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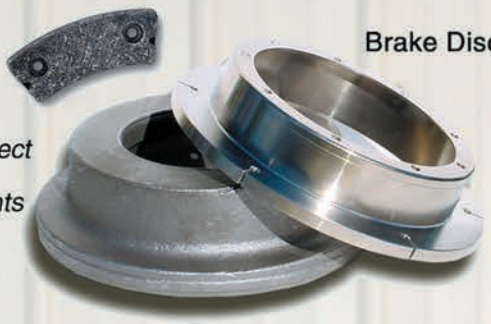

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Changing Times

The very word "lighthouse" evokes images of tall white towers with all-seeing beacons that are symbolic of maritime life. But technology has dramatically evolved and even eliminated the traditional role of the lighthouse keeper. And there is a parallel to be seen in the aviation industry.

If the iconic lighthouses serve as symbols, so do air traffic control towers, staffed by calm, cool, level-headed folks with headphones and a complex array of communication systems before them. Like lighthouses, these command towers are now changing with technology. This issue, in "Avionics Explained," Gordon Walker discusses NextGen avionics and its impact on the traditional working life of air traffic controllers, who may no longer even be in the same vicinity as the airport they are controlling. Again, not everyone is pleased with changing times. "Pilots are typically horrified to hear that the controller handling their flight may actually be located hundreds or thousands of miles away from their location, and totally unfamiliar with the airport and surrounding terrain which they are controlling," writes Mr. Walker in a fascinating look at how digitized data is completely reshaping the conventions and working relationships between pilots and their control towers, and ultimately creating safer skies.

We're all nearly adults now, right? We know better than to run with scissors, or "pull the mask on the old Lone Ranger" (thanks, Jim Croce). So it came as quite a surprise to some of us here at AMU when Sue Yost advised us in this issue's Human Factors article that the best place to leave winter boots is outdoors. Huh? "If your boots are cold, your cold feet stay drier, thus staying warmer for longer," says Ms. Yost.

Also in this issue, Mike Broderick concludes his three-part discussion of helicopter tail rotors with a look at two very different companies and their anti-torque solutions; Norm Chalmers reports on the legal sandbagging of a west coast private pilot; Stuart McCauley guides us through an engine removal process; and on its 50th anniversary Sam Longo looks back fondly at the beloved turboprop.

— John Campbell
Editor

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Upcoming Events

CANADA

Fort McMurray Air Show
May 31 – June 1, 2014
Fort McMurray, AB
www.airshowfortmac.com

Hamilton International Airshow
June 13 – 15 2014
Hamilton International Airport
Hamilton, ON; flyhamilton.ca

UNITED STATES

Heli-Expo 2014
February 24 – 27, 2014
Anaheim, CA; www.rotor.com/heliexpo

2014 International Women in Aviation Conference
March 6 – 8, 2014
Orlando, FL
www.wai.org/14conference

NBAA Schedulers & Dispatchers Conference
January 14 – 17, 2014
New Orleans, LA
http://www.nbaa.org/events

Business Aircraft Finance, Registration & Legal Conference
February 5 – 7, 2014
St. Pete Beach, FL
http://www.nbaa.org/events

Great Lakes Aviation Expo and Conference
February 14 – 15, 2014
Lansing Center
Lansing, MI
GreatLakesAviationConference.com

Sun 'n' Fun International Fly- In and Expo
April 1 – 6, 2014
Lakeland, FL
www.sun-n-fun.org

Mariposa Air Fair and Family Adventure Day
April 26, 2014
Mariposa-Yosemite Airport
Mariposa, CA
http://mariposaairfair.com

Virginia Regional Festival of Flight
May 31 – June 1, 2014
Suffolk Executive Airport
Richmond, VA; www.virginiaflyin.org

National Biplane Fly In
June 5 – 8, 2014
Freeman Field
Junction City, KS
www.nationalbiplaneflyin.com

Fly Iowa 2014
June 28 – 29, 2014
Iowa City Municipal Airport
Iowa City, IA; http://flyiowa.org

INTERNATIONAL

Bahrain International Airshow
January 16 – 18, 2014
Sakhir Air Base
Manama, Bahrain
www.royalbahrainairshow.com

AVM Summit Europe
January 21 – 22, 2014
London, UK
www.avm-summit.com/europe

49th Farnborough International Airshow
July 14 – 20, 2014
Hampshire, England
www.farnborough.com

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STCs & new products

New engine cleansing system for Pratt & Whitney PT6 engines

EcoServices and Vector-Hawk Aerospace have introduced a new version of the Eco-Power engine cleansing system. This system has been developed for commercial and military PT6 turboprop engine-powered aircraft. It uses only deionized, heated, atomized water for maximum cleaning efficiency. The patented EcoPower atomizing nozzles are said to ensure maximum penetration of the water throughout the engine. The system is designed for fast, repeatable, tool-free setup without risk of foreign object damage. It captures and purifies the water for re-use, eliminating ground contamination and conserving fresh water.

For more information visit www.ecopowerenginewash.com

Soloy finds solution to engine torque indicator failures

Soloy Aviation Solutions is now including a complete torque indication system to remedy the high rate of failure of a torque pressure transducer included in its AS350BA and AS350B2 Honeywell conversion kits. This kit, which includes both a transducer as well as a torque indicator gauge, is proprietary to Soloy but is created from parts engineered and manufactured in the United States. It will now be included as standard in all future Soloy engine conversion kits.

For more information visit www.soloy.com

Kimberly-Clark rolls out new line of certified wipes

Kimberly-Clark Professional has introduced a new line of aviation-certified wiping solutions that meet the requirements of Aerospace and Boeing Material specifications.

Kimtech Wipes for aviation are specifically engineered to perform in all areas of Original Equipment Manufacturing and Maintenance Repair Operations, including paint surface prep, engine maintenance and general-purpose cleaning. They are reportedly designed to deliver superior cleaning, improve operational efficiencies, reduce turn-around time, and maximize productivity while meeting the precision standards and requirements of the aviation industry.

For more information visit www.kcprofessional.com

Highway-towable mobile fall protection from Fall Protection Systems

Fall Protection Systems' Lifline Grabber is said to be the only mobile fall protection unit on the market today that can be towed on public roads at speeds up to 60 mph. It has 21-inch solid foam wheels and a torsion axle for independent suspension and a 10,000-lb. capacity towing system. The Grabber comes equipped with 7-ft. 6-in. extension masts that allow for the system's height to extend to 22 feet. Its total weight including counterweights is 2,700 pounds.

For more information visit www.fallprotectionsystems.com

Industry-first chemical-free windshield cleaner

New Clear Vision concentrated windshield wash solution from Kafko International provides an eco-friendly alternative to traditional wash fluids. Featuring unique plant-by-product chemistry, Clear Vision is believed to be the first windshield washer to be free of petrochemicals. The solution easily removes bugs, bird droppings, tree sap, traffic film and road grime and leaves glass crystal clear. Clear Vision is biodegradable, non-toxic, non-corrosive and contains no methanol and does not lower freeze point. This product is available in a five-gallon bucket and 55-gallon drum.

For more information visit www.oileater.com

Pocket Floodlight offers a big beam in tight places

Maxxeon's new WorkStar Pocket Floodlight is designed for tire technicians who need a lot of light but don't want to lug around a bulky work light or flashlight. The Floodlight features an LED that is said to produce over 140 lumens of light, several times more than competitive products. This technology means that the light produces over 10 times the amount of light produced by an incandescent light bulb using the same current. This new light is powered by three AAA batteries.

For more information visit www.maxxeon.com

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LANDMARK DECISION ON EMISSIONS REDUCTION

Aviation is a key enabler of global economic growth and social development. But, like all sectors of the economy, the aviation industry needs to contribute to reducing greenhouse gas emissions — although international aviation's current contribution is only around two per cent of global CO2 emissions. The industry recently recognized the need to stabilize its emissions when the Global Air Cargo Advisory Group (GACAG) said it supports the International Civil Aviation Organization (ICAO)'s decision to set an aggressive target for halving emissions by 2050, based on 2005 levels. The landmark decision was agreed upon at ICAO's 38th Assembly, held this past September in Montreal.

Chris Welsh, secretary general of the Global Shippers' Forum and chairman of the GACAG Sustainability Task Force, said, "GACAG is pleased to welcome a global approach to reducing carbon emissions from aviation. This will ensure that we prevent a patchwork of regional schemes which would have made carbon reduction complex and expensive. However, we must not underestimate the scale of the challenge for ICAO."

HARTZELL'S FIVE-BLADE PROP GETS FAA GREEN LIGHT

Hartzell Propeller Inc. has received type certificate approval from the Federal Aviation Administration and European Aviation Safety Agency for an advanced swept airfoil structural composite five-blade propeller for TBM 700/850 aircraft. The new design, specifically engineered for the single-engine TBM turboprop, is said to deliver faster takeoff acceleration, higher cruise speeds and better climb, along with less noise.

"The stronger structural composite construction of these advanced carbon fibre blades and their sophisticated aerodynamic design boosts the TBM's already-impressive performance to a higher level," said Hartzell president Joe Brown. "We just finished flying cross country from Ohio to the Pacific Northwest in our TBM 700 with the new five-blade prop, and the added quickness and speed is striking..."

Hartzell says that with its new propeller takeoff acceleration from zero to 90 knots is 10 per cent faster than with any other available propeller. The new prop also provides for a 100-feet-per-minute faster climb rate, two knots faster cruise than the current four-blade prop, and a full five knots faster than the five-blade wood-based propeller option. The new Hartzell five-blade prop is also significantly quieter in the cabin and in the pattern.

"Our TBM 700 with the new propeller will now climb comparable to our 850 model," said Hartzell corporate pilot Mike McCorkle. "Coming out of Coeur d'Alene, we went straight up to 27,000 feet in only 16 and a half minutes with

temperature eight degrees above standard. That's an average of nearly 1,500 feet per minute, and we shaved at least a couple minutes off of our normal time to climb."

HONDAJET PROGRAM DRAWS CLOSER TO FULL PRODUCTION

Honda used the opportunity of the NBAA 2013 Exhibition to announce that its ongoing HondaJet program is nearing production. Prototypes of the light jet have already flown more than 4,000 test points, with numerous missions conducted at sites across the US. In September, Honda Aircraft conducted cold weather testing at the McKinley Climatic Laboratory, the world's largest environmental testing chamber, located at Eglin Air Force Base in Florida. The company's fourth and fifth FAA-conforming HondaJets were subjected to extreme cold temperatures to test aircraft mechanical systems, engine starts, and electrical and avionics systems. The HondaJet program is currently undergoing FAA full-scale fatigue testing at Honda Aircraft Company's state-of-the-art R&D facility in Greensboro, North Carolina.

DELTA PLACES MULTI-BILLION DOLLAR ENGINE ORDER

Delta Air Lines has announced that it has placed more than $2 billion in orders for engines and maintenance from GE Aviation and its joint venture, CFM International.

The deals include GE's CF6-80E1 engines to power Delta's 10 recently ordered Airbus A330-300 aircraft, as well as a long-term agreement to service the engines. The deal is valued at up to $1.4 billion over the life of the agreement.

"Delta Air Lines will be the first North American CF6-80E1 engine operator and the launch customer of our newly enhanced engine," GE Aviation vice-president and general manager of Global Sales & Marketing Kevin McAllister said in a news release.

"The newly enhanced CF6-80E1 engine and 242-ton A330 aircraft combination will provide improved fuel efficiency, greater range and increased payload to help lower Delta Air Lines' cost of ownership."

HELICOPTER OPERATORS PLAN JOINT SAFETY REVIEW

Offshore helicopter operators Avincis Group, Bristow Group and Vancouver, BC-based CHC Helicopter have launched a safety review that will help them share best practices. The three companies leading this effort will reach out to other helicopter operators to encourage them to join the review group.

The joint review of safety-related processes, procedures, training and equipment will identify best practices on the ground and in the air, combining the operators' collective experience. Experts in safety, training and flight operations from the three companies will participate in the review initially, with subsequent involvement to include their maintenance personnel and other key industry professionals.

Plans for collaboration by the operators will complement a just-announced review of North Sea helicopter operations by the UK Civil Aviation Authority (CAA)—in partnership with the Norway CAA and European Aviation Safety Agency (EASA)—and will be done in cooperation with the International Oil & Gas Producers Association (OGP). Findings from investigations by the UK Air Accidents Investigation Branch (AAIB) and others into past incidents will also be incorporated into the group's work.

HIGH-TECH "EYES" FOR HELICOPTER SKYCANNON

Simplex Aerospace has selected Astronics Corporation's Max-Viz enhanced vision system as standard equipment for its SkyCannon and Fire Attack systems, the company announced in November.

The SkyCannon is a helicopter-mounted firefighting system that enables firefighters to reach fires in high-rise buildings more quickly and effectively than traditional ground-based systems. Complemented with the Astronics Max-Viz enhanced vision system, operators of Simplex firefighting equipment will be able to see through smoke while fighting high-rise fires.

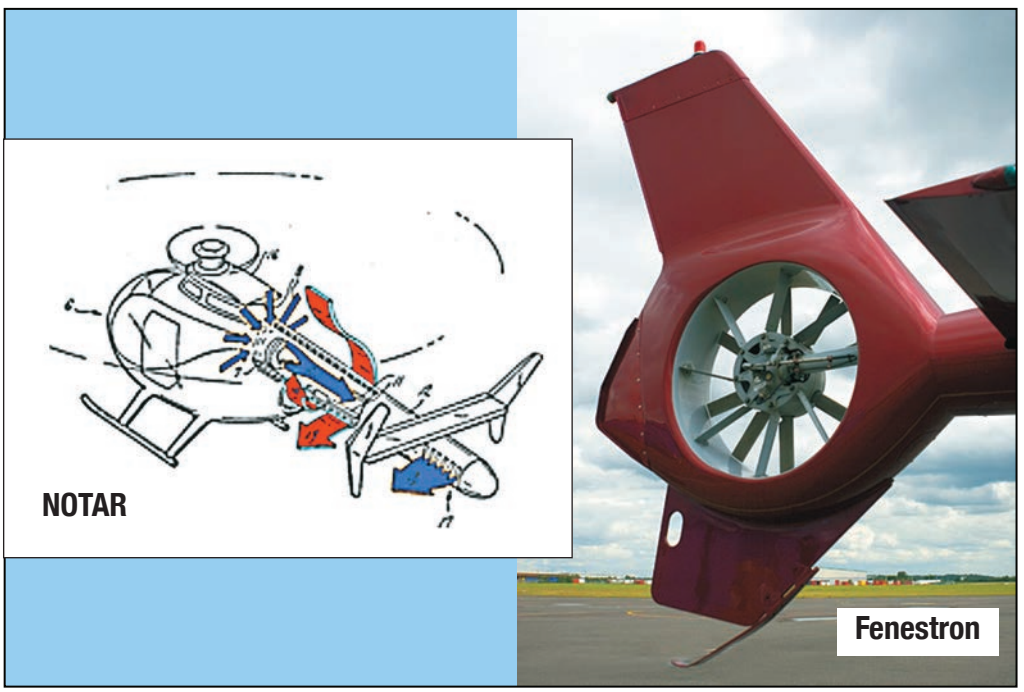
"The capabilities of the Astronics Max-Viz, which allows an operator to see through smoke, haze, light fog and darkness, is ideally coupled with Simplex Aerospace's breakthrough SkyCannon to make high-rise buildings safer from fire," said Astronics executive vice-president, Elliott Troutman.

Simplex offers the SkyCannon on the Avicopter AC313, Bell 412/212, AgustaWestland AW139, Eurocopter EC225 and Kamov Ka-32 firefighting helicopters. ■

Helicopter *tail rotors*

or why the helicopter doesn't chase its tail Part 3

BY MIKE BRODERICK
Helicopter Engine Repair
Overhaul Services



Ready for the tail end of our discussion on helicopter Anti-Torque Systems (aka Tail Rotors)?...Hey, hey... no groaning there… OK, I know, 1,000 comedians out of work and I am still trying…but I couldn't resist.

So anyway, I have checked my mail box and it appears you guys didn't have any questions on what we have discussed to this point. Good, glad to see you all understand why helicopters need tail rotors and thus we can dispense with a review. So then whad'ya say we start examining the anti-torque solutions from our good friends at MD Helicopters and Eurocopter. The one from MD helicopters is called a NOTAR and the one from Eurocopter is called the Fenestron. Then, as promised, after we have gone through the workings of these two systems we will then wrap up with an explanation about that fun activity that all pilots love: Loss of Tail Rotor Effectiveness (LTE). And as always you can expect some neat Cocktail Knowledge (CK) along the way. Also, I should and will take the time now to thank all my friends at Bell Helicopter, MD Helicopters and American Eurocopter, as well as some very knowledgeable field technicians for their invaluable help on these sessions. So without further delay let's get started.

NOTAR

NOTAR is the name of a helicopter anti-torque system which replaces the use of a traditional bladed tail rotor like those we have been talking about in the last couple of class sessions. NOTAR was developed by McDonnell Douglas Helicopter Systems (through their acquisition of Hughes Helicopters). The name is an acronym developed from the phrase "no tail rotor". The system uses a fan inside the tail boom to build a high volume of low-pressure air which exits through two slots and creates a boundary layer flow of air along the tail boom utilizing the Coanda effect. The boundary layer changes the direction of airflow around the tailboom, creating thrust opposite the motion imparted to the fuselage by the torque effect of the main rotor. Directional yaw control is gained through a vented, rotating drum at the end of the tailboom, called the

direct jet thruster. Although the concept took over three years to refine, the NOTAR system is simple in theory and works to provide some directional control using the Coanda effect. A variable pitch fan is enclosed in the aft fuselage section immediately forward of the tail boom and driven by the main rotor transmission. This fan forces low pressure air through two slots on the right side of the tailboom, causing the downwash from the main rotor to hug the tail boom, producing lift, and thus a measure of directional control. This is augmented by a direct jet thruster and vertical stabilizers. Benefits of the NOTAR system include increased safety (the tail rotor being vulnerable), and greatly reduced external noise.

NOTAR-equipped helicopters are among the quietest certified helicopters. And the first question I see is: "Who or what is a Coanda?" Good question and sit tight because here you go. First the simple explanation and the first bit of CK: The Coanda effect is the tendency of a fluid jet to be attracted to a nearby surface. The principle was named after Romanian aerodynamics pioneer Henri Coanda, who was the first to recognize the practical application of the phenomenon in aircraft development. (See Figure 1 at right.)

Notice the direction of item #6 the "Downwash". The air wants to bend around the tail boom; what keeps it on track to "stick" around the underside is the air driven from the fan inside the boom and exiting from the slots on the tail boom. That is the simple explanation, but you want some first-hand proof which will amaze your friends and maybe even win you an adult beverage? Here is what you will need: a 12 to

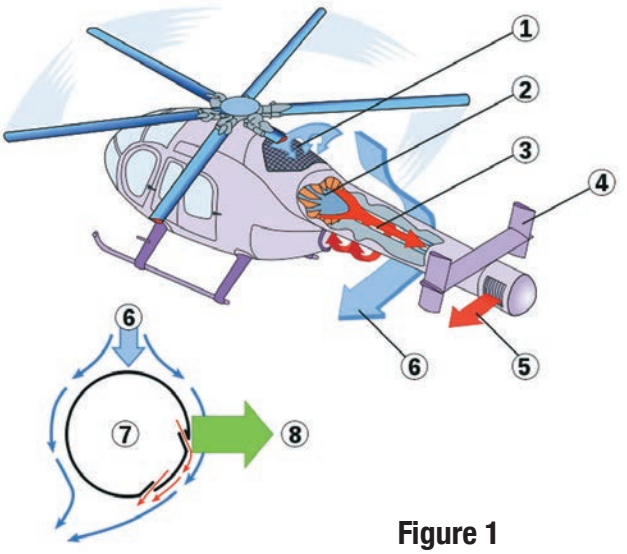


Figure 1

1. Air intake, 2. Variable pitch fan, 3. Tail boom with Coanda Slots, 4. Vertical stabilizers, 5. Direct jet thruster, 6. Downwash, 7. Circulation control tailboom cross-section, 8. Anti-torque lift.

14-ounce can; a candle which is shorter than the can; light the candle and put the can directly in front of the candle. Now blow on the can…the air will stick to the can and bend around it and put the candle flame out...Pretty cool, huh? Now that is some real usable cocktail knowledge.

History of NOTAR

Development of the NOTAR system began in 1975, when engineers at Hughes Helicopters began working with the concept development for an anti-torque system. In December 1981, Hughes flew an OH-6A fitted with NOTAR for the first time. The OH-6A helicopter (serial number 65-12917) was supplied by the U.S. Army for Hughes to develop the NOTAR technology and was the second OH-6 built by Hughes for the U.S. Army.

A more heavily modified version of the prototype demonstrator first flew in March 1986 (by which time McDonnell Douglas had acquired Hughes Helicopters). The original prototype last flew in June 1986 and is now at the U.S. Army Aviation Museum in Fort Rucker, Alabama. A production model NOTAR 520N (N520NT) was then produced and first flew on May 1, 1990. However on September 27, 1994 it was destroyed when it collided with an AH-64D while flying as a chase aircraft for the Apache.

MD continues with its production of the NOTAR in both single engine MD 520N (Figure 2) and a twin engine version MD 902 (Figure 3).

Figure 2

Figure 3

All right, now that I have warmed you up with info about NOTAR, how 'bout we delve into what the French have brought to the table with their invention, the Fenestron.

Fenestron

A Fenestron (or fantail, sometimes called "fan-in-fin") is a shrouded tail rotor of a helicopter that is essentially a ducted fan. The housing is integral with the tail skin, and like the conventional tail rotor it replaces, it is intended to counteract the torque of the main rotor. It was originally conceived by Sud Aviation (now Eurocopter, soon to be Airbus Heliocpters, part of the European Aeronautic Defence and Space Company (EADS).

While conventional tail rotors typically have two or four blades, Fenestrons have between eight and 18 blades. These may have variable angular spacing so that the noise is distributed over different frequencies and thus sounds quieter. The housing allows a higher rotational speed than a conventional rotor, allowing it to have smaller blades. And you want some more CK? Here you go: the term Fenestron is a trademark of Eurocopter. It comes from the modern French for a small window, and is ultimately from the Latin fenestra ("window").

History of the Fenestron

In the 1960s, as helicopters were doing more specialized work in some very unconventional areas there was an increase of tail rotor strikes. It became obvious that the exposure to the working environment of the conventional tail rotor system was an issue requiring research into reducing sensitivity of the tail rotor to its environment. Paul Fabre, head of the Sud Aviation Aerodynamics department and specialist in seaplanes, under the supervision of head engineer René Mouille in the Design Office, designed a fan-in-fin shrouded rotor for the SA340. (See Figure 4).

The Fenestron (see inset) was born, though few grasped the significance of the innovation at the time. This first metal-bladed Fenestron had one curious feature: the blade on top was the advancing blade. Aware that this would have constituted an error on a conventional rotor, Fabre believed that on the Fenestron the effect of the main rotor downwash would be negligible. His judgment proved correct for the Gazelle because the Fenestron was always positioned two or three diameters from the ground, but when the problem appeared on the SA360 Dauphin, the direction of rotation of the Fenestron had to be reversed. (See Figure 5.)

The obvious superiority of the design prompted Sud Aviation to test the Fenestron on an SA330 Puma in 1975. But on a helicopter of such weight (seven metric tons), the tests proved disastrous. "This failure forced us to go back to the drawing board," explains Bernard Certain. "We tried to improve on the design by constructing a prototype – the AS350 Z – which today has pride of place at the entrance to the Marignane site. The prototype enabled the Fenestron to become the reference design for a whole new generation of helicopters, the EC135, EC130, and EC155." (See Figure 6 on page 14.)

Figure 4

Figure 5

Figure 6

Nowadays all Fenestrons feature stators and "Chinese" (tuning) weights to reduce the power requirement and pitch control loads, with an even number of unevenly spaced blades designed to reduce noise levels.

As this picture denotes (Figure 7), this system is complicated but very effective. With this Fenestron design constantly evolving over the last 35 years, the Fenestron remains as important as ever. Indeed, with exciting challenges such as increased tonnages awaiting the Fenestron, we can expect to see more innovative evolutions. (See Figures 8, 9, 10 and 11.)

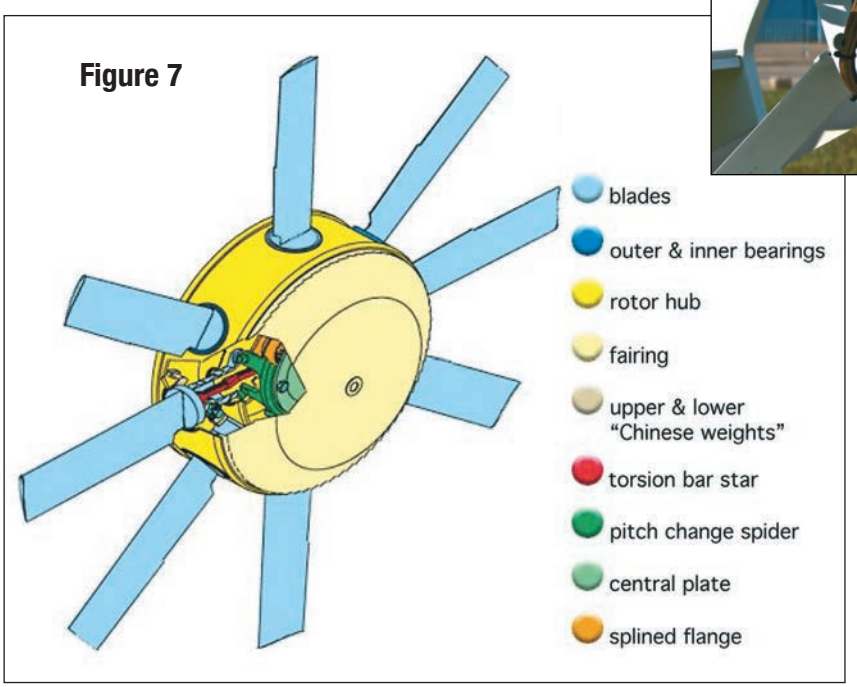


Figure 7

Figure 8


Figure 9

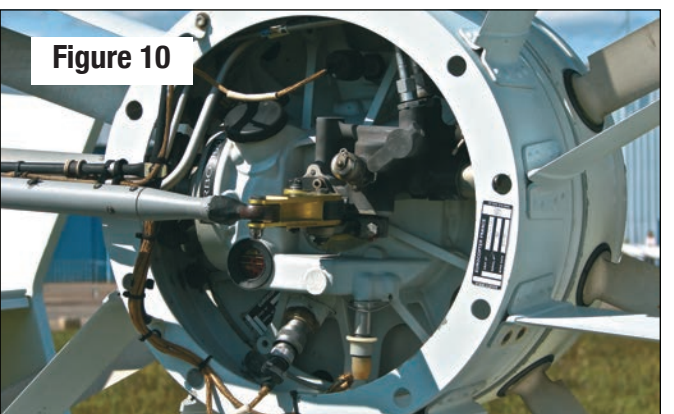


Figure 10


Figure 11

Advantages of the Fenestron:

- Increased safety for people on the ground, the enclosure provides peripheral protection

- Greatly reduced noise and vibration, due to the enclosure of the blade tips and the greater number of blades

- A lower susceptibility to foreign object damage, as the enclosure makes it less likely to suck in loose objects such as small rocks

Enhanced anti-torque control efficiency:

A computational simulation has suggested that maximum achievable thrust is twice as high, and that at identical power, thrust was slightly greater, than for a conventional rotor.

Disadvantages of the Fenestron:

The Fenestron's disadvantages are those common to all ducted fans when compared to propellers.

- An increase in weight and air resistance brought by the enclosure
- Higher construction and purchasing cost

So there you have it: two different approaches to the counter acting main rotor torque from the US firm of MD the French firm of Eurocopter. Which one is better? Good question. Let me know what you think.

And before we leave this portion of the class today how 'bout one more bit of CK. A little known fact about the origin of the Fenestron name. Paul Fabre, was born in Aix-en-Provence and very loyal to his roots. He chose the name "fenestrou", which is a Provencal word meaning "small round window" as the name of his rotor invention. However, his boss, Francois Legrand, told him "no way". Francois was not going to accept a colloquial deviation from the French langauge. Thus, Paul's "Fenestrou" became the "Fenestron".

OK now, as promised, here is our discussion on Loss of tail-rotor effectiveness (LTE): (LTE) occurs when the tail rotor of a helicopter is exposed to wind forces that prevent it from carrying out its function: that of cancelling the torque of the engine and transmission. Any low-airspeed high-power environment provides an opportunity for it to occur. And what causes LTE?

Environmental factors leading to LTE:

- Higher operating-density altitudes or temperatures, and high winds.
- A high gross weight will also instigate an LTE-conducive situation.

Causative wind-directions may include:

1. Main-rotor vortexes pushed into the tail rotor by wind. This can occur with wind coming from 10 o'clock on North American (counter-clockwise) rotors and from 2 o'clock on the main-rotor into the tail-rotor, preventing the tail rotor from having clean air to propel.

2. Wind from the tail (6 o'clock) can cause the helicopter to weathervane into the wind. The winds passing on both sides of the tail rotor make it teeter between being effective (providing thrust) and ineffective (not providing thrust). This creates a lot of pedal work for the pilot to eliminate unintended yaw.

3. Wind moving in the same direction as the tail rotor moves air. With pusher tail-rotors, that is wind from the opposite side of the tail-rotor. With puller tail-rotors, that is wind from the same side as the tail rotor. For main rotors with clockwise rotation (European), that is wind from 3 o'clock. For main rotors with counter-clockwise rotation, that is wind from 9 o'clock. The wind going through the tail rotor causes a stall condition as it decreases the effective airspeed of the air through the tail rotor. This condition will cause an unintended yaw that may develop into a spin. Recovery from this condition may be difficult if no airspeed is available, and will require entry into an autorotation (thus removing the torque of the engine and transmission).

And what clues tell the pilot that he is about to lose tail rotor effectiveness? How 'bout an environment of low airspeed, and a demand for power, or better yet, an unintended yaw that may even be opposite to pedal input? As I said, although these might be subtle, and if it is at the end of the day and the pilot is tired, they just might not catch it until it is too late.

So can the pilot get out of an onset of LTE? Yes, recovery is initiated by increasing airspeed, using the vertical stabilizer to reduce yaw or, if uncorrectable by application of speed or tail-rotor thrust, entry into autorotation. Now, he doesn't have to do a complete full Auto. Landing isn't necessary; just the mere entry into autorotation will eliminate the torque, and then the spin or yaw will reduce through friction, particularly with the build-up of forward speed. At that point, power recovery (while maintaining airspeed) can be successfully accomplished. This maneuver requires skill as well as a quick reaction time. Kind of gives you a whole new perspective about helicopter drivers, huh? Next time you run into one at the local watering hole, buy them an adult beverage…they might have just successfully recovered from an LTE and would appreciate the drink.

So ends our Tail (sorry couldn't resist again) on Anti-Torque systems. Once again, my thanks to my dog, Roxy, who gave me the inspiration, and all my tech-rep friends at Bell, MD and Eurocopter for their technical insight. With that, class is dismissed.

MIKE BRODERICK *is Vice President of Business Development at Helicopter Engine Repair Overhaul Services (HEROS). Over the past 35 years, he has served as a shop technician, engine shop supervisor, Engine Program Director, Director of Maintenance, Director of Operations, and owner of a Rolls-Royce engine overhaul and MD Helicopter component overhaul shop. He is a certified A&P, and holds a Bachelor of Science degree in Aviation Administration. As well, Mike has been appointed as an FAA representative for the FAA Safety Team (FAAST) and is a member of the HAI Tech Committee. Mike is a regular contributor to Air Maintenance Update.* ■

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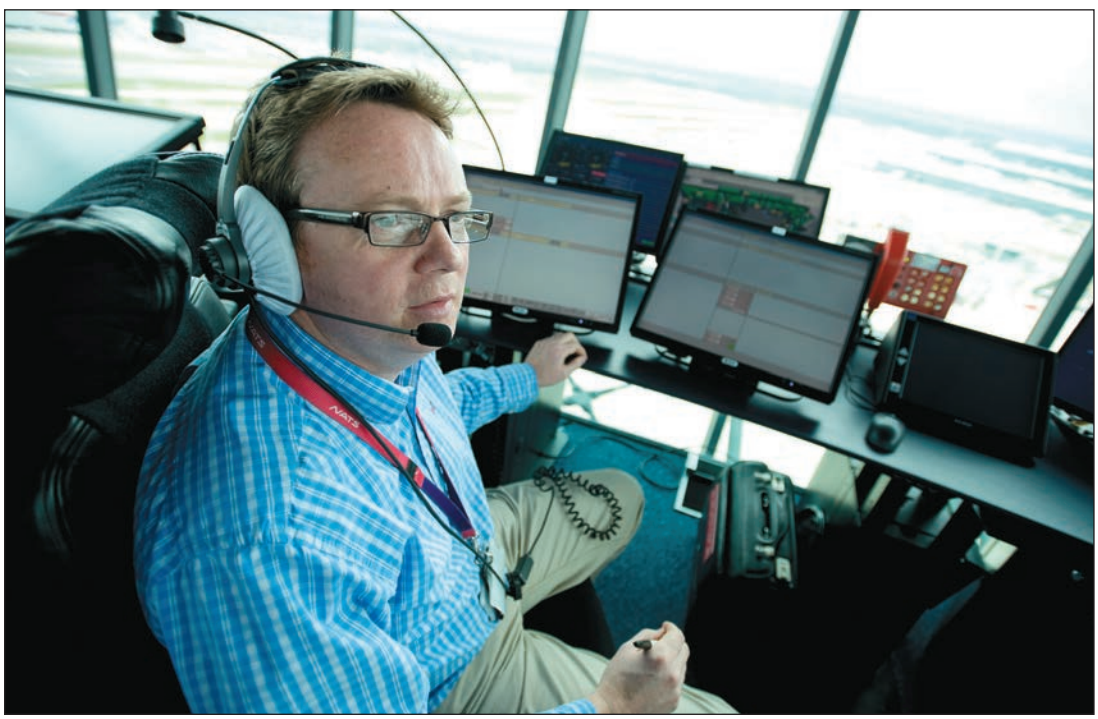

NextGen avionics are reducing the traditional chatter between pilot and controller, and are ultimately making for safer, more efficient approaches, departures and ground movements, even though the "tower" might be hundreds of miles away.

BY GORDON WALKER, AME 'E'
Professor of Avionics,
Centennial College

It's fair to say that after fire, the wheel, birth control pills, and Starbuck's coffee, the Internet ranks as one of the most significant inventions of all time (thanks Al Gore). That which we take for granted now, was inconceivable just a generation ago. I'm not THAT long in the tooth, but I do remember having to go to a bank teller to get cash, send mail using envelopes and stamps, and get my supply of "special interest" photographic magazines from the local variety store. Now, thanks to electronic networking, all of those things can be done quickly, conveniently, and with much less embarrassment, in the case of the last item.

As we move ahead with the "NextGen" avionics implementation, networking and data transfer begin to play a far more significant role than most of us could have imagined. The movement away from ground based surveillance radar in favour of satellite based Automatic Dependent Surveillance Broadcast (ADS-B) means that, in addition to providing a more accurate position fix, the actual three-dimensional (latitude, longitude, altitude from the GPS) location of the aircraft is being broadcast in a digital data format. This data is received by other aircraft in the vicinity, and by ADS-B ground stations, which in turn network the information to air traffic control facilities.

(ADS-B also transmits information such as heading, and airspeed, and more parameters are planned for the future.) Since the information is placed on the electronic network (think internet) it is instantly available to all users connected to that network. The ramifications of this are huge. Air traffic controllers no longer need to be in the vicinity of the airport they are controlling. It is conceivable that air traffic data from, say, the San Francisco Bay area could be accessed by a controller sitting in an office in North Tonawanda, New York.

Of course, there's more to air traffic control than just having the controller know the position of the aircraft in the control zone. Clearances have to be issued; confirmations and read-backs have to be broadcast, and so on. We all know that VHF communications are limited to "line-of-sight" range, so even the most powerful of VHF COM transmitters won't allow for communications between New York and California. Not a problem! Once again, by networking the voice communications, we are able to communicate instantly between all points on the network, allowing the controller and the pilot to conduct any required verbal exchanges.

The elimination of the requirement for controllers to be on-site at airports will allow controllers from less busy control zones to assist at airports with heavy traffic loads, during peak times. It will also allow ATC operations to be conducted from remote, less expensive sites such as suburban offices or industrial estates, rather than on-site at an airport.

Digitizing voice communications for network distribution and transmission may, however, become a moot point, as NextGen technology strives to eliminate the problem of narrow VHF-com bandwidth. Even with 8.3 Khz channel spacing, VHF voice communication is becoming overloaded. Since increasing the bandwidth is not an option, the best alternative solution is to reduce the amount of spoken word communication, and replace it with digitized data communications.

"DataCom" is the NextGen component making this concept a reality. The traditional air traffic control process follows a sequence in which a controller transmits a clearance, which the pilot writes down, then verbally transmits an acceptance reply. The controller then confirms the pilot's reply, and the pilot manually enters the clearance instructions into the flight management computer. This process is cumbersome, time consuming, and prone to errors in communication. By employing data clearances, rather than verbal instructions, controllers can now transmit a digitized data clearance to the aircraft. This data burst, which takes only microseconds of airtime, will appear on a cockpit screen to be either accepted or rejected by the pilot. Should the pilot accept the clearance, acknowledgement will be sent to the control centre, and the actual clearance instructions loaded into the navigation portion of the aircraft's flight management computer automatically. From the flight management computer, the ATC instructions can then be coupled to the autoflight system. The clearance can be simultaneously transmitted to the airline's operations centre, allowing dispatchers to calculate fuel loads etc.

In addition to reducing the amount of verbal "chatter" on the VHF-com frequencies, the DataCom system will eliminate

the spectre of misunderstood communications between controllers and pilots, and will ensure the aircraft is flown on the flight path the ATC facility intended.

Pilots are typically horrified to hear that the controller handling their flight may actually be located hundreds or thousands of miles away from their location, and totally unfamiliar with the airport and surrounding terrain which they are controlling. This fear is unfounded, as all clearances will be issued in a standard format, which is applicable to the control zone in which they are operating. It would be impossible for a controller to issue a clearance that would take the aircraft outside of the safe operational parameters of the airspace in question. The ATC software would not transmit inappropriate data, and the aircraft software would not accept it.

Not only will ATC instructions be safe and appropriate for the airport or control zone, but the use of GPS as a primary navigation aid, and ADS-B as a primary ATC protocol enables much more efficient approaches, departures and ground movements. Rather than stacking aircraft in a holding pattern, and forcing all aircraft to use the same ILS approach path, GPS approaches allow multiple approach paths, and facilitate constant vertical descent/near idle approaches. This results in shorter flight times, fewer delays, less fuel consumption, less noise and less pollution. Satellite receivers, designed to receive ADS-B broadcasts and relay them to ADS-B ground stations makes possible full global coverage, providing accurate ATC control of aircraft in remote and trans-oceanic locations.

In addition to these benefits, the digitizing and networking of avionics systems reduces the risk of miscommunication between controllers and pilots, and makes better use of air traffic control resources, both material and human. Sounds like a good plan to me.

Q: How is an air traffic controller using NextGen technology able to verbally communicate with an aircraft hundreds or even thousands of miles away?

Answer to previous question:

Q: What are some of the advantages of ADS-B over ground based air traffic control systems?

A: ADS-B uses GPS to provide a very accurate position fix, which can be seen by other aircraft, as well as air traffic control. It also transmits information such as aircraft heading and airspeed.

GORDON WALKER *entered the avionics industry after graduating from Centennial College in 1980. His career with Nordair, Air Canada, CP Air, PWA, and ultimately Canadian Airlines took him to many remote corners of Canada. Since leaving the flight line to pursue a career as a college professor, Walker has continued to involve himself in the aviation/avionics industry by serving on several CARAC committees concerned with the training and licensing of AMEs. As well, he has been nominated to the CAMC Board of Directors, and has been elected President of the National Training Association (NTA).* ■

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Annual General Meeting

The Annual General meeting of the AME Association of Ontario was held at the Meadowvale Conference Centre in Mississauga, on Oct. 30. Over 50 members and observers were on hand to receive the Board of Directors' Annual Report and discuss the association's activities.

Association vice-president Sam Longo briefed the attendees of the many activities and benefits of our association including: free subscriptions to four aviation magazines; reduced AME related insurance rates; free admission to the Canadian Warplane Heritage Museum; and special training courses. The financial statements showed a balance consistent with previous years and reflected the efforts of the board to control costs and spending.

The bylaws were amended to reflect the changes required for the new not-for-profit requirements of the federal government. Director Stephen Farnworth, who represented our association at the CFAMEA AGM in Calgary Sept. 29–30, made a comprehensive briefing.

An invitation was made to all association members who wish to attend the monthly Board of Directors' meetings and to assist in various association projects. The Board's goals are to grow membership, educate, communicate and provide balanced finances with a disciplined budget. We provide scholarships to students at the various aviation programs and we serve on the Program Advisory Committees of four colleges.

A very successful annual AME Symposium and Workshop was held at the Delta Meadowvale Conference Center in Mississauga Oct. 31–Nov. 1, 2013. Fifty booths were set up and approximately 500 people attended the two-day workshops. Thirty-four sessions were scheduled ranging from full day sessions for purchasing, batteries or MD training; through to shorter sessions for specific topics. The final standalone session for the Transport Canada update proved to be a lively conclusion to the two-day event.

Thursday evening's awards banquet was sold out. We had an excellent dinner, which was followed by a hilariously entertaining show with the singing comedy duo "Bowser and Blue." Winners of this year's awards were:

- Don Sherritt, Gordon B. Rayner Award—which recognizes a Canadian whose career will always remain outstanding as an aircraft maintenance engineer, a teacher, or a public servant.
- Norm Patterson, Clare Leavens Award—given to a member of the Aircraft Maintenance Engineers Association of Ontario who, in the opinion of the directors and members, has made a particularly outstanding contribution to the continued success of the Association.
- Stuart McAulay, Aviall High Achievement Award—given to an Ontario AME or individual associated with the aircraft maintenance business, who has consistently shown a positive attitude, a high level of professional skill in their particular work and leadership attributes which serve as an inspiration to young people.

Submitted by Stephen Farnworth
For the Board of Directors

Canadian Council for Aviation & Aerospace

CCAA e-Bulletin October 2013

CCAA Launches 17 "Occupation Specific" CARs Modules

The Canadian Council for Aviation & Aerospace (CCAA) has developed a series of training modules which streamline Canadian Aviation Regulations (CARs) training. CARs are Transport Canada regulatory requirements to enhance aviation safety. The CARs are a detailed, complex set of regulations that apply to all segments of the Aviation and Aerospace Industry. Different sections of the CARs apply to different segments of the industry (AMO, Manufacturers, Operators, FTU, Airports, etc.), and to different functions within a company. Transport Canada requires companies to provide appropriate training on relevant CARs.

In order to streamline this training, and make it more efficient and effective, CCAA has developed 17 online modules, each of which focuses on regulations that apply to specific occupations or functions. The courses are intended for individuals involved in manufacturing, maintenance and design occupations. CCAA expects the majority of individuals will need to register for only one of the 17 courses, based on their occupation and functions within an organization. These courses answer the question; "Which CARs apply to me and the job I do?" The courses are available in English and French and include:

- CARs overview as it applies to the sector
- Information on accessing and interpreting CARs
- Regulations on the roles and responsibilities of specific occupations
- Links to supplemental reference materials

The courses are user-friendly and will take an average learner one to 11 hours to complete, depending on the course. The estimated time is what would be expected for an average learner to read the course content and complete the quizzes. Courses are priced individually with discounts for CCAA members. Upon completion of the course the individual receives a PDF certificate that can be printed out for inclusion in corporate records and employee files, to demonstrate compliance with Transport Canada training requirements. Additional modules for other segments of the industry are under development. For more info: http://www.avaerocouncil.ca/en/canadian-aviation-regulations-cars-line-training

FAA Safety Team

Know your limits (Notice number NOTC5020)

Fuel starvation and exhaustion are still causal factors in many general aviation accidents. Fortunately, a large selection of fuel totalizing and monitoring options are available to help you prevent these very preventable accidents. But technology only helps when pilots apply it consistently and correctly.

Follow these three simple steps to avoid becoming a fuel accident statistic:

• Whether you're "sticking the tanks" or relying on cutting edge fuel management software, know how much fuel you have on board before each takeoff. If you have a fuel management system onboard, make sure you program it with accurate information before every flight.

• Know how much fuel you plan to burn and how much fuel you're burning. If you don't have on-board equipment to answer this question, calculate your fuel burn before each flight and confirm your calculations each time you refuel. Comparing your actual fuel burn to your calculated fuel burn will give you confidence in your fuel planning and you can often uncover fuel leaks or other small problems before they become big ones.

• Finally, make a commitment to join the many pilots that have a personal minimum not to land with less than one hour's fuel in the tanks. This will exceed any regulatory reserve fuel requirements and you'll never be anxious about pushing your fuel.

For more information, contact Kevin Clover: kevin.l.clover@faa.gov
http://www.faasafety.gov

PAMA First State

Chapter Meeting Speakers Needed

The First State Chapter – PAMA is currently looking for speakers or vendors who are interested in presenting a 45-minute technical presentation at our chapter meeting at FlightSafety International in New Castle Delaware at 7 p.m. on the following dates: January 14, 2014, March 11, April 8, and May 13. The cost for sponsoring the meeting and the presentation is $150, which covers the cost of the catered dinner. Anyone interested can email chapter president John Agnew (admin@firststatepama.com) or call (302) 983-0042.

First State to Host 12th Annual Symposium

Members are reminded that registration for the 12th Annual First State Chapter – PAMA IA Renewal and Maintenance Symposium will commence December 1, 2013. The event kicks off February 8, 2014 at the Deerfield Golf & Tennis Club in Newark, Delaware. Activities include eight hours of IA-approved training, breakfast, lunch, door prizes, cocktail hour and hors d'oeuvres. Vendors interested in sponsorship or tables at the trade show please contact John Agnew admin@firststatepama.com, or (302) 983-0042. www.firststatepama.com

About PAMA

The purpose of the Professional Aviation Maintenance Association 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 national, state, and local meetings and seminars; to recognize achievement in our field; 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; and to address the queries of governmental agencies pertaining to maintenance rules and guidelines.

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• Weekly emails with PAMA, local, nationwide and industry news.

• PAMA is the technician's advocate in FAA rule making and advisory committees. Alerts provided through PAMA Direct keep you updated on pertinent industry issues.

• Career services and job bank listings available exclusively to PAMA members.

• The Professional Aviation Maintenance Foundation (PAMF) achieves its mission by providing scholarships and other educational opportunities to young people entering the industry.

www.pama.org

PAMA SOCAL

PAMA SoCal Chapter

There's an app for that

The SoCal Chapter would like to thank Lew Wingate, vice-president Ground Support Test Equipment and Distribution, Chris Stanley, director GSTE and all at Barfield Inc. for their time and generosity in hosting the September 10, 2013 chapter dinner meeting and excellent technical presentation on "There's an App for That ... Aerospace Test Equipment and Tablets" at the 94th Aero Squadron Restaurant in Van Nuys, California www.barfieldinc.com

Employment and Educational Opportunities are broadcast via SoCal PAMA e-mail and posted on the SoCal PAMA website. To receive chapter meeting, employment opportunities and event announcements by email, go to SoCalPAMA.org and on the home page, click the "update email address" button.

Job Opening to Post?

Get the word out through SoCal PAMA. Send postings to SoCalPAMA@gmail.com Include company name, logo, position title, location of position, and contact information. The SoCal chapter offers employment and educational opportunity postings free of charge to the aviation maintenance community worldwide.

SoCal PAMA Website

Advertise your company on SoCalPAMA.org and support SoCal PAMA. It's only $50 for 12 Months. Contact Nikki King or Gail Erwin for posting a new ad, renewal fees, and artwork updates: nikki@extraordnair.com or gailjerwin@verizon.net

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Special thanks to SoCal chapter supporters

CENTRAL OHIO

Central Ohio PAMA

Late Fall Meeting

Our November 12 meeting featured a presentation titled "Preventive Maintenance—What Pilots Can Do", by FAASTeam member, Cliff Kelling. It was posted on the FAASafety.gov website and those attending, which included 15 local area pilots, earned credit for their Wings and AMT programs.

Cliff began his presentation with a review of his more than 50-year career in aviation. With the help of the FAA prepared PowerPoint, he covered the preventive maintenance items and their regulations, which allow pilots to perform certain tasks under specific conditions. The pilot rating and aircraft ownership/operation also define what is allowable by a certified pilot. We want to thank Cliff for his personal stories and experiences related to the subject.

A short business meeting also took place to elect our board members for 2014–2015. Joe Lippert and Chuck Jenkins were reelected and Richard Cady of Limited Brands joined the board to fill the position vacated by Paul Tursic. Paul served four years on the board, serving his last two as COPAMA Secretary. We wish to thank Paul for his service and will formally thank him at the holiday dinner.
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The lack of proper focus

One private pilot's legal wrangle with Transport Canada raises the larger issues of fairness and common sense. TC might benefit from both . . .

BY NORM CHALMERS
Pacific Airworthiness Consulting

My article "Issues related to Quality Assurance" in the October–November issue was missing some information that I had included in my original draft, but was somehow omitted in the final print version. To fill you in, the Transport Canada (TC) auditor exemption for the One-Person Approved Maintenance Organization (AMO, as approved by TC) can be found at this TC website: http://www.tc.gc.ca/CivilAviation/Regserv/Affairs/exemptions/docs/en/1827.htm

Last issue you may have noticed some improvement in my grammar away from the usage of big words and snarky comments. I'm back.

To start off this issue, an email from Wayne Dick has me drawn back to expound upon our old friend, the Airworthiness Directive (AD). Mr. Dick's query relates to the status of AD records involving service bulletins issued by the TC Holder and his emphasis is on the requirements of the various Civil Aviation Authorities (CAAs) when aircraft containing these "Service Bulletin Airworthiness Directives" (SBAD) are exported and imported from and to Canada. The answer is not a simple "Do This" procedure, but involves a lot of work on your part.

First, a bit of background info. As many of you know, when the CAAs, including TC, contemplate issuing an AD to address an aircraft problem they issue the AD incorporating TC Holder documents such as service bulletins, letters or kits. This is the case with many ADs because it is the TC Holder's responsibility to provide "continued airworthiness" support to aircraft owners, and because the TC Holder usually has the design knowledge to better devise corrective action. If the CAA that issues the AD is also the CAA responsible for the type certificate (and the TC Holder), then that CAA conscripts the TC Holder to engineer and publish an adequate corrective action in a documentary form such as a service bulletin. When that corrective action is deemed adequate, that CAA publishes the AD referring to that service bulletin.

That process involves the TC Holder in the ongoing continued airworthiness of the aircraft including the making and selling of improved parts. It also saves the government a bunch of time, paper and money in engineering work.

Now for the Canadian Aviation Regulations (CARS, which is a law of Canada), and your involvement. Here is a listing of TC requirements and informative notes regarding ADs that you need to have at hand and some familiarity with:

- **CAR 605.84 Aircraft Maintenance – General** has the requirement to comply with ADs and provides the details of the requirement.
- **CAR 605 Schedule II item four** addresses AD technical recording.
- **TC approved STandarD (STD) 625.84 Aircraft Mainte-**

nance - General Information Note IV provides more information on applicability.

- **STD 625.93 Technical Records – General paragraph four Information Note ii)** provides alternate technical record format.
- **STD 625 Appendix H** is the big picture document providing an AD summary in 1,200 words.
- **STD 571.10 Maintenance Release paragraph (three)** addresses responsibility as per CAR 605.84.
- **STD 571.10 paragraph (four) Table - Types Of Work – Additional Standards, item (g)** identifies records content requirements

Note that the regulations specify the owner responsible for ADs. When importing an aircraft into Canada, you get lists of all the effective Canadian and applicable foreign ADs. The next step is to research the aircraft records. The next step addresses the perplexity that Mr. Dick related to. (See my interpretation in the table.) The AD record found is on the left and your action on the right:

1	A current foreign SBAD was recorded as done	Ensure that the person or organization is valid, credible, and meets TC requirements as per an international agreement such as a Bilateral that specifies Canada accepts the maintenance certifications. Record that AD and SB, including the revision numbers, as found embodied with the reference to that technical record.
2	A foreign AD referring to previous revision SB was recorded as done	Execute and record the current SB and AD. Do your search, looking for a revision to the AD to mandate the revised SB.
3	A foreign AD was recorded as done when there is also an identical Canadian AD applicable	Do as per line above, recording the Candian AD as found embodied.
4	A foreign AD is recorded as done when there is also a Canadian AD that is different	Do whatever is necessary to ensure that the Canadian differences are addressed. Record the Canadian AD as done, including what was found embodied, and your implementation actions.
5	A foreign AD is recorded as done when there is no international agreement in place that allows acceptance of maintenance certifications	Do the AD.

Note: The reference to International Agreements refers to the limited acceptance of foreign maintenance certifications. The TC web page listing this is: http://www.tc.gc.ca/eng/civilaviation/standards/int-menu-3668.htm. It also includes EASA/Europe if the organization is also approved by TC: http://wwwapps.tc.gc.ca/saf-sec-sur/2/AO-OA/AO_OA.aspx?lang=eng

If TC is true to form, the TC digerati will soon change those web pages so nobody can find the information.

Now for something completely different. Many aviation professionals and amateurs work and play in fear of big brother TC. If you have a TC enforcement action started against you, you have the right to demand a Transportation Appeal Tribunal of Canada (TATC) hearing. That notification is contained in whatever form you receive notifying you of the TC action. If you disagree with the punishment, you need to appeal to the TATC immediately as indicated on the form. The principle behind the use of the TATC is to save you from the cost and complexity of going to court. It is alleged to provide you with the opportunity to argue your case free of delays and contortions of the legal system and of the generally unintelligible legal lexicology of lawyers with all of the attendant court costs. The theory is that you show up at the TATC hearing with your support information and witnesses if necessary for a fair hearing. The procedures are conducted in a common-sense manner and you will be given a full opportunity to be heard.

The "judge" of the TATC hearing is one or three people with some aviation background who listen intently to what you present, and they record every word. The hearing is an appeal so you will be the Applicant. TC will be the Respondent and will be represented by a Civil Aviation Safety Inspector (CASI) from the TC Enforcement section and the CASI that originated the action.

For a complete guide to the process for the applicant which may be you, visit: http://www.tatc.gc.ca/s5/s31/eng/guide-applicants-aviation-mode.

That's the way it is intended to work, but TC has been known to try to foil the fairness factor of the process and that is my next topic.

Recently I attended a TATC hearing held here in Vancouver. In this case, I will refer to the Applicant as Mr. B. He was appealing a $1,000 fine for flying a helicopter with some expired parts installed. After about 40 years of flying with a clean record, Mr. B. felt that he had been unfairly punished and ought to have received a warning known as an Oral Counseling. Mr. B. and the TC enforcement people had agreed that they didn't need to involve the use of lawyers. Mr. B. showed up at the hearing where, lo and behold, the unthinkable happened. TC showed up with their high-powered legal counsel flown in from Ottawa for this hearing. Mr. B. was dismayed by this turn of events but kept up his determination to present his case. If TC meant to flatter Mr. B. with all their specialist's attentions, it did not happen.

Mr. B. was very well prepared to argue his position. He had so much evidence to present that the hearing went on well beyond the allotted time of three or four days. Due to the busy schedules

of all involved, including Mr. B., the hearing was extended to four (yes, four) sessions spread out over 13 (yes, 13) months. This hearing was "heard" by the TATC chairman, the very knowledgeable and sensible Mr. Hall. After considerable rumination on the hearings, the TATC decision stated that, "due to mitigating factors, the penalty is lowered from $1,000 to $100." Those mitigating factors included having received the apparent blessing for this ferry flight by the aircraft TC Holder and by the AMO/AME that had been maintaining the aircraft under commercial registration.

"Once again, at the time I am writing this, the minister has shown his pugnacious side. TC has appealed the decision and aims to "get their man". Sometimes I think some TC personnel see themselves as major crime fighters . . .

Very few people will ever know how much it cost to prosecute this non-professional pilot flying his privately registered aircraft on a single ferry flight. Mr. Hall and the TC lawyer came from Ottawa and stayed downtown for a couple of weeks. Other costs included the rental of the courtroom, hiring the court reporter and the pay of the other TC employees in constant attendance. This would have cost more than a trip to the Swiss Alps or Aruba.

Once again, at the time I am writing this, the minister has shown his pugnacious side. TC has appealed the decision and aims to "get their man." Sometimes I think some TC personnel see themselves as major crime fighters.

Now the whole process starts over at the TATC second level. There will be

three TATC members for the appeal to the appeal. They and the TC legal counsel will be brought into Vancouver and put up in a downtown hotel with all the attendant costs. I will keep you informed of the changes in this case. By the time you read this, the TATC decision will be posted at: http://www.tatc.gc.ca/decision/decision.php?&lang=eng.

My purpose of going into detail on these hearings is to draw your attention to the underlying factors and to point out the possibility of this being you. Most of the CARs and attending standards are a complex mix. For the most part, they are impenetrable to people who are not expert in a particular aspect. For example, I don't understand piloting and air traffic control in sufficient detail to stay out of trouble. Almost all operators, both private and commercial, totally depend on the knowledge and skills of maintenance personnel to keep their aircraft and operation legal. If the AME/AMO says the aircraft is good to fly, the pilot operator takes it and flies around until the next scheduled check. This fact needs to be recognized by the minister and staff, not only to be fair to the industry and the individuals involved in it, but also to properly focus the TC resources as they are eroded. The perspective or argument regarding fairness has its merits. At some point in the process, this factor needs to be weighed by the authorities. Before jumping on the person or company with enforcement, the minister needs to ask this question of self: "What is the cheapest way to get future compliance?"

With that, I see I have run out of time and space, so Ta-Ta For Now.

Please be aware that I am not a lawyer or legal expert. What I write in my column is not legal advice or legal opinion. If you face a legal issue, you must get specific legal advice from a lawyer and preferably one with experience in the aviation matters in your own country.

NORM CHALMERS *worked with Transport Canada as an Airworthiness Inspector for 25 years. Before this, from 1967 to 1983, he worked in the aircraft maintenance industry in and around Western Canada and in the Arctic. His industry experience includes the operational maintenance of normal and commuter category aircraft and smaller transport category aircraft in the corporate sector as well as several years working in major repairs in the helicopter sector. As an Airworthiness Inspector, he has been responsible for most duties related to the position, including the approval of all aspects of maintenance, manufacturing, training, and responsibilities related to distribution organizations. Norm now operates Pacific Airworthiness Consulting; www.pacificairworthiness.ca.* ■

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Baby, it's COLD outside!

BY SUE YOST

When the mercury drops, it's time to rethink your outdoor work practices.

Time is flying. Just yesterday, it was May and I was writing about staying cool. Now, it's all about keeping warm. The full impact of winter will hit us soon, and all the things that we forgot about during the summer months will be upon us: skiing, sledding, snowmobiles (toddies by the fire) and pretty landscapes with sparkling snow –but also frozen fingers and toes, slippery roads, icy props and wings, cold starts and sluggish fluids, and very, very short daylight hours. Short days can sap energy and motivation as you get up, drive to work, and go home in the dark, and never see the sun unless you are lucky enough to catch a glimpse during lunch or a smoke break. Time drags, and snow is welcomed as it reflects the little light that is available.

But there are measures you can take to make winter more manageable. For example, even if you brownbag your lunch, try to get outside for a little while and enjoy the daylight; every minute helps. Bear in mind that cold affects us all differently. Some enjoy it, some don't. Conditions that will cause you to feel the cold are:

- Prolonged exposure to cold conditions (everyone's tolerance is different)
- Standing or lying in cold water for a long time (also wet snow, rain, wet clothing)
- Standing or lying immobile in cool air or on a cold surface (on wings or fuselage, under the aircraft)
- Medications or other health problems (heart conditions, diabetes, etc.) that can affect body heat or even a person's ability to detect changes in body temperature. This is especially true as we age.
- Circulatory system disorders (often caused by previous cold emergencies)
- A thin body or low body fat (some of us don't have that problem!)
- Hunger (lots of small snacks work better than one big meal)
- Fatigue

- Alcohol (still in your system from last night counts too!)
- Cigarette smoking (inhibits oxygen circulation)
- Dehydration (drink lots, but stay away from caffeine or alcohol)
- Periods of comparative inactivity immediately following physical exertion

The usual and obvious things that we associate with winter are the physical limitations on activity, mobility, and accessibility to all things outside. Digging, scraping, slugging through drifts; or at night, after a sunny day of snow thawing on the tarmac, and the ice patches that now form and make movement (yours and the aircraft's) treacherous, are all part of a Canadian winter. (This is where we need to remember those toddies by the fire!)

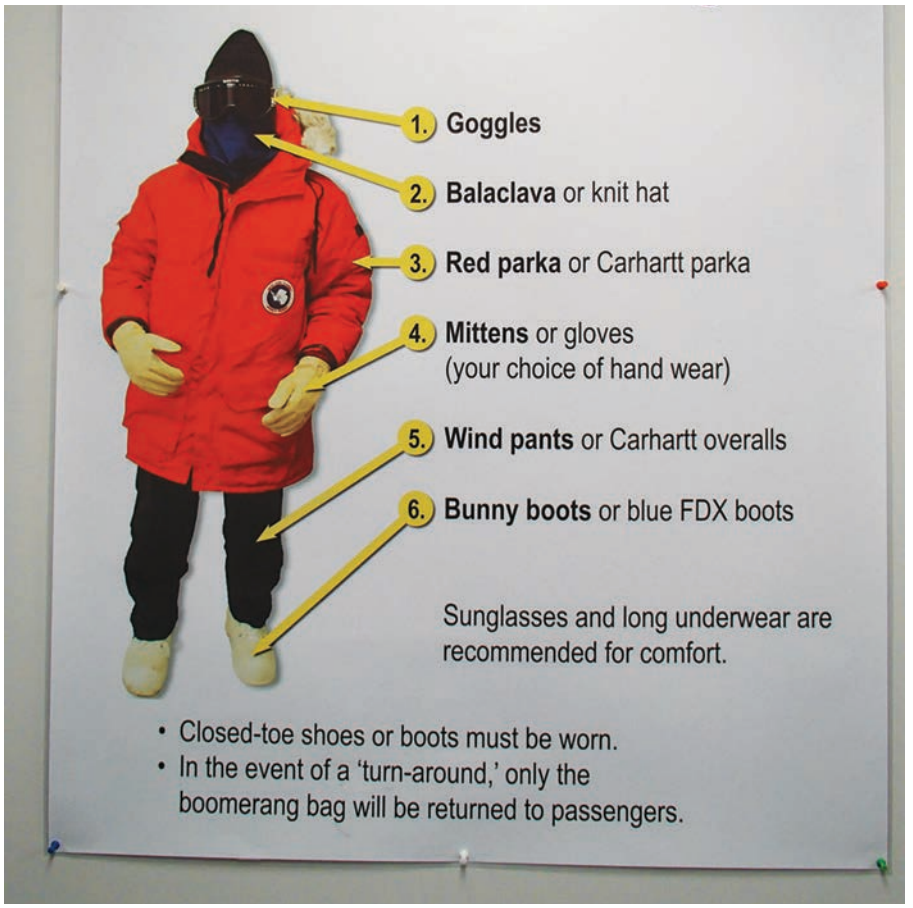
Prop wash and jet blast, always hazardous, will pick up and throw icy particles like little frozen missiles, that cut and embed themselves into frozen flesh, and can turn that postcard, sparkly snowdrift into a blizzard that cuts visibility, and deposits that postcard picture into the hangar in no time flat.

Apart from the more apparent risks at work, there are also dangers in the basic act of getting to work and home again. Driving is definitely a risky business, especially in winter conditions, but for many of you the danger is not over when you get to work. You may have different locations that you need to access during the day, maybe offices in one building, the hangar at the airport, or sub bases around the city or region, or even picking up from suppliers. If this is part of your work day, your employer should ensure that you have had winter driving training, and you need to ensure that you have an emergency car kit, and winter supplies kit in the back of your vehicle.

I live in southwest Ontario, and always encourage people to remember the storm from a few years ago that stranded motorists on Highway 402 for two days. Think of what you would need in the event of a similar circumstance, pack it into a duffle bag in your vehicles (both work and personal), and leave it there for the winter months. Inside the duffle there should be an extra toque, scarf, gloves, work socks, granola bars, candles, matches, Kleenex (for TP) large garbage bags for raincoats, etcetera.

Clothing should be adjusted for the weather. Layers of clothes that will protect you from cold, wind, and moisture are the best, and don't forget a hat that covers your ears (toques are great) scarves (just try one) gloves, rain/snow pants, and good boots. How many of you suffer from cold feet, even with your boots on? Here is a tip: leave your boots out in a cold area, (porch or unheated mudroom) before putting them on. When you put warm boots on, your feet sweat, and chill easily. If your boots are cold, your cold feet stay drier, thus staying warmer for longer. (Convoluted thinking, but it works.) Keep a couple pairs of old gloves with the fingertips cut out so that you can work in the cold with some dexterity while still keeping most of the hand warm.

There are various degrees of exposure to prepare for. Frost nip is surface freezing: the skin will turn white and waxy,



Pictured left: Proper winter wear is imperitive when working outdoors, especially in near-zero weather and during periods when factors such as wind-chill are present.

and will produce a burning sensation when warming. Frostbite is deeper: a larger area will be white, or blue, and the flesh is now hard and frozen (thaw slowly and gently).

In severe cases, flesh may be dark brown or black where the blood vessels have frozen and burst under the skin. If you suffer from this and may have to spend time outside before getting to a hospital, do NOT thaw the frozen part. If you thaw, and it refreezes, there will be irreparable damage. Leave the part frozen until it can be thawed by medical professionals, who can save as much as possible.

Cold will also impair your judgment, and you will start to make irrational and irrelevant decisions. This is not the time to be faced with critical choices about the aircraft. What about that washer that you just dropped into the snow? Will you dig for it with fingers that are already stiff and cold, or just say "forget it" and put the nut on without it?

Always use eye protection around a helicopter that has the blades moving. Eyeballs are mostly liquid, and can freeze when exposed to excessively cold temperatures caused by wind chill created by spinning blades.

Here are some of the signs of hypothermia as it progresses:

- Shivering
- Clumsiness or lack of coordination (there's that dropped nut!)
- Inability to pay attention for extended periods of time
- Slurred speech or mumbling
- Confusion or difficulty thinking (not good when making crucial decisions)
- Poor decision-making, such as trying to remove warm clothes
- Drowsiness or very low energy
- Apathy or lack of concern about one's condition (safety will suffer)
- Progressive loss of consciousness
- Weak pulse
- Slow, shallow breathing

As long as the person is shivering and complaining they are cold, do NOT massage or rub them to warm them. You can help by giving warm liquids, placing warm packs (any bottles or containers filled with hot water and wrapped) around the neck, under armpits, in the groin, and be gentle if you have to move them. Try not to let them help you or walk around. Circulation needs to start slowly, but blood flowing back to the vital organs from arms and legs is cold and will drop their core temperature even further.

Also, keep in mind:

- Move the person out of the cold, very gently; if this is not possible, protect them from wind, cover their head and insulate their body from the cold ground (use blankets, tarps, plastic sheeting, garbage bags)
- Remove wet clothing. Replace with a dry covering, preferably warm. Cover the person's head.
- Warm the person's body by removing clothing and lying next to the person, making skin-to-skin contact. Then cover both bodies with a blanket or get into a sleeping bag if possible.
- Do not give alcohol because it lowers the body's ability to retain heat. If the person is alert and is able to swallow, have them drink warm, non-alcoholic beverages. Do not offer liquids if vomiting.
- Do not leave the person alone. Stay with them at all times.
- Continually monitor breathing. If the person's breathing stops, start cardiopulmonary resuscitation (CPR) immediately, if you are trained.
- If the person has stopped shivering or complaining they are cold, even though they are still conscious. This is now a 911 emergency; the person needs medical help. Take steps above to warm them while you wait.

Most of this is common sense, and hopefully, most of you are lucky enough to work in conditions where you can get out of the cold periodically to stay warm.

Knowledge of, and treatment for, hypothermia is crucial to those of you working in isolated areas, or outside for long periods of time (or short periods in extremely cold temps). Pay attention to your body, and what it is telling you. Cold, at the very least, is uncomfortable. Extreme cold can have long lasting effects on your circulation, and severe cold can kill. Know the signs, take time to stay warm, and get through winter safely.

SUE YOST *is the owner and principal instructor for HPA Consultants, based in southwest Ontario. HPA conducts Human Factors training, initial and update, and also for pilots doing elementary work, and QA workshops, both classroom and online. HPA offers CARs courses, CRM, and SMS, First Aid and WHMIS. The company has added 'Effective Auditing,' a two-day course for anyone conducting internal or external audits, or responsible for the implementation of quality management procedures of an aviation company. Contact HPA Consultants at (519) 674-5050 or info@flysafe.ca* ■

steps to consider when performing a

piston engine removal

BY STUART McAULAY

The firewall and mounted components are more accessible for detailed inspection once the engine has been removed.

Aircraft piston engines are usually monitored for proper operation and power output before each flight, and again in more detail, during scheduled oil changes or inspections. Without a properly running engine, the pilot/owner is faced with the reality of handing things over to the maintenance provider for a closer look.

Those depending on the aircraft to run in accordance with the published parameters usually appreciate the work of the technician, or at least unconsciously trust that everything will work as it should. The technician's routine includes, but is not limited to, a good visual inspection, operational testing, magneto timing and cylinder compression checks, all in an effort to determine the continued serviceability of each and every engine that they maintain. Operating concerns can also include time in service, lack of pre-heating in winter and/or frequent cold starts, inefficient fuel management, inefficient cooling and an overall lack of regular use.

These are some of the main symptoms that mechanics consider in their assessment of an engine for continued operation. The pilot must also be aware of, and report, any indications that suggest the engine is not running as expected and make notes if necessary.

Even when things are going well though, there comes a time when that power center of the aircraft is going to reveal increased signs of wear and tear. This may take the form of one or more suspect observations, such as the gradual failing of cylinder compression, an increasing level of metal contamination in the oil, or a noticeable loss in power output.

The engine may also have reached its published TBO (Time Between Overhauls) or another pre-determined limit of on-condition operation until the tough decisions come into play

concerning repair or overhaul options. The published TBO is really a carefully speculated target time for the engine type, dependent upon the many variables associated with operation and/or maintenance. Any one of these preceding factors may be responsible for, or at least contribute to, the decision to end another chapter of a piston engine's serviceability and ultimately its long-term reliability. Once it has been determined that major overhaul is imminent, then engine removal becomes the next step.

Other more immediate causes for engine removal may include sudden stoppage, such as with a propeller strike, or other types of accident-related occurrences such as immersion in water or oil starvation. It could also point to oil filter or screen evidence proving a sharp increase in critical engine wear metals. Either way, these mechanical workhorses aren't designed to last forever, but they are capable of providing many hours of continued service when regularly and properly maintained and operated.

Engine care is in the hands of both the operator and the maintainer. The inevitable process of having to remove the engine from its familiar perch, firewall forward, will eventually come, and the trusted maintainers must be prepared to see it through with planned efficiency.

Engine removal can be a rather involved procedure when considering the condition of the accessories, hoses and other attachments. Engine removal also creates an opportunity for the technician to take a closer look at the firewall-mounted equipment and wire bundles, the engine mount and its welds, the baffles, seals and all mounted components. There is much more to consider beyond freeing the engine of its connections, hooking it up to a hoist, and hauling it out with reckless abandon.

More complex installations will require us to consider taking some strategic photographs of the engine configuration, and specifically, the routing of hoses, lines, wires and controls. Sometimes it just looks as though there is no real order to it when there actually may be a good reason for the existing routing. The opposite is also true when it may be necessary to correct an installation that was not planned well or was vulnerable to wear or stress. The time taken to ensure this step before disconnecting these items will often pay off when the time comes to reverse the procedure. Previous experience and a good memory help as well, but pictures can tell a story to whoever takes on the job of reinstallation. Labeling these items with masking tape or making detailed notes is also beneficial when there is the need to identify the specific orientation of hardware attachments or other key details such as specific routing and tie-offs. It also pays to have the service manual available in order to verify what we see versus what we should see so that we do not ultimately assume too much when looking ahead to the re-installation process.

If fluid carrying hoses are to be re-used and remain attached to the firewall, then the open end of the hose must be capped to prevent any foreign debris from entering the line. These hoses should really be flushed out as well to ensure that the concern of any contamination from the removed engine has been washed away. Hoses that are not due to be replaced,

Properly maintained engine baffles and seals are essential to engine cooling and operation.

usually by calendar time, should be inspected for unusual wear or abrasion that could shorten the service life of the hose. Engine compartment hoses should have adequate heat protection, usually in the form of a fire sleeve material or strategically placed heat shields and stand offs. Ensure that any repairs to these items are done at this time. Replace any hose whenever continued serviceability is questioned. A failed hose in flight can quickly stop things from going round and round. It is a great advantage for the maintainer to act on these items with the engine going out so that all of these areas can be addressed now rather than later when the return to service status is anticipated.

The engine change is also an ideal time to research the service hours on components like the alternator, vacuum pump or muffler assemblies. Consider whether it is an appropriate time to have these items overhauled or serviced in preparation to meet the newly repaired or overhauled engine being installed. The first few hours of operation could become frustrating when dealing with vacuum pump or alternator problems that could have been addressed at the engine change. If engine components are not specifically tracked in the technical records, it may be a good idea to include the status of these items in the maintenance entry, or at least on file for the engine change.

These are all good-to-know details for the "next person" and are most appreciated when that "next person" is you. The muffler should be carefully inspected and the heater shroud (if installed) cleaned of baked on oil drippings. Look closely at the intake scoop, hose or air box and its attachments for wear, loose rivets and cracks hidden by dried fuel and/or oil stains. Undetected flaws in this area could permit ingestion of dirt which shows up as increased silicon content in the oil analysis. Now that's no way to treat a new engine!

A new or newly overhauled engine often comes equipped with new or overhauled magnetos, fuel pump, carburetor or fuel control unit and starter. The rest of the items must be cleaned, researched and inspected before continued service. Other replacement items at this time include the inlet air filter, worn SCAT hoses and heat-damaged or brittle wiring. Wiring bundles, clamps or tie wraps on the firewall should be checked carefully for chafing or other issues that could be corrected when access to this area has never been better. The firewall inspection can even be extended to include the structural concerns that may be more difficult to inspect during routine checks. Consider the instructions for continued airworthiness for additional components specific to the aircraft, such as engine analyzers, other temperature probes and pre-heaters. These items too often get set aside and put back on just as they were removed. These considerations are not intended to create more work as much as taking advantage of the accessibility to these items, thus leaving less work for later.

One of the first steps for engine removal is the all-important tail stand (as required) before the actual releasing of the engine from its mount to compensate for a tail-heavy condition. Be careful with undoing and moving engine controls aside so that they are not bent too sharply or damaged any other way. The same goes for the soft primer lines woven around the sump and in between cylinders. The oil should also be drained before removal to avoid a mess on the floor later on. The steel tube engine mount and its welds are often taken for granted, and having the engine off permits the opportunity to remove the mount for closer cleaning, inspection and non-destructive testing. Once this has been completed, the engine mount can then be painted and mounted back onto the firewall in preparation for new engine shock mounts, hardware and of course, the engine itself which is dependent upon serviceable attachments making for a complete and reliable powerplant installation. While not always necessary, many of the steps described

Engine hoses should be inspected for condition, time in service and be capped to prevent contamination.

"Consider the instructions for continued airworthiness for additional components specific to the aircraft, such as engine analyzers, other temperature probes and heaters. These items too often get set aside . . .

above are addressed out of convenience and may be purposefully included in the aircraft maintenance schedule.

The propeller is not necessarily part of the engine change program per se but it should nevertheless be inspected at the same time. A constant speed model subject to wear metal contamination must be flushed out and inspected as well. Dynamic propeller balance will be affected by the engine change and should be re-done as desired by the operator. Always store the propeller in a safe location and off the shop floor to avoid unnecessary damage or contamination. Check spinner, bulkheads, ring gear and the alternator belt (if installed) for condition before reinstallation since they have already been removed for the engine change.

As with any routine inspection, the items removed from the outgoing engine should be cleaned and set aside to a designated area of the shop so that these particular inspections and repairs can be organized. Make note of any special fittings that need to be set aside and those that would normally be kept with the engine.

Take the time to order any parts, including gaskets and hardware, ahead of time in preparation for the engine installation. Some shops have prepared an engine removal checklist to ensure that all necessary steps are taken . . .

Items like the oil temperature bulb, oil pressure fitting and alternator/generator brackets which usually belong to the airframe manufacturer should be checked for overall condition and retained for later. Take the time to order any parts, including gaskets and hardware, ahead of time in preparation for the engine installation. Some shops have prepared an engine removal checklist to use in the same manner as an aircraft inspection checklist to ensure that all necessary steps are taken for both engine removal and the reversed installation procedures. The engine log book must also be updated and be kept with the engine as an ongoing record of maintenance events and release entries.

It would be a stretch to include the many possible scenarios associated with the different types of aircraft and engines and the methods used to bring them together. My intention here is directed more towards reviewing some of the more common steps or reminders associated with engine removal. It is also an opportunity to consider implementing formal procedures or introducing certain nuances for engine removal through company training or from our old friend, tribal knowledge. Whether there are some new ideas here for some to consider or just common sense review for others, let's take the time to do a complete and efficient job with engine removal. ■

CRASH AT Cape Cod Bay: Piper PA-24-180

On January 15, 2012, about 1005 Eastern Standard Time, a Piper PA-24-180 crashed into Cape Cod Bay near Brewster, Massachusetts. The airplane was registered to a private individual and was operated by a private pilot. Instrument meteorological conditions prevailed at the time and an instrument flight rules flight plan was filed for the instructional flight from Vineyard Haven, Massachusetts (MVY) to Hyannis, Massachusetts (HYA). The airplane was substantially damaged. The private pilot and a flight instructor were fatally injured.

The pilot filed a flight plan and obtained a weather briefing through the Direct User Access Terminal System (DUATS) at 1459 on January 14, 2012, the day prior to the accident. According to his wife, the pilot was practicing instrument procedures as part of an instrument proficiency check. After performing two practice approaches, the pilot requested four turns in holding at MECEJ holding fix.

After the pilot reported that he was established in the holding pattern at MEJEC, at 1504:01, the controller queried the pilot on his altitude control, stating that the aircraft altitude was varying by 500 feet. The controller asked the pilot if he needed assistance and at 1504:09 the pilot replied, "There's smoke in the cabin."

At 1504:24, the pilot stated, "We've got to clear the smoke and uh…" At 1504:33, the last transmission was received from the pilot, "Four eight pop I guess we'll sit... we'll stay in the uh... we've cleared the smoke we'll stay in the uh…" Radar and radio contact was subsequently lost. The pilot's wife listened to the recorded ATC voice communications after the accident and reported that the voices from the aircraft related to smoke in the cabin were that of her husband, the pilot. Recorded radar data indicated that at 1504:05 the aircraft was proceeding in a westerly direction at 2,200 feet above mean sea level (msl). The last radar return at 1504:45 indicated that the airplane had commenced a right turn and had descended to 1,300 feet msl. The wreckage was located about 0.3 nautical miles southeast of the last radar return.

The pilot held a private pilot certificate with ratings for airplane single-engine land and instrument airplane. On an insurance application dated January 9, 2012, he reported 676 hours total time, including 111 in the PA-24. His latest document flight review occurred on October 22, 2011.

The flight instructor held a commercial pilot certificate with ratings for airplane single-engine land, airplane multiengine land, airplane single-engine sea, instrument airplane, ground instructor, and flight instructor (airplane single-engine and multiengine, instrument airplane). He reported 7,384 hours of total flight experience on his latest Federal Aviation Administration (FAA) second-class medical certificate, dated March 30, 2011.

The airplane was a single-engine, low wing, retractable gear airplane, powered by a Lycoming O-360-A1D engine rated at 180 horsepower at 2,700 rpm. The tachometer time observed in the wreckage was 5,049.3 hours. It was equipped with an electrically heated pitot tube, but not equipped with ice protection on the wings, stabilator, or vertical stabilizer, nor was it certificated for flight in icing conditions. According to the aircraft maintenance records, the last recorded maintenance on the airplane occurred on December 16, 2011, at tach time 5,032.1 hours. The following entry was noted: "Checked for inoperative charging system, alternator circuit breaker found tripped, checked all alternator wiring from firewall forward, found that a 50-amp alternator circuit installed did not match 60-amp breaker called for in InterAv wiring diagram, 50-amp breaker previously approved by FAA form 337 dated 1/20/03, checked alternator brushes, adjusted alternator belt tension, ran engine several times and found charging system working properly, could not duplicate circuit breaker tripping. Replaced both wing tip navigation lamps P/N A7512-12."

The 50-amp circuit breaker was not replaced during the maintenance on December 16. The last annual inspection on

the airplane occurred on July 2, 2011, at tach time 4,983.9 hours. On June 11, 2008, during an annual inspection, the master circuit breaker was removed and replaced with another 50-amp circuit breaker.

The pilot's wife reported the following maintenance discrepancies during an interview following the accident. In November, 2011, the landing gear would not extend and the alternate extension system was required to lower the gear. On January 4, 2012, the voltmeter and ammeter were discharging. She stated that the airplane flew several times after that with no issues. There were no aircraft logbook entries to document the events.

According to the FAA, on December 27, 2011, the pilot was involved in an ATC deviation, and the pilot cited radio problems in his explanation of the event. ATC reported that the pilot did not respond to radio calls and deviated from his last assigned heading and altitude. The aircraft logbook did not include an entry related to a radio repair for the flight of December 27.

The wreckage was found submerged in Cape Cod Bay, at coordinates 41 46.600 north, 70 06.996 west. Once recovered, the wreckage was sent to a storage facility at Clayton, Delaware for examination, which did not reveal evidence of in-flight or post-crash fire and no soot was seen on the wreckage. The forward cabin section contained the instrument panel area, control wheels, rudder pedals, avionics and engine controls. The firewall was present and exhibited impact damage. The engine mount was attached to the firewall and the engine was attached to the mount. Side skins and top and bottom skins were missing, as were all window enclosures.

The rudder pedals were in place and the control cables were attached. The engine controls were impact-damaged and could not be moved. The pilot's control wheel was not present and the co-pilot's control wheel exhibited impact damage. Both rudder and stabilator trim controls and primary controls were impact-damaged and could not be operated. The cables were traced aft to their separation points. All breaks in the cables showed evidence of overstress or cuts by recovery personnel. The pilot and co-pilot seats were not located.

The primary electrical harness was in place. The circuit breakers were impact-damaged and separated from their mountings in the circuit breaker panel. Several electrical switches were impact-damaged. The pitot heat switch was found in the "on" position, as was the alternate pitot/static air source selector switch. The electrical harness was examined for pre-impact wiring integrity, as were various associated components. All panel-mounted avionics were impact-damaged. The aircraft's primary battery was not recovered. Several electrical and avionics components were removed for examination at the NTSB Materials Laboratory.

The center section of the fuselage had the left inboard wing root section attached. All top, bottom and side skins were breached. Two sets of seat belts were attached to the floor and side wall. One set had the shoulder restraint belt attached to the lap belt. The aft bench seat was located, but was not attached to the structure. The fuel valve was located and noted to be on the "right tank" position. The flap control lever was located and was impact-damaged.

The vertical fin was attached to the fuselage and exhibited leading edge impact damage and skin separation at its root areas. The rudder was attached to the vertical fin at its hinge points. It exhibited impact damage and breaching of the skins. The balance weight was not located. Control continuity was traced forward to the aft cabin area separations, then to the forward cabin area separations. All separations exhibited overload signatures or were cut by recovery personnel.

The left wing root section was attached to the fuselage. The main landing gear was damaged from impact and found in the up (retracted) position. The outboard section was breached and exhibited accordion type aft crushing of the leading edge. The fuel tank was not recovered. The upper spar cap was partially separated and bent upward approximately 45 degrees. The left aileron and its balance weight were separated. The weight was located. Aileron control continuity was established to its bellcrank. The aileron control cables were found in the instrument panel area and offered limited movement due to impact damage. The flap was segmented and partially attached.

The right wing was segmented and separated from the fuselage and had leading edge, accordion-type crushing aft. The wing skin was breached at the main fuel tank to inboard sections. The fuel tank was not recovered. The landing gear was attached and was in the up (retracted) position, with impact damage noted. The aileron was partially attached to its hinges and was bent from impact damage. Control cable continuity was established to the aileron bellcrank and then to cable separations. All separations exhibited overload signatures or were cut by recovery personnel. The propeller hub was fractured and about 60 percent was missing. The propeller blades were not recovered.

On his most recent FAA third class medical certificate application of December 9, 2010, the pilot reported the following medications: lovastatin, which is a cholesterol-lowering medication used to treat elevated lipids, allopurinol, which is used to treat gout, and vitamins. The FAA Bioaeronautical Sciences Research Laboratory (CAMI), Oklahoma City, Oklahoma, performed forensic toxicology testing pilot during which the following drugs were detected in the pilot's liver and blood: diazepam, nordiazepam in blood, tramadol and warfarin. Diazepam has sedative, muscle-relaxant and amnestic effects used to treat anxiety disorders, alcohol withdrawal, and muscle spasm. Nordiazepam is used as a treatment for anxiety. Tramadol is a prescription medication that is a centrally acting sedating narcotic analgesic. The makers of this drug warn it may impair mental and/or physical ability required for the performance of potentially hazardous tasks (e.g. driving and operating heavy machinery). Warfarin is a prescription anticoagulant used to treat patients with deep vein thrombosis, pulmonary embolus, and atrial fibrillation. A postmortem examination of the pilot noted the cause of death as severe multiple injuries and the manner of death was "accident (plane crash)." Following the wreckage examination of February 28, 2012, there was no evidence of overheating or fire on any of the examined components. ■

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BY SAM LONGO, AME A&P

Turbine Tributes

That aluminum clad, barrel-shaped, contraption hanging off the wing just outside your passenger window is a technical triumph that most airline travellers happily take for granted. However, the spool-up to its current level of reliability and sophistication was not without its hot starts and flame-outs. The patriarch of modern turbine power is, without doubt, Sir Frank Whittle. This British-born pioneer pilot and engineer persevered against all odds to produce the first practical turbine engine. His original 1932 patent had incorporated both axial and centrifugal compressors, but for his prototype he opted for the higher compression-per-stage centrifugal type.

His initial encounters with the British government left little hope of ever seeing his marvelous machine produced. Fortunately, a private backer saw the genius in his design and the Power Jets Company was formed to produce a prototype. This company also had the foresight to patent Whittle's revolutionary concepts for high bypass fans and afterburners in 1936. These ideas were so far ahead of their time that a patent extension was granted in 1952 before the first true Turbofan engine was ever built. That first prototype engine was produced on a shoestring budget of £2,000, despite his wishes to have pre-tested each individual component at a projected cost of £30,000. On April 12, 1937 the engine was ignited and became the first successful run of a jet engine worldwide. In fact it was so successful Sir Frank could not shut it down due to fuel pooling in the combustion cans!

With the British Air Ministry now keenly interested in the project, the wheels were set in motion to design and build an airframe to prove the engine in flight. Despite delays and teething problems with production engine manufacturers (Rover Car Company), the Gloster E.28/39 finally made its maiden flight May 15, 1941. With World War Two raging, the American company, General Electric, was given licence to build additional engines, and their keen adaptability to the new technology saw many rapid improvements. From humble beginnings, GE continues to be a key player in turbine technology today.

Although the German Messerschmitt 262 was the first "operational" jet fighter late in the Second World War, the Gloster still holds the honour of the first jet-powered flight. Despite the perceived glamour of the Luftwaffe's ME-262, its engines were notoriously fragile. Rumour has it that more pilots perished from catastrophic engine failures than by enemy fire, with critical "hot section" components rarely lasting longer than 15 hours! Not surprising, considering the fact that mastering metallurgy has always been the limiting factor in new technology since the dawn of mankind's mechanical evolution.

For his outstanding contribution to the aviation world Frank Whittle was knighted in July 1948 and subsequently received the Order of Merit by Queen Elizabeth in 1986. His concepts and commitment continue to influence modern turbine technology to this very day.

Fast-forward to May 30, 1961 when another milestone of turbine technology took place a little closer to home. Pratt & Whitney's iconic PT6 Turboprop made its maiden flight mounted to the nose of a Beech 18. The company is proudly celebrating its 50th anniversary this year since the first production engine was shipped to Beechcraft Dec. 22, 1963. This unique reverse-flow engine was designed as a workhorse capable of powering fixed wing aircraft, helicopters and multiple commercial applications. To date more than 50,000 variants have been produced, and they continue to serve customers worldwide. My introduction to this tenacious turbine started early in my aviation career. In 1974 Centennial College's "Turbine Guru" was Wally Hollman. As an ex-tech rep his specialty was the P&W PT6. He drilled us mercilessly on the minute intricacies of its very DNA. Later, as a fledgling apprentice at Nordair, I witnessed its rugged reliability mated to the DH Twin Otters operating in -60F in the frozen north. Spooling-up, after a short preheat, in that brutally cold environment never failed to amaze me. If you looked up reliability in an Arctic dictionary, a photo of that engine would be all the text required.

My familiarity with the PT6 came full circle as a professor in Centennial College's Aerospace Department when I attended the excellent "Heavy Maintenance Course" hosted by Standard Aero. The experience proved to be a hands-on, "tip grinding", in-depth extravaganza not to be missed by any true aviation maintenance gearhead. These superb engines have pulled me aloft in quiet comfort on numerous occasions, and their ability to return you safely home has never been in question. That they were conceived and manufactured in Canada is simply the icing on the cake.

Speaking of cake, I hope the folks at Pratt & Whitney celebrate the success of this "little engine that could" with pride and enthusiasm. Just like Sir Frank Whittle's initial vision of jet transport, good ideas mated with innovation and determination almost always lead to a brighter future. These jet propulsion pioneers deserve our gratitude as we safely and quietly traverse our rapidly shrinking planet.

For more published writing by Sam Longo, please visit www.samlongo.com ■

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