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AirMaintenance UPDATE

The Magazine for Aircraft Maintenance Professionals

Transport Canada Approved for R/T

RAISING THE BAR:
Cold Chill on a Warm Day

Exhaust Systems
Difficult or Deadly

Transport Canada 'Feedback'

Troubleshooting at Light Speed: Using A.I. in Maintenance

Publication Mail Agreement No. 0041039024
and Return Undeliverable Canadian Addresses to
Alpha Publishing Group (2004) Inc.
Unit 100 - 6660 Graybar Rd, Richmond BC V6W 1H9
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December - January 2024
Volume 22/Issue 4

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Boeing breaks ground in Winnipeg

THERE WAS GOOD NEWS from the Keystone Province in early November as Boeing broke ground on a CAD $20 million, 12,000 square-foot expansion at its Winnipeg manufacturing plant to more efficiently meet the growing demand for composite airplane parts. The expansion includes a 7,250 square-foot freezer for storing composite manufacturing materials, nearly doubling the site's freezer capacity and reducing manufacturing downtime due to built-in 100 percent operational redundancy. The freezer will lower annual energy usage by more than 20 percent and employs a modern CO2-based refrigeration system that produces less emissions. The LEED silver-certified design also reduces the expansion's carbon footprint compared to traditional construction.

"This investment demonstrates our continued commitment to Boeing's manufacturing presence in Winnipeg and environmental sustainability for our operations," said Teri Thompson, general manager of Boeing Canada Winnipeg. "Our advanced facility and talented team play a vital role in Manitoba's thriving aerospace industry."

The Winnipeg site produces hundreds of composite parts and assemblies for Boeing Commercial Airplanes, including the acoustic inner barrel for the 737 MAX and the main landing gear doors for the 787 Dreamliner. Canada is among Boeing's largest international supply bases with more than 550 suppliers and partners. Boeing says it contributes CAD $4 billion per year in economic benefit to Canada while supporting more than 14,000 jobs, including 1,500 Winnipeg-based employees.

"As the largest aerospace composite manufacturer in Canada, Boeing's Winnipeg expansion will help us better meet demand for our products, improve operational efficiency and support our climate goals," added Charles Sullivan, managing director of Boeing Canada. ■

— John Campbell, Editor

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AirMaintenance Update
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Richmond BC V6W 1H9 Canada
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Advertising inquiries: (604) 214-9824

production manager: Chrissie Harvey
circulation: Anne Gervin
cover photo: Dreamstime.com

Published by Alpha Publishing Group (2004) Inc.

Publication Mail Agreement Number 0041039024 and Return Undeliverable Canadian Addresses to:
Alpha Publishing Group (2004) Inc.
Unit 100 - 6660 Graybar Road
Richmond BC V6W 1H9 Canada

Subscription Rates: 1 Year: $40 2 Years: $60
AirMaintenance Update is published 6X annually.

Corporate Member of:

HAC · Helicopter Association International · NBAA

Publications Mail Registration No. 0007198278

ISSN 1703-2318

Upcoming Events

Honda unveils Echelon at NBAA-BACE

IT WAS IN LAS VEGAS in October during the 2023 National Business Aviation Convention and Exhibition (NBAA-BACE) where Honda Aircraft Company revealed "HondaJet Echelon" as the official name of its new light jet. The company says the name signifies that the path for the next-generation business jet is to deliver premium comfort and convenience."The HondaJet Echelon was born to create a new category that transcends the travel experience on conventional light jets," said Honda Aircraft Company President & CEO Hideto Yamasaki. "Expanding mobility skyward has been Honda's long-lasting dream, and the HondaJet Echelon marks the exciting next chapter while showcasing a classic Honda story of a product that creates new value for people."

The HondaJet Echelon, previously introduced as the HondaJet 2600 Concept in 2021 is said to be a mid-sized jet experience in the light jet category and was designed to be the world's first single-pilot light jet capable of nonstop transcontinental flight with seating for up to 11 occupants. The aircraft is said to feature the tallest cabin height, and a class-leading cabin altitude of 6,363 feet.

It incorporates automation of its systems including autothrottle, Emergency Autoland, autobrake, Advanced Steering Augmentation System (ASAS) and Runway Overrun Awareness and Alerting System (ROAAS). The working concept of the HondaJet Echelon revolves around offering an experience typically reserved for larger aircraft, and to deliver fuel efficiency to outperform conventional light jets on typical missions by up to 20 percent and mid-sized jets by over 40 percent.

Development of the HondaJet Echelon is well underway having completed several key milestones including installation of the first structural test rig, which was completed Q4 2021; and the official power-on ceremony for the Echelon's Advanced Systems Integration Test Facility (ASITF) at the company's Greensboro, North Carolina world headquarters on August 30, 2023.

The detailed design of the aircraft is also well underway, targeting an aircraft level Critical Design Review (CDR) summer 2024, with select long lead fabrication already in progress.

Production of the HondaJet Echelon will take place in Greensboro, with early build processes scheduled to begin in 2024. The first flight is planned for 2026, followed by type certification anticipated in 2028. ✪

COMING EVENTS

Buckeye Air Show/Copperstate Fly-In
February 16-18, 2024
Buckeye, Arizona
www.buckeyeaz.gov

MCAS Yuma Airshow
March 09, 2024
Yuma, Arizona
www.yumaairshow.com

Fiesta Of Flight
March 09, 2024
Laughlin AFB, Texas
www.laughlin.af.mil

New Orleans Air Show
March 23-24, 2024
NAS JRB New Orleans
Belle Chase, Louisiana
www.neworleansairshow.com

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STCs & new products

Spotlight does long-range targeting

Streamlight's Waypoint 400 rechargeable pistol-grip spotlight offers up to 1,400 lumens of ultra-bright white light with 400,000 candela and a beam distance of 1,265 metres for enhanced down-range lighting capability. The portable light can be used as either a handheld mobile searchlight or with its integrated stand as a hands-free scene light to illuminate an area. It uses a deep-dish parabolic reflector for long-range targeting with optimum peripheral illumination. The light runs for 3.25 to 84 hours on high and low respectively, and uses a rechargeable lithium-ion battery that fully charges in four hours. **www.streamlight.com**

Special-role radio is easily integrated

Canadian avionics manufacturer **Anodyne Electronics** has launched a new modern panel-mount radio for special-role and multi-mission platforms. Designed with the US Forest Service and aerial firefighting operators in mind, the MTP136D is a Project 25 Phase 1 compliant VHF/FM solution for digital and analogue communication on all channels across the 136MHz to 174MHz frequency band. The MTP136D boasts a robust design to ensure high performance in lengthy and demanding firefighting environments. It's easily integrated for tactical systems, platform upgrades, and is a plug-and-play replacement for existing legacy radios. **www.aem-corp.com**

Winglets reduce take-off distances

BLR Aerospace has received FAA certification of a King Air 200 series STC increasing maximum take-off weight up to 14,000 pounds when the aircraft is fitted with BLR winglets, high flotation landing gear, and a Centrex Halo 275 STC. With this STC, operators with PT6A-42 and PT6A-52 engines can now take advantage of certified performance up to the Centex Halo STC-certified gross weight limits. The advantages of the STC for aircraft include significant reductions in ground-roll and take-off distances and improvements in stall speeds. **www.BLRaerospace.com**

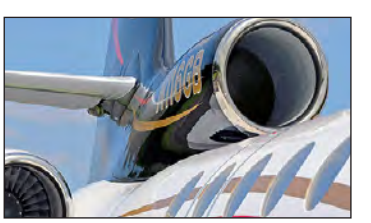
Gears connect misaligned shafts

KHK's new line of gear couplings is manufactured to the highest quality standards by **Kohara Gear Industry Co.**, of Japan. Known as the GC series, these gears and corresponding sleeves are designed to permit the connection of two shafts with minor misalignments. When designing a motion application, there is a need to connect to a motor shaft. Use of a KHK stock gear coupling will allow for torque of one shaft to be connected to another shaft and compensate for minor misalignment. KHK Gear couplings are produced in three sizes with 17 bore sizes. **www.khkgears.us**

Ladder still grips strong when oily

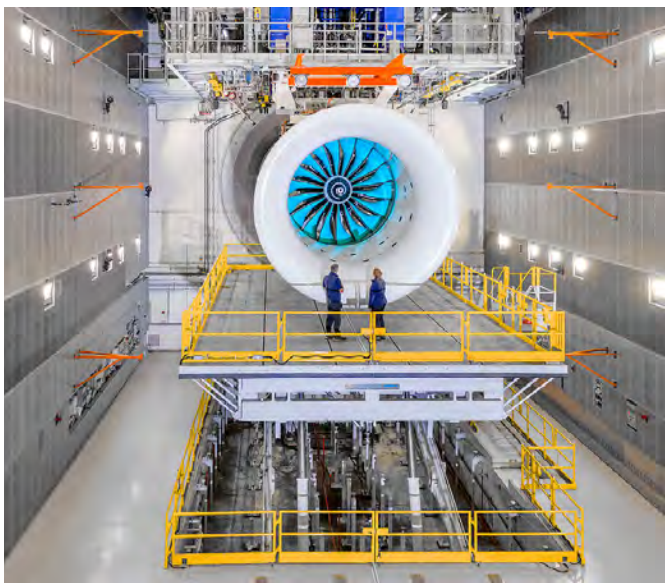
Metallic Ladder has introduced Aero Ladder, an aluminum specialty ladder for mechanics to reach electrical equipment bays, pylon panels, wheel wells, and more on aircraft. "Aero Ladder is 100 percent better than competing designs because of sturdiness, width, price, and quality," said Michael Romanowski, an aircraft maintenance manager for a logistics company. "If Skydrol hydraulic fluid gets on this ladder, there's sufficient grip to safely work. We replace fibreglass ladders every few years due to weather and exposure to Skydrol." **www.metalliclader.com**

Epoxy primer is ready to spray



Sherwin-Williams Next Generation epoxy primer is a two-component, corrosion-inhibitive primer that contains no chromate. The primer is ideal for application on all types of aircraft, including commercial aircraft, business jets, military aircraft, unmanned aerial vehicles, rotor aircraft and general aviation. It provides exceptional performance with various substrates and pretreatments and is designed to work with all Sherwin-Williams exterior topcoat systems. The primer's 2:1:1 mix ratio is ready to spray: no additional reduction is required. It also offers a broad application range using a single activator. **www.industrial.sherwin-williams.com**

To announce your STC or new product, email a JPG photo and a product description to John at: amu.editor@gmail.com



ULTRAFAN RUN TO MAX POWER

Rolls-Royce has now run its UltraFan technology demonstrator to maximum power at its facility in Derby, UK. This is an important milestone for the UltraFan demonstrator, which was successfully tested for the first time earlier this year. Since then, the UltraFan team has been gradually increasing the power as part of the testing regime and confirming this capability is a big step towards improving the efficiency of current and future aero-engines as UltraFan delivers a 10 percent efficiency improvement over Rolls-Royce's Trent XWB, which is already said to be the world's most efficient large aero-engine in service.

VALDOR BEAVERS TO GET NEW ENGINES

Pratt & Whitney announced in November that Valdor Aircraft has selected the PT6A-34 engine for its conversion program of the single-engine BX Turbo Beaver, under a new Supplemental Type Certificate from Transport Canada. Valdor Aircraft specializes in the maintenance, modification, and repair of several types of aircraft, with work conducted at its Val-d'Or facility in Quebec. The STC allows the company to replace the original Beaver piston engine with the PT6A-34 and install new BX wings built entirely at the Val-d'Or plant. Today's PT6 engine is up to four times more powerful and has a 50 percent improved power-to-weight ratio compared to the original engine.

RESEARCH PROTOTYPE BREAKS COVER

Bombardier has unveiled images of its EcoJet research project's second test phase, which involved flight tests conducted with an 18-foot-wide demonstrator. The project aims to reduce aircraft emissions by up to 50 percent through a combination of aerodynamic, propulsion and other enhancements. Analysis of the data will allow a deeper understanding about the behaviour of Blended Wing Body designed aircraft in free flight. The flight-testing program will be held over multiple years to generate data in real-world environments. Bombardier started testing real life feasibility of its theoretical work back in 2017 with the first prototype, which had a wingspan of approximately eight feet.

G500 CERTIFIED FOR STEEP APPROACH

Gulfstream's clean-sheet, next-generation Gulfstream G500 has now been certified for steep-approach operations by the U.S. Federal Aviation Administration, giving the aircraft access to some of the world's most challenging airports. The G500 demonstrated its low-speed handling and short-field capabilities in 2021 with landings at airports including London City Airport in

England, which has a short runway and strict noise abatement requirements, and Lugano Airport in Switzerland, which is situated in the mouth of a valley and requires an extremely steep approach. The G500 holds nearly 60 city-pair speed records and more than 110 are in service around the world.

AIR CANADA PLACES BIG ORDER

GE Aerospace recently confirmed that Air Canada has ordered 36 GEnx-1B engines plus four spares to power its new order of Boeing 787-10 aircraft. The order includes options for an additional 24 GEnx-1B engines. The Montreal-based carrier took delivery of its first Dreamliner in 2014 and currently operates 38 787-8 and 787-9 Dreamliners, all powered by GEnx engines.The GEnx engine family has more than 50 million flight hours since entry into service in 2011 and is the fastest-selling, high-thrust engine in GE history with nearly 3,000 engines in service and on backlog, including spares.

AUTOFLIGHT LAUNCHES FIREFIGHTING PROTOTYPE

Global eVTOL pioneer AutoFlight has launched a high-payload firefighting program and released a fully functional prototype. With a maximum takeoff weight of two metric tons, the firefighting model is designed to lift a 400-kilogram payload over a distance of up to 200 kilometres and can reach speeds in excess of 200 kmh. It can transport four high-performance fire-extinguishing canisters, each weighing 100 kg, with the capacity to extinguish fires covering up to 200 sq/m individually. This means that in a single payload, the four canisters can collectively extinguish fires spanning up to 800 sq/m. The firefighting model is expected by early 2024.

5G C-BAND GUIDANCE UPDATED

The FAA recently updated guidance to operators and pilots regarding potential adverse effects on radio altimeters from 5G C-Band interference, recommending operators equip affected aircraft with 5G C-Band tolerant radio altimeters as soon as possible. This guidance, published in SAFO 21007 – Risk of Potential Adverse Effects on Radio Altimeters when Operating in the Presence of 5G C-Band Interference – is the latest update since the July 1 deadline for airlines to equip their aircraft with filters to reduce the risk of adverse effects from 5G C-Band interference. The risk of interference is highest for aircraft that have not been retrofit.

SCHWEIZER COMPLETES AN INDUSTRY FIRST

Texas-based Schweizer says it has now completed the first helicopter of its new OEM Certified Helicopters Program.

The refurbished S300CBi includes a new engine, blades, interior, paint, and low time components. Schweizer says its OEM Certified Helicopters Program is the only one of its kind in the industry. With the program, Schweizer accepts older Schweizer aircraft, regardless of their airworthiness, for inspections, repairs, and component replacement. Customers can trade in their older Schweizers for either a discount equal to the value of the aircraft on a new helicopter or receive a percentage of their aircraft's sale price when Schweizer sells it. ■

Difficult and Exhausting

How a "simple" thing like an exhaust system can create deadly difficulties

BY JAMES WILLIAMS

Above: A post-accident photo of the fire damage to the nose of the airplane.

It SEEMS SO SIMPLE: just a metal tube to safely carry hot exhaust gases away from the aircraft. What could possibly go wrong?

AS IT TURNS OUT, QUITE A BIT. General aviation (GA) exhaust system failures have been indicated in many accidents over the years, leading to concern from the General Aviation Joint Safety Committee (GAJSC). Between 2011 and 2019, 23 GA accidents and incidents involved exhaust systems. This isn't a new concern. National Transportation Safety Board recommendations date back to the 1980s concerning exhaust systems, and prior agency concerns are documented back to the 1940s. That said, it's important to recognize that the solutions to these difficulties are a mix of modern technology and old-fashioned upkeep.

There are three general types of exhaust failures: muffler failures/blockages, exhaust leaks causing noxious gases or fumes to permeate the cabin, and exhaust cracks causing heat

An exhaust system is more than just a bunch of crudely welded pipe sections.

damage and/or fire. While there can be some overlap among the three, this framework offers a helpful way to think about preventing an exhaust-related accident.

ALL BLOCKED UP

We may scoff at calling the exhaust parts of the powerplant a "system," but it is more than just a bunch of crudely welded pipe sections. In highly competitive environments like Formula 1 racing, the exhaust systems are an area of an intense engineering competition. The racing teams continually try to maximize output while minimizing weight with exhaust system designs. The competition got so out of hand that officials had to limit the number of exhaust systems the teams could use per season. While GA aircraft exhausts are not nearly as refined, the same principle applies because even small constrictions or blockages can cause degraded performance or worse.

The unfortunate pilots of an amphibious Maule M-7 in Oregon found this out in the worst possible way. After an uneventful taxi and run-up, the pilots began a takeoff on a paved runway and lifted off with about 1,000 feet of runway remaining. The airplane struggled to gain altitude once it departed ground effect, and the pilot realized they would not clear the 50-foot-tall trees on the other side of the river they were approaching. The pilot decided to attempt a water landing but failed to retract the wheels on the floats, causing the airplane to nose over into the water. The pilot was killed, and his passenger received minor injuries.

The ensuing investigation revealed that both mufflers had suffered broken baffles, and the baffling in the right muffler had managed to rotate 180 degrees from its intended position, reducing exhaust flow from that muffler by 89 percent. The NTSB concluded that the loss of power caused by the separated baffling was the probable cause of the accident.

OUT COLD

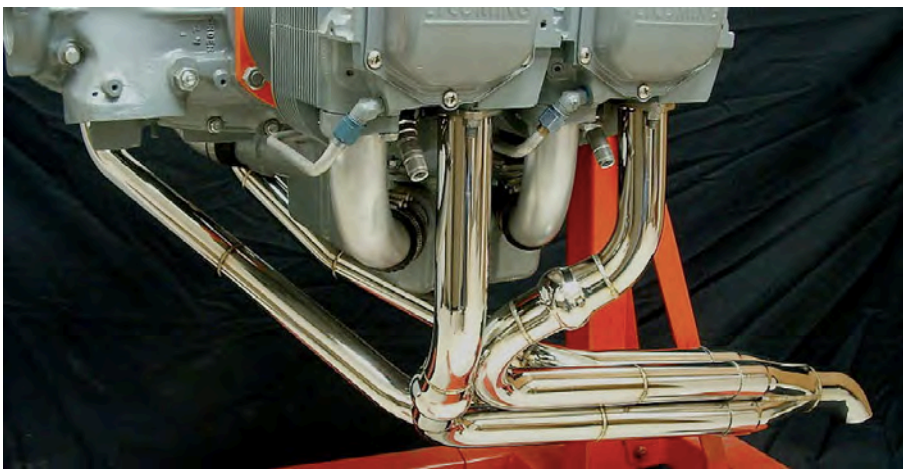
One of the fears I acquired during my flight training was the use of cabin heat. No matter how cold it was, I always had an unwarranted fear of sliding that lever over and enjoying one of nature's great ironies. While internal combustion engines are great at providing propulsive power in a space and weight-efficient package, they aren't great at transforming their fuel into kinetic energy. Most cars probably only convert 30-ish percent of that available energy into work, while our technologically less advanced aircraft piston engines are likely dipping into the 20s. But this major downside comes with one key advantage: most of that energy is transformed into "waste heat" that we can harness. My fear arose from how we harvest that heat. Generally speaking, many GA airplanes use a shroud that wraps around the muffler to circulate outside air around the hot part and then into the cabin. In theory, it's a great system that recycles "waste heat" into a warm cabin at no cost to performance and with no additional fuel burn.

As the saying goes, though, there's no free lunch. The drawback to this marvellous act of recycling is that any crack or leak in the muffler area covered by the shroud would allow exhaust gases, and most critically, carbon monoxide (CO), into the cabin. CO is an odourless, colourless, and tasteless gas that very easily bonds to the oxygen-carrying system in the blood at a far higher strength than oxygen. This means that once CO locks on, that red blood cell can no longer take oxygen from the lungs and to the rest of the body where it's needed. This impairs your ability to function and can ultimately be fatal even if you aren't at the controls of an airplane. That's why it was always a risk-reward calculation between cabin comfort and CO risk.

Unfortunately, a flight instructor and a private pilot ended up on the wrong side of that calculus in late 2020. The instructional flight departed from outside Little Rock. It made

a brief stop at an airport near the origination point, then flew up to northern Arkansas over a couple of airports before turning east southeast and requesting an IFR clearance to Walnut Ridge Airport (ARG) from Memphis Center. After initial radar and radio contact, the flight briefly proceeded before radar contact was lost and radio contact became intermittent. Efforts to contact the missing flight by ATC and aircraft in the area continued, but to no avail. The flight continued, but not directly toward the destination airport. The flight's last seven and a half minutes were an increasingly wobbly and looping mess ending just south of Franklin, Ark. The ADS-B track looked like a VFR into IMC accident despite it being clear below 5,000 feet above ground level (AGL) and 10 miles of visibility in daylight conditions.

Both pilots were killed, and the NTSB examination of the wreckage determined that there was cracking in the muffler that predated the accident leading to CO poisoning. Toxicology reports from the flight instructor confirmed this finding.



Exhaust system failures have been indicated in many accidents over the years, leading to concern from the General Aviation Joint Safety Committee.

Below: Photo of a headset that features a CO detector.

The last group of accidents is the one that really captures our attention: Fire. I've long known that fire is the one thing that truly scares me in aviation. Don't get me wrong: many potentially dangerous situations deserve consideration, but fire occupies a special place in my mind. Faulty exhaust systems can either be a direct source or create a source for fire. Many components in the engine compartment can be sensitive to high heat, including wiring and fuel lines (both of which can lead to fires if damaged).

The pilots and passengers of a Piper Malibu Mirage encountered such a situation. Thankfully no one was killed, but unfortunately two of the five on board suffered serious injuries when the airplane caught fire in 2018. Immediately after takeoff, the pilot noticed an odour of smoke. After a very brief attempt to troubleshoot the issue, he decided to turn the aircraft back to the airport. At that point, smoke began to pour into the cockpit. Shortly afterward, the engine made a loud noise, the oil pressure

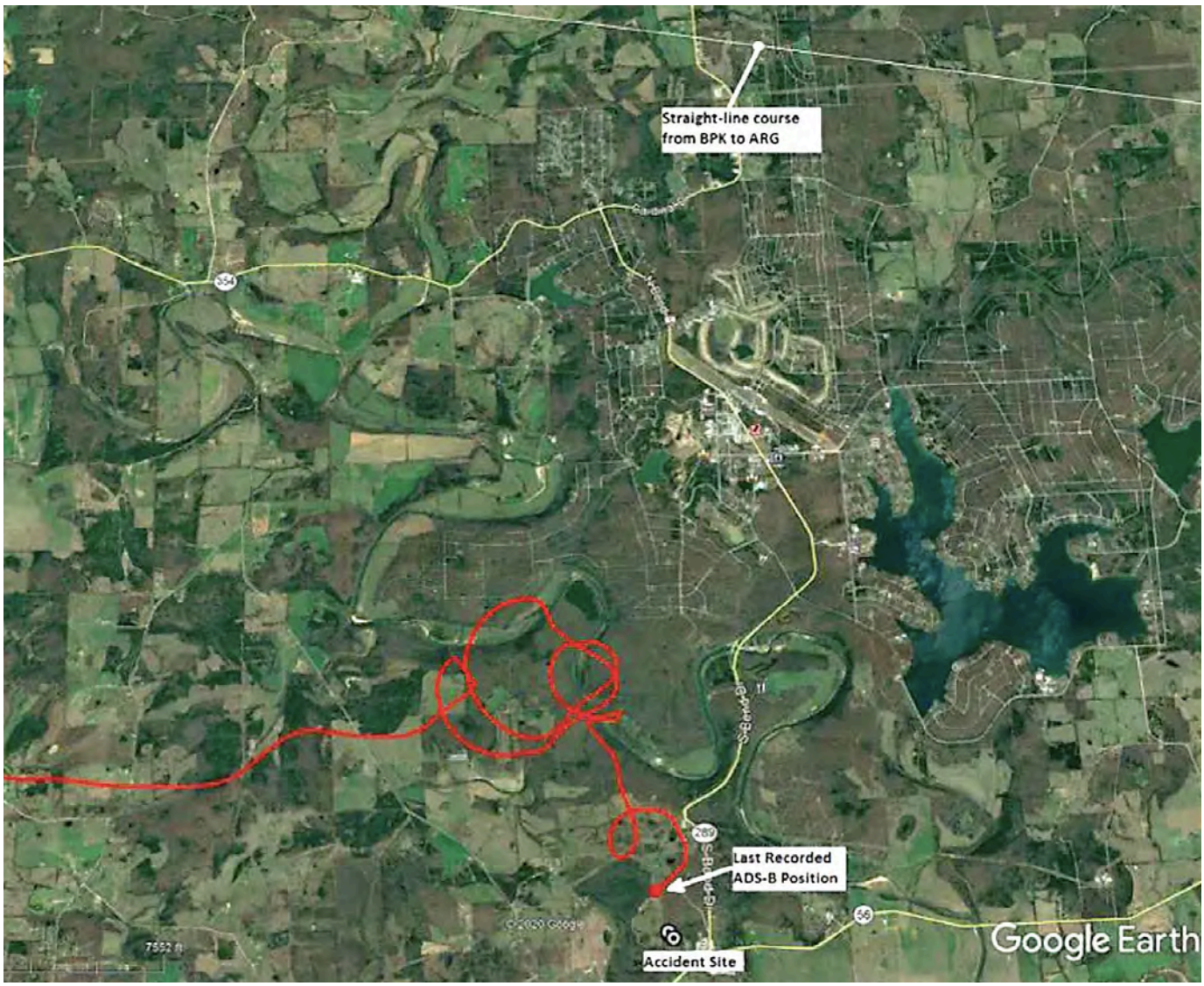
Faulty exhaust systems can either be a direct source or create a source for fire.

dropped to zero, and the engine lost all power. The pilot determined it was impossible to reach the airport and made a forced landing in a field. All five occupants were able to exit the airplane and get clear as the fire burned the forward section of the airplane in front of the cockpit. The local fire department arrived quickly and extinguished the blaze before it spread to the rest of the aircraft.

The NTSB investigation determined that the Aviation Maintenance Technician (AMT) completing a service bulletin on the exhaust system immediately preceding the flight failed to follow proper procedure when reassembling the exhaust leading to the leak and fire. Contributing was the AMT's supervisor, who failed to oversee the process and relied on a post-maintenance inspection where the error would not be visible.

EASING YOUR DIFFICULTIES

So what are we to do? It takes a mix of diligence, teamwork, and technology. The first and easiest thing to do is step up your preflight of the engine compartment. Look for obvious damage to the exhaust and indications of wear, damage, or staining to nearby components. This can be an excellent way to catch small leaks that can lead to larger cracks. If it's an airplane you fly regularly, consider taking periodic photos of the engine compartment so you can compare them. With almost everyone carrying a high-quality camera in their pocket, it's an easy way to detect slow-moving trends. That

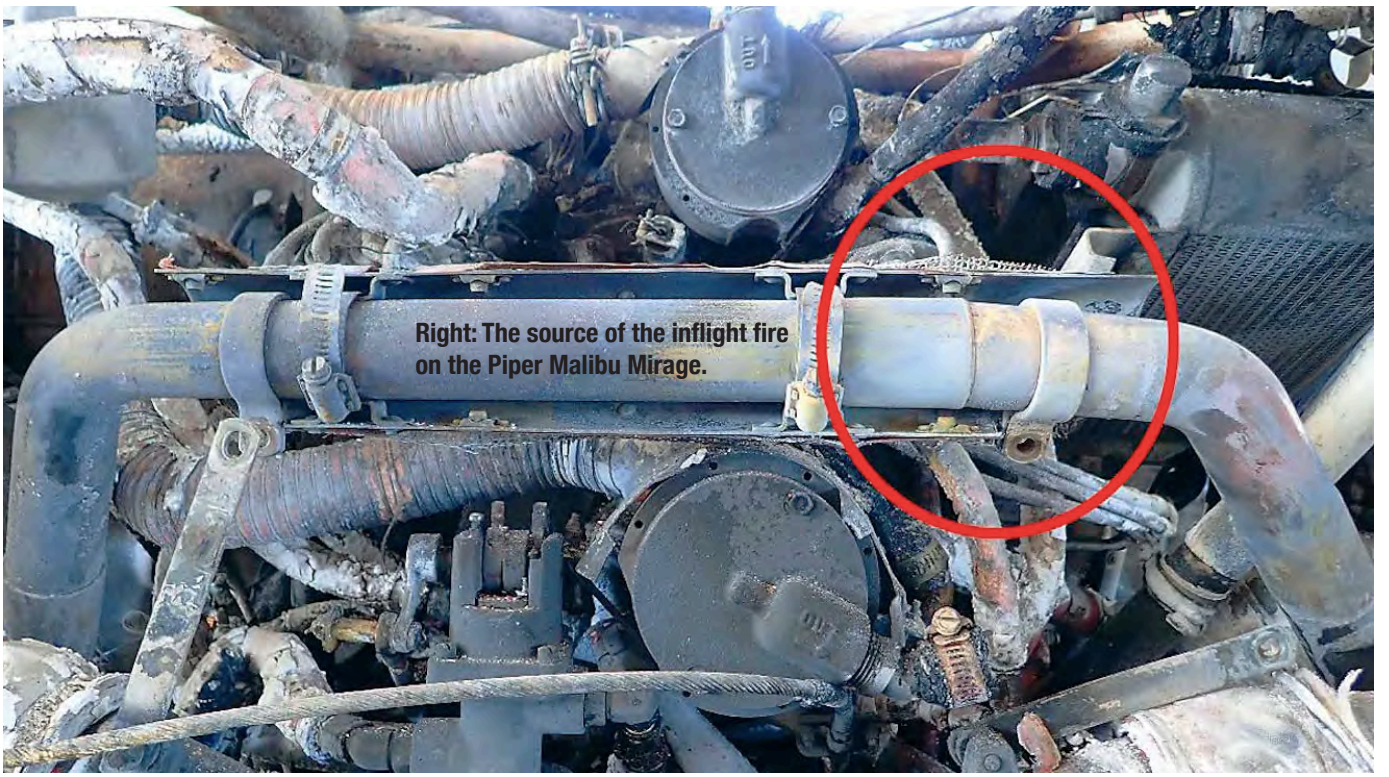


Above: The flight path of the last 7.5 minutes of the referenced CO poisoning accident.

way, you have a basis for comparison when something looks off, but you can't remember if it was that way last time. This might not work as well with every airplane but doing the best you can to get a good view of the compartment (like using a flashlight) improves your odds of avoiding adversity.

The next step is to team up with a good AMT and work out a plan. At what interval is your exhaust system inspected per the service manual? What does that inspection include? Do you and/or your AMT feel that is sufficient? There is no requirement to inspect the inside of the exhaust during a 100-hour or annual inspection using a borescope or other means. While we tend to think of an exhaust as a permanent part of our engine, perhaps that thinking should shift to view it as an exceptionally long-lived wear part. Look at it more like brake pads or tires; monitor the exhaust system's condition carefully and replace items before a failure. You may want to talk to your AMT about setting a schedule for periodic inspections and add that item to the nearest annual, 100-hour, or another shop visit. This practice might add a bit of downtime and cost, but it's money well spent.

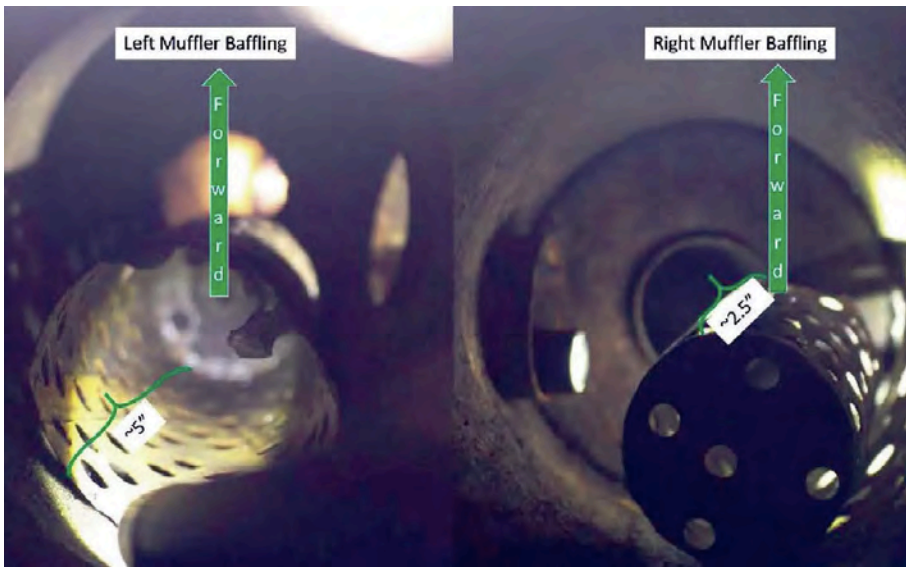
Another thing you and your AMT can do is report any issues encountered to the FAA's Service Difficulty Report



Right: The source of the inflight fire on the Piper Malibu Mirage.

System (SDRS). The SDRS (sdrs.faa.gov) allows the aviation community members to upload a report if they experience an issue with a part. It allows the FAA to collect data on service issues before they lead to accidents. Gathering data on some component failures during an accident investigation can be difficult. Having trained with accident investigators, I find it truly amazing what they can determine from what appears to be bent metal. Even so, there are usually limitations on what they can categorically declare, especially in cases of fire where much of the evidence may be consumed. Having information from much earlier in the failure chain provides a better look at the cause of the failure and how it might be prevented. GAJSC has struggled with a lack of data on exhaust failures so catching them early is critical.

The final leg of this triad is technology, particularly CO detection. CO detectors aren't new. But the ones that I was most familiar with were the little orange dot that was usually affixed to the panel; it would change colour in the presence of CO gas.



Above: Photo of the baffling that rotated inside the muffler leading to the accident referenced in this article.

Top, right: This CO detector is affixed to the panel where it changes colour in the presence of CO gas.

While they certainly work and are very cost-effective (in the vicinity of $5), these devices lack any kind of alarm, meaning you must actively scan them. Paradoxically this means that if CO is potentially impairing you, you must actively monitor a small dot on the panel while continuing all your other tasks. That is precisely the kind of thing that CO poisoning makes more challenging.

Modern CO detectors come in wide varieties; most include an audible alarm and/or visual annunciation, so you don't have to actively monitor them. Some will even log CO levels during flights in reports that you can access later, allowing you to detect small changes over time that may be below the levels that

Left: The wreckage of the muffler from the CO poisoning accident.

Below: There are three types of exhaust failures including cracks causing heat damage.

cause impairment, but that could indicate the start of a problem. There are both installed and portable options. One headset manufacturer has even integrated a CO detector into one of its products. You can also find CO detectors integrated into portable ADS-B In units. So even if you only rent airplanes, there are still plenty of options. They are available at many different price points, so a modern CO detector should be a part of your aviation kit every bit as much as your headset and electronic flight bag. Even the most expensive CO detectors are very cheap insurance against CO impairment.

Through these three methods, we can help reduce exhausting difficulties for the aviation community as a whole, making the skies safer for everyone. ■

(This article was originally published in the March/April 2023 issue of FAA Safety Briefing magazine, where James Williams is Associate Editor.)

★ TRANSPORT CANADA ★
Reports and Comments

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

Left: The Bell Textron 407.
Below: Bell Textron, hardware from the air conditioning system clamp.

REPORT: BELL TEXTRON 407

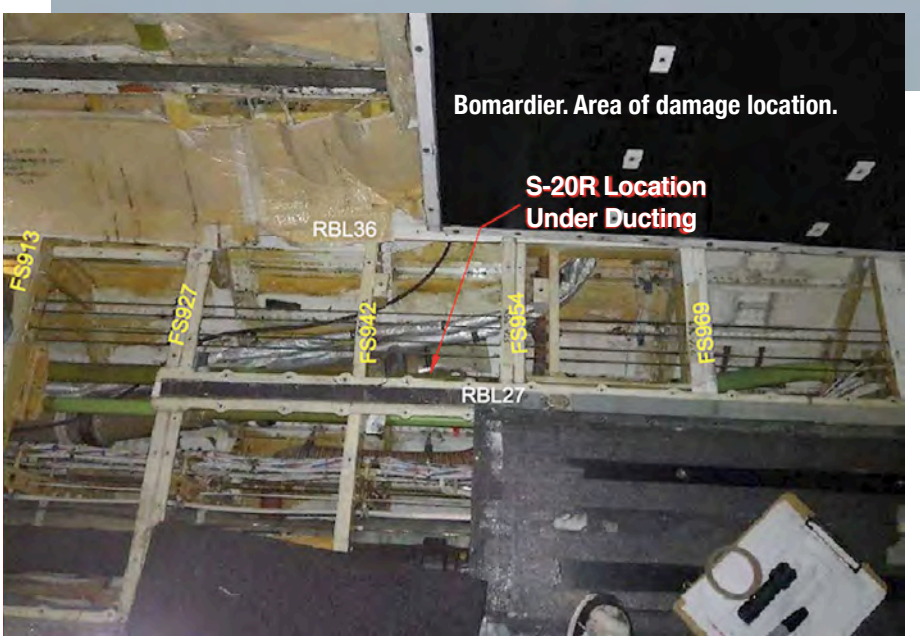
Smoke in the cockpit due to air conditioner system fouling

Subject:
Smoke in the cockpit with ground power on was reported to Bell. A clamp was found contacting transistor.

Transport Canada Comments:
The cause of this service difficulty was determined to be a clamp from the Air Comm Corporation air conditioner system fouling with the Bell Automatic Flight Control System (AFCS). The smoke was generated when the hardware that was used to secure the clamp contacted an electrical component of the AFCS. As a result of the Air Comm Corporation investigation, Service Bulletin (SB) 407-221012 was published. The SB provides instructions to resolve the potential fouling condition between the air conditioner system and the AFCS. Transport Canada Civil Aviation would like to raise awareness of this SB to the owners, operators and maintainers of Bell 407 helicopters with an Air Comm Corporation air conditioner system installed along with the AFCS or the provisions for the AFCS.

Right: Bombardier. Close-up of corrosion.

The Bombardier RJ900.



Bomardier. Area of damage location.

severely corroded area was located beneath an underfloor air duct. The air duct would have carried hot or cold air, and the underfloor area would have been the opposite temperature, either cold or hot and humid. In either case, this is a recipe for condensation and moisture creation and made the area susceptible to corrosion. Access to the area is hidden from the view of most general visual inspections (GVIs) and was only found when the floorboards were removed. If the corrosion had been discovered sooner, a stringer replacement may not have been needed, so more frequent inspections of this area are recommended.

REPORT: BOMBARDIER RJ900

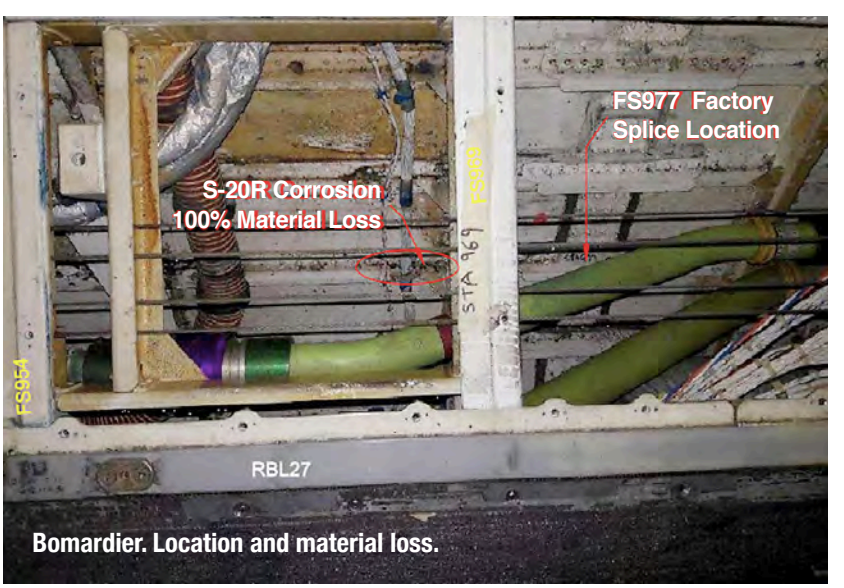
Fuselage stringer 20R corrosion

Subject:

During a maintenance check, it was noted that stringer S20R had corrosion damage from fuselage station (FS) FS.927 to FS.954. The corrosion was found when the floor was removed and was located below the underfloor ducting. There was 100% material loss found and the stringer had to be replaced. The final repair was a replacement of the corroded stringer section from factory stringer splices at FS.920 and FS.977.

Transport Canada Comments:

When localized corrosion is found there is usually a specific cause, and in this case the



Bomardier. Location and material loss.

Aircraft: a Cessna 208.
Left: Cessna, Elevator torque tube with excessive corrosion at end cap.

REPORT: CESSNA 208

Elevator torque tube corrosion

Subject:

Excessive corrosion was found on the left-hand (L/H) elevator torque tube assembly, originating at the end cap faying surface. Several cracks and converging cracks of varying sizes were found, including a triangle area of material missing due to corrosion. There was no apparent damage found on the visible inboard end of the torque tube assembly. The area of damage was not visible through routine inspection. The suspect area was inspected by removing the inboard leading edge skin, part number (P/N) 2634000-5. A visual inspection of the right-hand (R/H) elevator torque tube was carried out with a borescope through a tooling hole at the elevator inboard rib P/N 2634017-27, and no defects were noted. The aircraft is currently maintained under severe inspection time limits and operated as a float plane in a saltwater environment.

Transport Canada Comments:

The Federal Aviation Administration (FAA) published Special Airworthiness Information Bulletin (SAIB) CE-17-25 Elevator Torque Tube – Inspections for cracks and corrosion in elevator torque tubes. This publication highlights an airworthiness concern stating, "the potential for cracks and corrosion in elevator torque tubes on Textron Aviation Inc. (Cessna) 172, 175, 180, 182, 185, 188 and 208 airplanes."

The subject Service Difficulty Report (SDR) is a clear example of corrosion found in a Cessna 208 aircraft operating in a severe environment. As the submitter experienced, it may not be obvious during routine inspection to identify corrosion in this area. As such, special attention should be given when inspecting this area. Textron Aviation recommends that this area be inspected every 1600 hours or 24 months.

Since the publication of SAIB CE-17-25, similar defects have been reported on additional model 208/208B aircraft. Transport Canada Civil Aviation (TCCA) encourages opera-

tors to review SAIB CE-17-25, continue to inspect this area as recommended by Textron Aviation and report any defects by submitting an SDR.

REPORT: DIAMOND CANADA DA20 C1

Elevator control horn attachment bolt worn through lower skin

Subject:

During the performance of a 300-hour inspection, the forward elevator control horn attachment bolt was found worn through the lower skin of the elevator.

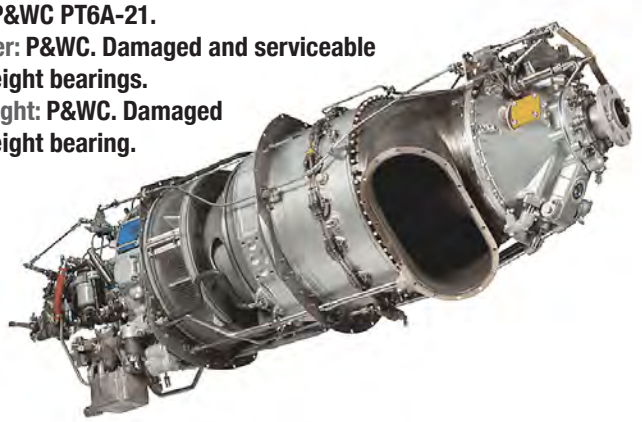
Top of page: a Diamond Canada DA20 C1.

Above: Diamond, View of removed elevator (upside down). Forward attachment bolt worn through lower skin.

Left: Diamond, View of removed elevator (upside down). Elevator control horn as installed on elevator.

Transport Canada Comments:

The root cause of this failure is not entirely clear. Incorrect torque during the installation of the control horn bolt, and/or horizontal stabilizer water drain hole obstruction in combination with freeze/thaw cycles may have contributed to this failure. Maintainers are reminded to refer to the appropriate fastener installation torque values. In cases where specific torque values are not defined, standard torque values should be referenced.



The P&WC PT6A-21.
Center: P&WC. Damaged and serviceable flyweight bearings.
Far right: P&WC. Damaged flyweight bearing.

REPORT: PRATT & WHITNEY CANADA PT6A-21

Propeller governor flyweight bearings insufficient ball retention

Subject:

During a normal inspection, it was discovered that the right-hand engine magnetic chip detector had a piece of metal attached to one of its magnetic pick-ups. It was a metal ball of 0.039 inch in diameter. We sent the information to the engine manufacturer and after several days, the information came back stating that the ball was probably coming from the propeller governor and possibly also from the overspeed governor. The propeller governor was removed and sent to the overhaul facility who confirmed that one of the four internal flyweight bearings failed. All eight (8) balls and race were missing. On our side, no other metal part has been found so far into the oil filter, on the aft Accessory Gear Box (AGB) pump inlet screen or around the forward AGB magnetic chip opening.

Transport Canada Comments:

Woodward, the propeller governor manufacturer, issued Service Bulletin (SB) 83053-61-027 in 2012. The SB provides instructions for replacing bearings that were assembled with lightly crimped bearing retainers. Engineering analysis, conducted cooperatively by the engine, governor and bearing manufacturers, concluded that the failure was likely caused by a vigorous oscillatory motion of the two-piece, loosely crimped, bearing retainer resulting in fretting wear of the retainer assembly.

Further to their investigation into this Service Difficulty Report (SDR), Pratt & Whitney Canada continues to promote compliance with Woodward SB 83053-61-027. Transport Canada Civil Aviation (TCCA) concurs with this position and would like to highlight the value in assessing and following manufacturers' recommendations, including those at the component or vendor level.

Left: Teledyne Continental.
Right: Teledyne, Worn magneto Shaft.

REPORT: TELEDYNE CONTINENTAL 10-550-F

Seized magneto

Subject:

At approximately 1500 feet indicated, 750 feet Above Ground Level (AGL) the pilot felt a sudden power reduction. The aircraft was put into a decent and a turn was made back towards the area on the lake the aircraft had departed from. The pilot conducted a brief cause check but could not determine the cause of the loss. The aircraft made a safe landing back on the water. A visual inspection of the aircraft on the dock revealed that the left magneto had separated from the engine. The magneto`s case and the engine adapter both showed damage consistent with a sudden seizure of the magneto. No other damage to the engine/aircraft was noted. Both magnetos were replaced with overhauled units and a replacement engine adapter was installed. Aircraft was grounded and flight checked serviceable.

Transport Canada Comments:

Transport Canada Civil Aviation (TCCA) has received several similar Service Difficulty Reports (SDRs) which indicate broken magneto mount flanges and/or adapters as well as impulse coupling fractures.

TCCA recommends that maintainers and owners pay particular attention to the flanges and adapters while inspecting the ignition system. SLICK Service Bulletins (SB) SB1-19A and SB2-19A address reports of impulse coupling broken rivets and stop-pins liberating and potentially entering the gear train, which could contribute to seizure of a magneto. The failed magneto in this event appears to still have the pin in place but it is difficult to determine if the rivets were a factor due to the damage. ■

PACIFIC

Pacific AME Association

Membership Dues: A special note to all

You will notice that there is a different look, feel and procedure to the Membership Renewal and Join process. Your Association (PAMEA) believes strongly in the National Association AMEC/TEAC and our relationship with the national organization going forward primarily in that Transport Canada will only communicate with AMEC/TEAC regarding Aircraft Maintenance Engineers (AME) issues.

PAMEA has decided to formally transfer Membership Administration to AMEC/TEAC which is currently handled by the Ontario Association. What this means for the Membership is that our web site page will send you to the Ontario Association Membership pages for you to Sign Up if you are a new Member or to complete your renewal as a PAMEA Member.

What this means for the future is more time to concentrate on Conferences; more time to communicate to members through a Monthly Newsletter; more time to deal with your issues.

It is hoped and planned that the AMEC/TEAC web site will have a completely new look and feel to it so that membership control will be under our own Chapter web site. This is a "work in progress."

Thank you for you understanding in this transition time. We are all working towards a stronger and better Association representing your issues Nationally.

Robert Horne – Ontario and AMEA/TEAC Membership Team
Peter Chick – PAMEA
www.amec-teac.ca/pacific

WESTERN

Western AME Association

About us

The Western AME Association is a non-profit organization consisting of AMEs, apprentices, students and corporate members.
Email, info@wamea.com or president@wamea.com

Phone: 587-713-WAME (9263)
www.wamea.com

CENTRAL

Central AME Association

Manitoba's Annual Aviation Symposium

The 27th Annual Aviation Symposium will be held February 29 and March 1, 2024. The event venue will be Canad Inns Destination Centre Polo Park in Winnipeg. Early bird discounts are in effect until December 31, 2023. By registering early you will save 10 percent off of the Symposium cost.

Symposium Schedule:

Thursday
0745 to 0900 Registration & Continental Breakfast in Trade show area
0900 to 1530 Speakers & Presentations / Trade Show Open
1530 to 1630 Skills competition
1630 to 1815 Banquet Reception/Cocktails On-site in the TYC Event Centre
1815 to 2100 Banquet in TYC

Friday
0745 to 0900 Registration & Continental Breakfast in Trade show area
0900 to 1630 Speakers & Presentations / Trade Show Open until 1400 (Booth tear down @ 1400)

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 support the national body AMEC-TEAC (Aircraft Maintenance Engineers of Canada).

Our organization works with Transport Canada in the formulation of new rules and regulations and provides a collective viewpoint for all AME's.

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

AME Association of Ontario

#613 - 7360 Bramalea Road, Mississauga, Ontario L5S 1W9
tel: 1-905-673-5681 email: association@ame-ont.com website: www.ame-ont.com

Driving industry worker retention through professional development

AME Association of Ontario: Addressing the Labour Shortage

https://www.ame-ont.com/cpages/sdf-project

By now we are all well aware of the labour shortage in the aviation industry (particularly in regard to Aircraft Maintenance). In August 2019, a Canadian aviation magazine posted an article about the global aviation industry shortage, and that all the focus up to that point was on the pilot shortage with little regard to the lack of attention on "Who will keep our future fleet in the air?"

Four years later, after a global pandemic where aircraft around the world were grounded, air travel is back on the rise – **just in time for half of Canada's existing AMEs to be near retirement age.**

In that same magazine article, it was reported that *"Canadian colleges graduate about 600 maintenance technicians per year, according to the CCAA, yet only about 77 per cent go on to work in the industry. More than 25 percent of companies surveyed for the 2018 report said they were having difficulty filling aircraft maintenance positions, especially those related to specialty areas such as structures and avionics."*

Now, the pressure is on to get new graduates/pre-licensed AMEs working and willing to stay in the industry. **So, what are we doing about it?**

As you may have already heard, in 2022 the AME Association of Ontario applied for and was **granted funding from the Ontario Ministry of Labour**, Immigration, Training, and Skills Development – Skills Development Fund (SDF) with the overall goal and mandate to help the Ontario Aviation Industry to recover from the pandemic and labour shortage. One of the ways the SDF Project is tackling this monumentally broad task is by addressing **retention through professional development.**

In the April/May 2023 issue of Air Maintenance Update magazine, part of a report by Oliver Wyman was reprinted, titled: "Not Enough Aviation Mechanics". An excellent point was made that **retention is helped by professional development.**

"Technicians also need to see clear pathways for professional development. This means companies need to provide access to and maybe even subsidize technical training programs that give workers new skill sets and licenses to work on different aircraft types and technical specialties, such as avionics or composite materials... (and) ...some mechanics may be interested in pursuing leadership roles, management and business courses, or coaching (AMU, April/May 2023, page 12).

Through the SDF Project - Professional Development Program, the AME Association of Ontario is focusing on connecting AMEs and AMTs with free professional development training opportunities that target key skills to help workers and job seekers thrive in any workplace and gain more confidence in their current positions.

One of our upskilling training opportunities (through WorkRight) focuses on the development of Soft Skills (communication, anti-discrimination, managing stress, receiving feedback). These skills are key for navigating any workplace environment and are highly valued. Another program (from WorkRight) focuses on Workplace Mental Health & Psychological Safety. This Masters Certificate was developed by mental health professionals.

Another package we are offering is a customized Industry Readiness course designed to bridge post-pandemic theory knowledge gaps for new workers. We also offer a Mentorship Marching program for new AMEs/AMTs. Upon successful completion, participants of all our training opportunities obtain a certificate to make them more attractive hires to other maintenance facilities.

Find out more about the SDF Project at:

https://www.ame-ont.com/cpages/pd-program.

By Julia Odebunmi

Project Manager - AME Assoc. of Ontario's SDF Professional Development Program. **www.ame-ont.com**

ONTARIO

Quebec AME Association

Association des Techniciens/Techniciennes d'Entretien d'Aéronefs du Québec

C.P. 34510, 3131 Côte-Vertu; CSP Place Vertu, Saint-Laurent, Qc, H4R 2P4
email: info@ame-tea.com website: www.ame-tea.com

Nous sommes l'Association des Techniciens et Techniciennes d'Entretien d'Aéronefs du Québec et nous sommes fiers de pouvoir servir et promouvoir la communauté des TEA du Québec. Membre de l'AMEC/TEAC, nous travaillons avec les différentes associations de TEA à travers le Canada sur différents dossiers, dont certains directement avec Transports Canada.

L'Association des TEA du Québec promeut la sécurité des personnes affectées par les métiers de la maintenance aéronautique, favorise des pratiques sûres sur le lieu de travail et reconnaît que la sécurité est la pierre angulaire de l'industrie aéronautique.

Nous avons récemment été actifs à différents niveaux et avons eu le plaisir de participer à la journée Carrière de l'École nationale d'aérotechnique de St-Hubert le 29 mars et avons eu la chance d'y rencontrer nombre de futurs TEA. Plus de 43 compagnies qui emploient des TEA au Québec y étaient présentes. Notre présence permet aux étudiants d'en apprendre plus sur les aléas du métier et de ce qui les attend lors de leur premier emploi. Aussi, plusieurs nouveaux étudiants profitent de cette journée pour faire le plein d'informations. L'Association des TEA du Québec continue la progression de différents dossiers tels que diverses questions de nos membres relatives à la réglementation et la recherche de nouveaux avantages pour eux avec différents partenaires. Vous pouvez en apprendre plus à notre sujet à l'adresse suivante :

www.ame-tea.com email: info@ame-tea.com

QUÉBEC

ATLANTIC

Atlantic AME Association

ARAMC 2024

The 44th Annual Atlantic Region Aircraft Maintenance Conference (ARAMC) is set for April 17 – 19, 2024 at the Delta Hotels by Marriot Beauséjour in beautiful Moncton, New Brunswick. Our committee is working on the final draft of our registration packages which will be emailed soon. For a limited time, the hotel will be offering a limited number of rooms to conference attendees at a special event rate of $179 per night.

For anyone who has travelled recently, this is an exceptionally generous rate. Hotel room rates are quoted in Canadian dollars and are subject to applicable local and provincial taxes (currently 3.5 percent Municipal Accommodation Tax and 15 percent HST) in effect at the time of check-out. Taxes are subject to change without notice.

Hotel: Discount room rate closes March 17, 2024…so hurry and book your room.

To help our association keep this conference affordable, it is important that, we take advantage of this great Hotel rate. Hotel facilities (display, banquet, breakout rooms…) are made affordable based on room sales. So please book early.

Reservations can also be made directly with Marriot Reservations at (506) 854-4344 pressing #1 by March 17, 2024.

Important: When making your reservation at the Delta, ask for the Aircraft Maintenance Conference Group rate.

Check your emails and keep an eye out on Facebook and our Atlantic AME Association website.

More information will be available soon. Thank you!

Jacques Richard
ARAMC 2024 Chair
www.atlanticame.com

SOCAL

SoCal PAMA Chapter

Flight Safety Detectives podcast:
Episode 190: Major League pitcher Halladay's flight stunts lead to death

A former major league pitcher who had a Hall of Fame career died when doing stunt-type maneuvers in his plane. Todd Curtis and John Goglia discuss Roy "Doc" Halladay's risk-taking behaviour that led to the November 2017 crash of the Icon A5 light sport aircraft he was piloting.

The plane crash occurred when Halladay was executing aggressive maneuvers at low altitudes over the waters near Clearwater, Florida. The NTSB investigation showed that Halladay had drugs in his system that would have likely impaired his decision-making ability.

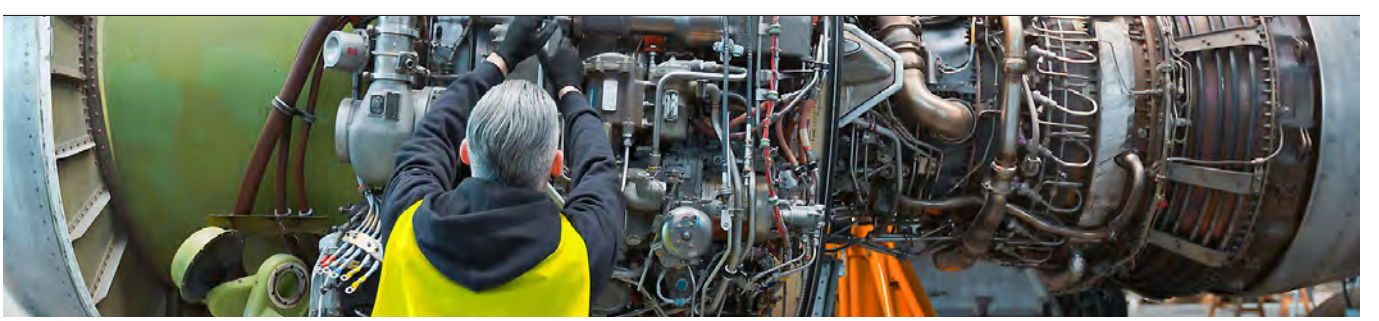
John sums up Halladay's actions as "absolutely crazy." Todd notes that the bad decision making started long before he got into the cockpit that day.

Pilots, mechanics, and others in the aviation community have a responsibility to act when others are making decisions or taking actions that put themselves and others at risk in the air. These actions may save lives and avoid aviation disasters.

Who We Are

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

www.socalpama.org

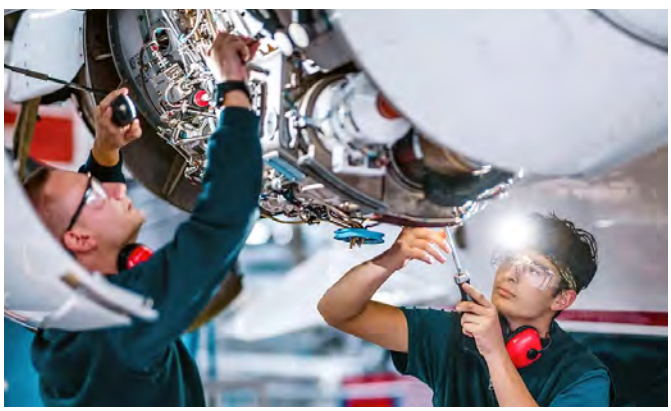


Central Ohio PAMA

Flight Safety Detectives podcast:
Episode 185: Medical helicopter crashes show Aviation Safety Risks

The sheer number of helicopter accidents in the last six months is raising safety alarms. Todd Curtis and John Goglia focus on the conditions that helicopter pilots, and specifically medical helicopter operations, experience.

John and Todd examine the relatively frequent accidents around the U.S. involving medical helicopters. The show starts with a deep analysis of events around the August 28 crash of a medical helicopter in Pompano Beach, Florida. A video of the crash was shared online shortly after the crash.



They compare the ongoing investigation of the Pompano Beach crash with another medical helicopter crash from 2017. Maintenance issues, flight conditions, and operating in areas with obstacles all play a role. In the case of ambulance operations, a sense or urgency also comes into play.

NTSB investigations and resulting reports often leave questions unanswered. Todd and John make the case that more thorough reports can help improve safety of helicopter operations.

Be a content contributor

Our members work at many airports in the Central Ohio area and may be interested in some event happening at your airport. This information might include visiting vintage aircraft or dignitaries, fly-ins, airshows, etc. If you know of some upcoming event or special interest item at your airport, pass us an email including some base information and we'll post it here for other members to view.

www.copama.org

Transportation Safety Board of Canada | Bureau de la sécurité des transports du Canada

Cold Chill on a Warm Day

The flight of this Cessna 172P illustrates how carbs can ice even in mild conditions.

Above: Event Aircraft near Hope, BC. - Brian Burger photo

Opposite page: Figure 1. Accident site, approximately 1880 feet east-southeast of the end of Runway 11.

ON **24 July 2022,** the privately registered Cessna 172P aircraft C-GGSN was conducting a recreational visual flight rules flight from Victoria International Airport (CYYJ), British Columbia, to Qualicum Beach Airport (CAT4), BC. Before the flight, 18 U.S. gallons of 100LL aviation grade fuel were added to the aircraft at CYYJ, after which a total of 30 U.S. gallons of fuel was onboard.

At approximately 1857, after the pilot had conducted the walkaround inspection and run-up checks, the aircraft departed CYYJ with only the pilot on board. The aircraft flew at a cruising altitude between 2300 and 2500 feet above ground level (AGL) for approximately 27 minutes. During the approach to CAT4 from the southeast, the pilot conducted a reduced power descent, first to 2000 feet AGL, then to 1300 feet AGL.

Shortly after the aircraft had levelled off at 1300 feet AGL, the pilot increased throttle and the engine began to sputter and its speed decreased from approximately 2300 rpm to 1200 rpm. The pilot further increased throttle, but the engine did not respond. The engine fuel mixture was set to full rich for the duration of the flight and carburetor heat was not applied at any time.

The pilot had been manoeuvring to join the downwind leg for Runway 29, but opted to conduct an emergency landing on Runway 11 and announced his intention on the airport's mandatory frequency. The pilot initiated a left turn, reduced throttle, added full flaps, and entered a forward slip in a steep descent. At 1938:28, the aircraft briefly contacted the surface of Runway 11 beyond Taxiway C (at which point less than 1850 feet of runway remained) and became airborne again.

The pilot initiated a go-around and increased the throttle to full power, raised the flaps, and the aircraft entered a climb.

Figure 1.

Approximately 19 seconds after the initial touchdown, the pilot initiated a steep right turn immediately before reaching tree-covered, down-sloping terrain, and the aircraft began a rapid descent in a right bank and nose-down attitude. The pilot declared a MAYDAY on the airport's mandatory frequency and the aircraft impacted terrain in the trees along the edge of a farmer's field (See Figure 1).

The 406 MHz emergency locator transmitter activated and local emergency services arrived on scene shortly after. The pilot received serious injuries and was transported to hospital by air ambulance. The aircraft was substantially damaged.

PILOT INFORMATION

The pilot held a commercial pilot licence – aeroplane, issued on 13 March 2022, and had a valid Category 1 medical certificate. The pilot had accumulated 289.7 total flying hours, 116.2 hours of which were as pilot-in-command. He had flown 11.8 hours in the 90 days before the occurrence flight, which was his first flight since 27 June 2022. The pilot had last flown a Cessna 172 aircraft on 24 April 2022.

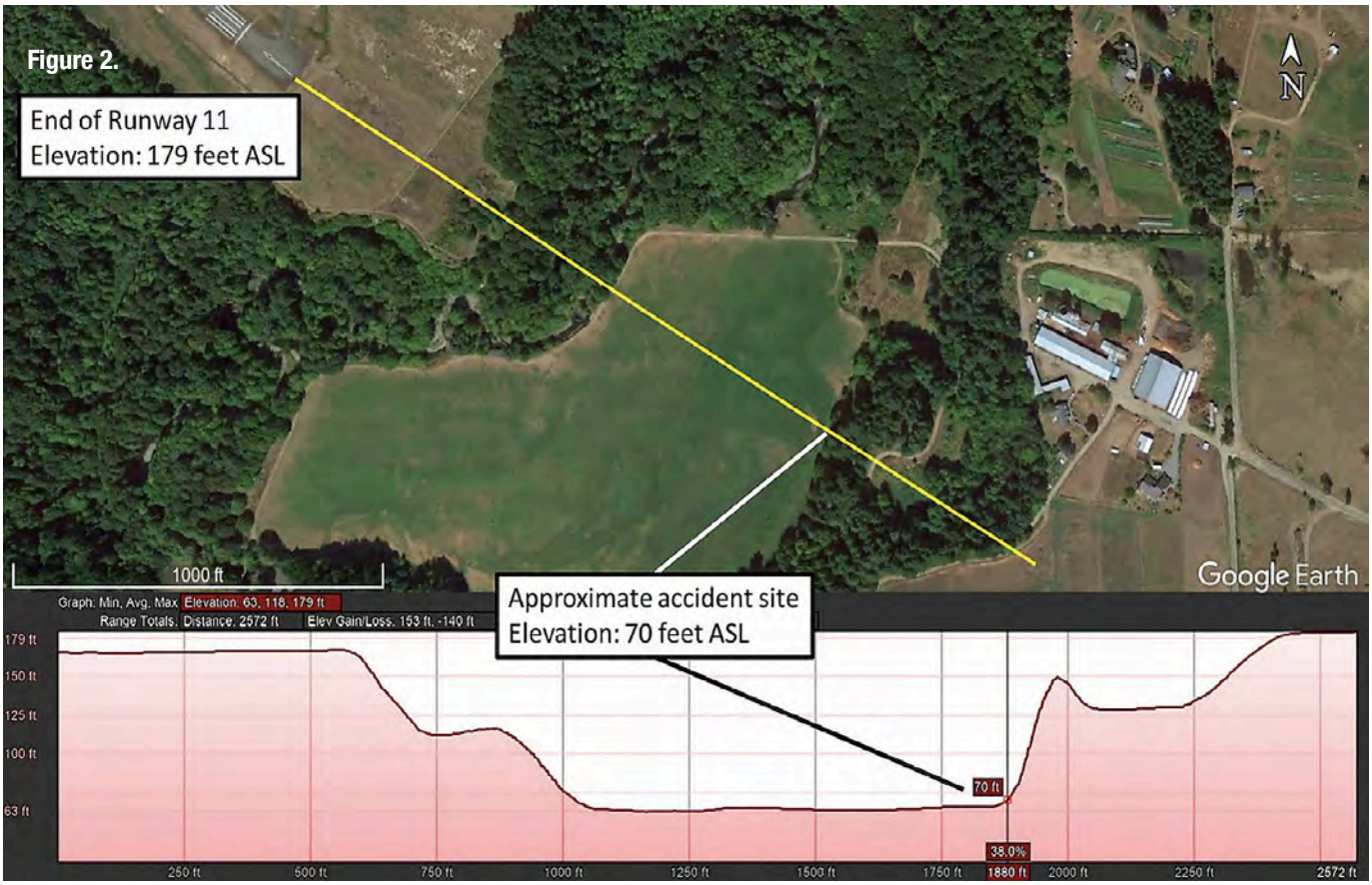
AIRCRAFT INFORMATION

The Cessna 172P aircraft is a single-engine, high-wing, all-metal monoplane equipped with a carbureted Avco Lycoming O-320-D2J engine, a McCauley all-metal, 2-bladed, fixed-pitch propeller, and fixed tricycle landing gear. The occurrence aircraft had accumulated approximately 21 463.2 total air time hours and was being rented by the pilot.

The investigation revealed that a pilot had reported a rough-running engine on the right magneto 52.9 air time hours before the occurrence. However, an aircraft maintenance engineer was unable to duplicate the fault during an engine run-up on the ground, and the aircraft was returned to service. The aircraft had undergone an annual inspection, including the removal and repair of the No. 2 and No. 3 cylinders, 8.3 hours before the occurrence. The aircraft was being operated within its weight and balance limitations.

METEOROLOGICAL INFORMATION

Environment and Climate Change Canada's weather station at



CAT4 records hourly weather information. The information recorded at 2000 indicated the following:

Winds from 300° true (T) at 7 knots
Temperature 23.5 °C, dew point 12.4 °C
Relative humidity 50%

An aerodrome routine meteorological report (METAR) for Nanaimo Airport (CYCD), BC, located 26 nautical miles east-southeast of the accident site, indicated the following weather at 2000:

Winds from 330°T, variable to 030°T, at 3 knots
Visibility 30 statute miles
Broken ceiling at 25 000 feet AGL
Temperature 27 °C, dew point 11 °C
Density altitude 1400 feet

AERODROME INFORMATION

CAT4 has 1 runway surface (Runway 11/29), which is 3564 feet long and has thresholds that are displaced by 485 feet and 200 feet respectively. The abbreviated precision approach path indicator (APAPI) angle is set at 4.5° for both ends of the runway. The Canada Flight Supplement entry for CAT4 includes a caution note informing pilots that 100-foot-tall trees are located about 3000 feet beyond the threshold of Runway 29.

WRECKAGE AND IMPACT INFORMATION

The aircraft was found approximately 1880 feet from the end of Runway 11, at the edge of a privately owned famer's field that's about 100 feet below the runway elevation (Figure 2).

The aircraft initially contacted trees at approximately 22 feet AGL. It came to rest on the sloped bank on a west-southwest heading, at a 62° nose-down attitude in a water-filled ditch that was approximately 12 to 24 inches deep.

The forward fuselage was significantly deformed from the impact and 3 of the 4 engine mounts were severed. The remainder of the aircraft was largely intact; however, the right-wing strut had separated from the fuselage and the right landing gear had rotated 180°. Both wing flaps were found retracted. The propeller was embedded in the ditch with 1 blade significantly bent aft and no damage to the second blade. This type of damage is consistent with the engine producing low power or not operating on impact. Continuity of the flight and engine controls was confirmed.

First responders noted that fuel was initially leaking from the right wing; TSB investigators recovered approximately 4.5

Opposite page, left: Figure 2. Map showing the approximate accident site and elevation profile between the end of the runway and the field.
Above: Qualicum Beach Airport (CAT4), BC Flight Simulator image. Right: Pilots should follow the guidance in their aircraft's POH with respect to the application of carburetor heat.

U.S. gallons of fuel that remained in the aircraft and noted the fuel as being 100LL aviation grade fuel, which was clean and bright.

ENGINE EXAMINATION

The engine was removed from the aircraft for a detailed examination and teardown. Despite minor impact damage, the overall condition of the assembled engine was unremarkable and the crankshaft rotated normally. The magnetos were synchronized with each other, the engine timing was correct, and all spark plugs operated normally. The carburetor was disassembled with no faults found. The filters and the screens from the oil and fuel systems were found clean and unobstructed.

The examination found 2 anomalies of note:
1. The right magneto was firing intermittently below 1800 rpm.
2. The oil sump contained significant magnetic metal particles.

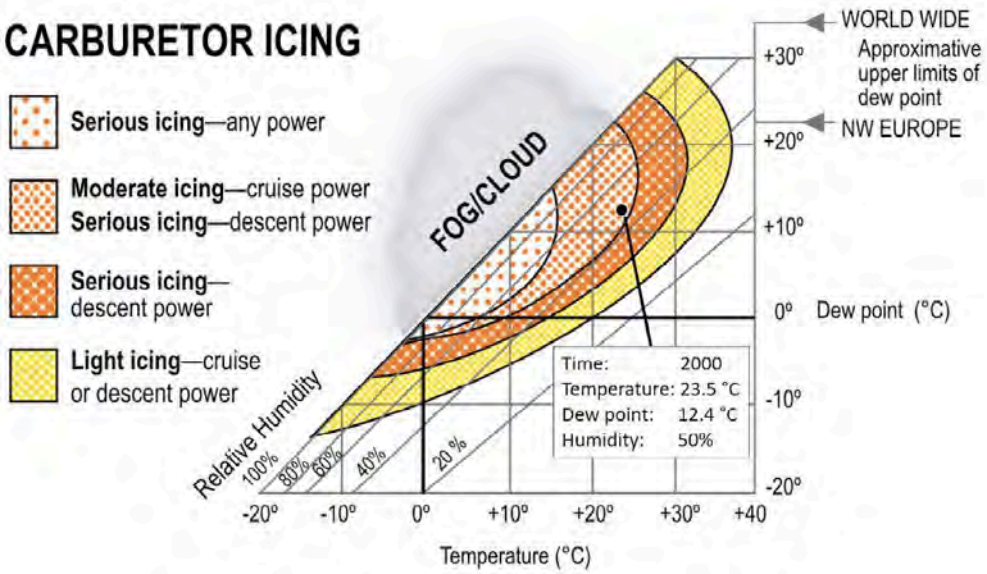
The right magneto was disassembled and signs of wear were evident on the carbon brush, distributor block electrodes, and contact points. It was also noted that the centre brass electrode was found loose on the centre steel shaft. The impulse coupling was operating normally. It is unlikely that the intermittent firing of the magneto would have significantly degraded engine operation.

The metal particles found in the oil sump could not be sourced to the failure or absence of an internal engine component. There were no signs that the particles caused secondary damage to the internal engine components or precluded the engine from operating.

SURVIVAL ASPECTS

In this occurrence, the aircraft remained upright and the fuselage maintained a survivable space for the pilot. Both of the occurrence aircraft's front seats were fitted with a safety belt consisting of a lap belt and a shoulder harness. First responders found the pilot's seat (left side) secured to the floor and the pilot secured with the lap belt only.

Upon further examination, the investigation determined that the shoulder harness was secured to the lap belt buckle,



Left: Figure 3. Chart providing weather conditions that can induce carburetor icing based on temperature, dew point, and humidity with the CAT4 weather conditions plotted.

Below: A newly constructed Cessna carburetor heat air box assembly from McFarlane Aviation.

but the stitching of the harness webbing had failed at the aft anchor bracket. As a result, the shoulder harness webbing pulled through the bracket during the impact sequence.

In accordance with the Canadian Aviation Regulations, safety belts are to be inspected every 12 months "for poor condition, fraying, and any other apparent defects." The occurrence aircraft's safety belts were inspected 10 days before the occurrence, during the aircraft's annual inspection. There is no service life limit for the safety belts installed on the occurrence aircraft.

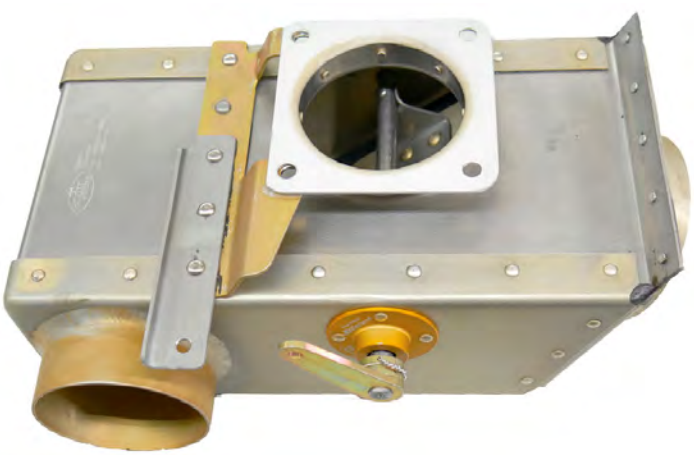
The Canadian Aviation Regulations also require that "each separate part of the safety belt assembly must be permanently and legibly marked." The occurrence aircraft's lap belts each had an attached label that included the rated strength of the belt; however, the shoulder harness did not have a label.

CARBURETOR ICING

The Cessna 172P Pilot Operating Handbook (POH) states that carburetor ice may result in "[a] gradual loss of RPM and eventual engine roughness." To prevent carburetor icing, the POH includes the application of carburetor heat on various checklists. In the Normal Procedures section of the POH, carburetor heat is included on both the Descent and the Before Landing checklists. In the Emergency Procedures section of the POH, it is included on the Engine Failure During Flight checklist. For the duration of the occurrence flight, the carburetor heat was in the OFF position.

The Transport Canada Aeronautical Information Manual provides guidance material and a reference chart for weather conditions that can induce carburetor icing (See Figure 3). The formation of carburetor ice can occur at all engine power settings and can vary with specific engine installations.

Based on the weather conditions recorded closest to the time of the occurrence at CAT4, carburetor icing was charted as moderate icing during cruise power and serious icing during descent power.



ENVIRONMENTAL IMPACT

The water-filled ditch where the aircraft came to rest was part of the neighbouring French Creek watershed. Following the release of oil and fuel from the aircraft, the area underwent an extensive environmental rehabilitation that included removal of contaminated water and soil.

SAFETY MESSAGE

Based on the conditions at the time of the occurrence, there was a potential for serious carburetor icing at descent power. Even though the investigation was unable to determine if carburetor icing was a factor in this occurrence, pilots are reminded that carburetor icing can occur even in warm temperatures. Pilots should follow the guidance in their aircraft's POH with respect to the application of carburetor heat. ■

(These were excerpts from the Transportation Safety Board of Canada's investigation into this occurrence. The Board authorized the release of this report on 08 February 2023. It was officially released on 16 February 2023.)

Troubleshooting at Light Speed

The controversial yet timely topic of artificial intelligence arose during the NBAA-BACE convention in October. Not surprisingly, there's a nearly universal buy-in among industry players, especially where maintenance is concerned.

Above: Among the key benefits of Smart Link Plus is that ground crews can remotely and independently "ping" the aircraft while in-flight.

AS AIRCRAFT PRODUCE MORE AND MORE DATA, what role can artificial intelligence (AI) and other technologies play in predictive aircraft maintenance to create efficiencies in aircraft operations?

The answer came during an education session at the 2023 NBAA Business Aviation Convention & Exhibition (NBAA-BACE), held in Las Vegas during the month of October and sponsored by the association's Business Aviation Insider magazine.

AI allows for continuous monitoring of several aircraft systems 24/7, providing data collection and analysis that is beyond human capability.

The FAA refers to these technologies generally as integrated aircraft health management (IAHM), said Thom Patterson, Business Aviation Insider managing editor and panel moderator.

"Everything is getting more and more connected," said Elza Brunelle-Yeung of Bombardier. "We wanted to integrate that to business aviation, so we created Smart Link Plus."

This system, developed with GE Aviation, collects data from an aircraft and transmits the data wirelessly to maintenance planners and technicians. Among the key benefits of Smart Link Plus is that ground crews can remotely and independently "ping" the aircraft while in-flight for additional information to get to the root cause of a fault notification. This request for information can be done without having to distract the flight crew. Full flight data is automatically transmitted and accessible once the aircraft has landed. Access to full flight data provides additional information required to troubleshoot more complex faults

These technologies that allow technicians to determine root causes of maintenance issues more effectively and efficiently even in flight resolve some ages-old maintenance scenarios.

"It can stop that repetitive cycle of 'Troubleshoot, fly, troubleshoot,'" said Kevin Ryan of Camp Systems. "The reality is there are a lot of other platforms today that are generating data. Creating data is one thing – getting the data off the aircraft is another challenge. Then the next big challenge is analyzing that data to make an aircraft more available and less expensive to operate."

"We realize everything is digital these days and this system (Smart Link Plus) unlocks a tremendous amount of a data that was previously unavailable," said Kevin Duffner of GE Aerospace. For example, it can determine if a part is nearing the end of its useful life. "Repair turn-around time and fix effectiveness are both improving with these technologies," Duffner added.

Chris Poliak, of Executive Jet Management, said increasing utilization of an aircraft and minimizing Aircraft On Ground events is an ongoing goal for aircraft operators. He said using real-time data can not only meet those goals, but potentially lead to inspection schedule efficiencies in the long-term. He told NBAA-BACE attendees that it will take time for the FAA to fully recognize the potential of predictive maintenance programs based on real-time data, adding that industry will play a significant role in educating the agency and developing a higher acceptance of these programs.

AI brings another level of potential efficiencies to these activities. "AI can help analyze big data and predict when a part will fail. No human can really analyze that volume of data and that's where AI comes in," said Bombardier's Brunelle-Yeung. AI can also assist diagnostics and prognostics.

Rolls-Royce is another example of a manufacturer that harnesses the power of AI to deliver more Intelligent diagnostics and engine inspections. The company's Innovation Hub came up with the Intelligent Borescope that can reduce the time it takes to inspect an aircraft engine by 75 percent and could save millions of dollars in inspection costs over five years.

Bell and Microsoft are continuing their exploration of intelligent systems in Project Bonsai.

"Our new Intelligent Borescope capability brings together cutting-edge technology and AI in a way that has never been used in the aviation industry before," says Adriano Pulisciano, Rolls-Royce Imaging and Computer Vision Specialist.

An average aircraft does 20,000 flights in its lifetime – that's the equivalent of 60 million miles or 2,400 times around the world. The engines on the aircraft work hard and so regular inspections are carried out to make sure everything is in good working order. There are around 20,000 components in any engine and one way of getting inside the engine to look at them is with a borescope. "A routine borescope inspection can take an aircraft out of service for 12 hours– that's 12 hours that the aircraft is on the ground and not in the air making money for our customers," adds Pulisciano. "The Intelligent Borescope is an industry first AI engine inspection which dramatically reduces the time taken to complete the measurement and sentencing part of certain inspections."

SO, HOW DOES IT WORK?

The tip of the Intelligent Borescope, which is about the size of a pen lid, is enabled with a scanner that can generate 3D colour images. It can view and scan whole objects as large as high pressure turbine blades. As it moves through the engine, the borescope captures images which are analyzed by the AI App installed on the Borescope handset and then sent to the Rolls-Royce Cloud.

The Intelligent Borescope, powered with a menu driven inspection process, is directly connected to a Rhinestahl CTS electronic turning tool that automatically rotates the engine stage and positions each blade correctly. After each blade is successfully positioned by the turning tool, it communicates with the borescope to capture the image automatically.

The next step is to process the data in the App, which is achieved using AI technology similar to that used for facial recognition. The App maps the blade in the same way a face is mapped looking for key image features that represent inconsistencies or irregularities. This is the first time facial recognition AI technology has been used in this way in aerospace inspections and it required the team to design and build the AI network from scratch with representative data collected from across the Rolls-Royce fleet of engines.

Once the AI process is complete the operator has to review and approve the predictions. During the review process they can easily fine tune the predictions if needed. In the days before developing this App, Rolls-Royce says processing this data for particular inspections took an operator 90 minutes – it now takes just 10.

But AI is a broad realm that provides alternative sources of information and solutions beyond engine maintenance and hard, crunchy service factors. For example, Airbus wondered if more precise tracking of in-flight catering – from meal and beverage service to the collection and disposal of waste – could lead to more sustainable air travel.

The Airbus digital solution to this challenge was the Food Scanner, an artificial intelligence-enabled device that analyses the composition of food in a simple point-and-shoot process. It uses the same principle as scanners that are increasingly available in supermarkets today. The Food Scanner's downward-looking camera identifies what is on the meal tray as

Airbus's Food Scanner is an AI-enabled device to analyze the composition of food in a point-and-shoot process.

the cabin attendant pulls it out from the trolley during the in-flight service, and subsequently captures pictures of what remains when the tray is returned. A horizontally-oriented barcode scanner tracks the beverage bottles and cans that typically are placed atop the trolly.

By integrating such information in an artificial intelligence-driven system, airlines could optimize their catering services and better manage the after-meal disposal – leading to a potential for double-digit reductions in their CO2 emissions through weight reductions and fuel savings.

Elements of this solution have undergone initial evaluations in realistic conditions aboard the Airspace Explorer – a dedicated cross-program flight test platform that Airbus utilizes to test and demonstrate new innovations for future aircraft cabins.

And of course, AI will play a prominent role in the development of defence assets. Toward that end, Boeing and Shield AI recently signed a memorandum of understanding to explore strategic collaboration in the areas of autonomous capabilities and artificial intelligence on current and future de-

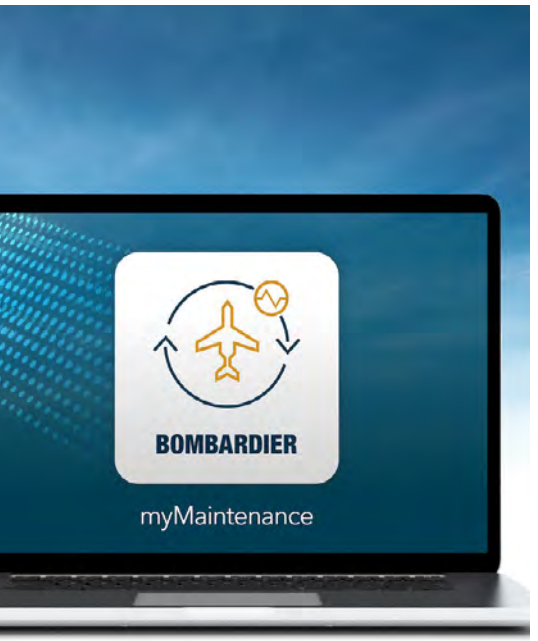
Bombardier launched its App for Smart Link Plus Connected Aircraft Program.

fence programs. The agreement, signed at the Air Force Association Warfare Symposium, will be managed by Boeing Phantom Works.

Shield AI created Hivemind, an artificial intelligence pilot that has flown a variety of aircraft. According to Shield AI, the AI pilot can also enable swarms of drones and aircraft to operate autonomously without GPS, communications or a human pilot in the cockpit.

"AI pilots are the most strategic deterrent technology since the introduction of stealth aircraft and have proven successful in flying air-combat scenarios" said Brandon Tseng, president and co-founder of Shield AI and a former Navy SEAL. "Integrating Boeing aircraft with our AI pilot would redefine what large aircraft, crewed or uncrewed, could do."

Beyond pure military concerns, AI will allow entry points into places where humans cannot always go. At the Consumer Electronics Show in 2020, Bell unveiled Bell AerOS, which enables companies to manage their fleet information, observe the health of their vehicles, manage throughput of goods and products, and aggregate predictive data



and maintenance information, built on the Microsoft Azure cloud platform. Bell and Microsoft are continuing their exploration of intelligent systems in Project Bonsai, a Microsoft autonomous systems initiative that will enable Bell's vehicle to identify safe landing zones and then land autonomously, all while gaining a better understanding of the technologies and infrastructure that will be required.

"We're using Project Bonsai because it allows us to quickly create and teach an AI just like if we were training a pilot on what to look for," says Matt Holvey, senior manager of Intelligent Systems at Bell. "You can get the AI to understand what decisions to make about altitude and pitch based on the identified landing zone it sees."

Unmanned aircraft cannot practice identifying landing zones and landing in the real world for three key reasons: safety concerns, potential damage to the aircraft and the amount of time it would take to train in enough real-world scenarios. That's why AI practices in AirSim, a simulated environment, where it can execute thousands of landing identification scenarios in minutes. These exercises offer the experience needed for Bell aircraft to conduct safe operations and locate easy landing points to deliver goods and cargo to customers.

The Intelligent Borescope provides consistent and fast data collection.

Shield AI created Hivemind.

"With AI, aviation maintenance teams can predict and prevent maintenance issues before they become unmanageable or result in downtime," says the firm QOCO, which develops digital software for Airlines, MROs and OEMs.

"AI allows for continuous monitoring of several aircraft systems 24/7, providing data collection and analysis that is beyond human capability. The highly complex algorithms used by AI, coupled with the extensive database that is used to generate predictions and reports, provides detailed information that the aviation industry can utilize to improve safety, efficiency, and overall operations.

"The aviation industry is continuously shifting towards implementing AI technology in maintenance and safety procedures. It is for the benefit of everyone involved, whether it be the airline, aviation team, or passengers; it is important to make aviation maintenance safer, efficient, and cost-effective. Given the potential for AI in aviation maintenance, it is apparent that technology is the future of aviation maintenance. The integration of AI in aviation maintenance is undeniably the right step toward a safer, modern, and efficient aviation sector."

"(But) Fully leveraging these technologies is going to take "tight cooperation" within the maintenance community," cautions Camp Systems Kevin Ryan.

FAA IAHM ADVISORY CIRCULAR 43-218

This circular entitled Operational Authorization of Integrated Aircraft Health Management describes the FAA's process for authorizing the use of IAHM to develop a predictive maintenance program. The agency's three-paragraph introductory description is worded this way:

"Aircraft health monitoring for maintenance uses onboard sensors, data transmission, and data analysis to provide information regarding aircraft system performance and structural condition. The result is then used to make aircraft airworthiness determinations that provide economic efficiencies while maintaining or enhancing operational safety. This end-to-end process is known as Integrated Aircraft Health Management (IAHM).

"This AC provides guidance for developing an operator's IAHM program. This AC describes an acceptable means, but not the only means, to comply with the applicable sections of Title 14 of the Code of Federal Regulations (14 CFR). However, if you use the means described in this AC to show compliance, you should follow it in all important respects.

"This guidance is not legally binding in its own right and will not be relied upon by the Federal Aviation Administration (FAA) as a separate basis for affirmative enforcement action or other administrative penalty. Conformity with the guidance is voluntary only and nonconformity will not affect rights and obligations under existing statutes and regulations." ■

(With files from Airbus, Bell, Boeing, Bombardier, GE Aviation, Rolls-Royce, QOCO, and NBAA)

Aviation Services

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Polar Mission

British Antarctic Survey unveils pilotless plane for testing in Antarctica

POLAR SCIENCE could reach new heights as British Antarctic Survey (BAS) researchers prepare to test the new Windracers ULTRA autonomous drone in Antarctica this season. The state-of-the-art autonomous drone capable of carrying a wide range of science sensors is heading south for its inaugural flight on the icy continent this Antarctic field season from January to March 2024. This forms part of BAS's plans to automate its science platforms. UK-based Windracers is a firm that was conceived to provide essential logistical support where transportation links are poor.

Designed for extreme environments like Antarctica, the Windracers ULTRA UAV (uncrewed aerial vehicle) is a twin-engine, 10-metre fixed-winged aircraft, capable of carrying 100 kilos of cargo or sensors up to 1,000 kilometres. It can take off, fly and land safely with minimal ground operator oversight thanks to its Masterless autopilot system, developed by Distributed Avionics.

Incorporating a high level of redundancy, the ULTRA can continue to fly even if one of the engines or components is damaged or fails. The flexible platform can also be configured as required to carry a range of sensors for collecting scientific data. Using AI-driven SWARM technology multiple autonomous drones can organize themselves as a single unified system to collect science data across a larger area.

The ground-breaking project is being funded by Innovate UK's Future Flight 3 Challenge and is part of its pilot program called 'Protecting environments with uncrewed aerial vehicle swarms', aimed at demonstrating how advanced drone technology can be used to gather environmental data in Antarctica.

Under this season's testing phase, the Windracers ULTRA will be deployed to survey protected environmentally sensitive areas and assess the marine food chain (krill) using cameras; investigate tectonic structures with magnetic and gravity sensors; assess glaciological structures using airborne radar; and test an atmospheric turbulence probe for studies of boundary layer processes coupling ocean and atmosphere.

"The Windracers ULTRA is an ideal platform for integrating science sensors on to, because it has a large floor area, volume and 200W of power available for science instruments, which means a wide range of science sensor payloads can be flown," says Carl Robinson who manages BAS's use of UAVs. "The ULTRA's range and speed, and systems redundancy are well suited to the Polar environment and make for an attractive science platform. The removable floor can be quickly replaced with floors dedicated for various science sensors, allowing for a quick change between science applications. Using the easily configurable mission plans, our scientists can quickly plan flights to collect science data in areas of interest, allowing flexibility to collect their science data." ■

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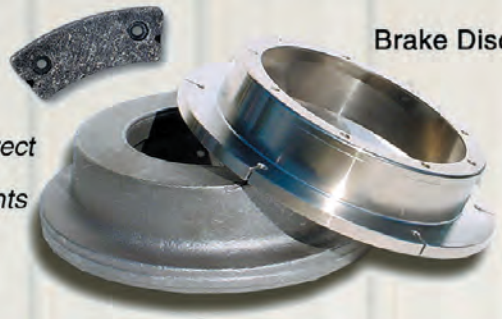

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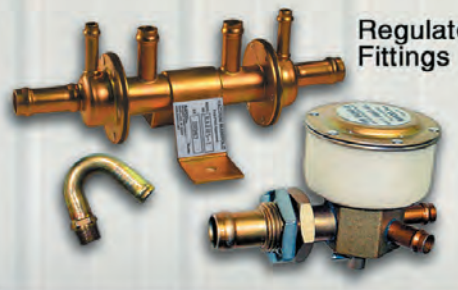

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