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# AirMaintenance

The Magazine for Aircraft Maintenance Professionals

# UPDATE

Transport Canada Approved for R/T



## Passenger to Freighter Conversions

## Expedited Installation

## KODIAK 900: Backcountry Workhorse

## PAMA and AME news



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# Help! Tech Skills Wanted

**A**VIATION MAINTENANCE, repair, and overhaul sector spending will approach \$80 billion in 2022 and come close to matching pre-COVID levels in 2023, according to the global industry management consulting firm, Oliver Wyman. However, the industry is facing significant growth-inhibiting challenges, many of which are detailed in Oliver Wyman's annual MRO survey, titled The Quest for Stability. "The MRO industry has displayed remarkable resilience during the past two years, but it may not be enough as it faces a new set of challenges around labour, inflation and sustainability," said Brian Prentice, a partner with Oliver Wyman, which has offices in more than 70 cities across 30 countries.

The need for pilots is well known, but another critical segment of the industry could keep planes from flying. A lack of technical staff was cited in the survey as the top disruptor for the MRO industry over the next five years. Some 80 percent of North American respondents said that finding mechanics and technicians has become challenging, with Europe (65 percent) and other geographies (79 percent) feeling a similar strain. The challenge of securing labour has become critical, with more than half of survey respondents reporting that the lack of labour is already beginning to constrain growth – even with demand not yet fully at pre-pandemic levels.

COVID brought about a wave of retirements and fewer new people are entering the industry. While apprentice programs and technical school partnerships continue to work well as traditional recruitment tools, it is not enough to combat the ongoing and overall talent shortage. ■

— John Campbell, Editor



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# Upcoming Events

## Invitation to attend ISABE Conference



As the incoming **International Society of Air Breathing Engines Vice-President**, it is my privilege to welcome you to Ottawa, Canada for ISABE 2022 on its special golden jubilee anniversary. As a proud supporter of ISABE since its formation 50 years ago, my organization, the National Research Council of Canada, would like to extend a special welcome to all delegates of ISABE 2022.

With the fifth largest Aerospace industry, Canada is an Aerospace nation. The Canadian Aerospace industry is well diversified in the Civil, Defence and Space sectors, generates over \$31 billion in revenue each year, and employs 215,000 highly qualified professionals in every region of the country. Canadians are immensely proud of their aerospace heritage from the Avro Arrow, to the Canadarm. Canada is also a major player in the gas turbine segment, being home to the world's number one manufacturer of turboprop and turboshaft engines, Pratt & Whitney Canada. Given our climate, Can-

ada can also claim to be the engine icing certification capital of the world.

As Canada's Capital city, Ottawa is a hub for the Aerospace, Defence and Security sectors. Seven of the world's top ten Aerospace and Defence companies have their Canadian headquarters in Ottawa and it is home to Canada's armed forces, aerospace regulators, and the testing facilities of the National Research Council of Canada.

At ISABE 2022, it is my hope that you will have productive technical discussions, as well as plenty of opportunities to reconnect with old friends and make new acquaintances – all adding up to an enriching and memorable time. Once again, we are delighted to welcome you to Ottawa for the 25th ISABE conference, and invite you to experience the best that the city has to offer during your stay. ✨

*Dr Ibrahim Yimer  
ISABE Vice President and ISABE-2022  
Conference Chair*

## COMING EVENTS

### Abbotsford International Airshow 2022

August 5-7, 2022  
Abbotsford, British Columbia  
[www.abbotsfordairshow.com](http://www.abbotsfordairshow.com)

### Canadian International Air Show

September 3-5, 2022  
Toronto, Ontario  
[www.airshow50.com](http://www.airshow50.com)  
[www.cias.org](http://www.cias.org)

### Aéro Montréal International Aerospace Week

September 6-8, 2022  
Montreal, Quebec  
[www.aeromontreal.ca](http://www.aeromontreal.ca)

### Sky Drive 2022 (presented by Airshow London)

September 9-11, 2022  
London, Ontario  
[www.airshowlondon.com](http://www.airshowlondon.com)

### Aero Gatineau-Ottawa 2022

September 16-18, 2022  
Gatineau, Quebec  
[www.aerogatineauottawa.com](http://www.aerogatineauottawa.com)

### International Society for Air Breathing Engines 2022

September 25-30, 2022  
Ottawa, Ontario  
[www.conference.isabe.org](http://www.conference.isabe.org)

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# STCs & new products

## Helmet light automatically turns off

Lincoln Electric's new Viking 2450 ADV auto-darkening welding helmets feature an integrated LED light and 4C optics. The light adjusts to the environment to improve users' visibility of the weld, work piece and weld joint. Operators can easily activate or deactivate the light using a low-profile external control. When activated, the light illuminates the work area for increased workspace visibility during arc-off time. The LED light automatically turns off when the operator strikes an arc and turns back on when the arc is extinguished. [www.lincolnelectric.com](http://www.lincolnelectric.com)



## Penetrant provides long-lasting lubrication

Kano Laboratories' Kroil penetrant with graphite is a blend of oils, solvents and graphite engineered to penetrate the smallest gaps of corroded metals to loosen seized parts. The graphite is designed to stick to metal and provide long-lasting lubrication, which will remain in place in operating temperatures up to 700F (371C). The penetrant can be used on nuts and bolts, fan shafts, valve stems, hinges, gaskets, transfer belts, bearings, locking mechanisms and leaf springs. It is available in 13-ounce aerosol cans, and one, five, and 55-gallon liquid containers. [www.kroil.com](http://www.kroil.com)



## Scimitar prop improves climb performance

Supplemental Type Certificate has been approved to replace McCauley propellers on Mooney M20M/TLS/Bravo series single-engine aircraft with Hartzell Propeller's 75-inch diameter three-bladed aluminum props. Airplanes covered by the STC are powered by TIO-540-AF1A and TIO-540-AF1B Turbocharged Lycoming Sabre engines. Hartzell's Scimitar-style prop covered by this STC is said to deliver eight to 10 percent improvement in climb performance and a two to three knot increase in cruise. It has a 2,400-hour, six-year time between overhaul, and warranty until first overhaul. [www.hartzellprop.com](http://www.hartzellprop.com)



## App supports aircraft maintenance

The aircraft maintenance project management app eWork is designed to provide complete visibility, detailed monitoring and analysis of the airworthiness, engineering, logistics, tooling and cost management aspects of line and base maintenance. The app is designed to support the maintenance of aircraft anywhere in the world. It is intended as an affordable tool for small and medium-size airlines, corporate, VIP, general aviation, para-public and military fixed wing aircraft and helicopter operators as well as third party aircraft maintenance and repair organizations. [www.adsoftware.fr](http://www.adsoftware.fr)



## Pliers deliver best in class strength

The new flat jaw locking pliers by Snap-on Industrial provide a patent-pending power ring that increases thread strength and delivers a clamping force up to 5,000 pounds. The pliers feature a pinned and brazed upper jaw; broaching technique that creates sharp teeth, an oversized adjustment screw with a wide head that provides a comfortable gripping surface, making adjustments easier on hands and accepts a 5/16 hex key for added versatility while adjusting clamping pressure, and a smooth and polished trigger that allows for easy release. [www.snapon.com](http://www.snapon.com)



## Spray cleans and inhibits corrosion

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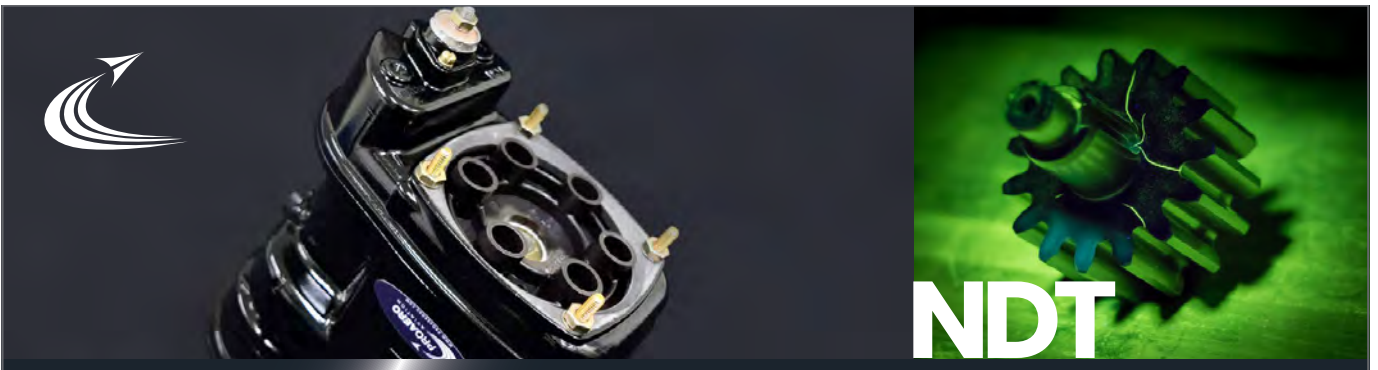
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## CANADIAN BEARINGS IN HIGH DEMAND

Canada's Marsh Brothers Aviation says it has experienced an increase in orders from Australian aviators for its grease-free bearings, seals and washers following the appointment of CJ Aerospace as its local distributor. Operators of a range of aircraft are now being supplied with the company's proprietary grease-free non-metallic self-lubricating polymeric bearing and sealing technology from CJ Aerospace facilities in Sydney and Cairns. Its range of lightweight seals and bearings are intended to deliver enhanced reliability, maintainability and efficiency for landing gear door hinges, piston rods and fuel caps.

## TESTING VALIDATES SAF PERFORMANCE



Embraer and Pratt & Whitney have successfully tested a GTF-powered E195-E2 aircraft on 100 percent sustainable aviation fuel. The test validated that

GTF engines and the E-Jets E2 family can fly on both engines with blends of SAF without any compromise to safety or performance. The aircraft completed two days of ground tests at Fort Lauderdale International Airport, culminating in a 70-minute flight test at Vero Beach Regional Airport in Florida. All Pratt & Whitney engines and Embraer aircraft are currently certified to operate with SAF blended up to 50 percent with standard Jet A/A1 kerosene.

## HEAVY LOAD CONCEPT FLIES LOW

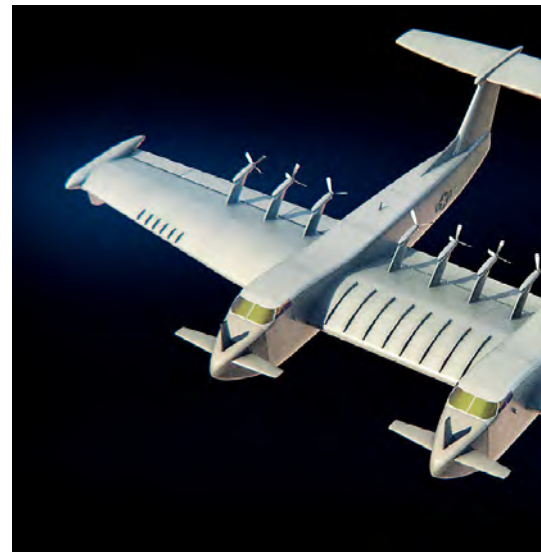
DARPA has launched a new Liberty Lifter program to build wing-in-ground effect aircraft for transporting heavy loads over long distances without runways. The envisioned plane will combine fast and flexible strategic lift of very large, heavy loads with the ability to take off/land in water. Its structure will enable controlled flight close to



## MASSIVE ONE-STOP SHOP FOR TOOLS

Airbus Services company Satair, has created a "one stop shop" for aircraft ground support equipment and tools, gathering 70,000 part numbers from 1,600 original equipment manufacturers across the globe. Satair's portfolio ranges from standard tools and GSE to complex zero stress jacking, engine change equipment, and rarely used test equipment to all customer segments in the aviation industry. Satair says airlines, MROs, lessors and airports will benefit from its increased global delivery capacities from a new 50,000 m2 warehouse and service centre, pending to open in 2023.

turbulent water. When a plane flies very close to the ground – at an altitude less than half of its own wingspan – it can ride on a cushion of high-pressure air between the wing and the surface, gaining additional lift while reducing lift-induced drag.







## BOEING FORECASTS STRONG DEMAND

In its recently released 2022 Commercial Market Outlook, Boeing has projected demand for more than 41,000 new airplanes through 2041. Boeing's CMO forecasts a market value of \$7.2 trillion for new airplane deliveries, with the global fleet increasing by 80 percent through 2041 compared to 2019 pre-pandemic levels. Approximately half of passenger jet deliveries will replace today's models. In addition, Boeing Global Services forecasts strong demand for maintenance and modifications such as converted freighters; digital solutions that increase efficiency and reduce cost; and effective training to enable the supply of pilots and technicians.

## G800 MAKES FIRST INTERNATIONAL FLIGHT

Gulfstream's all-new ultra long-range Gulfstream G800 made its first international flight in early July, flying from Savannah to Farnborough, England. The longest-range business aircraft in the industry, the G800 can fly 8,000 nautical miles at Mach 0.85 and 7,000 nm at Mach 0.90. The G800 cabin can be configured with up to four living areas with seating for up to 19 passengers and sleeping space for up to 10. Gulfstream says it invented the first purpose-built business aircraft, the Gulfstream I, which first flew in 1958. Today, more than 3,000 Gulfstream aircraft are in service around the world.

Bell will perform modifications on the first nine helicopters in the Mirabel facility, then manage a process to subcontract suppliers to perform modifications on the remaining 76 helicopters. The Griffon fleet is the largest helicopter fleet in the RCAF's inventory and has deployed internationally as part of United Nations and NATO missions. Domestically, the fleet has supported civilian authorities in firefighting, life-saving, and security.



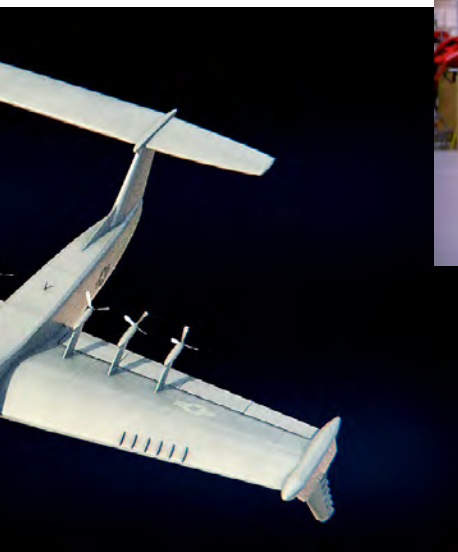
## ULTRAFAN ENTERS FINAL BUILD PHASE

Rolls-Royce has entered the final build phase for the world's largest aero-engine technology demonstrator, UltraFan. The demonstrator engine, with a fan diameter of 140 inches, is being completed at the company's facility in Derby, UK, prior to its first run on 100 percent Sustainable Aviation Fuel later this year. UltraFan's scalable technology from 25,000 to 100,000 pounds thrust offers the potential to power new narrowbody and widebody aircraft anticipated in the 2030s. UltraFan provides a platform for the use of a diverse range of energy options and power systems, including current jet fuel and sustainable aviation fuels. ■



## BELL LANDS EXTENDED GRIFFON CONTRACT

The Government of Canada has announced a contract for Bell Textron Canada to extend the life of the Royal Canadian Air Force's fleet of 85 CH-146 Griffon helicopters until the mid-2030s. Under the nearly \$800 million contract,



# Passenger to Freighter Conversions

By Jacob Netz

Passenger aircraft conversions are the hot ticket right now as the aviation industry struggles to keep pace with world cargo demands. Here, one industry expert summarizes some recent history and considerations of the freighter conversion business.

**CIVILIAN FREIGHTERS** are versions of passenger aircraft. Some of them are production built and others are used passenger aircraft converted to freighters (P2F). The business of converting military or passenger aircraft to freighters goes back to the early era of commercial aviation. In 1919, American Railway Express used a converted Handley-Page bomber in an attempt to fly 1,100 pounds of freight from Washington, D.C., to Chicago.

In reality, Air cargo did not pick up significantly until after WWII. With plenty of ex-military aircraft such as DC-3/C-47, DC-4/C-54s on the market in the postwar period, it wasn't surprising that some of them were converted to commercial freighters. Later, other piston engine aircraft such as the Lockheed Constellation and DC-6 (including the Freddy Laker Carvair) were also converted to commercial freighters.



Above: A Boeing 747-8 Freighter taking shape.

Right: Joining the wing to the body of a 747-8 Freighter.

### Short History

The turboprop era was dominated by two P2F aircraft: the Lockheed L-188 and the Convair 580/5800. Years later, there were also additional turboprop P2F programs: ATR-42/72, BAe-748/ATP, SAAB 340 and few Bombardier Q400s.

Quite a few jet models were feedstock to a number of P2F programs: B727- 100/-200, B737-200/-300/-400, B707, B747-100/-200/-400, DC-8, C-9, DC-10, MD-11, MD-80, BAe-146, A-300B4, A-300-600, A-310, and few Bombardier CRJs. More recent P2F conversion programs include A-320/A321, A-330, B737-700/-800.

### P2F Conversion

When an aircraft is almost “reaching its age” and has completed its useful operational service as a passenger jetliner, it









**Above: Israel Aerospace Industries (IAI) has signed an agreement to carry out passenger-to-freighter (P2F) conversions for Cargojet Canada's Cargo Airline.**

can either be scrapped or recreated again in a different segment. Converting passenger aircraft into a freighter is a way to extend the economic life of an aircraft. Quite a number of cargo airlines choose to operate a first-hand quality converted freighter. The converted freighters meet the high dispatch reliability required, they are more economical for the company, and they can gain the same amount of revenue without using an expensive production freighter.

Historically, more than 90 percent of narrowbody freighters are converted aircraft. Mid-size freighters are divided 50:50 between production and converted freighters. Only one-third of the large widebody freighters are converted passenger aircraft. Since the 2008 global financial crisis, the trend is to increase the portion of the new production freighters in this segment (converted freighters are considered less fuel efficient).

Most conversions are to freighters, but a few small size jets were converted to combis (cargo and passengers on the main deck) and fewer to Quick Change (dual-use aircraft carrying passengers during the day and freight at night).

Traditionally, production freighters are designated with the letter F. Converted passenger aircraft are designated with the letters SF. In recent years, three conversion houses use their own designations:

**BCF** Boeing Converted Freighter

**BDSF** Bedek Special Freighter.

**PCF** Precision Conversions Freighter

#### **P2F conversion involves:**

- Changing the aircraft mission and configuration and adapting it to a new market
- Major structural modifications as required for the new configuration
- Installation of specific systems as required for the new missions
- Certification. Supplementary Type Certificate or amendment of a Type Certificate

#### **Typical conversion tasks include:**

- Removing anything that is no longer needed, i.e. seats, galley, toilets, stowage bins, side and ceiling liners, carpet flooring, oxygen, overhead consoles, entertainment system etc.
- Removing or deactivating passenger doors
- Replacing or reinforcing floor beams
- Installation of the Main Deck Cargo Door (MDCD) with safety vent doors and replacing or reinforcing surround structure. If there is no reason that prevents





**Above: South Korea's flag carrier Korean Air Lines Co. has converted its passenger plane Boeing 777-300ER into a cargo carrier to further boost cargo operations.**



**Cargo operators have been experiencing steady growth on both B2B and B2C eCommerce demands**



**Throughout the prolonged COVID-19 crisis, a number of airlines have tried to make up for their steep losses in passenger revenue by transporting cargo in their bellies and cabins.**

it, the MDCD is placed on the fuselage left-hand side in front of the wing

- Installation of hydraulic/electric MDCD operation system
- Installation of 9g rigid barrier nets
- Modifying the area behind the cockpit for extra seating
- Modification of the cargo compartment
- Modification of the cargo compartment to Class E
- Installation of one-minute smoke detecting system
- Installation of non-powered/ powered Cargo Loading System (CLS), allowing loading of various arrangements of ULDs (unit load devices) within the main deck

**Aircraft Type Suitability Factors:**

- Payload
- Range
- Fuselage Cross-section
- Weights/structural limitations
- Electric/Hydraulic ECS Provisions





**Above: IAI BEDEK passenger to cargo conversion of 737-700. Right: More and more conversion houses work in collaboration with the OEMs or authorized by the OEMs.**

- Age (10 - 20 years old?)
- Compatibility with other freighters
- Infrastructure commonality

**Other considerations in conversion:**

- Remaining design life (hours, cycles, age)
- Maintenance condition and history
- Structural limitations
- Supplemental Structural Inspection Document or other program effects
- Impact upon existing Advisory Directives
- Relevant STC
- Ownership “complications”

**P2F Conversion Suppliers**

Traditionally, a P2F conversion can be carried out by:

- The aircraft manufacturer (OEM)
- A third-party contractors or independent companies that enter into cooperation agreements with the OEM
- Third-party contractors that develop their conversion solutions independently

In recent years, as a result of Boeing charging “access fees” and the modern aircraft technical complications (Fly-By-Wire, etc.), more and more conversion houses work in collaboration with the OEMs or authorized by the OEMs. Boeing and Airbus sometimes provide the engineering task for TC Amendment/STC. EFW is Airbus’s conversions house. In recent years EFW teamed with ST Aero.

The price of the converted freighter must be attractive in order to compete with production freighter. As a rule of thumb, target prices for a 20-year-old converted freighter is 25-30 percent of same size new freighter. Examples:

- Small: US\$10-\$12 million
- Medium narrowbody: US\$15-\$20 million
- Medium widebody: US\$20-\$30 million
- Large: US\$55-\$65 million

The price of a new production medium widebody is over US\$70 million, and a new production large widebody is over US\$150 million.

**P2F Conversion Programs**

In the jet era of commercial flight, two types of converted freighters accompanied the development of the Air Cargo industry. The first was the B-727 which was the backbone of small and medium freighters (106 converted B727- 100 and 350 converted B727-200).

The second, in the larger size segment, was DC-8 in which more than 200 were converted to freighters. Quite a number of 727s/DC-8s were successfully operated for more than 40 years. When the time came to phase them out, there were no aircraft with similar sizes that could replace them and the industry had to move to larger or smaller aircraft. Over the years, there were other P2F programs, but none have come to the 727/ DC8 figures.





2012, the demand shrunk to zero. Quite a number of converted 747-400s along with a production 747-400 were stored. It wouldn't be an exaggeration to say that the 747-400 P2F programs died and there was no way they could come back to life as they missed the conversion window. Again, the main factor was timing.

**Boeing B767-300** Industry experts predicted a rosy P2F future. Two conversion programs were established. In June 2008, ANA took delivery of the first 767-300BCF from Boeing, and in 2010 euroAtlantic airways took delivery of the first 767-300BDSF from M&B Conversions (a joint venture company of IAI Bedek and Mitsui & Co. of Japan).



Unexpectedly, only 20 aircraft were converted. The rate of conversions in both programs was very low (some years, zero conversions). A shortage of 767-300 feedstock was the main reason. Long delays in the 787 program caused airlines to continue to fly the 767-300s that had to be phased out and become the feedstock for conversions. The shortage of 767-300s caused high prices for the few proposed for selling. Again, timing. But it seems that the 767-300 is a "late bloomer". In 2015 the two conversion programs received orders and the conversion lines came back to life. ■

*(Jacob Netz is a Senior Consultant at Air Cargo Management Group. Previously he worked for Israel Aerospace Industries - BEDEK Aviation Group as the Analysis & Strategy Director of Freighter Conversions.)*

**Top right: Precision Conversions Freighter is a conversion house with its own designation, PCF.**

**Below right: Last year Airbus canvassed airline support for a potential freighter version of its A350 passenger jet.**

Some P2F programs have reached significant numbers:

- B- 737-300/-400 (more than 220)
- B-757-200 (more than 190)
- MD-11 (121), DC-10 (106)

A very important factor in the success of a P2F conversion program is timing. Following are three examples of cases where timing had a crucial influence on their success.

**Airbus A300B4** This model was not considered popular as a passenger aircraft and airlines phased them out relatively early. But it was at the right time to become a freighter as no other aircraft in its size was available. Seventy-four A300B4s were converted in two P2F programs (1987-2000) and many of them flew as freighters for more than 10 years. The main factor was timing.

**Boeing B747-400** Industry experts predicted the converted 747-400 would be a success as a favourable replacement for the aged 747-200 freighters. However, the 2008 aviation down-time, the high fuel price and the low-yield market made it difficult to compete with the more efficient 777 and 74-8 freighters. A total of 79 747-400s were converted. From

# Backcountry Workhorse



*At this summer's Oshkosh air show, Daher unveiled a \$3.5 million "adventure" plane.*

**A**IRVENTURE OSHKOSH in Wisconsin has long been one of the most significant summer air shows for industry players as well as the general public. It's where the aviation community gathers to be entertained and educated by everything that's cutting-edge new and Old School classic in the world of flight.

Among the unveilings at Oshkosh 2022 in late July was the Kodiak 900, which made its world debut as Daher's larger, faster version of the Kodiak 100 – filling out the company's airplane product line in joining the TBM 910 and TBM 960 very fast turboprop aircraft.

Inheriting the Kodiak 100's qualities as a backcountry STOL (short takeoff and landing) and multi-role airplane, the Kodiak 900 marks a further step with its fuselage length extension of 3.9 feet to provide more passenger room and cargo space, a cruise speed increase to 210 KTAS, and a

greater useful load while offering a maximum range of 1,129 nautical miles.

In addition to these enhancements, the Kodiak 900's operating economics have been improved, with a nine percent reduction in specific fuel consumption – which are in double digits when compared to competitors, according to Daher. This lowers the cost-per-seat-mile and the direct operating costs for commercial operators.

The Kodiak 900 was certified by the U.S. Federal Aviation Administration on July 20, and deliveries will begin in 2023. Production of the Kodiak 900, along with the Kodiak 100 in its latest Series III version, is performed at the Sandpoint, Idaho facility of Daher's Aircraft Division.

The Kodiak 900's stretched fuselage provides a total cabin volume increase of 20 percent to 309 cubic feet, and it features an all-new interior. With the new Summit+ passenger seats









that are multi-directional, the Kodiak 900 responds to a wide array of user requirements and mission profiles. The interior can be arranged in multiple configurations – from a double club layout to all-forward-facing arrangement. The Summit+ seats – which also are being used in the Kodiak 100’s upgraded interior – can be removed entirely for maximum space and payload. Individual amenity panels that include USB-a and USB-c ports, LEMO airplane-powered headset jacks, cup-holders and phone holders are now at every seat.

The new seats come with quick-release handles that allow them to easily slide in the seat-tracks or be removed entirely by one person without the need for tools or specialized equipment. Each seat reclines and has two armrests and a headrest with bolstering and padding, ensuring comfort on even the longest-range trips.

The cabin retains all of the Kodiak 100’s versatility. Numerous cargo tie downs throughout enable flexibility for securing down a variety of items. Cargo carrying capability and three entry/exit doors enable the entire cabin to be used for cargo, if needed.

A new colour pallet has been introduced for the Kodiak 900’s standard interior. The seats come in black, while durable

and weather-resistant black carpeting is installed throughout. The sidewalls, headliner and rear bulkhead utilize the same composite material from the Kodiak 100. Sound damping has been incorporated to the Kodiak 900’s unpressurized interior, creating a quiet cabin experience.

One of the most apparent differences in the Kodiak 900’s airframe is the addition of a fifth set of passenger windows, which adds to the brightness and the feeling of spaciousness.

The airframe has been re-engineered and refinements have been introduced in an effort to reduce drag – with such changes as replacing the external pilot entry step with a foldable ladder, as well as adding flaptrack covers on the wing and wheel fairings to the landing gear. An internal airflow “clean up” was performed as well, with the ducts, inlets, and air intakes redesigned, modeled and engineered for low drag.

The use of wheel fairings is another of the Kodiak 900’s visual differences. They have been certified as “secondary structures,” built to strict FAA standards and subjected to the same analysis and testing for such components as the cargo pod. Their design is targeted so that the wheel fairings can withstand off-pavement landings, and the main gear wheel fairing can be used as a step for pre-flight operations or single-point





refueling. Access doors make the tires' valve stem accessible, avoiding the need to remove the wheel fairings for general inspection or minor maintenance of the brakes and tires.

Removal and reinstallation of the wheel fairings is a pilot-maintenance function – ensuring that owners and operators can handle them without a maintenance logbook entry.

As the Kodiak 900 sits higher in the rear than the Kodiak 100, a complete redesign of the rear main cargo door was made. The integration of additional steps create an entry and exit point for passengers, while also facilitating the loading of payloads. There is an added handhold to assist with the added height of the plane on entry/exit. The door retains the Kodiak's clamshell design with fold-flat capability, allowing for loading/unloading of large bulk items, pallets, or stretchers for MEDEVAC customers.

Daher's Kodiak Care four-year maintenance program includes scheduled maintenance of the aircraft up to 1,000 total flight hours, or through the fourth annual inspection.

The Kodiak 900 is powered by Pratt & Whitney Canada's 900-shaft horsepower PT6A-140A turboprop engine, which is tailored for the utility aircraft market and optimized for rugged, demanding conditions. Its all-aluminum gearbox





housings have better corrosion resistance, and the engine delivers the best “hot and high” performance in its class. The PT6A-140A is part of Pratt & Whitney Canada’s next-generation PT6A-140 series, which already has logged more than two million hours of flight.

A new constant speed, full-feathering and hydraulically-actuated five-blade composite propeller from Hartzell is used on the Kodiak 900. Its design and low 1,900 rpm setting contribute to the low noise level of 79.5 dB, allowing the aircraft to operate in the most strictly regulated noise sensitive areas.

In the Kodiak 900’s engine bay, many components have been re-engineered to maintain key features of the Kodiak 100 version. The air-intake system is designed for low starting temperatures that allow for multiple battery engine starts per hour – a requirement for high-cycle customers such as skydive operators and in short-haul commercial flights. New



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additive manufacturing processes (3D printing) are applied in producing the alternator cooling shroud and some of the cowl exit ducts, reducing complexity and weight.

For special missions, the Kodiak 100's design, stability and handling characteristics complement the Kodiak 900's larger cabin volume, higher speed, faster climb and more rapid arrival at altitude/on station. Advantages for critical missions include its nine-hour loiter time, slow flight handling characteristics, and the 210 KTAS sprint/cruise capability.

In ISR (intelligence, surveillance and reconnaissance) op-

erations, the Kodiak 900's 300-amp starter/generator and 60-amp alternator meet high-demand electrical needs for mission systems, and the aircraft is easily adaptable to state-of-the-art equipment. It can carry a full team of specialists with the low vibration levels of a turboprop aircraft.

The Kodiak 100's capabilities in the firefighting support role are further improved with the aircraft's ability to climb more rapidly and fly faster. It also retains the Kodiak 100's STOL characteristics for delivering crews and supplies to off-airport strips. For law enforcement, public safety and agency operations, the plane offers increased cabin volume and convertible interior. In the air ambulance/MEDEVAC role, the larger cabin accommodates two stretchers, and its increased speed is vital when time is of the essence.

Development of the Kodiak 900 began in 2016. Three test aircraft have been built to date: a static test airframe for structural testing, a flying prototype for flight testing, and the first conforming production aircraft for FAA function and reliability testing. Maiden flight of the Kodiak 900 occurred on February 28, 2020. The test program has accumulated over 600 hours of flight testing and 800-plus hours of ground runtime across the test fleet. ■

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# AirMaintenance

## UPDATE

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## Pacific AME Association



### Mission Statement

The Pacific AME Association shall always promote and protect the professionalism of the AME, while developing, maintaining and improving our relations with regulatory bodies affecting our industry. We shall represent the views and objectives of our members while promoting proficiency through educational collaboration with other groups

on matters of mutual interest. We shall promote honourable practices among our Members and others in the aviation industry, while remaining non-union, non-sectarian and non-partisan.

[www.amec-teac.ca/pacific](http://www.amec-teac.ca/pacific)

## Western AME Association



### Website Still Under Maintenance

#### Website still 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](mailto:info@wamea.com) or [president@wamea.com](mailto: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](http://www.wamea.com)



## Central AME Association



### About CAMEA

The association is formed for the following and other purposes:

1. To provide a forum for Aircraft Maintenance Engineers resident or employed in the Central Region and more particularly to promote that species of knowledge which distinguishes the occupation of Aircraft Maintenance Engineer in the aviation industry.
2. To constitute a body through which the views and objects of Aircraft Maintenance Engineers may be represented, which body will be available for advice or consultation on all questions, policy matters, and all other areas of the aviation industry which affects or may affect the Aircraft Maintenance Engineer.
3. To constitute a body which will be recognized by the Minister of Transport regarding the regulation of any matter in the aviation industry which affects or may affect the occupation of Aircraft Maintenance Engineer, and to obtain the recognition of all other government departments which touch upon the aviation industry.
4. To facilitate the interchange by members of the Association of their views in relation to the aviation industry, to the minister of Transport, or to any other matter which is of common interest to the members,
5. To promote honourable practices in the aviation industry, to repress

malpractices, to settle disputed points of practice and to decide all questions on usage or courtesy between or among its members and those engaged or otherwise interested in the activities of the Association.

6. To promote, improve and generally advance the occupation of Aircraft Maintenance Engineer and to increase the knowledge of its member's relation to the aviation industry through education and research.
7. To print, publish and disseminate technical or other information which relates to the occupation of Aircraft Maintenance Engineer or to the aviation industry in general.
8. To maintain a high standard in the aviation industry, and in particular the occupation of Aircraft Maintenance Engineer and to further the status of the Aircraft Maintenance engineer at all times.

### 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](http://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](mailto:association@ame-ont.com) website: [www.ame-ont.com](http://www.ame-ont.com)



## Awards

The Aircraft Maintenance Engineers Association of Ontario provides Scholarship Bursary awards to deserving students studying in Aircraft Maintenance Programs at colleges throughout Ontario. A \$500 Scholarship Bursary is awarded to an accredited student at each College that participates in this program.

In May, Canadore College selected winners for the AME Association awards. We are pleased to announce the following students in their respective programs:

AMT Nick Villeneuve

AVN Connor Wilson

ASR Johnathan Van Dyk

In June, Mohawk College selected its winners. Congratulations to:

**Maintenance** Shalom Immanuel

**Avionics** Erikson Jardim

**Structures** Manuela Perez Velasquez.

We look forward to continuing our "Promote and Mentor" support of future AMEs in Ontario.

## Annual General Meeting

The Annual General Meeting of the AME Association of Ontario is

scheduled for Monday, September 12, 2022. The meeting will be held online as a Google Virtual Meeting starting at 7PM. We've been using Google Meetings for scheduled monthly meetings, as it allows us to maintain safety guidelines, and it has proved most convenient in avoiding traffic jams; Also, it allows those who live at some distance from Toronto to attend, and share documents, charts and photos. A "clickable link" with joining instructions will be emailed to members.

## 2022 Ontario Aircraft Maintenance Conference

The 2022 Ontario Aircraft Maintenance Conference will be held in Toronto at the Delta Hotel on Dixon Road on November 2-3, 2022. For details and registration see our website.

Something new this year is a special two-day "Fatigue Risk Management" course November 1-2 for managers and safety stakeholders. This course, along with other seminars planned for the conference, address the demand for more training within the "soft skills." And, the very popular Skills Competition will return with several new challenges. This event allows teams of students and veteran AMEs to show their abilities in problem solving, knowledge and manual dexterity to complete a series of tasks in aircraft maintenance. — **Stephen Farnworth**



# Quebec AME Association

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



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We are delighted that you will continue to support us in our efforts to make our careers stronger and better recognized, while building cohesion between Aircraft Maintenance Engineers from Quebec and the rest of Canada.

## 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. Our association offers many benefits to its members such as group discounts from various vendors, free magazine subscriptions, and discounts for AME's insurance.

[www.ame-tea.com](http://www.ame-tea.com) / e-mail: [info@ame-tea.com](mailto:info@ame-tea.com)

## Qui sommes-nous ?

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.

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 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.

[www.ame-tea.com](http://www.ame-tea.com) / e-mail: [info@ame-tea.com](mailto:info@ame-tea.com)



# Atlantic AME Association



## Objectives / By-laws

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.

### AME ASSOCIATION (ATLANTIC) INC BY-LAWS:

- 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.

### BY-LAWS

1. Membership privileges are available to all members in good standing with dues paid to date. Lapsed membership may be re-instated with the payment of annual dues.

2. The Association President shall call Executive meetings as are deemed necessary. Normal notice of meetings shall be thirty days. Emergency meetings will be called as required. 3. Executive decisions can only be made with a quorum of 50% of the directors + one. Either the President or Vice-President must be included as one of the directors.
4. An annual meeting of the general membership will be held to normally coincide with the ARAMC.
5. All committee Chairpersons will report to the general membership at the Annual General Meeting.
6. An election of executive officers will be held annually at the general meeting. In the event that an elected committee chairperson resigns, for whatever reason prior to the expiry of his/her term, the President shall appoint another elected director to fill the position for the remainder of the resignee's term.
7. The Executive committee will be composed of a maximum of ten (10) and a minimum of six (6) directors who will manage the affairs of the Association.
8. Half of the executive will be elected at each AGM. All nominations must be accompanied with one signature of a member in good standing. Elections will follow the nominations. Nomination Forms must have the nominee's signature of acceptance of the nomination or the acceptance can be verified by phone call or e mail from the nominee.
9. If a serving member of the executive is nominated to another position on the executive, he/she shall tender their resignation upon accepting the nomination.
10. Elections will be by secret ballot.
11. Members serving on the Executive should be prepared to offer their service for two years and attend executive and other meetings as required.
12. The president will not be a voting member, with the exception of a tie-breaking vote. 13. An agenda will be required for the AGM for discussion and action on items proposed during the year, and will be mailed thirty days in advance.
14. Membership fees (regular, student and corporate) will be established on an annual basis by the members at the AGM.
15. Any amendments to the AME Association Objectives or By-Laws will be approved by the general membership at the AGM.

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

# SoCal PAMA Chapter



## Flight Safety Detectives: Episode 222

Covering the "sister" accident to the flight crash discussed in Episode 122, John, Greg and Todd focus on the role played by manufacturers in aviation safety and maintenance. The NTSB findings place the blame for the 1995 crash squarely with the propeller manufacturer and FAA oversight.

Nine of 29 people aboard the Embraer EMB-120RT were killed in the crash of Atlantic Southeast Airlines Flight 529. In-flight loss of the propeller blade led to the collision. "This crash is the result of the failure of the process, training and management of the manufacturer's maintenance and repair facility," John summarizes.



The accident was the first investigation John was onsite for as a NTSB board member. One of the first items he noticed at the crash scene was the propeller crack that was ultimately determined to be the cause.

Greg adds details on findings that are also important to improving aviation safety: better communication between cockpit and cabin, and improvements in the design of the cockpit crash ax.

The episode concludes with an updated report from Todd's return to flight. Hear what he found in a routine preflight inspection of a rental aircraft that led him to file a Freedom of Information Act request with the FAA.

#### FAA Issues Guidance for Aircraft Health Programs

The FAA has issued policy notice 8900.1 and Advisory Circular (AC) 43.218 that together provide guidance for fractional and commercial operators to obtain authorization to use digitally integrated aircraft health management (IAHM) programs to meet maintenance requirements. Comprehensive IAHM is an end-to-end concept that encompasses aircraft systems, data transmission, and data analysis/implementa-

tion, often on ground-based equipment, to provide information regarding aircraft system performance and structural conditions.

To enable IAHM approval, the FAA's aircraft maintenance division has developed operations specifications for letters of authorization and letters of deviation authority (LODA) that apply to Part 91K, 121, 125, 135, and combined 121/135 operators and LODA holders requesting authorization to use an IAHM program.

The policy notice contains examples of templates providing each operator segment with the information that must be provided to the FAA to obtain approvals. A key provision to use an IAHM is that the "certificate holder has incorporated policies and procedures into its maintenance programs to use IAHM for airworthiness decisions and for adjusting its maintenance or inspection program's interval or scope."

The AC describes an acceptable means to comply with IAHM requirements. However, the FAA cautions that if these means are used "to show compliance, you should follow it in all important respects." This guidance also applies to MRO organizations, the agency said.

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

## Central Ohio PAMA



#### Flight Safety Detectives: Air crash not an accident

Some air crashes are not really accidents. Todd and John characterize the focus of this episode of Flight Safety Detectives, an event where a perfectly good airplane was destroyed.

"Some pilots have more money than brains, and this seems to be a case of that," John says.

The 2021 air crash event involved a Cessna Citation flown by a single pilot. Although the pilot had experience in aviation, he had been denied a type rating for the plane and single pilot authorization by an Arizona flight school.

This fateful flight started in the Portland area. Before takeoff, the pilot was not fully responsive to air traffic control. That issue continued as the flight progressed to the Mount Hood area.

"Something was amiss and it wasn't the aircraft," Todd notes.

The flight ended with an extended spiral into the ground.

Also in this episode is advice related to restricted air space rules and risks and the need for student pilots to secure renter's insurance.

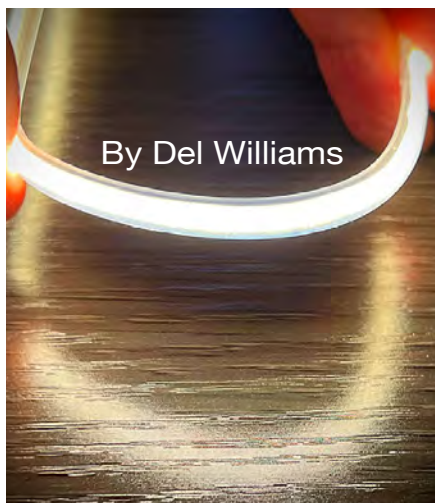
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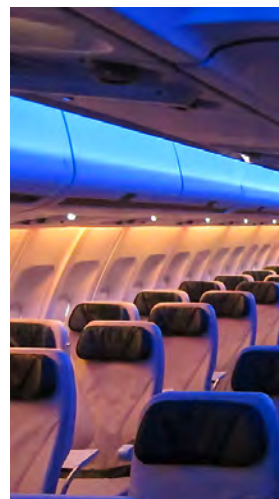
# EXPEDITED INSTALLATION

*Cut-to-fit LED lights and how they can be installed in hours onsite.*



**IN** THE AVIATION INDUSTRY, MROs are using flexible “cut-to-fit” strip LEDs to dramatically speed wash and accent lighting upgrades, while reducing cost and increasing profit margins. The approach is helping to efficiently modernize aircraft cabins during routine maintenance without costly delays due to manufacturing lead times and logistical backlogs.

With the increasing utilization of LED lights for aircraft cabin lighting, MROs are receiving a much higher volume of requests to upgrade fluorescent lighting and flood incandescent fixtures to LED. However, not all lighting implementations are created equal.





There are substantial differences not only in the quality, design, and performance but also in the speed of implementation. This is particularly the case when replacing legacy fluorescent lighting.

Often a fluorescent wash lighting system is comprised of many different-sized tubes at specific lengths, located throughout the aircraft. In many cases, after the MRO provides the manufacturer with the exact specifications, significant lead time is required to produce the tube lighting to length and spec, so time to receipt could take more than 20 weeks, according to Alex Yoon, Principal Engineer at DPI Labs, Inc., a global provider of Cabin Management Systems for VIP aircraft based in La Verne, California. The company also provides entertainment solutions for all types of aircraft including High Definition In Flight Entertainment Systems, OLED flat panel



**Left: LED fixtures can be fitted with continuous or step dimming capability.**  
**Bottom left: DPI's LED fixtures can be installed into existing fluorescent fixtures using the same wiring and connectors.**

**Top right: LED light strips can be installed in hours onsite.**

**Bottom: LEDs dim with no loss of colour fidelity.**

**Bottom right: Flexible LED strip lighting is useful for new installations, particularly if there are any custom cabin features.**

displays, Blu-Ray DVD systems, and Digital Audio systems.

“Today, it is much more efficient to use PMA and STC certified rolls of LED strip lights that can be measured, cut-to-fit, and terminated on site, if not in the airplane. This eliminates a tremendous amount of costly lead time and extra work,” says Yoon. He notes that with this technique MROs can now replace any length of fluorescent tube with one part number for the roll, accommodate any size of custom cabinetry, and even eliminate gaps that had existed between tubing.

An expedited approach enables light-

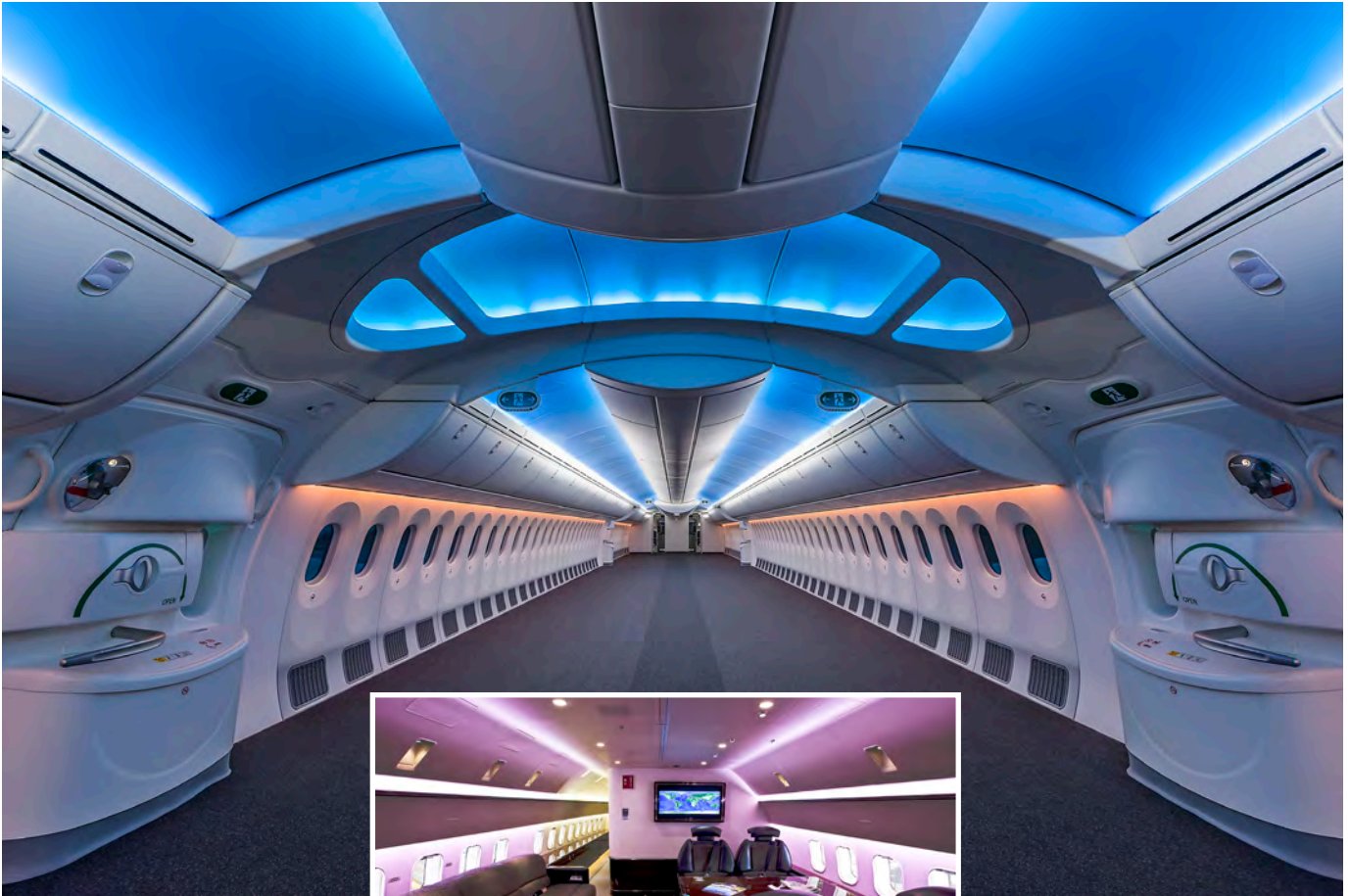
ing upgrades to be cost-effectively and easily installed whenever the aircraft is in a facility for maintenance. With the faster installation, significant savings in materials and labor are available for many lighting upgrades. These savings can accrue to the MRO's bottom line or be passed along to the customer.

#### **Expediting upgrades**

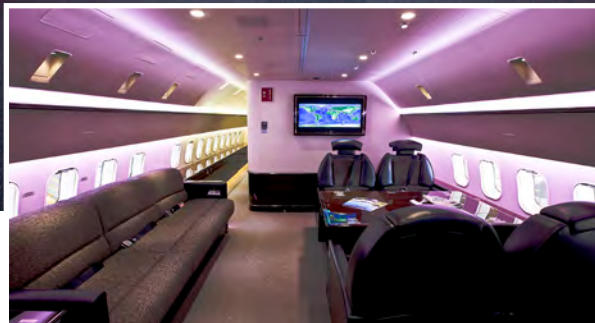
Many lighting retrofits involve replacing sections of fluorescent lighting because the tubes tend to burn out and the ballasts are hot and power hungry. In contrast, quality LEDs can last for the life of the aircraft. LEDs can not only reduce







**Above: Cut to fit strip LEDs speed up lighting upgrades.**



**Left: Now, continuous lighting can be provided in virtually any length.**

power consumption tremendously and last 50,000 hours but also weigh less and improve lighting quality compared to conventional choices. The luminous efficiency of white LEDs can reach 130 lumens per watt versus 12 to 18 lumens per watt for typical incandescent lamps and 16 to 24 for halogens.

Today when it comes to installing LED wash lighting, the most productive and economical approach is utilizing strips that can be cut-to-fit.

“The integrator can cut the flexible LED strip from the roll to fit the specific lengths required, which accommodates variations within different aircraft or cabins. The lighting can be cut and installed onsite so does not need to be special ordered with lengthy lead times, which makes it much more cost effective than conventional rigid fixtures,” says Yoon, whose company has more than 40 years of experience in the aviation industry.

As an example, the SmartLight Flex-

ible LED Wash Lighting by DPI Labs can be installed by MROs in a matter of hours, not days. Conventional aluminum strip LED lighting systems need to be manufactured to custom lengths, which extends lead times.

The accelerated approach streamlines installation. The LED fixtures can be installed into existing fluorescent fixtures using the same wiring and connectors. This eliminates the need for modifications. “You remove the old fluorescent tube and ballast, then install the dimmer module. Instead of one ballast per light, you can utilize up to 24 feet of strip LED lighting with a single dimmer module,” says Yoon.

The strip LEDs provide a wide range of colour options including white, full colour RGB or RGBW (where white could be fixed or adjustable between warm, neutral, and cool) as well as individual colours like red, green, blue, and amber. The system’s dimmer unit is compatible

with a wide variety of lights and can be adapted into most existing installations.

Freeing MROs from the inherent limitations of fluorescent tubes and ballasts also opens new design possibilities for interior lighting. Now, continuous lighting can be provided in virtually any length, and in various configurations, including where previously there were gaps between fluorescent tubes. The flexible LED strip lighting is useful for new installations, particularly if there are any custom cabin features. When cabinet measurements vary or are a little off, adjustments or accommodations can be quickly and easily made onsite.

Currently available on the market is a wide variety of purposely designed LED fixtures for the entire cabin. Examples include reading, dome, overhead, aisle, emergency, and mood lighting as well as lighting for the flight deck.

Another benefit of switching from conventional lighting to flexible strip



LEDs is that they provide Hollywood studio-grade, flicker-free illumination. In contrast, fluorescent tubes are known for flickering, and even previous generations of LEDs flicker rapidly when dimming.

“Airborne aircraft cabins can induce subtle flickering that causes eyestrain and tends to result in a disorienting, stroboscopic effect,” says Yoon.

He notes that LED fixtures can be fitted with continuous or step dimming capability down to zero percent with a simple wiring change (adding a dimming control interface). The LEDs dim with no loss of colour fidelity and no colour temperature shifting (yellowing). These dimming features enhance cabin interior aesthetics and passenger comfort.

Beyond flexible, cut-to-fit strip lighting, other types of LED lights, notably dome and reading fixtures, offer some intriguing options as well.

Yoon explains, “When design flexibility is important, some dome and reading fixtures can be installed from the front. This is helpful on large aircraft and even on smaller planes with a headliner, where typically removing the headliner can only be done by removing the galley.”

In addition, some reading and dome lights are also certified to function as emergency lights since the units are designed with emergency circuits as well. This can present an opportunity to eliminate some existing emergency lighting equipment.

Outfitting aircraft with the best in cabin lighting used to be problematic, when ordering essentially custom conventional parts resulted in lengthy manufacturing lead times, logistical delays, and cost overruns.

The availability of advanced cut-to-fit strip LED systems that can be installed in hours onsite using PMA and STC certified stock changes the equation. MROs that take advantage of this cost-effective alternative can now upgrade lighting for their customers during routine maintenance while profiting for the effort. ■

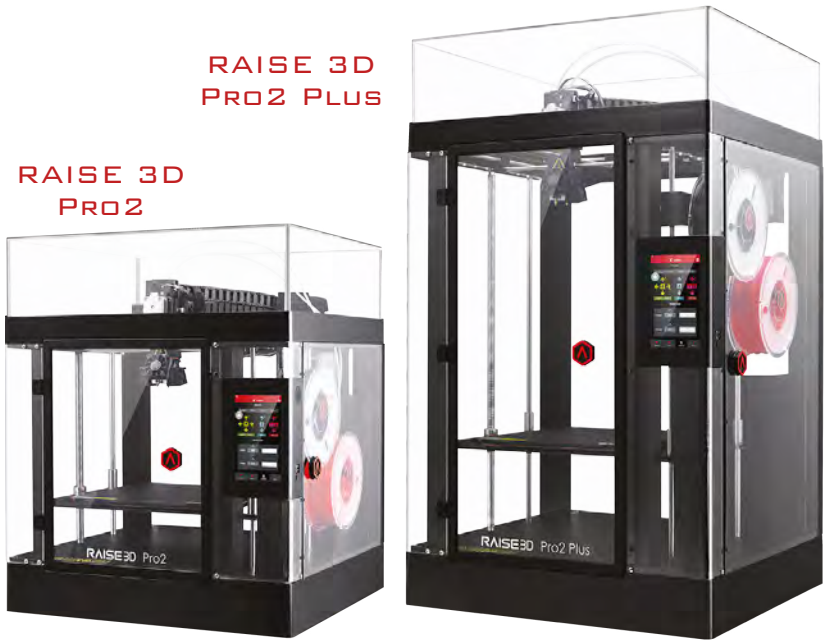
*(Del Williams is a technical writer based in Torrance, California.)*

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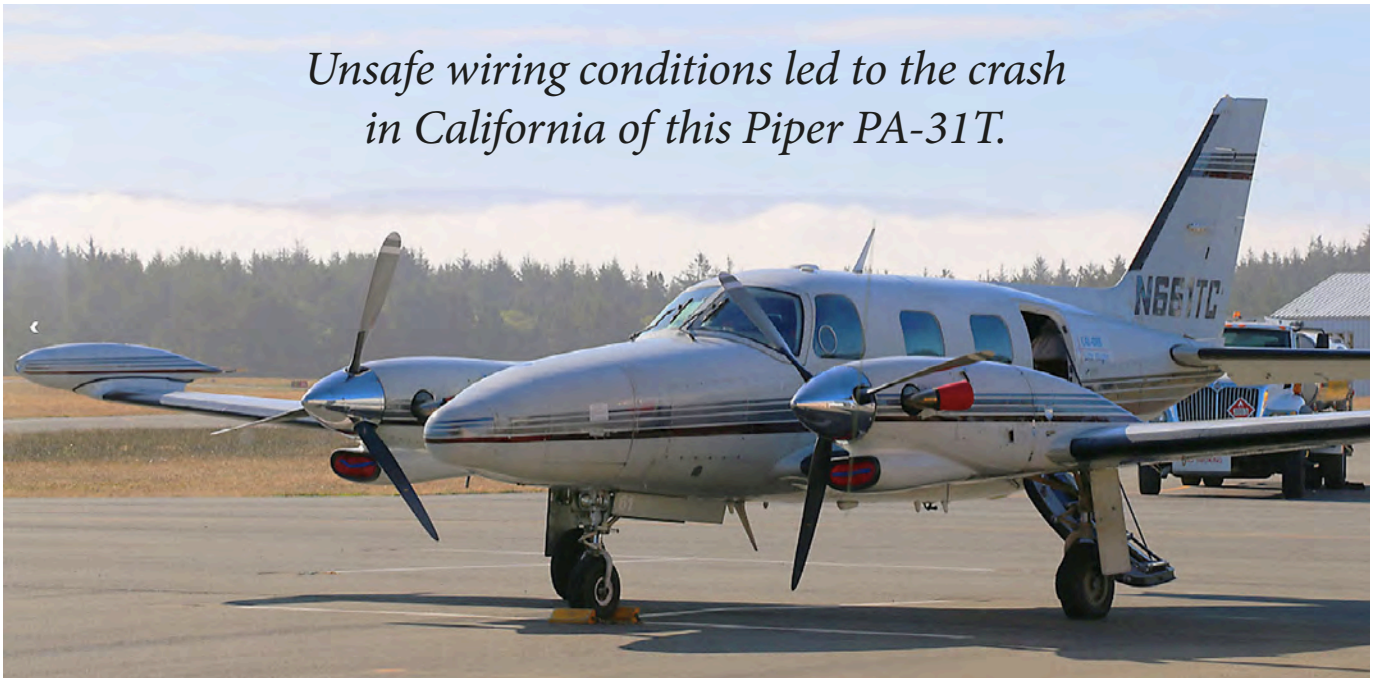
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## *Problems in the Panels*

*Unsafe wiring conditions led to the crash in California of this Piper PA-31T.*



### BACKGROUND AND ANALYSIS

ON JULY 29, 2016, about 12:58 am Pacific daylight time, the pilot of a Piper PA-31T airplane, N661TC, reported the smell of smoke in the cockpit to air traffic control (ATC) and indicated that he wanted to return to the departure airport in Crescent City, California. ATC provided the clearance for the flight. About one minute later, the pilot reported that he had smoke in the cockpit and declared an emergency. There were no further communications from the pilot.

According to the flight's primary radar returns, the airplane continued to fly for about three minutes before breaking up in flight. The wreckage was found in tree-covered terrain near Arcata/Eureka Airport, McKinleyville, California. The airplane was being operated by Cal-Ore Life Flight as an air transport medical flight under the provisions of 14 Code of Federal Regulations Part 135. The airline transport pilot, two medical personnel, and one patient died.

### AIRCRAFT INFORMATION

The airplane was manufactured in 1981 and was equipped with retractable landing gear, two Pratt and Whitney PT6A-135A engines, and controllable pitch propellers. It was also equipped with a handheld fire extinguisher, smoke goggles,

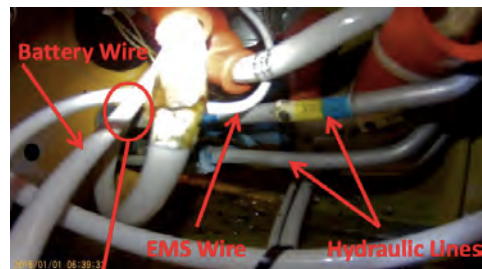
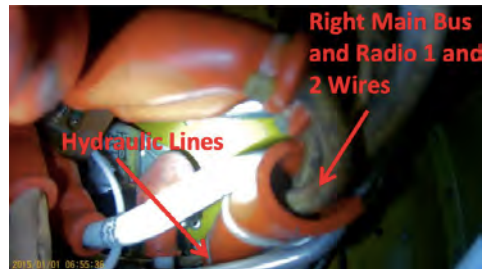
**Above: Incident Aircraft Piper PA-31T airplane, N661TC. Opposite page: Fuselage caught within trees at accident site. Top right: Three photographs showing contact between wires and hydraulic lines in exemplar Piper PA-31T-series airplanes. Bottom right: Remains of the right engine and propeller, and far right of that photo, the right outboard wing section.**

and a LifePort stretcher system that had been installed in conformance with LifePort supplemental type certificate No. SA00528SE. The modification required additional power requirements, which are discussed below.

The operator maintained the airplane in accordance with Piper Progressive Inspections on a 100-hour cycle per Piper document 761-664, dated October 27, 1994. The most recent inspection was completed on July 14, 2016, when the airplane had accumulated 7,286.6 hours total time in service.

At the time of the accident, the airframe had accumulated 7,309 hours total time in service. Both the left (S/N PZ0641) and right (S/N PZ0642) engines had accumulated 3,712 hours since new. Both the left (S/N 27825) and right (S/N 27829) propeller assemblies had accumulated 1,662 hours since overhaul.





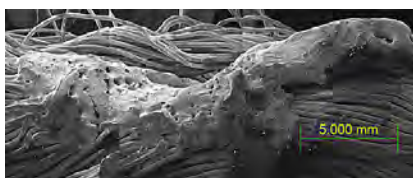
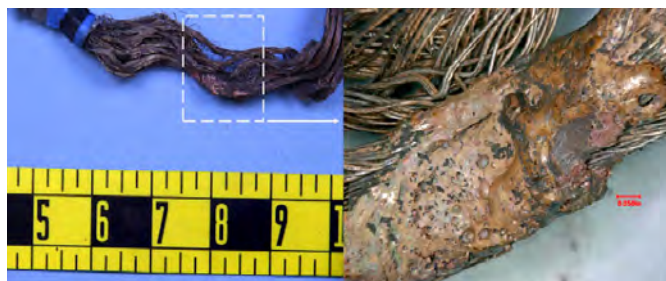
**Basic event details:**

<b>Accident Number:</b>	WPR16FA153
<b>Operator/Flight Number:</b>	Cal-Ore Life Flight
<b>Aircraft and Registration:</b>	Piper PA-31T, N661TC
<b>Location:</b>	McKinleyville, CA
<b>Date:</b>	July 29, 2016
<b>Adopted:</b>	January 5, 2017





Google Earth Debris Field.



**Top:** The wire identified as P3H contained both terminal ends. The entire wire section was missing insulation.

**Close-Up:** The wire identified as L Main 2 was trapped inside a section of aircraft structure. A portion of the circuit breaker remained attached to the wire. About 11 inches of wire insulation were missing from the fractured end of the wire.

## ELECTRICAL SYSTEM

The Piper PA-31T is equipped with a 28-volt direct current electrical system powered by a battery and two starter generators. External power provisions are available for ground operational requirements. The typical power distribution system

is of split-bus design with individual circuit protection and separate pilot-accessible bus-tie circuit breakers that includes diode protection and provides operational flexibility during single-engine or single-generator operation. The main bus tie circuit breakers are located on a panel in the floor between the pilot and copilot seats. The cockpit floor separates the pressurized area (cabin) and the unpressurized area (below the circuit breaker panel).

The airplane's panel contained, at the time of delivery, twelve circuit breakers (C/Bs) in two rows of six with current ratings ranging from 50 amps (A) to 200 A. The LifePort modification required the addition of two circuit breakers to the main bus tie panel with ratings of 30 A and 50 A. Based on a review of the airplane wreckage and discussions with the owner, the 50 A C/B "EMS INV" was located next to the "Right Generator" C/B on the first row, and the 30 A C/B "EMS PWR" was located next to the "R Main 2" C/B on the second row.

In the structural bay, below the floor where the main bus tie panel was located, additional wiring and components for the left and right starter solenoids were mounted.

## HYDRAULIC SYSTEM

The Piper PA-31T is equipped with two hydraulic systems: one for the retractable landing gear and landing gear doors and one for the airplane's braking system. The nominal landing gear system operating pressure is 1900 pounds per square



inch, and the landing gear system remains pressurized during gear extension and retraction operations. The hydraulic fluid used in the hydraulic system is MIL-H-5606.

A hand pump, located in the cockpit floor just forward of the circuit breaker panel, is installed to serve as an emergency pump in the event of a failure of the engine-driven pumps. The pump is accessed by a door in the cockpit floor, and the handle can be extended to allow pump operation. The pump handle, when in the stowed position, is partially located in the structural bay that contains the electrical circuit breakers.

Four hydraulic lines for the main landing gear travel from the hydraulic reservoir, along the fuselage below the floor, through the main spar, and then to the left and right main landing gear actuators and door actuators. A production break of the hydraulic line sections is located below the circuit breaker panel, where each of the lines are joined using AN-type union fittings. Aft of the main spar, the lines connect to AN-type T-fittings and proceed to the main landing gear bays in the left and right wings.

Examination of the wreckage found evidence of thermal damage near the main electrical bus circuit breaker panel. This enclosed space also includes hydraulic lines that run directly below the panel. Examination of the wiring in this area showed evidence of electrical arcing damage, and sections of the adjacent hydraulic lines were consumed by in-flight fire. The NTSB's investigation evidence indicates that the in-flight fire occurred in the area where these electrical wires and adjacent hydraulic lines may have been in contact.

## WRECKAGE AND IMPACT INFORMATION

The accident site was located in an area of brush and heavily forested terrain. Portions of the burned and fragmented wreckage were scattered along a debris path oriented along a magnetic heading of 354° that measured about 2,400 ft in length. The first identifiable pieces of wreckage were a horizontal stabilizer

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**The left inboard wing section (above) at the accident site near McKinleyville, California (far right).**

tip, the nose baggage door, and the vertical stabilizer. The right engine and both wings separated and were near the middle of the debris field. The fuselage followed by the left engine were the last major pieces of debris. There was no evidence of significant postcrash/ground fire to the wreckage except for the inboard sections of both wings, which sustained severe postcrash fire damage.

A section of the forward fuselage, wiring and associated components were removed and sent to the NTSB's Materials Laboratory in Washington, DC, for further examination.

On November 2 and 3, 2016, the wreckage was reexamined at the facilities of Plain Parts Enterprises. A localized area of thermal damage to a section of wiring was located in a large wire bundle that ran through the centre tunnel in the floor of the cockpit. All the insulation was either melted, thermally discoloured, or missing. One large gauge wire end was found to have beading, welding and melting on one end. All other wire bundles located in this area were intact and sustained minimal thermal damage.

The main bus tie circuit breakers in the panel on the floor between the pilot and copilot's seats were partially missing. The remaining breakers were heavily sooted on their aft ends, and one breaker was thermally discoloured. There were areas of charring on the backside of the panel. A majority of the wiring in the area directly around the circuit breakers and in the structural bay containing the circuit breaker panel was either melted, thermally discoloured, or missing.

The four hydraulic lines servicing the landing gear system were located in this area. All the lines exhibited signs of thermal exposure with melting and missing sections of material.

The main bus tie circuit breaker panel, landing gear hydraulic lines, fuel crossfeed lines, and the high voltage wir-

ing that connected to the circuit breaker panel were removed from the airplane and sent to the Materials Laboratory for further examination.

Advisory Circular (AC) 43.13-1B, "Acceptable Methods, Techniques, and Practices— Aircraft Inspection and Repair," advises against wires and fluid lines being in contact due to the risk of chafing, which can lead to thermal stress and arcing in an area where flammable liquids are routed. AC 43.13-1B section 11-126 indicates that "An arcing fault between an electrical wire and a metallic flammable fluid line may puncture the line and result in a fire. Every effort must be made to avoid this hazard by physical separation of the wire from lines and equipment containing oxygen, fuel, hydraulic fluid, or alcohol." This guidance material specifies a minimum 1/2-inch clearance between the wires and the fluid-carrying lines.

During this investigation, the NTSB and the FAA examined the same area in six exemplar Piper model PA-31T-series airplanes and found instances on all six exemplar aircraft of unsafe conditions in which electrical lines and hydraulic lines were in direct contact. The NTSB examined two airplanes and the FAA examined four airplanes as of December 20, 2016.

Some of the wires in the exemplar aircraft showed chafing between the hydraulic line and the electrical wires, which, if left uncorrected, could have led to electrical arcing and subsequent fire.

The NTSB notes that, currently, about 317 Piper PA-31T-series airplanes are registered with the FAA. During annual inspections, the area below the circuit breaker panel is only accessible through a panel in the belly of the airplane. The number of electrical wires and hydraulic lines that are routed through the area further obscure an already confined space where visual sight lines are limited. Current maintenance pro-





allowing contact between electrical wires and hydraulic fluid lines to persist undetected.

On December 16, 2016, the FAA issued Special Airworthiness Information Bulletin (SAIB) CE-17-05 to alert owners and operators of these airplanes about this safety issue. The SAIB recommends that the condition of all wiring in the floor-mounted circuit breaker panel be inspected at the next scheduled maintenance visit using “a mirror, a suitable light source or other equipment (small cameras, borescopes, magnification, etc.) capable of providing equal or better resolution.” It also recommends that owners and operators repair or replace any damaged wires and ensure that proper clearance between wires and hydraulic lines is maintained.

cedures in AC 43.13-1B only specify a general visual inspection of the area to check “electrical wiring for security.”

The difficulty of detecting this unsafe condition through visual means alone likely explains why it was not previously identified on all six of the exemplar airplanes examined during our investigation using a borescope and camera. We were concerned that current maintenance procedures did not provide adequate guidance for inspection in these areas, thereby

The NTSB believes that the issuance of the SAIB was a good first step in alerting owners of this safety issue but that more urgent, mandatory action is needed to prevent future accidents. Given that this unsafe condition was observed on all six exemplar airplanes that were examined during this investigation, we were concerned about the potential for additional fires to occur, leading to similar accidents.

The NTSB recently completed the investigation of an April 12, 2015, accident involving a Piper PA-31T1 in which the

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pilot and three passengers died. Before a collision with terrain on final approach, the pilot reported smoke in the cockpit to ATC. The NTSB determined the probable cause to be “a rapid onset of smoke and/or fire in flight for reasons that could not be determined due to the post-impact fire and the condition of the wreckage.”

Additional information about this accident, NTSB case number ERA15FA181, can be accessed at the NTSB’s Aviation Information Resources web page, [www.nts.gov/air](http://www.nts.gov/air).

The SAIB contains clear guidance that we believe owners and operators of these airplanes should be required to follow as soon as possible. The NTSB concludes that an unsafe condition exists that requires owners and operators of Piper PA-31T-series airplanes to immediately take action to identify and repair (or replace) damaged wires in the floor below the main circuit breaker panel and to ensure proper clearance between wires and hydraulic lines. Therefore, the NTSB recommends that the FAA issue an emergency airworthiness directive (AD) that requires owners and operators of Piper PA-31T-series airplanes to take the actions recommended in SAIB CE-17-05 immediately after the AD is issued.

## RECOMMENDATIONS

On December 16, 2016, the FAA issued a Special Airworthiness Bulletin (SAIB), CE-17-05, concerning wiring on Piper aircraft including the PA-31T series. The SAIB provided information on wiring conditions in the area below the floor mounted circuit breaker panels that could lead to chafing, thermal stress, or arcing. The SAIB recommended best practices for securing high electrical current wires in the aircraft.

On January 6, 2017, Piper Aircraft, Inc., issued Service Bulletin (SB) 1301. The SB described procedures for visually inspecting the area below the main circuit breaker panel and rerouting and replacing wires and/or parts as necessary.

Based on the SAIB, the SB, and preliminary results from this investigation, on January 10, 2017 the NTSB issued Urgent Safety Recommendation A-17-001 concerning unsafe wiring conditions that may lead to arcing and cause fires on Piper PA-31T series airplanes to the FAA.

The urgent recommendation requested that the FAA: Issue an emergency airworthiness directive (AD) that requires owners and operators of Piper PA-31T-series airplanes to take the actions recommended in Special Airworthiness Information Bulletin CE-17-05 immediately after the AD is issued.

On February 7, 2017, the FAA issued AD 2017-02-06, requiring repetitive detailed visual inspection of the wiring below the floor mounted circuit breaker panels per the Piper SB 1301. The AD’s effective date was February 22, 2017, and the AD required the initial inspection to be accomplished within 30 days after the effective date and then at repetitive intervals not to exceed 12 months. ■

*(This report was written by the National Transportation Safety Board, adopted January 5, 2017 and reissued on April 13, 2017, with corrections to page four.)*



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# Dear Prime Minister

*The Canadian Business Aviation Association has penned the following letter to the prime minister's office expressing the industry's frustration with the federal government's proposed Luxury Tax, due to come into effect in September.*



**P**LEASE ACCEPT THIS LETTER as a follow-up to the serious concerns that have been raised by Canada's aerospace, aviation and manufacturing industries regarding the Select Luxury Items Tax Act and the dramatic, negative impact on Canadian manufacturing and jobs that will be experienced should the Act be implemented as currently drafted.

We recognize that you and your colleagues are faced with many challenging fiscal pressures. However, the proposed Select Luxury Items Tax Act will penalize manufacturers, operators, distributors, pilots and suppliers, and negatively impact jobs. It will also cause significant repercussions within the supply chain, maintenance, repair and overhaul industries, and the entire aviation ecosystem at a time when they are just beginning to recover from the devastating effects of the COVID-19 pandemic.

We estimate almost \$1 billion in lost revenue and losses of over 1,000 direct value-added Canadian jobs in manufacturing due to this legislation. This on top of the over 30,000 jobs lost through the pandemic.

The proposed tax and its threshold for exemptions will also be a major deterrent to private aircraft operators who want to convert to newer aircraft with lower operating costs and carbon footprints. As a direct result, there will be fewer private aircraft being purchased, which will translate into reducing activity that is critical for the operation of community

aerodromes that benefits economic growth in small communities. The trickle-down effect of the implementation of this proposed luxury tax on private aircraft will have long-term detrimental effects on the average working-class Canadian family.

Canadian firms should not be at a disadvantage relative to international competitors. Lessons can be learned from other countries that introduced such a tax, only to ultimately repeal it due to the significant damage it caused to their domestic manufacturing sectors.

If the government proceeds, the current legislation will need substantial modifications. Methods already exist to tax personal usage of aircraft and using these would be much less detrimental to the workers that make up this innovative industry in a large country like Canada that is reliant on aircraft for transport. Additionally, the aerospace industry is a national strength that provides jobs and can support green innovation.

If this tax moves ahead, Canada will be sending the wrong message. In addition to undercutting aerospace manufacturing activities and employment, the tax will jeopardize Canada's attractiveness for business investment from abroad. All policy levers should be pulled in the same direction to support our nation's economic and job recovery. We stand ready to work with government to achieve this. ■



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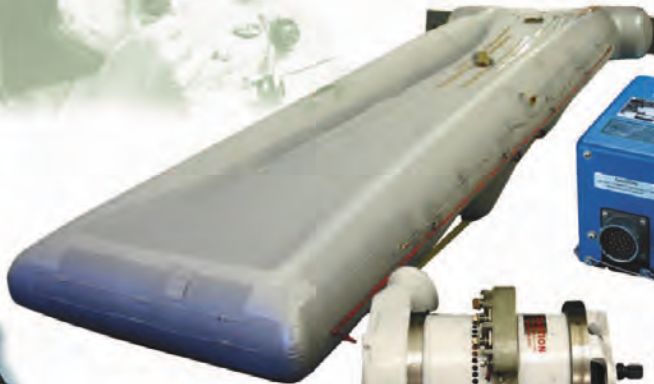


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