Clare Leavens Award • Joe Chase Award • Aviall High Achievement Award

AirMaintenance UPDATE

The Magazine for Aircraft Maintenance Professionals

Transport Canada Approved for R/T

2022 Recurrent Training Exam

From Power to Pilotless:

Imagining the Future of Aircraft Design

Wings Through Time

Transport Canada 'Feedback'

Raising The Bar: Rag Time

Fickle Fate of a Piper Cherokee

Publication Mail Agreement No. 0041039024
and Return Undeliverable Canadian Addresses to
Alpha Publishing Group (2004) Inc.
Unit 7, 11771 Horseshoe Way, Richmond, BC, V7A 4V4
email: amumagazine@outlook.com

June - July 2022
Volume 21/Issue 1

$7.95

Canadian Aero Accessories Ltd.

Component Sales **Overhaul & Repair**

Trusted
Experience
Since 1964

CALL US FOR THIS & MORE !

- Fire Bottles • Oxygen Bottles • Escape Slides • Life Rafts
- Starter Generators • AC Generators • Generator Control Units
- Boost Pumps • Fuel Pumps • Blowers • Valves • Brakes
- Hydraulics 5606 and Skydrol • Electronics/GCUs
- Actuators - Hydraulic and Electrical

Authorized repair Station For

GOODRICH

Ice protection systems

170 George Craig Blvd. N.E., Calgary, AB, Canada T2E 7H2
ph: 403.250.9077 • fax: 403.250.6841
sales@cdnaero.com

www.canadianaero.com

The Forecast is for Strong Filter Sales

FILTERS. Not a sexy topic by any standard, but at least one industry watcher is excited as they anticipate "outstanding growth" in the aerospace filter market by 2030. According to the market research firm Fact.MR—which is headquartered in Dubai, UAE with offices in the US and India—the global aerospace filter market was valued at US$ 6.6 billion in 2020, but will surpass US$ 13 billion by the end of the forecast period (2020-2030).

The company cites various factors contributing to its prognosis including a Post COVID-19 rise in passenger air traffic and growing airline fleets that are foreseen to open new growth avenues in the aerospace filter market. Another factor is that regulations associated with environment safety and emission standards have become more severe—both the International Civil Aviation Organization and the Environmental Protection Agency are formulating regulations with an aim to lower carbon emissions from commercial planes. This is expected to boost the demand for aerospace filters during the forecast period.

Fact.MR says oil and lube filters should account for nearly one-quarter of the total market share, and are projected to be valued at US$ 3 billion by the end of forecast period. Aftermarket sales of aerospace filters are expected to grow more than double OEM sales by the end of 2030, while narrow body aircraft are projected to see a compound annual growth rate of 6.3 percent.

The takeaway here presumably: with every crisis there is also opportunity. ■

— John Campbell, Editor

Departments

Features

AMU is viewable online: subscribe and download at www.amumagazine.com

AirMaintenance Update
Unit 7, 11771 Horseshoe Way
Richmond BC V7A 4V4 Canada
phone: (604) 214-9824
fax: (604) 214-9825

email: chrissie@amumagazine.com
website: www.amumagazine.com

editor: John Campbell
art director: Cliff Vickstrom
publisher: Bill Carter
sales manager: Bill Carter
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 7, 11771 Horseshoe Way
Richmond BC V7A 4V4 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

Cargo Conversion

An agreement between Israel Aerospace Industries and Cargojet Canada is valued at tens of millions of dollars

Israel Aerospace Industries has signed an agreement to carry out passenger-to-freighter conversions for Cargojet Canada's Cargo Airline. The agreement was signed in early May as a result of the growing global demand for cargo aircraft, and includes the conversion of four B777-300ER aircraft and additional options in the future.

IAI has recently signed a number of new agreements for cargo conversions, including converting B777-300ER aircraft for Emirates and establishing new conversion lines worldwide. "We have been experiencing a rise in demand for converted cargo aircraft," said IAI President and CEO Boaz Levy. "The rise in e-commerce, coupled with the COVID-19 pandemic, has resulted in cargo aircraft becoming a central player in the world of aviation."

Cargojet is a provider of air cargo services to all major cities across North America, providing dedicated ACMI and International Charter services and carries over 25,000,000 pounds of cargo weekly. The company operates its network with a fleet of 31 aircraft and is a long-term IAI customer for aircraft conversions. Currently, IAI is converting the first B777-300ER aircraft for AerCap Cargo, who are also the co-investor on the program, in a process which is expected to finish in 2022. This is the first conversion of this model in the world. ✪

COMING EVENTS

WW2 Weekend: Gathering of Warbirds
June 3-5, 2022
Reading, Pennsylvania
www.maam.org

Spirit of St Louis Show & STEM Expo
June 11-12, 2022
St. Louis, Missouri
www.spirit-airshow.com

Northern Thunder Air & Space Expo
June 18, 2022
Grand Forks, North Dakota
www.grandforks.af.mil

Olympic Air Show
June 18-19, 2022
Tumwater, Washington
www.olympicairshow.com

CFB Borden Armed Forces Day & Air Show
June 18-19, 2022
Borden, Ontario
www.bordenairshow.ca

Aviation World Congress
June 23-24, 2022
London, England
www.aviationconference.com

COPA National Fly-In and Aviation Exhibition
June 23-25, 2022
Saint-Jean-sur-Richelieu, Quebec
www.copanational.org

Advertisers Index

the Amazon staircimber

the AUTOMATED lifting solution

- safe, dignified passenger transfer
- self-propelled: no lifting required
- versatile: used on commercial and corporate aircraft
- simple and easy to operate: training provided
- lifts 350 lbs. / 160 kg with the push of a button
- portable: use at base or take it with you

- compact and lightweight
- transports passeners quickly
- ensures fast and efficient turn times
- reduces risk of injury to staff and passengers
- unique, specialized design
- patented braking system

Tel: (604) 247-2128
Fax: (604) 214-9825

BKD Aerospace Industries Inc.

Call us for a quote or visit our website for more details.
Watch our online videos at www.bkdaerospace.com

info@bkdaerospace.com
Unit 7 — 11771 Horseshoe Way
Richmond BC V7A 4V4 Canada

STCs & new products

Mask protects against harmful fumes

AMERON has received FAA-PMA approval for its oxygen mask. It is an integral component of the OEM MF20 series full face quick donning mask regulator assembly, which is an emergency breathing device made for airliner crews that fly no higher than 40,000 feet. When in use, the mask assembly gives protection to the flight crew against effects of depressurization, harmful gases, and fumes. AMERON recommends the mask be inspected by the customer regularly for any damage that may affect the pilot's ability to see clearly. **www.amerongloba.com**

Coupler provides signal isolation

CCX Technologies has introduced its new GPS Antenna Coupler, which is used with the T-RX Avionics Tester to validate the functionality of aircraft GPS radios. It provides more than 20 dB of antenna isolation to ensure there is no interference from outside GPS signals during testing. The new GPS Antenna Coupler provides signal isolation so that testing of radios can occur inside or outside the hangar without worrying about interference from satellites or interfering with the GPS radios of other nearby aircraft. **www.ccxtechnologies.com**

Device will measure six particle channels

Triplett Test Equipment's new EPC600 Environmental Particle Counter is a compact tool for indoor air quality testing. The EPC600 can simultaneously measure six channels of particle sizes down to 0.3 microns of methane, propane, butane, ammonia, carbon monoxide, and many other substances. It can also measure air temperature, humidity, dew point, and wet bulb. It features a 2.8-inch colour thin-film-transistor display. With its built-in camera, the EPC600 captures JPEG images and video and can store up to 5,000 records with date/time, counts, temperature, humidity, sample volume, alarms, and location label. **www.triplett.com**

Cartridge replaces OEM unit

AMETEK AMERON has received FAA-PMA approval for its fire extinguisher cartridge, part number M30903962. The cartridge is used on the Embraer 170 series fire extinguisher bottles and is a direct replacement alternative for the OEM cartridge. The main function of the cartridge is to fracture the rupture disc and start the release of fire extinguishing agent. During a fire, an electrical signal is sent to the aircraft flight deck indicating an overheat or fire condition. The pilot then actuates a control switch, which sends a current to the cartridge. **www.amerongloba.com**

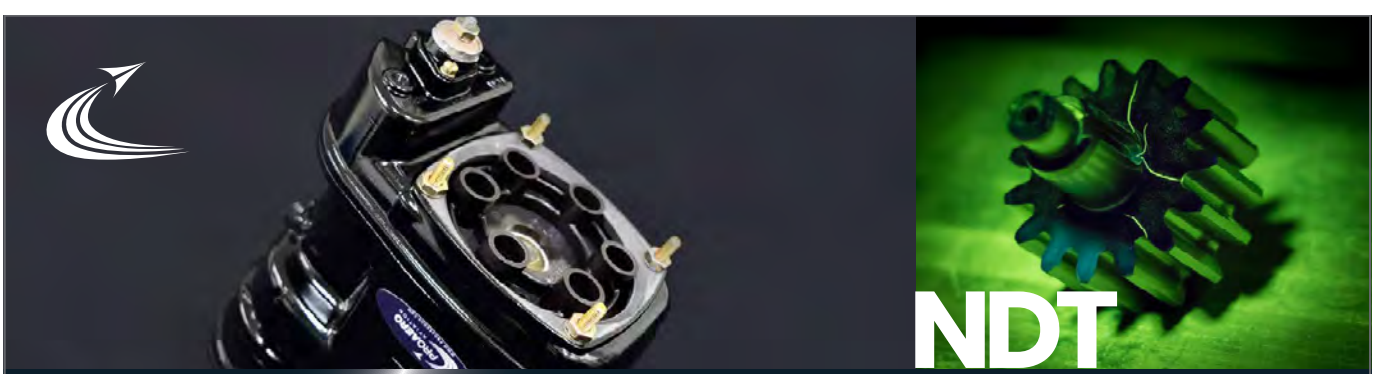
Kit reduces decibel levels

Skandia has received FAA and EASA STC approvals for its acoustic soundproofing kit for the Bombardier Challenger 600 series of business jets. The kit reduces overall dB(SIL) levels significantly with minimal net weight penalty. The kit includes skin and floor damping, thermal acoustic insulation bags, overframe blanket and Aerolite carpet pad. The available Challenger 600 series kit is provided as turnkey with installation schematics and instructions for a straightforward install process. This latest soundproofing kit adds to the list of over 80 airframe-specific soundproofing kits available. **www.skandiainc.com**

Wrenches are Intrinsically Safe

Snap-On's new Intrinsically Safe ControlTech Wireless Electronic Torque Wrenches are designed for working in a Class 1 Division 2 environment where flammable gases, vapours or liquids may potentially be present. Intrinsically safe equipment is defined as equipment and wiring which is incapable of releasing sufficient electrical or thermal energy under normal or abnormal conditions to cause ignition of a hazardous atmosphere mixture in its most easily ignited concentration. Designed for repeated use, Intrinsically Safe ControlTech Torque Wrenches are accurate to +/- 2 percent clockwise, +/- 3 percent counterclockwise. **www.snapon.com**

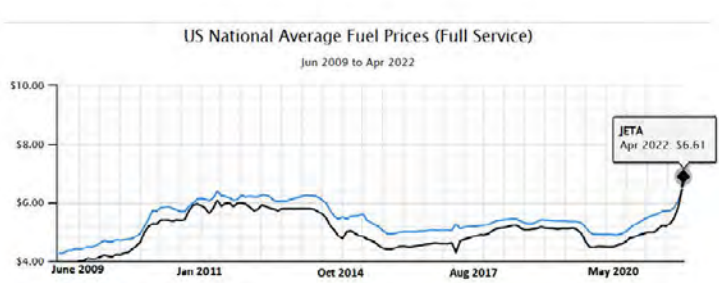
To announce your STC or new product, email a JPG photo and a product description to John at: amu.editor@gmail.com



FIELD AEROSPACE WILL SUPPLY ANTARCTIC SURVEY AIRCRAFT

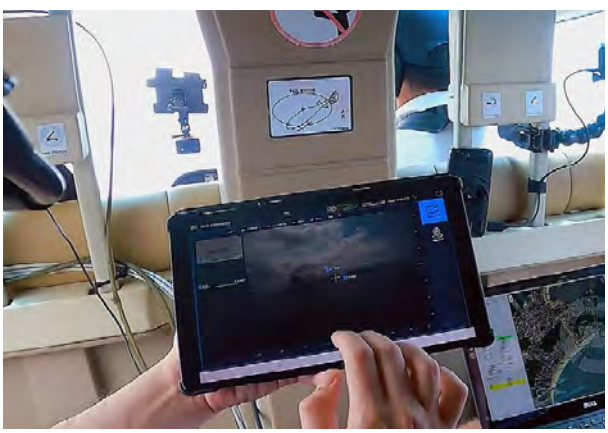
Field Aerospace has been awarded a contract by United Kingdom Research and Innovation to supply a De Havilland DHC-8 to the British Antarctic Survey. The aircraft will replace the four-engine DHC-7 in service with BAS since 1994, which was also modified by Field Aerospace. The DHC-8 will be used to ferry passengers and cargo to and from the Rothera Research Station, Antarctica in support of polar science and operations. Medical transport configuration, long range fuel tanks, and the Collins Aerospace cargo freighter door round out the significant modifications aft of the flight deck.

JET FUEL PRICES NOW SURPASS 100LL



In its nearly 15 years of tracking aviation fuel prices across the United States, GlobalAir.com says it is now seeing jet fuel prices hitting a record-high spike, with April 2022 being the first time ever that Jet A prices surpassed 100LL prices. Since the average retail price of Jet A price hit a three-year low of $4.49 in May of 2020, compounded by surplus supply and pandemic-driven airline shutdowns, it has risen 47.2 percent in the past two years, with a current national average of $6.90.

The GlobalAir.com Airport Resource Center provides fuel prices for airports throughout the United States.



EMBRAER MAKES AUTONOMOUS FLIGHT OVER RIO

During the month of May Embraer concluded a series of experimental flights in Rio de Janeiro, Brazil, focused on evaluating new autonomous system technologies in real flight conditions. The goal was to enable safe autonomous operation in complex urban environments. The company explored nominal and edge-case scenarios for take-off, climb, cruise, approach and landing flight phases. The helicopters used for the flights were from Helisul Aviação, and were controlled by professional pilots at all times while systems captured data and performed real-time calculations. The data collection is part of the Embraer Autonomous Systems project ("Project EASY") to enable the autonomous aviation of the future.

MAAS AVIATION PREDICTS COLOURFUL HORIZONS

Dublin-based MAAS Aviation, specializing in aircraft painting and exterior coatings, says there's mounting optimism in the aviation sector as they report a strong start to 2022. Chief Commercial Officer, Richard Marston says, "The industry is seeing strong post-pandemic growth as travel restrictions ease and we go back to everyday life. With more aircraft returning to the skies, the global MAAS teams have been busy with programs for new and existing customers throughout the first quarter of this year. With the 21/22 winter painting season coming to an end, there is plenty to talk about."

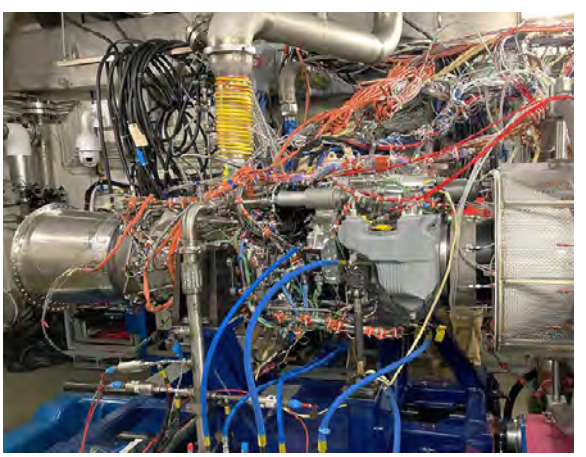
Boeing assigns HQs to Arlington, North Virginia

PRATT & WHITNEY CANADA EXPANDS PT6 E-SERIES

Pratt & Whitney Canada says the new engine model for its PT6 E-series—the PT6E-66XT— is purpose built for Daher's latest very fast single-engine turboprop airplane, the TBM 960. The PT6 E-series is the first engine family with a dual-channel integrated electronic propeller and engine control system in the General Aviation turboprop market. The digitally enabled single lever simplifies engine operation and allows for precision-controlled auto-throttle. The engine control system constantly reviews and processes all the engine and many aircraft parameters, making fine adjustments to fuel flow and propeller blade angle during all phases of flight.

GE BEGINS TESTING T901 TURBOSHAFT

GE has initiated testing on the first T901-GE-900 engine, GE's next-generation rotorcraft engine that will power the U.S. Army's UH-60 Black Hawk and AH-64 Apache. The First Engine to Test



milestone is being performed in a recently upgraded test cell at GE's Lynn, Massachusetts facility. Compared to its predecessor, the GE T700, the T901's 50 percent power increase restores aircraft performance, while its 25 percent better specific fuel consumption reduces fuel usage and carbon emissions. Increased component durability will lower life cycle costs. GE's advanced materials include 3D-printed (additive) manufactured parts and ceramic matrix composites.

BOEING NAMES NORTHERN VIRGINIA ITS GLOBAL HQ

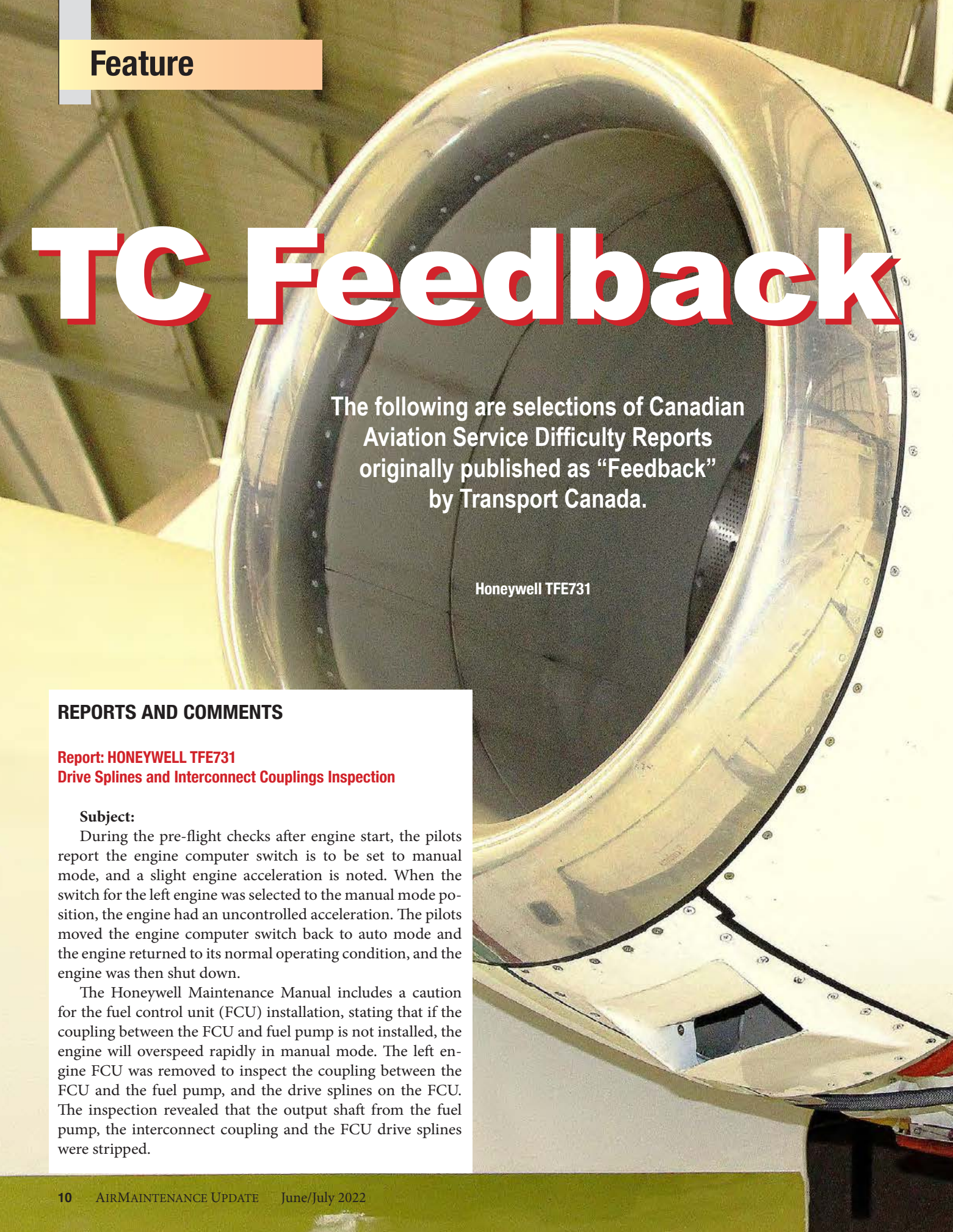
Boeing has appointed its Arlington, Virginia campus just outside Washington, D.C. as the company's global headquarters. The aerospace and defence firm's employees in the region support various corporate functions and specialize in advanced airplane development and autonomous systems. In addition to designating northern Virginia as its new headquarters, Boeing plans to develop a research and technology hub in the area to harness and attract engineering and technical capabilities. The hub will focus on developing innovations in the areas of cyber security, autonomous operations, quantum sciences and software and systems engineering.

TEXTRON DELIVERS NEW CESSNA SKYCOURIER

Textron Aviation has announced the first delivery of the Cessna SkyCourier twin utility turboprop to FedEx Express. This is the first of 50 freighter aircraft that global logistics firm FedEx Express ordered as the Cessna SkyCourier's launch customer. In addition to the initial fleet order, FedEx Express has options for 50 more SkyCourier aircraft. The aircraft is powered by two wing-mounted Pratt & Whitney PT6A-65SC turboprop engines and features the McCauley Propeller C779, a heavy-duty and reliable 110-inch aluminum four-blade propeller, which is full feathering with reversible pitch. It is operated with Garmin G1000 NXi avionics. ■

TC Feedback

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



Honeywell TFE731

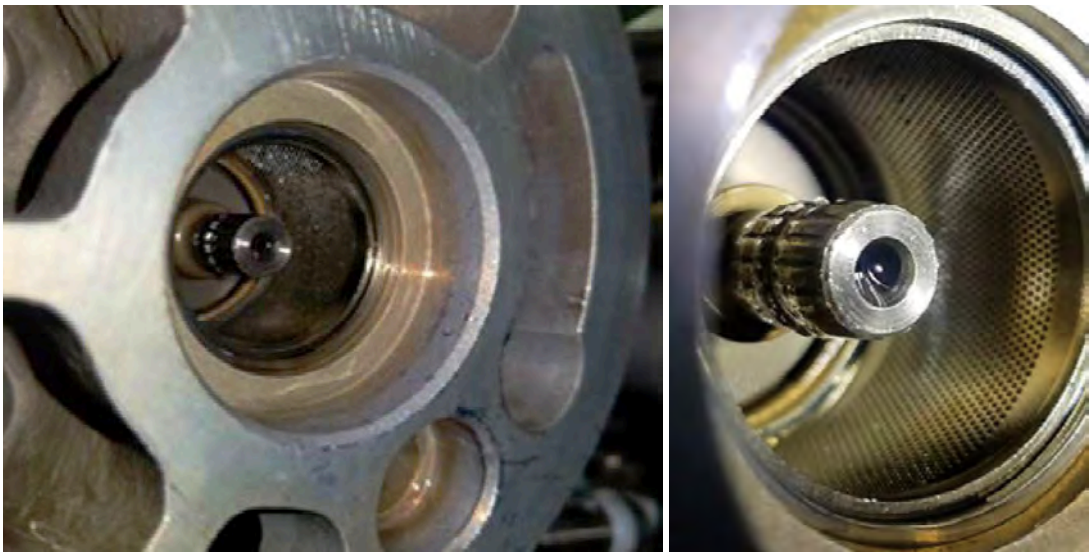
REPORTS AND COMMENTS

Report: HONEYWELL TFE731
Drive Splines and Interconnect Couplings Inspection

Subject:

During the pre-flight checks after engine start, the pilots report the engine computer switch is to be set to manual mode, and a slight engine acceleration is noted. When the switch for the left engine was selected to the manual mode position, the engine had an uncontrolled acceleration. The pilots moved the engine computer switch back to auto mode and the engine returned to its normal operating condition, and the engine was then shut down.

The Honeywell Maintenance Manual includes a caution for the fuel control unit (FCU) installation, stating that if the coupling between the FCU and fuel pump is not installed, the engine will overspeed rapidly in manual mode. The left engine FCU was removed to inspect the coupling between the FCU and the fuel pump, and the drive splines on the FCU. The inspection revealed that the output shaft from the fuel pump, the interconnect coupling and the FCU drive splines were stripped.



Honeywell TFE731 Fuel pump drive spline and close-up view

Transport Canada Comments:

It is common practice for many manufacturers to mate components together using interconnect couplings. These couplings are made from a variety of materials depending on the application. Some couplings are designed to shear if a component seizes, to limit the extent of damage to its mated component.

The root cause of these stripped splines has yet to be determined, but improper alignment during installation and material defects are possibilities. As stated in this event, the manufacturer's Instructions for Continued Airworthiness (ICA) does bring attention to ensuring interconnect couplings are installed to prevent overspeed of the engine. However, maintainers are reminded to inspect the condition of the mating surfaces and to pay attention when installing components to ensure proper engagement.

Report: CESSNA 150M
Rudder Pedal Torque Tube Failure

Subject:

On the co-pilot's side, the right rudder pedal failed when fully depressed. Maintenance found the right rudder bar weld assembly broken at the pedal arm attachment location, on the tube. The rudder bar was replaced.

Transport Canada Comments:

Cessna 150 aircraft Supplemental Inspection Document (SID) 27-20-01 describes the recommended inspection to verify the integrity of the rudder pedal torque tube assembly. As the SID states, typical failures occur at or close to welds.

The rudder pedal torque tube design is similar across 100 and 200 series Textron Aviation Inc. (Cessna) models. Transport Canada Civil Aviation (TCCA) suggests that owners, operators, and maintainers of all series 100 and 200 models review SID 27-20-01, pay special attention to this area, and incorporate its contents into the aircraft's maintenance program.

CESSNA 150

CESSNA.
Rudder pedal bar
failure location.

Report: AEROSPATIALE HC AS 350B2
Damaged Tail Rotor Control Rod Assembly

Subject:

On a scheduled inspection, it was found that the protective sheathing was damaged and worn away to the point where the tail rotor control rod was damaged. The control rod guide had pressure on it as did some of the forward guides. It was found that the control rod was likely bent during a previous removal and installation. The maintenance manual describes the removal and installation, and if that process is followed, there is a risk of bending the control rod. To reduce this risk, the fin can be easily removed.

Transport Canada Comments:

The submitter of this Service Difficult Report has provided an excellent example of maintainers needing to remain

AEROSPATIALE. Damage found on the tail rotor control rod assembly after the rod was found bent during an inspection.

vigilant during the performance of scheduled or unscheduled maintenance. As described by this submitter, the tail rotor control rod was only damaged because of the control rod being bent due to suspected improper maintenance during a previous installation or removal. Maintainers are reminded to always exercise good technical judgement and practices when performing any maintenance task to avoid inducing damage as described in this example.

Report: PRATT & WHITNEY – CANADA PW150A Improper Generator Installation

Subject:

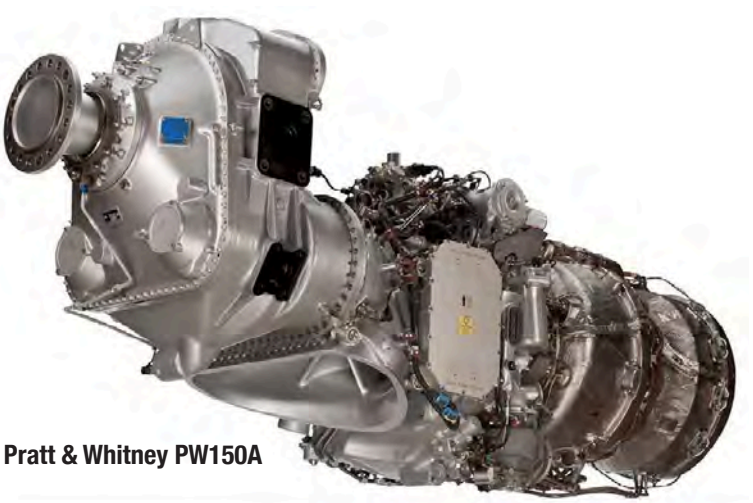
The crew reported that the right-hand direct current (DC) generator caution light was illuminated followed by an oil pressure warning light during flight. The crew commanded shutdown of the engine and landed without any incident. Upon troubleshooting, maintenance found the right-hand DC generator separated from its mount on the reduction gearbox.

Transport Canada Comments:

An investigation by the engine manufacturer found the oil pressure warning was caused by an oil leak from the DC generator that was not seated on its mount. The root cause was determined as improper generator installation. Generators or starters on most aircraft tend to be heavy, cumbersome to handle or install, and located in an area that is usually difficult to access and congested with lubrication and fuel lines as well as wire bundles. The securing hardware of the generator to its drive varies from basic stud mounts with nuts, to band clamps that encompass the generator and gearbox mounting flanges.

Although these different mounting systems may seem straightforward, you must follow the manufacturer's instructions to ensure proper installation. Normally, they need to be in a certain orientation for wiring hookup, which may or may not be aided by a locator pin. Many have specific torque procedures for clamps or specific torque sequences for stud mounted, and other components may require removal to facilitate an installation.

In this event, the crew was fortunate to land without incident but had the generator detached from the mount, it may have resulted in a very different outcome. Transport Canada Civil Aviation reminds all maintainers to be diligent and follow the manufacturer's Instructions for Continued Airworthiness (ICA) regardless of how simple the task may seem.



Pratt & Whitney PW150A

Report: BEECH 1900D Incorrect Fuel Filter Assembly Leading to Low Pressure Condition

Subject:

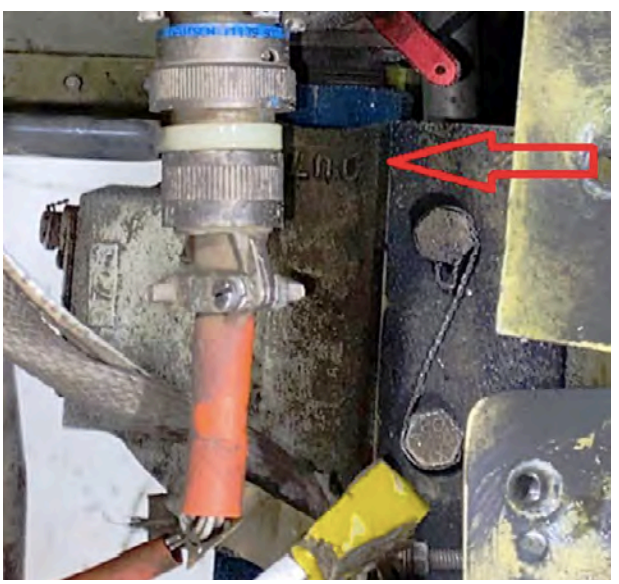
During flight, the L FUEL PRES LO annunciator came on, so the pilot turned on the standby pump, but the light did not extinguish. The airframe fuel filters were inspected, and the red (bypass) indication poppers were not popped though both filters were full of ice. The left-hand (LH) filter discs were severely deformed and bulged. Further investigation determined that the incorrect part number airframe filter assembly was installed on the LH side of the aircraft. A right-hand (RH) filter assembly was installed on the LH side prior to the aircraft joining our fleet.

BEECH 1900D

Transport Canada Comments:

The maintenance error went unnoticed until ice buildup in the fuel filter assembly installed on the LH side significantly reduced the fuel pressure, resulting in a warning annunciation. Fuel bypass would not be possible as the direction of flow (IN/OUT) was the opposite than intended. The fuel filtering function would also flow in the opposite direction than designed; outwards versus inwards of each disc.

Unfortunately, it is possible to install an opposite filter assembly (LH instead of RH) and it may not be obvious on a post-installation leak check or ground run. Fuel pressure indication will continue to function, although without a functioning fuel filter bypass, ice build-up within the filter assembly can restrict fuel flow with consequences possibly being fuel starvation.



BEECH. (above) View from upper access panel with OUT marking evident. (left) Bulged filter disc due to the fuel flowing in the opposite direction than designed.

Please note that the IN/OUT markings on the fuel filter assembly casting are not visible when viewing through the under-wing filter access door as they are located on the top side of the casting inlet and outlet ports. The upper access panel on the top of the wing may need to be removed to see the markings on the casting.

Report: PILATUS PC12 47E Shocking Fuel Leak

Subject:

The pilot discovered significant fuel leakage from the belly of the aircraft, inboard of the left-hand (L/H) wheel well area, while the aircraft was shut down on the ramp after a call. Upon investigation by maintenance, it was noted that a main fuel line had a small pinhole in it, causing a steady stream of fuel to jettison the aircraft. In the area of the puncture was a wire bundle that appeared to be chafed. It appeared that the wire chafed a hole in the fuel line, and the fuel was spraying onto the chafed electrical wires. The fuel spill was contained on the ramp, and the leaking fuel line was contained using temporary means to prevent further fuel loss on the ramp.

Fuel stream (left) from the chafe (above) on the fuel line.

Transport Canada Comments:

The operator provided the following additional information about this issue:

A hole was found in the L/H wing fuel line part number (P/N) 528.24.12.173A caused by a chafing wire from the belly beacon P/N L78B18/l79A18N, which chafed through the insulation, exposing the bare wire, and had arced on the fuel line, causing the leak. The wire was able to chafe due to a rotated Adel clamp and standoff, which held the two beacon wires.

The aircraft was defuelled, the fuel line was removed, the wire was repaired with Raychem in accordance with standard practices, silicon fusion tape was applied to the hydraulic line, which the Adel clamp was attached to, and the Adel clamp was attached/reinstalled on the tape and positioned away from all lines. The Adel clamp cannot rotate due to friction from silicon tape. A new fuel line P/N 528.24.12.173B was then installed in accordance with standard practices.

The aircraft was refuelled, and the line was pressure tested with the boost pump. The engine run was completed; no further faults were found, and the aircraft returned to service.

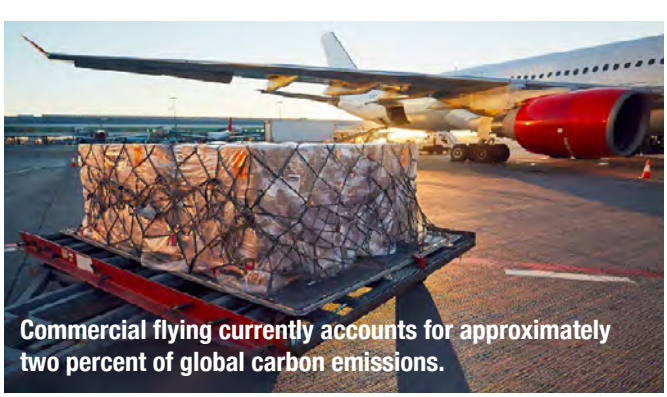
This operator was fortunate that this difficulty did not progress into something much worse. A fleet campaign was initiated to inspect for proper clamp and wire position to ensure for necessary clearance between the two wires and fuel lines. No further findings were reported.

Clearance must be maintained between wires and adjacent components and structures. Please be vigilant for these types of dormant failures. ■

Artemis Aerospace owner Jim Scott discusses how he sees aircraft design evolving

From Power to Pilotless:

Imagining the Future of Aircraft Design



Commercial flying currently accounts for approximately two percent of global carbon emissions.

SINCE THE GOLDEN AGE of air travel started with BOAC's 44-seat Comet 1A in 1952, the jet aircraft has been a ubiquitous fixture in our skies that has thrilled enthusiasts and created the convenience and safety that transcends other forms of transport.

While few fundamental features have changed since the 1950s, jet engines have continued to improve in power and efficiency with modifications made to fuselage, flight decks and engines among other essential adjustments.

Indeed, two of the most popular and long-serving aeroplanes in operation — Boeing's 737 and Airbus's A320 — have moved through many variants since they launched in the

Opposite: Honeywell unveiled Anthem — a revolutionary, fully integrated flight deck that has been built with advanced connectivity in mind.
Above: As it stands, biofuels are already in use and blended with traditional jet fuel of up to 50/50 in ratio.

1960s and 1980s respectively. However, the basic concept has remained the same: to provide safe and economical air travel.

POWERING INTO THE FUTURE

Efficiency has been a key driver in the constant efforts to improve and update aircraft. Lower emission engines, enhanced aerodynamics and an increase in composite materials have all been pivotal in this quest, helping to reduce fuel burn and boost efficiency.

Further improvements in efficiency are likely to continue in the near future. For example, the latest aircraft from Boeing, the 777X, has utilized composite fan technology, composite wing construction and folding wingtips to counteract the necessary design adjustments that have meant the aircraft's engine and wings have increased in size considerably. However, while engine size and wing design are making a difference in creating more economical aircraft, more radical changes will be required when it comes to powering planes.

Aviation is now moving into an era of renewable energy sources with biofuel, hydrogen and battery technology all being explored and developed. Commercial flying currently accounts for approximately two percent of global carbon emissions and around 12 percent of transport emissions, according to data from the Air Transport Action Group. The aviation industry's target is to slash this in half by 2050.

As it stands, biofuels are already in use and blended with traditional jet fuel of up to 50/50 in ratio – the maximum allowed under current fuel specifications. However, Boeing has already committed to making planes that fly on 100 percent biofuel by 2030 and the company even staged the first commercial flight in 2018 using 100 percent biofuel on a FedEx Corp 777 freighter. The next challenge will be supply. Significant market development is needed to deliver the levels required by the aviation industry if targets for sustainable aviation fuels (SAFs) are to be met.

Battery operated planes are also making progress. As far back as 2010, the Swiss company Solar Impulse built an electrically powered aircraft that could run on solar power during a 26-hour trial flight. Airbus also embarked on its electrification journey in the same year, committing to developing the world's first all-electric, four-engine aerobatic aircraft, CriCri.

Without pilots in situ, who on board will be making the call about emergency landings?

Hydrogen is being hailed as an important pathway to creating zero-emissions aircraft.

Since then, the manufacturer, in partnership with Siemens and Rolls-Royce, has made significant progress, launching its E-Fan X – a hybrid-electric aircraft demonstrator – in 2017. In fact, it is probable, given the complexities of electrifying aircraft in the short to medium term, that hybrid aircraft are more likely to become mainstream.

Hydrogen is being hailed as an important pathway to creating zero-emissions aircraft. Whether it is used to power a fuel cell or directly combusted, the only waste product is clean water. Even more crucially, hydrogen offers three times more energy per unit mass than conventional jet fuel and more than one hundred times that of lithium-ion batteries. Governments and companies are now investing in this potential.

In April 2021, California-based start-up ZeroAvia's six-seater Piper M-Class took off from Cranfield Airport in the UK. Supported by the UK government, this maiden flight sparked the next stages in the journey towards zero carbon aviation.

In September 2020, Airbus announced its project ZeroE, unveiling three concept planes which it is aiming to have ready for roll out in 2035.

However, questions still remain about the feasibility of hydrogen. While hydrogen offers more energy per unit mass, the energy density of liquid hydrogen is only around a quarter of jet fuel's, meaning to produce the same amount of energy it needs a storage tank four times in size. Clearly, this has consequences for aircraft design and passenger capacity, ultimately affecting the commercial viability of such an aircraft. According to the Air Transport Action Group, the most likely scenario is the direct use of hydrogen will be marginal and SAFs will be the game-changer in 'mission zero-emissions.'

THE FUTURE OF THE FLIGHT DECK

Next generation avionics design is increasingly being geared towards IoT (the Internet of Things). In November 2021, Hon-

Existing autopilot systems are perfectly capable of flying aircraft from take off to landing.

eywell unveiled Anthem — a revolutionary, fully integrated flight deck that has been built with advanced connectivity in mind. Anthem features expanded customization options for OEMs, intuitive touch controls and smart prompting, as well as enhanced fleet management capabilities through anytime, anywhere data analytics.

Safety is also at the heart of Anthem's design. For example, its engine-out function will automatically guide pilots to the nearest airport, taking into account important differentiating factors such as terrain and wind. Its landing assist, meanwhile, will provide help in the event of a pilot medical issue, offering path guidance to an airport before switching to pilot control 200 feet from centreline.

PILOTLESS PLANES

Existing autopilot systems are perfectly capable of flying aircraft from take off to landing. However, it is unlikely this will ever be a popular option for passenger aircraft – especially in the event of an emergency.

Despite this, pilotless aircraft could save airlines $35 billion per year. Pilot shortages are also causing huge challenges

Aviation is now moving into an era of renewable energy sources.

– particularly since many pilots were furloughed or took redundancy during the pandemic.

Airbus has said that the technology for safely operating autonomous aircraft now exists. However, introducing it to commercial fleets depends on regulators and the reaction from passengers. Without pilots in situ, who on board will be making the call about emergency landings due to medical emergencies or disruptive passengers?

FLYING IN THE FUTURE

Advances in innovation should go hand in hand with commercial viability. While addressing carbon emissions is extremely important, accommodating people's desire to travel and purchase goods cannot be overlooked.

Passenger numbers will continue to rise and the love affair for everything online is unlikely to wane anytime soon, making freight and logistics an ever-growing and important part of the aviation ecosystem.

Turning to the future, the aviation industry is starting to look towards how it can encompass challenges faced by urban environments, such as traffic congestion. For example, the electrically powered Lilium Jet from Munich — a five-seater air taxi with the capability to take off and land vertically. It is thought that it could start operating as early as 2025, picking up passengers from rooftops.

Whatever the outlook, aviation remains at the forefront of thought-provoking and cutting-edge design that inspires and drives engineering onwards. What cannot be denied is that the majestic profile and graceful beauty of the current-day commercial jet plane is one of humankind's most revered and respected engineering accomplishments. ■

(Artemis Aerospace is based in West Sussex, UK.)


AMU
AirMaintenance
UPDATE
The Magazine for Aircraft Maintenance Professionals
HOME PAGE
CURRENT ISSUE
FEATURES
NEWS
ARCHIVE
EVENTS
CLASSIFIEDS
JOBS
Features
AMU Chronicles
Canadian Aero Accessories Ltd.
Component Sales
Overhaul & Repair
www.canadianaero.com
Advertising space is available on
our website or contact us to
advertise in our magazine.
E-mail: chrissie@amumagazine.com
or call (604) 214.9824 F.M.I.

PACIFIC

Pacific AME Association

Corporate Members

Our corporate members are important to us. From supporting/sponsoring the Association's workshops to donating boardrooms for our meetings and training, we appreciate their hard work and dedication to furthering the industry.

Corporate benefits

1. Work shop and meetings during the year on topics of interest to AMEs.
2. Opportunity to meet and exchange ideas at our functions.
3. A representative of a corporate member has the right to attend and speak at all membership meetings, but is not entitled to vote or to hold office in the Association.
4. Corporate Members are entitled to advertise that they are members of AME Association.
5. Opportunity for employment networking at our workshops.
6. Free advertising of your company on our website.
7. Two corporate members able to attend our workshops.
8. Free job postings on our website.

www.pamea.ca

WESTERN

Western AME Association

Website Now Under Maintenance

The WAMEA website is currently undergoing maintenance and will be back soon!
For any inquiries, the usual communication methods are still in place:
Email: info@wamea.com or president@wamea.com
Phone: 587-713-WAME (9263)

While the WAMEA website is undergoing maintenance, please take the opportunity to peruse the National AME Association website for your professional interests at:
http://www.amec-teac.ca

Thank you for your patience,

Greg Andersen
President, Western AME Association
www.wamea.com

www.wamea.com

CENTRAL

Central AME Association

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.

New Date: annual Aviation Symposium (postponed)

Although CAMEA was scheduled to host the 26th Annual Aviation Symposium on March 3-4, 2022 at Canad Inns Polo Park in Winnipeg, Manitoba, organizers unhappily announced that the event has been postponed until next year

www.camea.ca

AME Association of Ontario

c/o Skyservice F.B.O. Inc., PO Box 160, Mississauga, Ontario L5P 1B1
tel: 1-905-673-5681 fax: 1-905-673-5681
email: association@ame-ont.com website: www.ame-ont.com

ONTARIO

About Time

It seems that some of the requirements for subject matter being taught in the aircraft maintenance programs at the colleges will finally be changing. It's about time to have these criteria changed. Although there are still fabric and wood structure aircraft out there, a very basic reference should be made. When it comes to LORAN and ADF, this should have been dropped years ago. Instrumentation and navigation systems have changed dramatically over the past decade, but the teaching criteria has not changed. Fortunately the colleges are including lessons in the new technologies.

The National Training Association (NTA - https://www.nationaltrainingassociation.ca) has put forward a list of changes that they would like Transport Canada to approve. Ultimately, what needs to be done is to have the criteria listed in different way. Rather than having so much detail embedded in the regulations i.e. CAR 566 and its Appendixes; the CARs should only give an overview with the details in another publication such as an Advisory Circular. This AC would be much easier to amend as it would not require the whole CARAC process.

Other changes are being considered including CARs 507. Our AME Association will be closely monitoring these proposed changes to ensure that our interests are protected.

Submitted by Stephen Farnworth
For the Board of Directors

www.ame-ont.com

Quebec AME Association

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

QUÉBEC

About Us

The association's mission is to represent all AMEs in Quebec regardless of the company or the contracts on which they work. Regardless of the type of aircraft on which the AME works, he/she will be welcome. We will simply recognize ourselves as a holder of an AME Transport Canada M1/2, E or S license with an attachment in Quebec.

The Association will ultimately become the AME's voice to Transport Canada's ears and will work with existing AME associations from coast to coast to make our profession stronger and more cohesive. One of the great goals of our association is to elevate ourselves to the status of a professional and to be recognized as such by the various federal government bodies. The other major mission of our association will be to make our profession better known to the public and to get involved with young people so that they know what AME's work is and consider it as a career choice.

In addition, our association will offer many benefits to its members such as group discounts from various vendors, free magazine subscriptions, and discounts for insurance companies offering products designed for AMEs.

Learn more about us at:
www.ame-tea.com
e-mail: info@ame-tea.com

Nous sommes vraiment heureux d'apparaître pour la première fois dans le magazine AMU. 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.

Ayant été constitués relativement récemment, nous faisons partie de l'AMEC/TEAC et 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.

Faire partie d'une association régionale de TEA amène certains avantages. Outre l'accès à des rabais intéressants pour les TEA, vous recevrez plusieurs magazines dédiés au monde de l'aéronautique directement à la maison. C'est aussi un excellent moyen pour les TEA de participer à cette communauté.

Nous avons dû suspendre nos assemblées annuelles dû à la Covid-19, mais nous sommes résolument décidés à pouvoir rencontrer nos membres à nouveau dès ce printemps.

Vous pouvez en apprendre plus à notre sujet à l'adresse suivant :
www.ame-tea.com / e-mail: info@ame-tea.com

ATLANTIC

Atlantic AME Association

Objectives

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.

MEMBERSHIP:

• All voting members of the Association must currently hold an AME license in any category or be a retired AME who has held an AME license. [or

• Be a non-licensed aviation maintenance technician, technologist or individual meeting a recognized aviation trade standard (CGSB, Mil Standard, CCAA, SCA) or holding a position named in a MCM, MPM or ATO [or

• Be a non-licensed person who holds a paid or volunteer administrative position actively involved in the daily running of the AME association for a period of no less than 5 years. Such person shall not occupy the position of president, vice president or sit as the representative of the Atlantic AME association on the CFAMEA board of directors.

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 their AME license may become full voting members by paying the difference between student membership fees and regular fees.

CORPORATE MEMBERSHIP:

• Corporate membership is available to any corporation supporting the objectives of the Association, and which is actively involved in the aviation industry in the Atlantic region.

• A representative of a Corporate member shall have the right to attend all meetings but shall not be entitled to vote or hold office in the Association.

Visit our website for a list of BYLAWS **www.atlanticame.com**

SOCAL

SoCal PAMA Chapter

Who We Are

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

www.socalpama.org

CENTRAL OHIO

Central Ohio PAMA

2022 Ohio Aviation Maintenance Symposium

The 2022 Ohio Aviation Maintenance Symposium was a big success: 212 were pre-registered through the FAASTeam website with 133 from Columbus GL07 and Cleveland GL25 FSDOs and waiting on the total from the Cincinnati GL05. We also had 40 vendors and an additional 12 speakers along with the E.C.C. and COPAMA volunteers. We will most likely total over 300 attendees and will update when we arrive at a final number. Thanks to all who attended and hope to see your next year!

Jeff Gruber accepts FAA position at Cincinnati FSDO

Congratulations and good luck to Jeff as he leaves his teaching position at Columbus State AMT facility at Bolton Field and joins FSDO GL05 as an Aviation Safety Inspector. He resigned his position as Vice President and Board Member of COPAMA effective April 5th 2022.

In his letter to the board he stated, "It has been a good journey with you all and I am proud to have been associated with this group. I will continue to support the organization within the capacity I can." He and his family will remain in the Columbus area for the present time.

We wish him and his family well as they start this new chapter in his aviation career. He has been a member of COPAMA, Board Member, Vice President and Golf and Holiday Dinner Chairman over the 20 years of the organizations existence. Upon notice of his leaving, the Board moved to enact Article IV - OFFICERS, Section 2 - Vacancies of the COPAMA By-Laws that allows the Board to fill his position for the rest of his term which ends November of this year.

Christopher Deem, CSCC Aviation Instructor, has agreed to coordinate distribution of scholarship funds to CSCC student recipients in place of Jeff. He accepted the Boards request to complete Jeff's term on the board. This will maintain a CSCC Instructor on the Board after Jeffs departure and Gene Sprangs retirement.

The Board welcomes Mr. Deem aboard and looks forward to his input and participation! The position of a new VP will be resolved.

www.copama.org

RAPCO, inc.

REPLACEMENT AIRCRAFT PARTS CO.

Rapco, Inc. can help you reduce maintenance costs...this is good for you and your customer. With the impact fuel prices have had on general aviation flying, and the resulting impact on maintenance facilities, everyone needs to find a way to decrease their operating costs, without sacrificing quality or safety. Rapco can help.

All Rapco parts are FAA-Approved, warranted better than the OEM, to save you and your customers money. Call now to see how we can help you - 1-800-527-2726

Vacuum Pumps

Easily check vane wear

Brake Discs

Over 80 direct brake disc replacements

Electroless Nickel plating

Regulator & Fittings

De-Ice Components

Leads, boots, modules, brushes & more

Visit: http://www.rapcoinc.com/acappguides.html for individual specific application guides for most popular aircraft

Request an e-card at www.rapcoinc.com

PARTS DEPARTMENT

1-800-527-2726

RAPCO, inc.

REPLACEMENT AIRCRAFT PARTS CO.

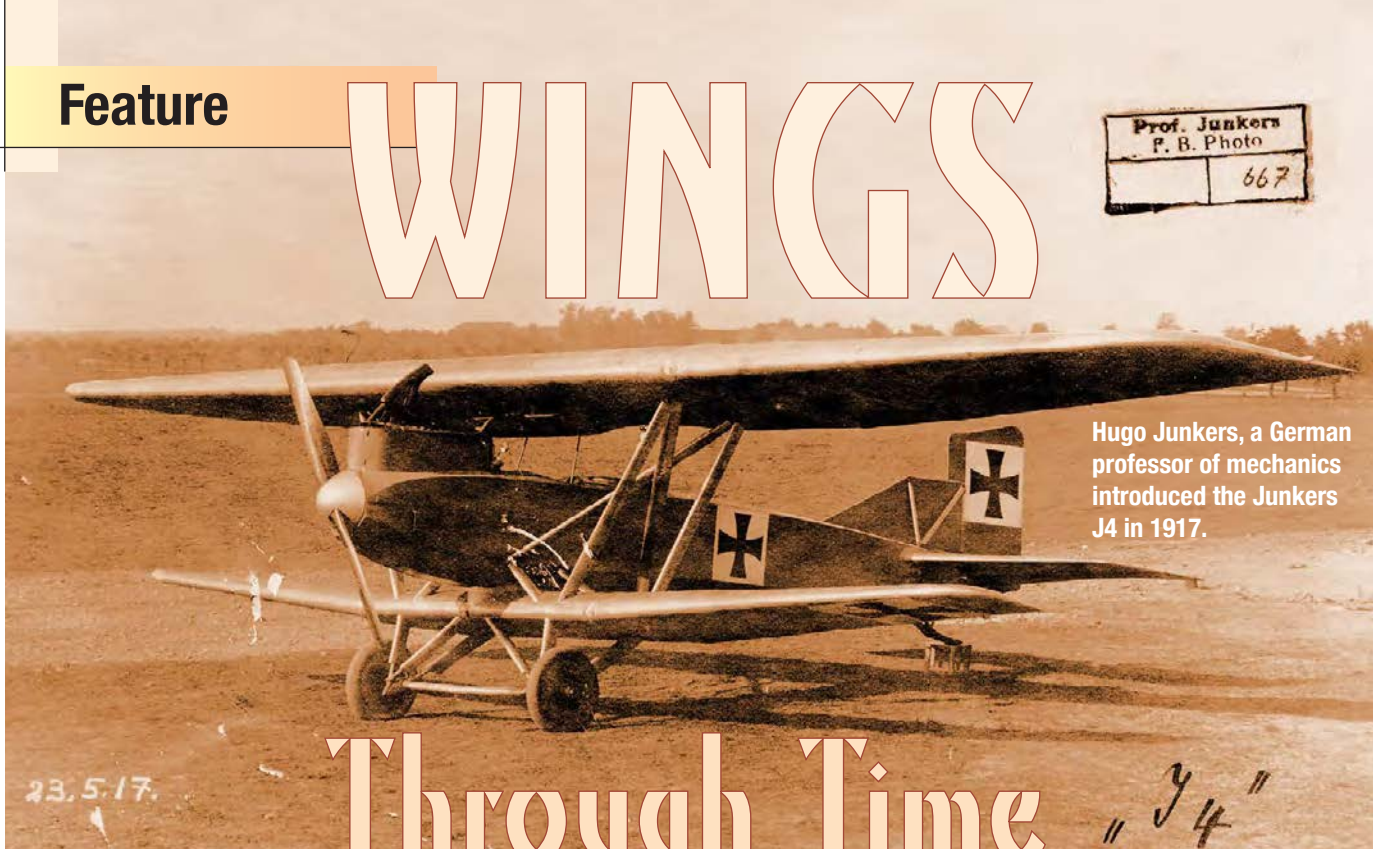
www.rapcoinc.com

NO PLANE NO GAIN

visit www.noplanenogain.org

Feature

WINGS Through Time



Hugo Junkers, a German professor of mechanics introduced the Junkers J4 in 1917.

In 1933 Douglas introduced the DC-1.

The Heinkel HE178 is the world's first jet aircraft.

EFFORTS TO tackle the engineering problems associated with powered flight began well before the Wright brothers' famous trials at Kitty Hawk. In 1804 an English baronet, Sir George Cayley, launched modern aeronautical engineering by studying the behaviour of solid surfaces in a fluid stream and flying the first successful winged aircraft of which we have any detailed record. And of course Otto Lilienthal's aerodynamic tests in the closing years of the 19th century influenced a generation of aeronautical experimenters. In the 20th century, advances in aeronautical engineering soon had us soaring in safety and comfort across all the continents and oceans.

1901 First successful flying model propelled by an internal combustion engine

Samuel Pierpont Langley builds a gasoline-powered version of his tandem-winged "Aerodromes." the first successful flying model to be propelled by an internal combustion engine. As early as 1896 he launches steam-propelled models with wingspans of up to 15 feet on flights of more than half a mile.

1903 First sustained flight with a powered, controlled airplane

Wilbur and Orville Wright of Dayton, Ohio, complete the first four sustained flights with a powered, controlled airplane at Kill Devil Hills, 4 miles south of Kitty Hawk, North Carolina. On their best flight of the day, Wilbur covers 852 feet over the ground in 59 seconds. In 1905 they introduce the Flyer, the world's first practical airplane.

1904 Concept of a fixed "boundary layer" described in paper by Ludwig Prandtl

German professor Ludwig Prandtl presents one of the most important papers in the history of aerodynamics, an eight-page document describing the concept of a fixed "boundary layer," the molecular layer of air on the surface of an aircraft wing. Over the next 20 years Prandtl pioneers theoretical aerodynamics.

1910 First take off from a ship

Eugene Ely pilots a Curtiss biplane on

Above: Igor Sikorsky developed the VS300 helicopter in 1939.

The De Havilland Comet made its first flight in 1949.

The prototype Learjet 23 makes its first flight in 1923.

the first flight to take off from a ship. In November he departs from the deck of a cruiser anchored in Hampton Roads, Virginia, and lands onshore. In January 1911 he takes off from shore and lands on a ship anchored off the coast of California. Hooks attached to the plane's landing gear, a primitive version of the system of arresting gear and safety barriers used on modern aircraft carriers.

1914 Automatic gyrostabilizer leads to first automatic pilot

Lawrence Sperry demonstrates an automatic gyrostabilizer at Lake Keuka, Hammondsport, New York. A gyroscope linked to sensors keeps the craft level and traveling in a straight line without aid from the human pilot. Two years later Sperry and his inventor father, Elmer, add a steering gyroscope to the stabilizer gyro and demonstrate the first "automatic pilot."

1914-1918 Dramatic improvements in structures and control and propulsion system

During World War I, the requirements of higher speed, higher altitude, and greater maneuverability drive dramatic improvements in aerodynamics, structures, and control and propulsion system design.

1917 The Junkers J4, an all-metal airplane, introduced

Hugo Junkers, a German professor of mechanics introduces the Junkers J4, an all-metal airplane built largely of a relatively lightweight aluminum alloy called duralumin.

1925-1926 Introduction of lightweight, air-cooled radial engines

The introduction of a new generation of lightweight, air-cooled radial engines revolutionizes aeronautics, making bigger, faster planes possible.

1928 First electromechanical flight simulator

Edwin A. Link introduces the Link Trainer, the first electromechanical flight simulator. Mounted on a base that allows the cockpit to pitch, roll, and yaw, these ground-based pilot trainers have closed hoods that force a pilot to rely on instruments. The flight simulator is used for virtually all U.S. pilot training during WWII.

1933 Douglas introduces the 12-passenger twin engine DC-1

In that summer Douglas introduces the 12-passenger twin-engine DC-1, designed by aeronautical engineer Arthur Raymond for a contract with TWA. A key requirement is that the plane can take off, fully loaded, if one engine goes out. In September the DC-1 joins the TWA fleet, followed 2 years later by the DC-3, the first passenger airliner capable of making a profit for its operator without a postal subsidy. The DC-3's range of nearly 1,500 miles is more than double that of the Boeing 247. As the C-47 it becomes the workhorse of WWII.

1933 First modern commercial airliner

In February, Boeing introduces the 247, a twin-engine 10-passenger monoplane that is the first modern commercial airliner. With variable-pitch propellers, it has an economical cruising speed and excellent takeoff. Retractable landing gear reduces drag during flight.

1937 Jet engines designed

Jet engines designed independently by Britain's Frank Whittle and Germany's Hans von Ohain make their first test runs. (Seven years earlier, Whittle, a young Royal Air Force officer, filed a patent for a gas turbine engine to power an aircraft, but the Royal Air Ministry was not interested in developing the idea at the time. Meanwhile, German doctoral student Von Ohain was developing his own design.) Two years later, on August 27, the first jet aircraft, the Heinkel HE 178, takes off, powered by von Ohain's HE S-3 engine.

1939 First practical singlerotor helicopters

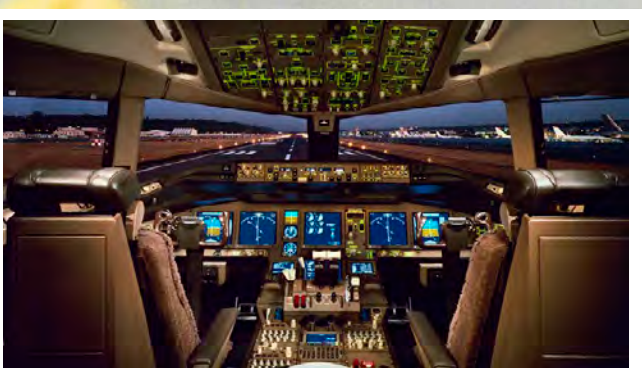
Russian emigre Igor Sikorsky develops the

In 1969 Boeing launched the first wide-body, turbofan-powered commercial airliner, the 747.

The Concorde SST was introduced into commercial service in 1976.

The stealth B-2 Bomber was made of composite materials rather than metal.

The Tu-144LL is a flying laboratory.



Boeing's 777 was the first computer-designed aircraft.

VS-300 helicopter for the U.S. Army, one of the first practical singlerotor helicopters.

1949 First jet-powered commercial aircraft

The prototype De Havilland Comet makes its first flight on July 27. Three years later the Comet starts regular passenger service as the first jet-powered commercial aircraft, flying between London and South Africa.

1950s B-52 Bomber

Boeing makes the B-52 bomber. It has eight turbojet engines, intercontinental range, and a capacity of 500,000 pounds.

1952 Discovery of the area rule of aircraft design

Richard Whitcomb, an engineer at Langley Memorial Aeronautical Laboratory, discovers and experimentally verifies an aircraft design concept known as the area rule. A revolutionary method of designing aircraft to reduce drag and increase speed without additional power, the area rule is incorporated into the development of almost every American supersonic aircraft. He later invents winglets, which increase the lift-to-drag ratio of transport airplanes and other vehicles.

1963 First small jet aircraft to enter mass production

The prototype Learjet 23 makes its first flight on October 7. Powered by two GE CJ610 turbojet engines, it is 43 feet long, with a wingspan of 35.5 feet, and can carry seven passengers (including two pilots) in a fully pressurized cabin. It becomes the first small jet aircraft to enter mass production, with more than 100 sold by the end of 1965

1969 Boeing 747

Boeing conducts the first flight of a wide-body, turbofan-powered commercial airliner, the 747, one of the most successful aircraft ever produced.

1976 Concorde SST introduced into commercial airline service

The Concorde SST is introduced into commercial airline service by both Great Britain and France on January 21. It carries a hundred passengers at 55,000 feet and twice the speed of sound, making the London to New York run in 3.5 hours—half the time of subsonic carriers. But the cost per passenger-mile is high, ensuring that flights remain the

privilege of the wealthy. After a Concorde accident kills everyone on board in July 2000, the planes are grounded for more than a year. Flights resume in November 2001, but with passenger revenue falling and maintenance costs rising, British Airways and Air France announce they will decommission the Concorde in October 2003.

1986 Voyager circumnavigates the globe in nine days

Using a carbon-composite material, aircraft designer Burt Rutan crafts Voyager for flying around the world nonstop on a single load of fuel. Voyager has two centerline engines, one fore and one aft, and weighs less than 2,000 pounds (fuel for the flight adds another 5,000 pounds). It is piloted by Jeana Yeager (no relation to test pilot Chuck Yeager) and Burt's brother Dick Rutan, who circumnavigate the globe (26,000 miles) nonstop in nine days.

1990s B-2 bomber developed

Northrop Grumman develops the B-2 bomber, with a "flying wing" design. Made of composite materials rather than metal, it cannot be detected by conventional radar. At about the same time, Lockheed designs the F-117 stealth fighter, also difficult to detect by radar.

1995 First aircraft produced through computer-aided design and engineering

Boeing debuts the twin-engine 777, the biggest two-engine jet ever to fly and the first aircraft produced through computer-aided design and engineering. Only a nose mockup was actually built before the vehicle was assembled—and the assembly was only 0.03 mm out of alignment when a wing was attached.

1996-1998 Joint research to develop second-generation supersonic airline

NASA teams with American and Russian aerospace industries in a joint research program to develop a second-generation supersonic airliner for the 21st century. The centre piece is the Tu-144LL, a first-generation Russian supersonic jetliner modified into a flying laboratory. It conducts supersonic research comparing flight data with results from wind tunnels and computer modelling. ■

Rag Time

Sabotage or negligence? This was the question as investigators puzzled over a Piper Cherokee's death by fuel starvation.

The accident aircraft is of low-wing design and is equipped with a carburetted engine and one 25-US-gallon fuel tank in each wing.

THE PILOT OF A PIPER PA-28-140 Cherokee Cruiser and two passengers were on a flight from the Little Grand Rapids Airport, Manitoba, to Matheson Island when the aircraft's engine lost power. The pilot carried out a forced landing in a marshy area. The aircraft sustained extensive damage and the pilot suffered minor injuries; both passengers were uninjured. The Transport Safety Board determined that the aircraft's engine lost power because of fuel starvation resulting from rags placed in the aircraft's fuel tanks by a person or persons unknown. Contributing factors were the ease of access by the public to aircraft parked on the ramp, and the lack of security of the aircraft's fuel supply.

HISTORY OF THE FLIGHT

The Piper PA-28-140 Cherokee Cruiser departed Little Grand Rapids, Manitoba, at 1430 central daylight time (CDT1) for a business flight to Matheson Island, Manitoba. The aircraft carried a pilot, two passengers, and their baggage. As the aircraft was climbing through 2,200 feet above sea level (asl2), the engine lost power and the aircraft descended and struck a

Little Grand Rapids map (left) and the Little Grand Rapids airstrip (below).

tree. The aircraft's engine regained power and the aircraft resumed its climb. As it was climbing through 2,000 feet asl, the engine again lost power and descended; the pilot carried out a forced landing in a marshy area approximately 27 nm west of Little Grand Rapids.

DAMAGE TO AIRCRAFT

The aircraft struck a number of evergreen trees measuring between one and three inches in diameter during the forced landing, and sustained extensive damage to its wings, fuselage, landing gear, and engine mountings. The aircraft's records indicate that the aircraft was certified and maintained in accordance with existing regulations.

METEOROLOGICAL INFORMATION

The area forecast for the time of the occurrence called for a layer of scattered cloud based at 3,000 feet, with an occasional layer of broken cloud based at 5,000 feet, and visibility of more than six miles, with localized snow showers with visibilities of four to six miles. Isolated towering cumulus clouds were forecast, with visibilities of one to three miles in snow.

A weather observer at Berens River, approximately 40 nm northwest of the crash site, observed the following conditions at 1500 CDT: a layer of broken cloud based at an estimated 2,000 feet, visibility 15 miles, temperature zero ° C, dew point minus five ° C, winds 330 ° true at 10 gusting to 17 knots, altimeter setting 29.91 inches of mercury. The atmospheric conditions were conducive to light carburetor icing at cruise or descent power.

Each fuel tank outlet is at the rear inboard corner of the Piper Cherokee, which is normally the lowest part of the tank. Opposite, top: The pilot had rented the incident aircraft two days before the accident, and had flown to the Little Grand Rapids area.

ITINERARY

The pilot had rented the aircraft two days before the accident, and had flown to the Little Grand Rapids area. The aircraft made several flights, and was refuelled once. The pilot used a jerry can for refuelling the aircraft and strained the fuel through a screen into the aircraft fuel tanks. The pilot flew the aircraft about four hours before it was parked on the ramp at the Little Grand Rapids Airport at about 1700 on April 22. It stayed there until the accident flight on the afternoon of April 24.

AERODROME INFORMATION

Little Grand Rapids is a certified airport located about 148 nm northeast of Winnipeg, Manitoba, and operated by the Government of Manitoba Department of Highways. It is served by an unmonitored non-directional beacon (NDB), which may be used as the navigation aid for a Transport Canada company approved approach, and is a station stop for several regional air carriers. Transport Canada Publication 312 serves as "the authoritative document for airport specifications" for land airports in Canada. It contains "recommended practices" which are "desirable in the interest

of safety, regularity, or efficiency of air navigation, and to which operators will endeavour to conform." Section 8.4.1.2 contains the following recommendation: "A fence or other suitable barrier should be provided on an aerodrome to deter the inadvertent or premeditated access of an unauthorized person to a non-public area of the aerodrome."

The terminal building at Little Grand Rapids is open to the public from 0800 to 1600 Fridays, closed Saturdays, and open from 1300 to 1600 Sundays. While it is open, it is occupied by the airport manager, maintenance staff, and, from time to time, the staff of several regional airlines using the airport. When the terminal building is closed, the door allowing access to the ramp is locked. The runway is unfenced, but a fence extends along two sides of the ramp. The ramp fence has a gate approximately four feet wide, which the operator of the airport leaves unlocked to allow access by tourists, general aviation personnel, and those involved in medical evacuations.

WRECKAGE AND IMPACT INFORMATION

Physical evidence at the site indicated that the aircraft's final descent angle was about seven°, and the engine was pro-

Piper Cherokee aircraft such as this have a Maximum Allowable Take-off Weight - 2,150 pounds.

ducing very little power at impact. The aircraft struck a number of trees measuring between one and three inches in diameter and came to rest in a nose-down position in a marshy area. The nose landing gear broke on impact with the ground, and the left wing fuel tank was punctured.

AIRCRAFT SYSTEMS

The accident aircraft is of low-wing design and is equipped with a carbureted engine and one 25-US-gallon fuel tank in each wing. The aircraft's engine is equipped with a carburetor air heater. Post-accident investigation revealed that the carburetor heat control cable was partially seized, so that when full carburetor heat was selected, only partial carburetor heat was being applied.

Each fuel tank outlet is at the rear inboard corner, which is normally the lowest part of the tank. The outlet is equipped with a finger type screen which projects into the tank. Each fuel filler cap is at the front outboard corner of the tank, and cannot be locked. The fuel filler neck affords a view of the area immediately below the cap only. No tank baffle or filler neck screen is fitted. The left wing tank was punctured and contained very little fuel. The right wing tank contained about five gallons of fuel.

Fuel is delivered to the engine by one mechanical pump and one electric pump. During examination of the aircraft after the accident, the engine started and appeared to be capable of producing normal power; however, an abnormally low fuel pressure was noted. The fuel pumps were tested and both were found to be serviceable. The fuel lines, filters, and screens were found to be clear. No fuel contamination was found. However, each fuel tank was found to contain a cloth rag about 6 by 14 inches in size. The rags were not apparent on visual inspection with the fuel tanks mounted in the wings, but were discovered

when the tanks were removed and inverted. The rags sank when they were placed in a jar of fuel.

AIRCRAFT HANDLING

The pilot performed a pre-flight walk-around check of the aircraft. Pilots are directed to remove the fuel tank filler caps during the walk-around and visually check the supply and colour of the fuel. The pilot's operating handbook (POH) directs that the carburetor heat be checked before flight, and be applied in flight in the event of engine roughness or engine failure. The pilot reportedly checked the carburetor heat on the ground prior to the flight, and found it serviceable. He selected carburetor heat "on" shortly before the first power loss, and left it on for most of the remainder of the flight. The POH requires that the electric fuel pump be turned on for take-off, and turned off after climb to cruising altitude. The electric fuel pump was reportedly switched on throughout the flight.

ANALYSIS: CARBURETOR HEAT

The atmospheric conditions were conducive to light carburetor icing at cruise or descent power. As the aircraft engine was operating at either take-off or climb power from take-off until the loss of engine power, the formation of carburetor icing was unlikely.

Even though carburetor heat was not required by the POH, the pilot applied carburetor heat during the climb, shortly before the engine lost power. A slight reduction in rpm was observed, indicating that carburetor heat was reaching the engine. This application of carburetor heat further reduces the likelihood of carburetor icing being a causal or contributing factor in this occurrence.

ANALYSIS: FUEL TANK DESIGN

The rags found in the tanks sank when placed in fuel. Since the fuel tank outlets are at the lowest point of the fuel tanks, the rags, when placed in the tank, would have gravitated toward the fuel tank outlet. Given that the filler neck affords a view of its immediate area only, the rags would have been out of the sight of the pilot carrying out a pre-flight check.

ANALYSIS: FUEL STARVATION

Once the engine was started and the aircraft was moving, the rags would have been drawn to the fuel tank outlets by the additional effects of fuel movement in the tanks and fuel flow out of the tanks to the engine. The rags collected at the fuel tank outlet and restricted the flow of fuel to the engine, leading to fuel starvation and loss of engine power.

When the aircraft struck the tree after the first power loss,

Post-accident investigation revealed that the carburetor heat control cable was partially seized, so that when full carburetor heat was selected, only partial carburetor heat was being applied.

the fuel in the fuel tanks probably moved abruptly, dislodging the rags from the fuel outlets and allowing a temporary resumption of fuel flow and engine power before the rags again migrated to the fuel outlets.

ANALYSIS: AIRCRAFT SECURITY

Since the aircraft had been flown about four hours before the accident and the rags sink in fuel, it is unlikely that the rags entered the fuel tanks before the aircraft left its base. As the pilot used no rags while operating or refuelling the aircraft, the rags were probably put in the tanks while the aircraft was parked at Little Grand Rapids.

Since no screens were fitted on the filler necks of the fuel tanks, rags and other foreign objects could be introduced into the fuel tanks. Once in a tank, any object would likely move out of view and would then be undetectable during pre-flight inspection.

FINDINGS

The pilot was certified and qualified for the occurrence flight in accordance with existing regulations. The aircraft's records indicate that the aircraft was certified and maintained in accordance with existing regulations. The aircraft's engine lost power because of fuel starvation resulting from rags placed in the aircraft's fuel tanks by a person or persons unknown. The rags were probably placed in the fuel tanks while the aircraft was parked on the ramp at the Little Grand Rapids Airport.

The airport fencing allows public access to aircraft parked on the ramp via a gate and via the runway area. There is no supervision of persons on the ramp area after normal working hours or on Saturdays. The aircraft fuel tank design does not incorporate a lock or filler neckscreen, and does not allow easy inspection of the entire fuel tank. ■

(This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board, consisting of Chairperson, John W. Stants, and members Gerald E. Bennett, Zita Brunet, the Hon. Wilfred R. DuPont and Hugh MacNeil, authorized the release of this report on 16 January 1995.)

Aviation Services

Aviation Services

Aviation Services

Texas Showdown

Canadian military AMEs earned hardware at the annual Aerospace Maintenance Competition, which returned following a two-year absence.

AFTER A TWO-YEAR HIATUS the Aerospace Maintenance Competition was back in action in Dallas, Texas The competition, presented by Snap-On and hosted by the Aerospace Maintenance Council April 25-28, involved 90 teams, 27 separate events and 28 multiple heats. The event gave teams of licensed AMTs, AMEs, international military personnel and qualified aviation maintenance students the chance to test their aviation maintenance skills against those of their peers. The competition included challenges in areas such as avionics; safety wiring; fibre optics/flight control rigging; hydraulics; jet engine troubleshooting; workplace safety SMS; and other tasks. Teams had 15 minutes to accurately complete each task; teams that finished their tasks in less than the allotted time received higher scores.

Among the participants proudly representing Canada was a contingent from the Royal Canadian Air Force – 12th Air Maintenance Squadron, which claimed first place in the Military Category as well as winning the Paul Cousins Award for their first-place finish in the International Category.

"The Aerospace Maintenance Competition is a venue for aircraft technicians and students from around the world to come and compete against each other. But the competition is designed to show the public what our responsibilities are; the knowledge, skill and integrity that we all possess," said Ken MacTiernan, chairman of the Aerospace Maintenance Competition. "We have teams competing from three different countries. The airplane does not care where you come from. It just cares about the knowledge of the technician holding that tool, and the knowledge here at the competition is off the scale."

Overall, the FedEx Indy squad took home the William F. "Bill" O'Brien Award for their performance—this team won the title in 2015 as well. The award is the grand prize for the team with the overall winning score in the competition. The four-foot-tall O'Brien trophy will be on display at FedEx Indianapolis' maintenance facility for the next 12 months. The trophy features a bust of Charles E. Taylor, an aviation pioneer who built and maintained the first aircraft engine used by the Wright Brothers. Sponsorship of the Award is part of Snap-on's continued commitment to the Aerospace Maintenance Competition and aviation maintenance technicians around the world.

In addition to the O'Brien Award, Snap-on provided all the tools and equipment used by the participants during the competition and donated more than $75,000 in tools and equipment prizes to top finishers in the competition. More than 50 other companies, educational institutions, community organizers and individual volunteers contributed time, resources, prizes, product and airline miles to the event. Other top sponsors include American Airlines and Pratt & Whitney (Platinum); International Association of Machinists and Aerospace Workers, PPG, SkyWest Airlines, Teamsters, TAMC and United Airlines (Gold). ■

JetBed™

Easy to Carry • Easy to Stow • Ready to Go

"Thank you for finally providing a solution to a comfortable, restful sleep on a corporate jet . . . back support is superb . . . the quality of your bed is evident. . . a real winner."

Lusardi Construction Co.

The Comfortable Way to Fly

Easy to use, easy to stow! Removable mattress, for easy cleaning. Meets or exceeds FAR-25-853a standards for flammability. JetBed™ weighs no more than 20lbs!

Available for:

Cessna CJ-1
Cessna CJ-2
Cessna CJ-3
Cessna XL & XLS
Cessna XLS-PL, XLS Plus
Cessna Encore & Ultra Encore
Citation X & Sovereign
Gulfstream G200
Gulfstream 550
Gulfstream G-IV
Gulfstream G-V
Challenger 300
Challenger 600 Series
Falcon 2000
Global Express
Learjet 45
Hawker 800
Falcon 50

". . . a long flight was proof that JetBed was the right decision. Without hesitation, I would recommend JetBed to any operator seeking ease, reliability and quality . . . Kudos to you and your Jet Bed staff for such a quality and innovative solution. You have surpassed all of my expectations . . ."

JetBed™

". . . a great addition to our cabin requirements . . . deployment is extremely easy . . . stores easily . . . definitely a satisfied JetBed customer."

Qualcomm Flight Department

BKD
mobility products
Approved distributor

Tel: 604.247.2128 Fax: 604.214.9825

www.bkdaerospace.com
info@bkdaerospace.com
BKD Aerospace Industries Inc.

Canadian Aero Accessories Ltd.

Component Sales **Overhaul & Repair**

Trusted
Experience
Since 1964

CALL US FOR THIS & MORE !

- Fire Bottles • Oxygen Bottles • Escape Slides • Life Rafts
- Starter Generators • AC Generators • Generator Control Units
- Boost Pumps • Fuel Pumps • Blowers • Valves • Brakes
- Hydraulics 5606 and Skydrol • Electronics/GCUs
- Actuators - Hydraulic and Electrical

Authorized repair Station For

GOODRICH

Ice protection systems

170 George Craig Blvd. N.E., Calgary, AB, Canada T2E 7H2
ph: 403.250.9077 • fax: 403.250.6841
sales@cdnaero.com

www.canadianaero.com