynamics F-111 "Aardvark" and the Mach 2+ McDonnell Douglas F-4 Phantom while in the USAF in Germany. Bill's exemplary work ethic and ability earned him an "incentive ride" on the McDonnell Douglas F-4 Phantom, a flight of a lifetime! When he returned to the US, he was assigned to the 6592nd Support Group AFSC Air-Ground- Equipment at Air Force Station Los Angeles (LAAFS) providing support on the various aircraft that came through until his discharge in 1971. Bill had achieved the rank of Staff Sergeant, E4.

Bill then went to work at Allied Signal Garrett Air Research (later Garrett Aviation) located at LGB & LAX in 1972 and retired from there in 1995.

At "Garrett", as an FAA A & P Aircraft Mechanic and aircraft electrician, Bill was instrumental in the development and production of the engine retrofit program converting the four engine Lockheed JetStar corporate jet, from Pratt & Whitney turbo-jet engines, to the Garrett TFE-731 Turbo-Fan engines. The aircraft then became known

as the "JetStar- 731", and about 60 were produced. Subsequently, due to the success of this program, Lockheed introduced the new JetStar II, and built 40 of them at their Georgia factory with the new Garrett engines, re-designed pylons and re-designed external fuel tanks.

In addition to the many other corporate aircraft Bill worked on another engine Garrett started retrofit program. This time it was the very well designed two-engine Dassault Falcon 20, where they worked to redesign the engine pylons and other systems and installed the next generations of the TFE-731-5 engines. This aircraft became known as the Falcon 20-5, and about 119 of this variant were retrofitted.

Bill served on the PAMA (Professional Aviation Maintenance Association) National Board of Directors as Secretary 1987-1989, Vice President 1990 and Executive Vice President 1991 through 1992 in the early formative years of the organization. He also served as the Southern California Chapter of PAMA President from 1986 through 1990 also known as SoCal PAMA. Bill was an essential member of the group's efforts to enhance the professionalism and recognition of the individuals working as FAA licensed Airframe & Powerplant technicians. PAMA is dedicated to promoting professionalism and recognition of the Aviation Maintenance Technician through communication, education, representation, and support of continuous improvement in aviation safety.

Bill fulfilled his career in the Aviation Industry when he retired from Garrett after decades of time and dedication.

Bill wasn't ready to hang it up so Bill and his brother Andy started a business, American Data Plate and Aviation Collectables in 1993, and he worked with Andy in that endeavor through 2003. While building the American Data Plate business, Bill was hired by Spears Manufacturing Company in 1998 as the Director of Maintenance for their corporate aircraft.

When Bill went to work at the Spears who owned Land, Sea, Air

Leasing Company, they were operating a JetStar II S/N 5216, which was then and remains today the lowest time JetStar II in the world. In 2001 the corporate flight department added a new Dassault Falcon 2000, and the JetStar was retired soon after. Bill kept the JetStar in flyable condition for a few years and now this great legacy airplane occupies a part of the hangar alongside the Falcon.

In addition to maintaining the Falcon 2000, he has done a lot of work on the other aircraft the company operates including helicopters, a single engine Turbo-prop, Light Sport Aircraft (LSA) and the new "Carbon Cub". At his employer's hangar, Bill also coordinated with and was the airport "Host" for the US Navy Blue Angles and the US Air Force Thunderbirds during the LA County Airshow in Lancaster the past several years. Bill really enjoyed this and was a very gracious host.

He was known as a man that could fix anything. We will miss him very much and will never forget the years we shared with him.

### June Dinner Meeting

The SoCal Chapter thanks Dan Rugenstein Operations Manager, Blake Davies, Director of Sales and all at H.E.R.O.S. for their time and generosity in hosting the June 2016 Chapter dinner meeting, Annual Scholarship Awards, and excellent technical presentation on "Safety Culture" at the 94th Aero Squadron Restaurant in Van Nuys, CA. To learn more about H.E.R.O.S contact Dan directly at 661-505- 5668, Blake at 661-310-8570 or visit [www.wherosinc.com](http://www.wherosinc.com).

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## Central Ohio PAMA



### The Central Ohio Aviation Golf Outing (COAGO)

Every year in September, Central Ohio aviators look forward to this day of golf with their friends and coworkers. This year, we had beautiful weather and a great turnout the COAGO event. 138 players teed off on September 5th to enjoy a day of relaxation, food and raffle prizes for our local aviators, sponsors and guests. This event, which is co-hosted by the Professional Pilots Association (PPA), has been the main fundraiser for the COPAMA Scholarship Fund which provides monetary awards for tuition and testing fees of local student Aviation Maintenance Technicians. The event proceeds will keep the fund ready to help those who request testing scholarship help for next year.

### The Holiday Dinner

This event allows us to gather with friends and family and enjoy the spirit of the upcoming Holiday Season. The evening includes a light aviation topic geared toward spouse and friend participation. Last year's presentation was by Mike Kent, Retired Master Sergeant USAF on his Experiences in Antarctic Air Operations. His presentation was filled with information, including photos and personal experiences that makes even the coldest winter day in Central Ohio seem warm.

Tuesday December 9th has been chosen for this year's Holiday Dinner, and we'll once again use the Villa Milano to host the event with PPA. The ticket provides for dinner and a cash bar is available. Raffle prizes are donated for several raffles that include a main raffle to help fund the Sam Dodge Memorial Endowment through the Columbus State Community College Development Fund.

Our entertainment speaker will be Dwight Jarboe of MMS Aviation at Coshocton County Airport. The topic will be Missionary Maintenance Services, their training program and support for Missionary Aircraft around the world. Sponsor forms are now available on the Holiday Dinner web page. You may also purchase Dinner and Raffle Tickets and Beverage Coupons. Please mark your calendars!o attend!

### The Ohio Aviation Maintenance Symposium

Each year, we co-host the Ohio Aviation Maintenance Symposium with Columbus State Community College Aviation Maintenance Technology facility at Bolton Field. The event provided contact with vendors and presentations to help attendees meet the requirements for next years IA renewal. Representatives from the Columbus and Cincinnati Flight Standards District Offices also attend to provide information and FAA training sessions throughout the two-day event. The 2014 one-day, single-session Maintenance Symposium moved to the Columbus State Community College Conference Center, located in the Center fororkforce Development Building, on Columbus State's main campus. The session was developed by the FAASTeam Program Manager, Inspector Mark Harden with registration made through the FAA Safety website, [www.faasafety.gov](http://www.faasafety.gov).

### District 7 Science Day

We participate as sponsor judges for aviation-related science projects at the District 7 Science Day. The event is held in March on the main campus of Columbus State Community College and exhibits projects from Elementary, Middle and High School students. COPAMA provides three monetary and two honorary awards in hopes of encouraging youth to enter into the aviation and aerospace industry.

### Youth Aviation Adventures

Youth Aviation Adventures holds events in May and September, which provide educational opportunities for youth interested in career paths in aviation. Each youth progresses through a series of stations where they can learn about aviation-related experiences. YAA has several squadrons across the U.S., and our local group holds events at The Ohio State University Airport. COPAMA has provided support for YAA through volunteer and monetary means.

[www.copama.org](http://www.copama.org)

Thirty-five years after the first flight of the BAe 146/Avro RJ, new operators are still putting these aircraft into service, but in dramatically repurposed ways . . .

# *With new assignments*



Another new niche, which the BAe 146 and Avro RJ have successfully penetrated, is the demanding Airtanker (aerial firefighting) role.

**O**n September 3, 1981 the first BAe 146 regional jetliner took to the skies from the British Aerospace airfield at Hatfield, Hertfordshire. The aircraft — and its later-build successor, the Avro RJ — was destined to become Britain's most successful jet airliner.

A total of 394 aircraft were built, with the final new-build aircraft delivered from the Woodford, Cheshire production line 22 years later in November 2003. Today, around 220 of these aircraft remain in service in a wide variety of roles, supported fully by BAE Systems Regional Aircraft at Prestwick, Scotland—the Original Equipment Manufacturer. More than 12 million flight hours of service have been accumulated.

Acknowledging the first flight anniversary, Sean McGovern, Managing Director of BAE Systems Regional Aircraft recently said: “It is important to understand that this aircraft has many years of productive service yet to offer. In addition to supporting all our customers we work to help introduce the aircraft to new market applications through our extensive and specialist engineering capabilities. BAE Systems can provide a total support package, planned for at least a 15-20 year period.”

As an early footnote, a distinction must be made here in terms of the acronyms. British Aerospace (BAe) was a British aircraft, munitions and defence-systems manufacturer. Its head office was at Warwick House in the Farnborough Aerospace Centre in Farnbor-

ough, Hampshire. In 1999 it purchased Marconi Electronic Systems, the defence electronics and naval shipbuilding subsidiary of General Electric Company, to form BAE Systems.

The aircraft still finds favour with new operators such as Pionair of Sydney, Australia, which is just starting BAe 146QT (Quiet Trader) overnight freight services on behalf of Virgin Australia, which has won a five-year US\$575 million contract from TNT Express.

The newly acquired BAe 146-200QTs will fly the dedicated Eastern seaboard routes with one aircraft routing from Cairns-Brisbane-Sydney-Melbourne to Adelaide and the second in the reverse direction but with the addition of Townsville, slotted in between Brisbane and Cairns.

Steve Ferris, Chairman and Owner of Pionair adds: "Significantly, the whisper-quiet BAe 146 is still the only jet airliner allowed to operate at both Sydney and Adelaide during airport curfew hours."

At around 10 tonnes freight payload it is also the right size for the job. The two aircraft will fly around 2,800 hours a year in total on this contract. "In addition, we have acquired two BAe 146-200QC (Quick Change pax-to-freight variants)," says Ferris. "One of these aircraft has been converted to a full QT freight configuration for use as a maintenance spare for this contract and for ad hoc charter work. The other QC is likely to be leased out to another operator in Africa."

For freight charter work Pionair carries outsize cargo mainly for mining support work and is also looking at international markets for wet-lease services. "The unique short-field performance, rough-field capability and large freight door makes the BAe 146 very attractive for remote operations," says Ferris.

Another new niche, which the BAe 146 and Avro RJ have successfully penetrated, is the demanding Airtanker (aerial firefighting) role. Three operators in North America have selected the aircraft as their preferred 3,000-gallon Type 1 large airtanker. The latest operator to convert an aircraft is Air Spray of Chico, California, which is in the final stages of converting the first of five BAe 146-200s

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Above: A BAe Systems Regional Aircraft Avro RJ Freighter.

and anticipating Supplemental Type Certificate (STC) approval early next year ready for the 2017 fire-fighting season.

The two other operators—Conair/Aero Flite (RJ85) and Neptune Aviation Services (BAe 146-200) each have seven aircraft in service. Both fleets have been heavily utilized throughout North America this year and Neptune reports that one of their aircraft flew 18 sorties in one very busy day.

All these airtanker operators envisage acquiring and converting additional BAe 146/Avro RJ aircraft over the next few years to meet firefighting demands and for replacement of venerable older piston and turboprop aircraft in their fleets.

As Avro RJs are starting to come out of mainline European service after many years of service with top-ranking operators such as Swiss, Brussels Airlines and CityJet, so the feedstock of aircraft available to new operators remains high.

Many of these aircraft have accumulated between 20,000-35,000 flight cycles (depending on aircraft age and history). BAE Systems offers an Avro RJ Life Extension Program, which commences at 40,000 flight cycles and clears the aircraft life limit up to 60,000 flight cycles, ensuring many years of operational service.

It is probable that potential new airline customers for the Avro RJ will take advantage of the aircraft's low acquisition costs, proven economics, and the current low oil price to acquire these attractive aircraft for new operations in other parts of the world.

In addition, BAE Systems Regional Aircraft has just announced that it is working toward the possible launch of a

passenger-to-freighter conversion program for the Avro RJ. Building on the experience gained with the BAe 146QT, the business has spent the past 12 months (3,500 man-hours) assessing the feasibility of the Avro for freighter conversion and coming up with an industrialization plan.

The principal variant for conversion would be the RJ100 which can carry up to 14 tonnes of cargo, or with the addition of a modular under-floor fuel tank system, a smaller payload can be carried for an extra 1,000 nautical miles.

The company is currently assessing market reaction and looking for interested parties to commit to the program for a minimum of 10 aircraft to initiate a full industrial program.

BAE Systems will have a strategic MRO partner who will provide the freighter conversion or working party support to suit any need. The plan is to have the first conversion completed by the end of 2017.

BAE Systems will also work with any potential Avro RJ Freighter customers to develop custom modifications for the aircraft to suit differing requirements, including loadmaster seat, extended range and increased/re-distributed floor loading.

In addition to the RJ100, the RJ85 can also be developed as a freighter using the same kit. The RJ85 is cleared for unpaved runway operations, so making the aircraft very suitable for remote operations for low-density freight operations and life-line/humanitarian use.

Seems like there are no truly "old" aircraft ...just ones that have not yet been repurposed. ■

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Above: Pionair BAe 146QT. Below: The unique short-field performance, rough-field capability, and large freight door makes the BAe 146 very attractive for remote operations.





# When the rubber *doesn't meet the road*



**During a Jazz flight into Edmonton, a ruptured tire on contact with the tarmac leads to the collapse of the aircraft's right main landing gear.**

**T**he Jazz Aviation LP (doing business as Air Canada Express) Bombardier DHC-8-402, registration C-GGBF, serial number 4433, operating as flight JZA8481, departed from Calgary International Airport (CYJC) with an intended destination of Grande Prairie, Alberta. During the takeoff roll, the number three tire of the main landing gear failed. The flight was diverted to Edmonton International Airport (CYEG); aircraft rescue and firefighting equipment was standing by for the landing on

Runway 02. On touchdown at 2030 Mountain Standard Time, the right main landing gear collapsed. Upon contact with the ground, all of the right-side propeller blades were sheared, and one blade penetrated the cabin wall. The aircraft came to a stop off the right (east) edge of the runway surface. Passengers and crew evacuated using all four exits. Three passengers sustained minor injuries. There was no post-accident fire. The accident occurred during the hours of darkness.

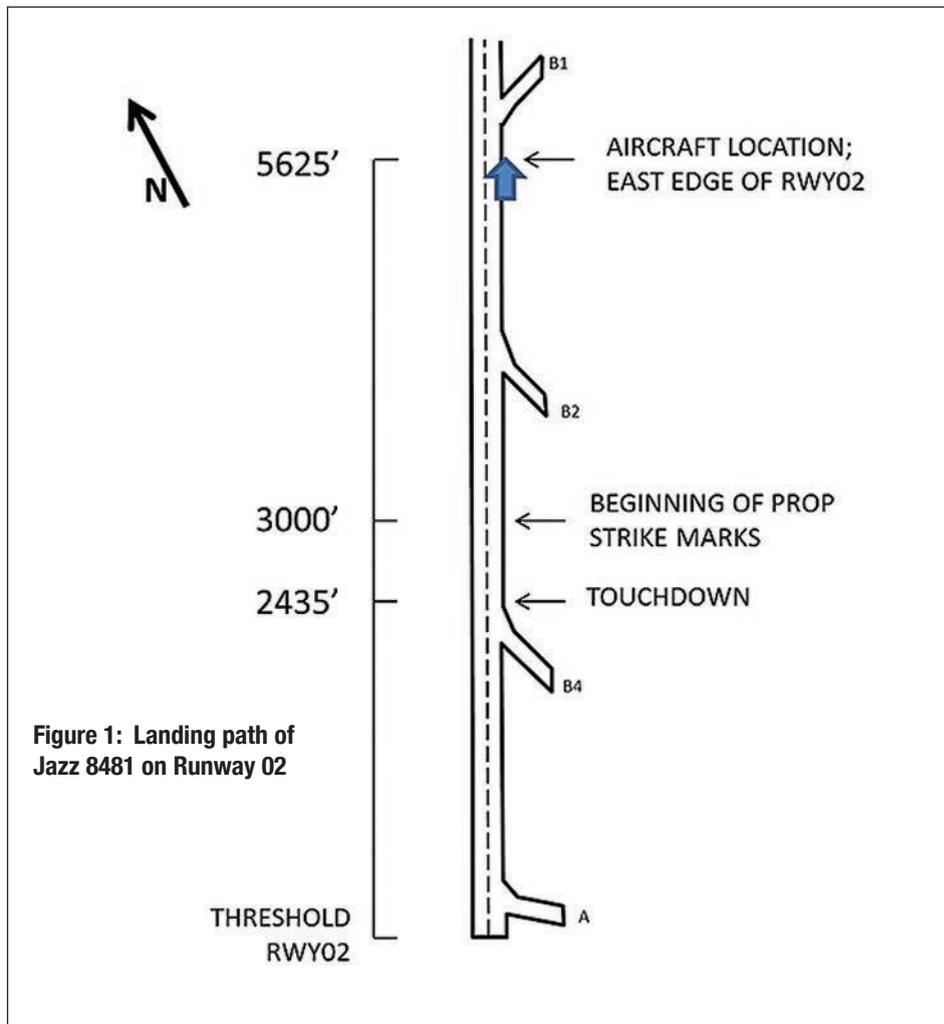
## History of the flight

During takeoff, Bombardier DHC-8-402 registration C-GGBF, serial number 4433, approached rotation speed (Vr). A noticeable vibration ended once the aircraft was airborne. Once the landing gear was retracted and the aircraft was established in the climb, the flight crew discussed the vibration. The cabin crew informed the pilots that a tire had blown. Company maintenance and operations crews at its dispatch centre were contacted through the company's very high frequency channels. Because of strong crosswinds, returning to CYYC was not an option, and a decision was made to land at Edmonton International Airport and to switch aircraft owing to the ruptured tire. Maintenance personnel recommended that a hard landing be avoided.

Air traffic control arranged for the aircraft to level at 13,000 feet above sea level. The cabin crew confirmed that the number three tire had blown and revealed that something had struck the aft fuselage. Throughout the approach phase of the landing sequence, the landing gear control panel indicated that the landing gear was down and locked. The aircraft touched down lightly on Runway 02 at CYEG. As the wheels spun up, a pronounced vibration shook the aircraft 2.4 seconds after initial touchdown; while the nose wheel of the aircraft was still airborne, the right main landing gear (MLG) collapsed. The right-side propeller blades struck the runway, and all were sheared on contact. One large section of a propeller blade penetrated the aircraft cabin next to passenger row seven. At the same time as the propeller contact, the nose landing gear came down and its tires ruptured. The aircraft slid slightly to the right and came to a stop off the right edge of the runway, approximately 3200 feet past the touchdown point.

## Digital flight data recorder

Data from the aircraft's digital flight data recorder (DFDR) were analyzed



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Above: Bombardier DHC-8-402 registration C-GGBF, serial number 4433. (Don McKay photo)

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at the TSB Laboratory. The focus of the analysis was on the takeoff roll, when the tire failed, and on the subsequent collapse of the right MLG on landing. The DFDR had recorded tri-axial accelerations, which provided information on the aircraft vibrations when the tire failed. The landing gear data consisted of a number of discrete signals that indicated the status of the uplocks and downlocks for the nose landing gear and MLGs, the landing gear handle position, and the weight-on-wheels (WOW) state.

The landing gear was selected down as the aircraft descended through approximately 7,800 feet above sea level before intercepting the instrument landing system for Runway 02. The aircraft was approximately 18 nautical miles from CYEG at this time. Both main and nose landing gears changed from "up and locked" to "down and locked," as they normally would. No master warning or master caution alerts were displayed during the approach, and there were no abnormal indications concerning the hydraulic system pressure or fluid quantity.

Information from the landing gear manufacturer (Goodrich Aerospace Canada Ltd.) indicates that the discrete output for MLG downlock activates when (1) either the primary or alternate system downlock sensor for each main gear measures "down and locked" and (2) at least one downlock sensor of each main gear is not faulted. Subject to these conditions, if the MLG downlock releases on either gear, the discrete output deactivates (i.e., the MLG state becomes "not down and locked").

There was no indication of any abnormal condition other than the ruptured tire. As a consequence, the crew expected a normal landing and followed all the proper procedures for that expectation. No emergency was declared, nor was aircraft rescue and firefighting equipment requested. However, the equipment did roll out to meet the aircraft during the landing.

A momentary MLG WOW was recorded at 118 knots calibrated airspeed (KCAS). The power levers were retarded to flight idle at initial MLG WOW, with the recorded vertical load factor at

approximately +1.05g. Approximately 1.5 seconds later, full MLG WOW was recorded at 114 KCAS; the recorded vertical load factor was +1.07g. This is an indication of very light touchdown forces and a soft landing.

At this point, the power levers were retarded below flight idle, and the ground spoilers were extended. The propeller beta discrete signal subsequently recorded a change into “reverse.”

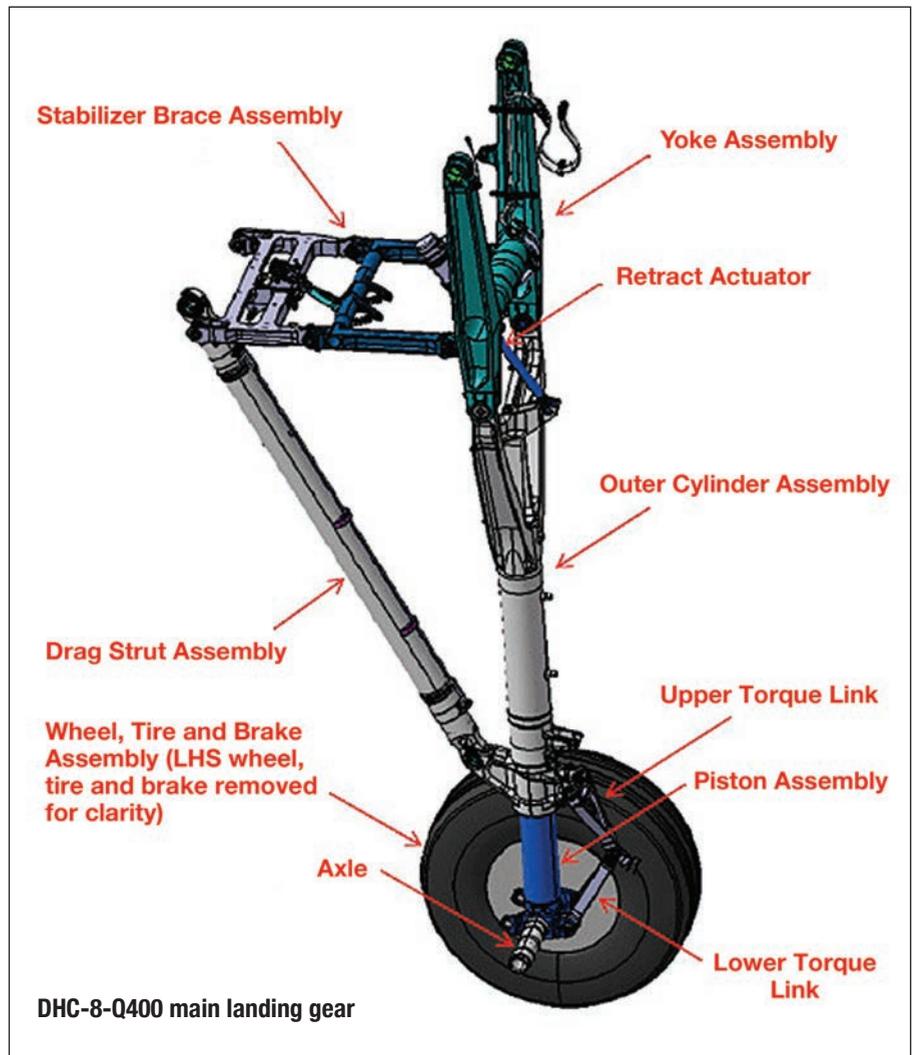
The aircraft rolled suddenly to the right 2.3 seconds after the second MLG WOW indication, which was consistent with the right MLG collapsing; the airspeed at that time was approximately 105 KCAS. During the gear collapse, the power levers were being retarded into reverse. The MLG WOW changed back to “air,” and the MLG “down and locked” discrete signal, which is sampled every four seconds, was changing from “down and locked” to “not down and locked.”

An aural warning tone activated, as well as several discrete parameters on the DFDR, including the master warning, the master caution, and the “touched runway” discrete signals. A vertical acceleration peak of 2.68g was recorded as the aircraft rolled to the right and struck the ground. No previous warnings or cautions had been recorded on the DFDR nor had any abnormal indications been associated with the hydraulic system or the landing gear.

## Maintenance

A thorough check of the recent maintenance records and all actions relevant to the components in this occurrence was carried out. All of the systems and components directly involved were inspected and/or tested in detail. No anomalies were found. All records indicate that the aircraft was certified, equipped, and maintained in accordance with existing regulations and approved procedures.

The aircraft was equipped with a tire manufactured by Dunlop Aircraft Tyres Ltd. that had been retreaded once. Immediately after the accident, management of Jazz Aviation decided to mitigate any possible future damage from MLG tires and no longer use retreaded tires on the MLG of its DHC-8-Q400 fleet, effective November 10, 2014.



## Accident site and wreckage trail

The area of the propeller strike marks was about 40 feet long, with two feet between marks. Based on the propeller speed of 1,020 revolutions per minute (rpm), which had been briefed by the crew and recorded on the DFDR, the strike marks indicated an approximate ground speed of 120 knots. However, the DFDR recorded airspeed of 105 KCAS at the time of the collapse, and the DFDR with WOW recorded airspeed of 118 KCAS just before the collapse.

The nose wheel left marks on the runway indicating that it had come down hard at the same time as the propeller strikes began.

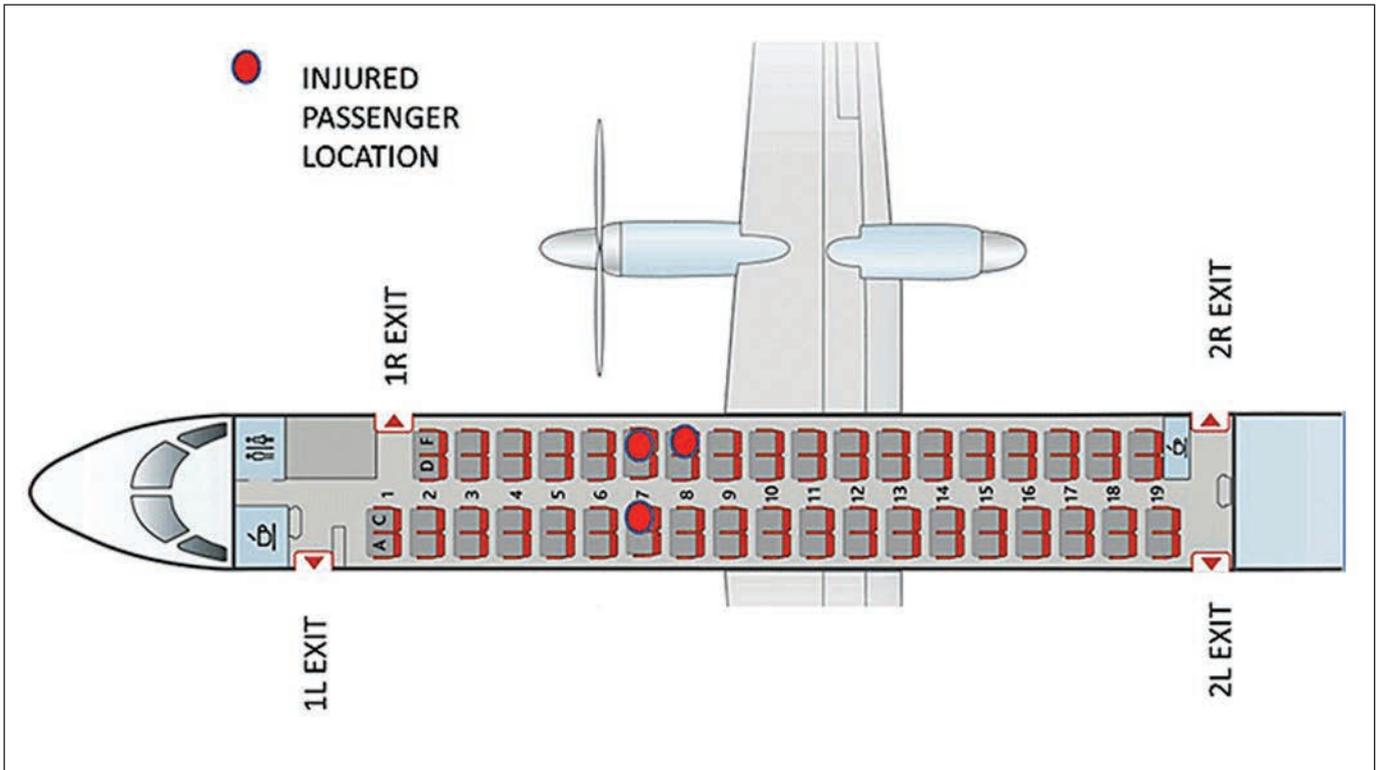
The distance from the propeller strike marks to the nose gear contact point was the same as the distance on the aircraft from the propeller rotational plane to the nose gear location.

The aircraft landed slightly right of centre line on Runway 02 at 2,435 feet from the threshold. Throughout the landing phase, the landing gear collapse, and the subsequent slide to a stop, the aircraft maintained runway heading. It came to rest 3,190 feet after touchdown. The left side main wheels were still on the runway. The left side of the fuselage was on the right-hand edge of the runway asphalt, still parallel to the runway heading. The right wing was touching the ground.

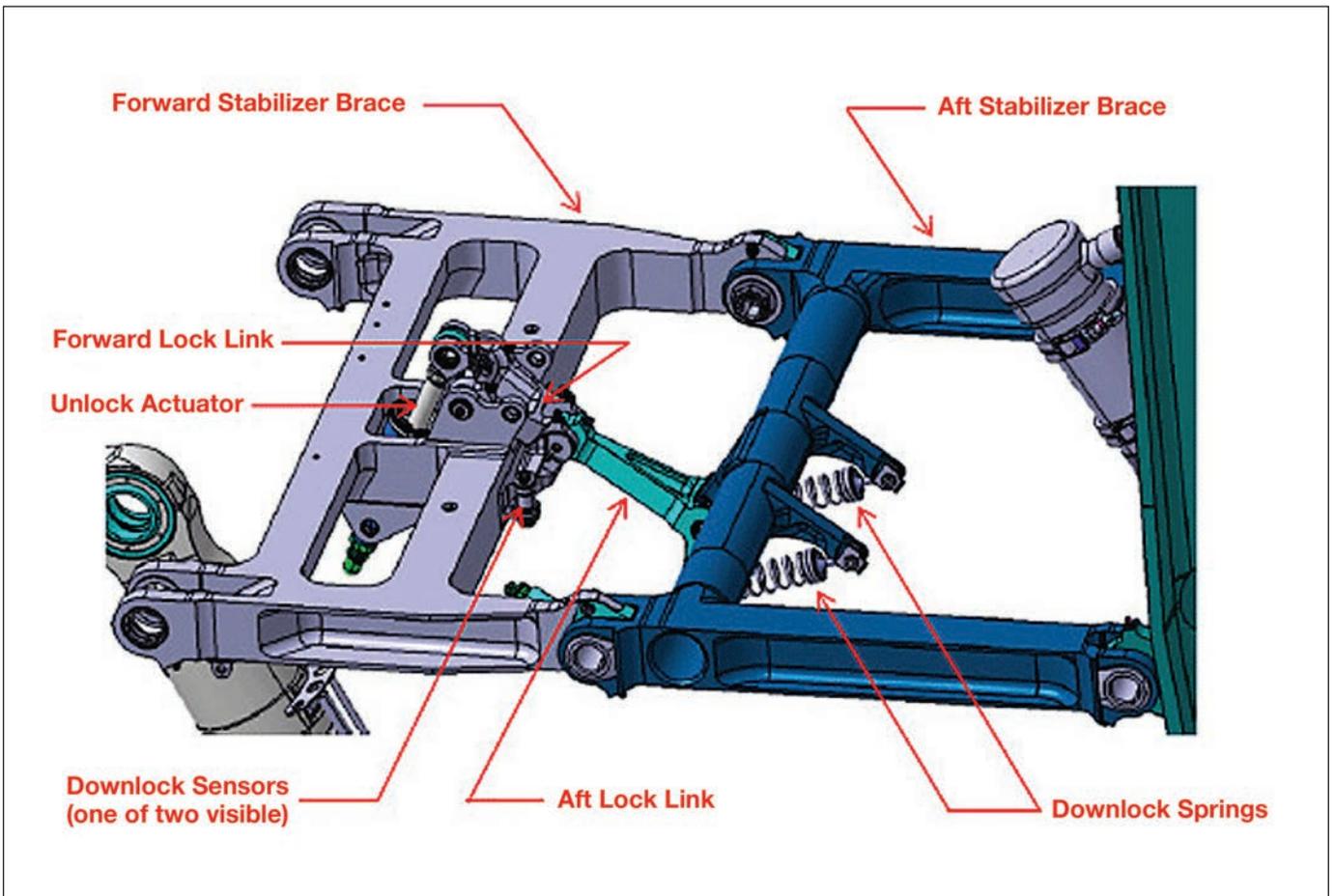
The nose landing gear had collapsed rearward during the slide and was approximately five feet from the right-hand edge of the asphalt.

## Propellers

At initial contact, the propellers shattered into small pieces near the tips; then, as they came closer to the ground,



Above: Figure 2: Jazz 8481 cabin layout showing location of injured passengers.  
 Below: Zoomed view of the main landing gear stabilizer brace assembly.



they sheared at the hub. This is an expected and normal mode of failure when composite blades contact hard objects. A reinforced area on the fuselage (called the “ice shield”) is designed to protect against ice shed from the propeller blades during icing conditions but is not designed to resist impact from objects such as debris from the propeller.

### Tire failure

The number three MLG tire, deflated but still mounted on the wheel, was submitted for examination to the TSB Laboratory. The fracture surfaces on both the casing and the tread fragments showed characteristics consistent with rapid tearing, except for a few locations where abrasion damage caused by contact with the runway was observed. No sign of cuts or punctures was found on the recovered fragments. The number three MLG tire failed due to an impact break, most likely caused by running over a hard object at high speed during takeoff.

The investigation determined that some airlines have found that the number three main tire fails more frequently than other tires on this Q400 aircraft type. Aircraft that have not had a passenger bridge sometimes make hard right turns under power while departing from the gate, and use the right-side brakes to assist in the manoeuvre. This hard braking and turning may cause an extreme shearing force on the tread area and on the sidewalls of the number three tire in particular, because it is the pivot point.

### TSB Analysis

The flight crew was certified and qualified for the flight in accordance with existing regulations. The flight crew and cabin crew conducted all operations following the applicable manuals, and operational issues are not considered to have been a factor in this occurrence. All crew members were well rested, and fatigue or other human factors are not considered to have contributed to the occurrence.

Weather was suitable for visual flight, and the runway condition was bare and dry; therefore, weather factors are not considered to have contributed to the accident.

All records indicate that the aircraft was certified, equipped, and maintained in accordance with existing regulations and approved procedures.

An unexpected high rotational imbalance was created on the number three tire when it failed during takeoff. During landing, the failed number three tire was spun by contact with the ground and was maintained at a rotational speed that was the same as or very close to one of the natural frequencies of the main landing gear (MLG). This caused the lock links to trigger (through the proximity sensors gap) the proximity sensor electronic unit (PSEU) to de-energize the solenoid sequence valve (SSV), thereby relieving system pressure from the extend port of the unlock actuator. In this condition, the vibration caused the lock links to overcome the force from the downlock springs and unlock the stabilizer brace as a result of gear dynamics, which led to collapse of the right MLG.

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The propeller blades broke up when they struck the runway. While there is a reinforced area on the fuselage to protect against ice shed from the propeller blades, it is not designed to stop portions of failed propeller components from entering the cabin . . .

If there are no specific requirements for dynamic vibration testing of components or completed airframes, there is a risk that similar or other aircraft systems could fail during high-vibration conditions.

The propeller blades broke up when they struck the runway. While there is a reinforced area on the fuselage to protect against ice shed from the propeller blades, it is not designed to stop portions of failed propeller components from entering the cabin. The evacuation was carried out efficiently.

### Other findings

Short-radius turns with hard braking may cause an extreme shearing force on the tread area and on the sidewalls of the number three tire in particular, because it is the pivot point.

### Safety action taken

Immediately after the accident, management of Jazz Aviation decided to mitigate any possible future damage from

MLG tires and no longer use retreaded tires on the MLG of its DHC-8-Q400 fleet, effective November 10, 2014.

Jazz Aviation has made changes to its DHC-8-Q400 Line Indoctrination Guide – Pilot Line Indoctrination, items 14 and 30, to avoid the use of braking and tire pivot whenever possible. The company has also made changes to volume two of its aircraft operating manual and issued a memo (Q400 Memo 2014-131) that addresses Q400 gate arrival and departure taxi techniques, in order to lessen stresses on the main landing gear tires.

Other operators that use this aircraft have changed operational procedures to mitigate effect of the sharp right turns on the ramps near the gates in order to lessen the extreme shear loads primarily affecting the number three tires.

*(This report concludes the Transportation Safety Board's investigation into this occurrence. The Board authorized the release of this report on March 9, 2016. It was officially released on April 6, 2016.)* ■

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## Still busy a quarter century later

The 25th anniversary of the Jetstream 41's first flight was marked in September, even as its largest operators found new applications.

It was 25 years ago, on September 25 1991, that the first Jetstream 41 regional turboprop airliner first took to the skies from Prestwick International Airport. And like the BAe 146/Avro RJ that was discussed earlier this issue in the story "With New Assignments," the Jetstream 41 is also enjoying a rejuvenated life with fresh roles to play. A total of 104 aircraft were built through to 1998 and around 64 of the 29-seat aircraft continue in service today with some 18 operators in Europe, the Americas, Asia, Africa and the Middle East. A further 25 aircraft are currently stored, available to be returned to service. Over the life of the aircraft to date some 3.3 million cycles have been accumulated.

While most of the in-service aircraft continue to fly on airline duties, two of the largest operators have this year found new applications for the Jetstream, underlining its flexibility for different roles.

In the UK, the Maritime and Coastguard Agency has announced that it is trialing a Jetstream 41 from this month as part of a development to support its search and rescue (SAR) helicopters. The aircraft is provided by Eastern Airways (which has a fleet of 17 Jetstream 41s) on behalf of Bristow Helicopters and has a dedicated crew. The aircraft will be controlled through the Aeronautical Rescue Coordination Centre (ARCC), and will be tasked where there is a risk to life and in support of the Agency's helicopters.

Painted in red and white HM Coastguard colours, the Jetstream 41 will be patrolling the southern and eastern seaboard of the UK.

The aim of the trial is to assess whether a fixed-wing aircraft will provide valuable additional support for the SAR helicopters. The new capability will help save lives at sea by identifying people, boats or ships in distress. The Agency states that if the trial is successful, options for permanent provision will be explored, possibly in combination with similar requirements elsewhere in Government.

In South Africa, leading regional carrier Airlink (which has a fleet of eight Jetstream 41s) has won two contracts from mining companies to operate scheduled mining support air services to the paved but narrow runway airfields at Tommy's Field, Northern Cape Province and to Venetia in Limpopo

Province. Services to both airfields commenced on August 1st. These three-year contracts were awarded by Anglo American Limited subsidiaries Kumba Iron Ore for the Kolomela iron ore mine near to Tommy's Field and by Venetia Mine, which mines diamonds. In both cases the Jetstream 41 has replaced Beech 1900D aircraft on these services, giving significantly greater payload, and enhanced interior amenity to include a flight attendant, a galley for inflight catering and a toilet.

BAE Systems Regional Aircraft is supporting Airlink to approve Jetstream 41 operations to these narrow runways (Tommy's Field runway width is 18 metres and Venetia is only

15 metres) because the aircraft is normally cleared to operate from runways of 30-metre width and above.

A new modification is being worked on for the Jetstream 41 incorporating the water methanol engine rating already fitted to the aircraft and a 15 degree flap setting which should improve payload by up to seven passengers at the 4,360-ft altitude Tommy's Field. This narrow runway operation modification will derestrict the aircraft from operating in most narrow runway environments thereby enabling the Jetstream 41 to address many new market opportunities. ■



### Spread far and Wide

In addition to Eastern Airways and Airlink, main fleet operators of the Jetstream 41 include:

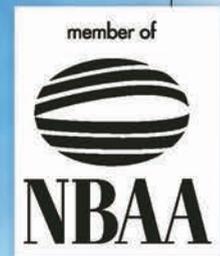
- Airjet, Angola (3)
- Proflight, Zambia (3)
- MCC Aviation, South Africa (3)
- Yeti Airlines, Nepal (7)
- Royal Thai Army (2)
- Sky Express, Greece (2)
- AVDEF, France – operated on behalf of the French Navy (2)
- Easyfly, Colombia (12)
- Buzz Airways, USA (2)
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