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

AMU

AirMaintenance UPDATE

The Magazine for Aircraft Maintenance Professionals

Helicopter tail rotors

the Regs: the minister does it again!

Transport Canada Approved for R/T

Publication Mail Agreement No. 0041039024
and Return Undeliverable Canadian Addresses to
Alpha Publishing Group Inc.
Suite 2 - 203 4360 Agar Drive, Richmond, BC, V7B 1A3
email: amu.magazine@telus.net

June - July 2013
Volume 12/Issue 1

$7.95

RAPCO, inc.

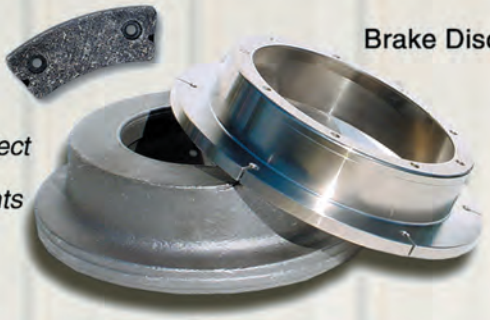
REPLACEMENT AIRCRAFT PARTS CO.

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

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

Vacuum Pumps

Easily check vane wear



Brake Discs

Over 80 direct brake disc replacements

Electroless Nickel plating

Regulator & Fittings

De-Ice Components

Leads, boots, modules, brushes & more

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

Request an e-card at www.rapcoinc.com

PARTS DEPARTMENT

RAPCO, inc.
REPLACEMENT AIRCRAFT PARTS CO.

1-800-527-2726

RAPCO, inc.
REPLACEMENT AIRCRAFT PARTS CO.

www.rapcoinc.com

NO PLANE NO GAIN

visit www.noplanenogain.org

The Livin' Is Easy

Ah, summertime, and the livin' should be easy, according to famed songwriter and composer George Gershwin. But not for those who tackle the annual Air Maintenance Update Recurrent Training Exam. This is the time of year for the exam that has questions relating to topics discussed in the magazine during the past year. It begins with the June/July 2012 issue and goes to the April/May 2013 issue. For Canadian AMEs, it counts for recurrent training time, so give it your best shot, send it to us here at AMU, and Chrissie Harvey will mark it for you. For those of you outside Canada, feel free to do the exam, and Chrissie would be glad to mark yours too. Wouldn't you Chrissie?

Also relating to summer, Sue Yost has provided a Human Factors piece that tells of some symptoms that may give you an indication that you're suffering from the heat. Give it a good read and make sure you keep yourself safe out there on the ramp. Your well-being is not only good for you, but can help ensure the safety of those who fly in the aircraft you maintain.

Mike Broderick was inspired to write this issue's article on tail rotors when he saw his golden retriever chasing its tail. Of course that's exactly what a single rotor helicopter would do if it weren't for the tail rotor. The lesson here is that you never know where your next bit of journalistic inspiration will come from. Good work, Mike.

It's also airshow season for those who haven't had enough of airports when the weekend comes (and for those who actually get weekends off). It can be good to see some variations on the aviation theme, apart from the aircraft we work on every day. It's not a bad idea to go and have a look.

And of course, it's also the time of year to close the hangar door and go to the lake for a barbecue. Enjoy the summer season, protect yourself from the heat, and do remember to leave work behind once in a while.

— Ian Cook
Editor

Departments

Features

AirMaintenance Update
Unit 7, 11771 Horseshoe Way
Richmond BC V7A 4V4 Canada
phone: (604) 214-9824 • **fax:** (604) 214-9825
toll free: 1-877-214-9826

email: amumagazine@outlook.com **website:** www.amumagazine.com

managing editor: Ian Cook
art director: Gregory Kero
publisher: Bill Carter
sales manager: Bill Carter
Advertising inquiries: (604) 214-9824

production manager: Chrissie Harvey
circulation: Anne Gervin
contributors: Mike Broderick, Norm Chalmers, Sam Longo, Stuart McAulay, Brian McNair, Gordon Walker, Sue Yost

Publications Mail Registration No. 0007198278

Published by Alpha Publishing Group (2008) Inc.

Publication Mail Agreement Number 0041039024 and Return Undeliverable Canadian Addresses to:
Alpha Publishing Group Inc.
Unit 7, 11771 Horseshoe Way
Richmond BC V7A 4V4 Canada

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

Corporate Member of:
HAC · Helicopter Association International · NBAA

This publication neither endorses nor confirms the information contained within. The appropriate authorities should be contacted prior to commencing work on any aircraft or aircraft part or procedure.

ISSN 1703-2318

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

Upcoming Events

CANADA

2013 Canadian Aviation Expo
June 1 – 2, 2013
Region of Waterloo International Airport
Breslau, ON
www.canadianaviationexpo.com/

Canadian Business Aviation Association Convention 2013
June 25 – 27, 2013
Vancouver, BC
www.cbaa-acaa.ca

2013 Abbotsford Airshow
August 9 – 11, 2013
Abbotsford Airport
Abbotsford, BC
www.abbotsfordairshow.com

Canadian International Airshow
August 31 - September 2, 2013
Canadian National Exhibition
Toronto, ON, www.cias.org

SAE 2013 AeroTech Congress & Exhibition
September 24 – 26, 2013
Montreal, QC
www.sae.org/events/atc

Ontario AME Association Annual AME Workshop and AGM
October 30 – November 1, 2013
Toronto, ON, www.ame-ont.com

UNITED STATES

Business Aviation Regional Forum
July 11, 2013
TAC Air, Centennial Airport
Denver, CO, www.nbaa.org

Arlington Fly-In
July 11 – 13, 2013
Arlington Airport
Arlington, WA
www.arlingtonflyin.org

EAA AirVenture
July 29 – August 4, 2013
Wittman Regional Airport
Oshkosh, WI, www.airventure.org/

Business Aviation Regional Forum
September 12, 2013
Landmark Aviation
Waukegan Regional Airport
Chicago/Waukegan, IL
www.nbaa.org

2013 AOPA Aviation Summit
October 10 –12, 2013
Fort Worth, TX
www.aopa.org/summit

2013 NBAA Business Aviation Convention & Exhibition
October 22 – 24, 2013
Las Vegas Convention Center
Henderson Executive Airport
Las Vegas, NV
www.nbaa.org

INTERNATIONAL

50th Annual Paris Airshow
June 17 – 23, 2013
Le Bourget, France
www.paris-air-show.com

10th Annual Latin American Business Aviation Convention & Exhibition
August 14 – 16, 2013
Congohas Airport
Sao Paulo, Brail
http://www.aeropodium.com/cp/bala.html

Advertisers Index

AIRPARTS NETWORK LTD.

GREAT QUALITY AT A GREAT PRICE

IN STOCK FOR SAME DAY SHIPPING

AIRPARTS NETWORK IS AN AUTHORIZED DISTRIBUTOR FOR THE FOLLOWING:

LYCOMING · SUPERIOR AIR PARTS, INC. · HARTZELL ENGINE TECHNOLOGIES · PHILLIPS 66 · LAMAR

TEMPEST

Powerflite Starters approved on TCM models feature a 5 year TBO Warranty! Spark plugs, filters, pumps and more also in stock!

electroair

Direct Fire Ignition Systems

4 cylinder electronic ignition systems for certified aircraft provide a 10-15% gain in fuel efficiency!

Electroair will have 6 cylinder electronic ignitions for certified aircraft coming soon!

APS

aviation products systems, inc.

Experience the strength, corrosion resistance, and precision manufacturing of these brake pads and discs at a fraction of the competitor's price.

SKYTRONICS INCORPORATED

Airparts is the only Canadian Authorized distributor for these quality harnesses and alternator kits.

HUTCHINSON® aerospace BARRY CONTROLS Aerospace

Barry engine mount rubbers are a quality product at an affordable price.

CJ Aviation

CRS# YPGR715L · EASA.145.5330

Affordable new outright hydraulic pumps so you don't have to worry about the core!

Fuel boost pumps also available.

GREGORASH AVIATION

ENGINES PARTS SUPPLIES

WWW.GREGORASHAVIATION.COM

CONTACT US

560 Marjorie St. Winnipeg, MB | R3H 0S9

toll free 1.888.744.9944 phone 204.772.0800 fax 204.772.0600 email info@airpartsnetwork.com

AIRPARTS NETWORK LTD. IS A GREGORASH AVIATION COMPANY

AERO RECIP · ULTIMATE Oil Coolers · CANTHERM DISTRIBUTORS · DYNO POWER XPERIMENTAL · AIRPARTS NETWORK LTD.

STCs & new products

West Star Aviation now offering G-200 Lavatory Modification

West Star Aviation, Inc. has announced that the company now offers the G-200 Lavatory Toilet Modification for G-200 aircraft with the 3-gallon lavatory tank. This modification replaces the existing tank with a new Zodiac 8-gallon tank. The work can be performed at West Star's East Alton and Grand Junction locations. A larger capacity toilet and waste water holding tank will be installed, allowing the system to hold five additional gallons. The existing toilet and enclosure will be removed and a new lavatory toilet seat and enclosure will be fabricated and installed.
For information visit www.weststaraviation.ca

AvFab Airline-style seats approved for all King Air Models

Aviation Fabricators (AvFab) recently received final Transport Canada approval for their Airline Style Seating for King Air Models 300/350. The Airline Style Seats are now approved in Canada for all King Air Models. These seating options were designed for high-density applications, and are available in two models: Econo Seat and Traveler Seat. Both options also have FAA and EASA STC Approval. They are also available in a "Narrow Back" version, allowing installation in a later model B200/B200GT or 350 King Air without removing the arm ledges from the sidewall. **For information visit** www.avfab.com

Shadin 1553 to ARINC 429 Interface System receives TSO certification

Shadin Avionics has announced TSO certification for the first of its AIS-460 (Avionics Interface System) line of 1553 to ARINC 429 data conversion units. Under contract with Support Systems Associates Inc. (SSAI), Shadin modified the AIS-460 to integrate the APX-119 transponder on select C-130 aircraft for the purpose of achieving Mode Select (Mode S) Enhanced Surveillance (EHS) capability. Shadin also provides a modified version of its AMS-2500 Altitude Management System to accomplish Pilot Selected Altitude functions for the program.

For more information visit www.shadin.com

Sherwin-Williams introduces Urethane Primer and Sanding Surfacer

A new Urethane Primer and Sanding Surfacer (CM0481827) has been introduced by Sherwin-Williams Aerospace Coatings.

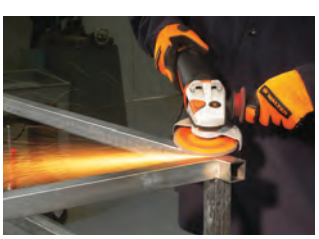
It provides tremendous production time savings opportunities, as it can double as either a traditional sanding surfacer or as a primer that offers great flexibility. Also, it dries twice as fast as traditional epoxy surfacer technology. This latest primer/surfacer is a high performance, corrosion inhibitive urethane primer that contains no hexavalent chromium.

For more information visit www.swaerospace.com

Sierra Industries G501SP retrofit receives Canadian STC Approval

Marking a significant milestone in the Sierra/Garmin avionics retrofit program, the FAA-certified G501SP has now received approval from Transport Canada. Canadian Citation 501 owners and operators can now benefit from the high-tech cockpit upgrade.
Developed in cooperation with Garmin International, the G501SP upgrade gives the classic Citation 50 series cockpit the look, feel and functionality of a brand new business jet at an unequalled price**.** **For more information visit** www.sijet.com

Walter Surface Technologies announces improvements to Finishing Discs



The most durable flap discs on the market today are now better than ever. Walter Surface Technologies, a leader in innovative solutions for the metal working industry, has announced key enhancements to its cutting edge line of flap discs branded as Enduro-Flex and Enduro-Flex Turbo for metal finishing applications – earning high marks in finishing performance, removal rate, and cost efficiency. The eco-friendly discs have been improved with an innovative backing made from a base of natural and sustainable plant fibers.

For more information visit www.walter.com

To announce your STC or new product, email a JPG photo and a product description to amu.editor@gmail.com or amu.magazine@telus.net

Canadian Aero Accessories Ltd.

Component Sales

Overhaul & Repair

Trusted
Experience
Since 1964

CALL US FOR THIS & MORE !

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

Authorized repair Station For

GOODRICH

Ice protection systems **PowerSystems**

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

www.canadianaero.com

TIMKEN RECEIVES MTU AWARD

CANTON OH, April 17, 2013 — The Timken Company recently received the MTU Maintenance Supplier Award for MRO (Maintenance, Repair and Overhaul) in the category of Best Outside Vendor for outstanding performance for the second consecutive year. MTU Maintenance, a division of MTU Aero Engines, is the world's largest independent provider of commercial engine maintenance services.

MTU recognized Timken for the company's support during 2012 in several key areas:

- rapid repair development for a new project at a facility in Berlin, Germany
- top performance on a key engine platform
- supporting capabilities development for a facility in Vancouver, Canada
- industry leading turnaround time and on-time delivery

Timken has been repairing aerospace bearings for more than 55 years and considers its Los Alamitos, California, facility as a center of expertise for bearing inspection and repair. The facility can repair more than 5,000 part numbers spanning 80 engine platforms. The Timken Company's global aerospace organization includes bearing repair operations in Wolverhampton, United Kingdom, and bearing inspection in Chengdu, China. For more information visit www.timken.com.

ROTOR BALANCING FACILITY OPEN AT VIBRATION SOLUTIONS NORTH

STOWE VT, March 27, 2013 — The Vibration Solutions North subsidiary of Moscow Mills, Inc. today announced the opening of a new state-of-the-art rotor balancing facility that delivers vast improvements in the speed and precision of balancing processes for jet engines and other complex equipment. VSN's advanced capabilities and leading balancing experts are helping companies streamline maintenance, overhaul processes and manufacturing, and reduce the excessive wear and energy loss that results from unbalanced rotors.

Based on the company's Kin-Dex technology, a patent-pending design approach to balance machine tooling, VSN's advanced rotor balancing capabilities include:

- Rotor Balancing Services: The state-of-the-art VSN Rotor Balancing facility is equipped to balance any rotor up to 100 inches in diameter and 5,000 lbs. to extremely tight tolerances of only a few micro-inches.
- Balancing Tooling: VSN designs and manufactures custom balance machine tooling that reduces the time required to properly balance legacy rotors as well as the new generation of rotors to the extremely tight tolerances specified for jet engines and other precision equipment.

Using the Kin-Dex technology, the balancing process time for a jet engine rotor can be significantly reduced in some cases, from several shifts to a single shift or less.

• Tooling Evaluation and Repair. VSN balancing experts can diagnose a company's current tooling and processes, and repair or replace the tooling to meet exacting customer requirements. For additional information visit moscowmills.com/balancer_tool/Kin-dex.html

STANDARDAERO RECEIVES AEROSPACE COATINGS CERTIFICATION

TEMEPE AZ, May 6, 2013 — StandardAero and eight of its aircraft paint technicians have completed the Embry Riddle Aeronautics University/Society for Protective Coatings (SSPC) program in aircraft painting. The six-week program confers a license in Aerospace Coatings Application (ACA) to those paint technicians who successfully complete the course and pass an examination administered by an SSPC proctor. StandardAero is the first MRO to implement the ACA program into its paint operations.

The ACA program, a joint venture developed by Embry-Riddle Aeronautical University Worldwide's Office of Professional Education (OPE) and the Society for Protective Coatings (SSPC), was developed to verify the knowledge, skills, and abilities of aircraft-specific paint technicians throughout the aerospace industry.

The ACA initiative is the very first of its kind; it confers a certification and license to an industry standard for aircraft paint quality, with an emphasis placed on safety-of-flight concerns. It teaches core knowledge and promotes a common language regarding the aircraft coatings process.

Of the 14 certified Aerospace Coatings Applicator Specialists (ACAS) in existence, eight work for StandardAero. The company's goal is to have 100 percent of their paint technicians ACAS certified within the next 12 months. In addition to this new certification for paint technicians, every technician in the company's Business Aviation sector is a licensed A&P Mechanic.

"We believe we're the only MRO that provides the industry with 100 percent certified A&P mechanics at all of our repair facilities," Taylor added.

For more information visit www.dubaiaerospace.com.

JETSUITE TECHNICIANS EARN INDUSTRY HONORS

IRVINE CA, March 26, 2013 — JetSuite, operator of a fleet of Phenom 100s and JetSuite Edition CJ3s, recently received the aviation industry's two most prestigious maintenance awards, furthering its continued commitment to the safety of its clients. The Federal Aviation Administration's 2012 Aviation Maintenance Technician (AMT) Diamond Award of Excellence recognizes that 100 percent of JetSuite's technicians received an individual AMT Award after passing specialized, continuous training in aircraft systems, regulations and FAA rules over a 12-month period. In addition, JetSuite received the National Air Transportation Association's AMT Five Star Award for achieving 100 percent technician participation in a recurrent AMT training program.

"At JetSuite, we understand that the safety and maintenance of our aircraft is of supreme importance," said JetSuite CEO Alex Wilcox. "Under the leadership of our Director of Maintenance Gary Geis, JetSuite has built a highly regarded maintenance organization. These awards from the FAA and NATA publicly evidence our commitment to operate to the very highest standards in aviation." For information visit www.jetsuite.org.

MILLENNIUM SUPPORTS HONEYWELL PRIMUS SERIES

Lee's Summitt MO, March 30, 2013, 2013 — Millennium International has announced the addition of avionics support for the Embraer ERJ 135,145 Honeywell Primus Avionics Suite. This is aimed at further improving its support of the Embraer fleet as well as broadening regional MRO activities.

For information on the Avionics Suite, visit www.avionics411.com. ■

Helicopter *tail rotors*

or why the helicopter doesn't chase its tail

BY MIKE BRODERICK
Helicopter Engine Repair
Overhaul Services

Welcome once again my faithful students. Hope all has been severe clear and blue skies since last we met. Now, I must admit I was having one heck of a time coming up with a subject for today's lesson, then into the room walked Roxy, my slightly overweight golden retriever. The only thing that dog loves more than sneaking a snack is to chase her tail. Not sure why, and perhaps I really don't want to know. However, when I saw her going round and round I thought, Now that is what would happen to a helicopter if it didn't have a tail rotor. Shazam. Thanks to Roxy, we now have something to talk about today. So, what keeps helicopters from chasing their tail during flight? Well, hang around and we'll find out together. And thanks again, Roxy. Hmm, I wonder if mounting something on her tail would stop her from chasing it.

Torque

So, if we want to know how to keep the helicopter from chasing its tail we should discuss why on earth it would do so in the first place, right? The reason is torque, or as explained by our good friend Sir Isaac Newton "For every action there is an equal and opposite reaction." One of the very first problems helicopter designers encountered when they tried to create a machine that could hover was the problem of torque reaction, and constantly getting dizzy proving Newton's third law. As you know, a typical single main rotor helicopter has a rotor system mounted on a rotor mast. The helicopter engine supplies power so that the helicopter can turn the mast, and thus the rotor system connected to it. When the helicopter applies torque to the mast to spin it, there is an equal-and-opposite torque reaction which tries to turn the attached helicopter airframe (and the passengers inside) in the opposite direction. *(Continued on page 12)*

"Brand New Twin Otter Nose Wheel!"

We're shouting from the roof tops, Beringer Aero is making it and Thunder Bay Aviation Ltd is bringing you this fantastic new wheel.

No matter how you look at it, the new Twin Otter Nose Wheel is a thing of beauty!

The new Beringer wheel has a number of features and benefits:

- Machined from high strength aluminum alloy.
- High strength to weight ratio.
- Anodized to substantially increase corrosion resistance.
- Incorporates Lip seals on the bearings to prevent ingress of moisture to the bearing.
- Less maintenance on the sealed bearings.
- Supplied in kit form with all necessary parts to install the new wheel.

The new Beringer wheel is STC approved by EASA ,FAA & TCCA.

To order your STC 008 wheel kit please contact:

Dave Breton; dave@thunderbayaviation.com

Steven Appelt; steve@thunderbayaviation.com

BERINGER BRAKE SYSTEM ©

THUNDER BAY AVIATION LTD.
SERVICE - OUR SPECIALTY

309 Hector Dougall Way
Thunder Bay, ON, P7E 6M5

Phone 807-475-5249
Fax 807-473-8238

www.thunderbayaviation.com

Eliminating the Torque Reaction

Counter-rotating Rotors

One way to counteract the torque of a rotor turning clockwise is to have one mounted in the same plane spinning counter clockwise. This is what most of the early designers seemed to use as a way to cancel the torque. The advantage of these types of systems (co-axial, tandem, intermeshing) is that the torque is countered with no loss of power. When 50% of the torque is used to turn one rotor clockwise, and 50% of the torque is used to turn a second rotor counter-clockwise, the torque reactions balance out. 100% of the engine power goes into turning the lifting rotor systems. Sounds good so far, right? These systems, though, are very complex mechanically and require more maintenance man-hours. However, there are still several production helicopters that do use multiple counter-rotating rotors as a way to cancel out torque. Examples are (at right, viewing clockwise from top left photo) the Boeing-Vertol tandem rotor helicopters; Charles Kaman's intermeshing rotor system; the Russian co-axial helicopter, the Hokum; and finally, we the V22 tilt-rotor, which uses counter-rotating prop-rotors in order to cancel out torque. The V22 system is similar to a tandem rotor system when in helicopter mode.

In my humble opinion, the tandem counter-rotating system is not as popular as the tail rotor because of the complicated mechanics involved as well as the expense in maintenance time and component cost. So thanks to Igor (when you are as old as I am you are allowed to call him by his first name) we have the ever-popular tail mounted, anti-torque stability systems, aka tail rotors.

Tail Rotors

I believe Igor was the first to settle on using a single rotor mounted at the rear of the helicopter as a way to counter the torque. And as I said earlier, this is the most popular arrangement in today's helicopters. Sikorsky engineers actually experimented with many different configurations before selecting a single tail mounted rotor.

Now, even though the majority of helicopters produced use this method of counteracting torque, there are some problems with this method that counter-rotating rotor systems do not have. One major issue with tail rotors is that they rob an enormous amount of power. As a rule of thumb, tail rotors consume up to 30% of the engine power. Yeow! That is a bunch of power, isn't it?

Next is that due to size, weight constraints and location, tail rotors are more susceptible to encounters with obstacles during maneuvers in close proximity to

the ground. Because they are mounted at the rear of the helicopter out of the pilot's sight, there is an increased possibility of helicopter accidents caused by the tail rotor smacking a rock, tree, fence (well you get the point) and losing all anti-torque capability. This of course will cause an immediate inadvertent interface with the ground due to the loss of horizontal and yaw stability.

Finally, tail rotors can be difficult to control accurately. Turbulence and crosswinds make it very challenging to hold a constant heading in a tail rotor-equipped helicopter. The workload is very high, and good results are difficult to achieve. Many larger helicopters end up being designed with a yaw stabilization system, which is essentially an autopilot for the tail rotor. Trust me, I know from personal experience that learning to hover is a very humbling experience. During my brief but exciting flight training, there was not a 100-yard spot large enough for me to hover within. The skill set required to fly a helicopter produced that infamous aphorism (a cool "cocktail knowledge" [CK] phrase) "Real pilots fly helicopters."

Tail Rotor Aerodynamics

As you might expect, the tail rotor assembly shares many of the aerodynamic tendencies of the helicopter main rotor system. After all, the tail rotor is essentially identical to a main rotor only mounted sideways. The tail rotor is controllable in collective pitch, but is not capable of cyclic feathering, thus causing an issue of correcting for dissymmetry of lift. For a tail rotor system, cyclic feathering is attained through the "flapping" action of the tail rotor blades which counteract dissymmetry of lift.

Tail Rotor Dissymmetry of Lift

Now you all remember the term "dissymmetry of lift" from our last session when we were going over helicopter terminology, right? When we discussed it, we concentrated on the main rotor system only. But it does make sense that tail rotors experience dissymmetry of lift just as a main rotor system does. (Tail rotor dissymmetry of lift will be discussed in greater detail during our next lesson.) For right now, suffice it to say that lift dissymmetry would cause a torque around the tail boom, which would tend to roll the fuselage in the same direction as main rotor lift dissymmetry. While cyclic pitch could be used to counter the rolling tendency, the tail rotor blades are typically allowed to flap, eliminating the lift dissymmetry. The photo at right shows a Bell 206 Jet Ranger tail rotor flapped to right and left extremes.

Tail Rotor Translational Lift

Just as a main rotor produces more lift when it moves into clean air, a tail rotor develops extra thrust when the helicopter moves it into clean air. Unfortunately, the pilot sees this as a change in anti-torque force, which results in an un-commanded yaw of the aircraft. The pilot is forced to make an adjustment to his anti-torque pedals as the tail rotor goes in and out of translational lift. There is no aerodynamic solution to this problem, and this is just one of the items that makes a tail rotor helicopter more difficult to fly. One solution that is sometimes used is a yaw-damper, essentially an autopilot that uses a gyroscope to detect un-commanded yaw, and then changes tail rotor pitch in order to prevent this exciting event.

> Indeed, a crosswind can induce the ring vortex state without any yaw being present . . . it's a rare occurence, but it does happen and is one more thing to keep in mind.

Tail Rotor Settling with Power

Just as a main rotor can get into a ring vortex state by settling into its downwash, yawing the helicopter such that the tail rotor settles into its downwash (side-wash?) can and will induce the same ring vortex state. Indeed, a crosswind can induce the ring vortex state without any yaw being present. As I said, this is a somewhat rare occurrence, but it does happen and is just one more thing for the pilot to keep in mind.

The solution to this problem is similar to that for the main rotor: try to prevent it from happening, but if it does, either move the tail rotor into clean air (by moving the helicopter), autorotate (to eliminate the torque), or try to get out of the ring vortex state by a very rapid and large increase in thrust (but if the pedal is already at the stop, this probably isn't possible). A hovering auto is probably the safest, most reliable way to get out of this situation, but as I am not a pilot, I will listen to any pilots who might have strolled into our class and will share some information. Any comments?

Tail Rotor Coning

While some tail rotors may be designed to allow coning, all tail rotors that I am familiar with simply pre-cone the blades, and don't worry about coning in the design. Helicopters with more than two blades (or more than two double stacked blades like the Hughes/MDHC-500) probably have a flapping hinge which acts as a coning hinge.

Changing the Pitch

In order to yaw the aircraft both right or left, the tail rotor blades need to be set to both negative and positive angles of attack, unlike main rotors which are normally only capable of positive angles of attack. The angle of attack of the tail rotor is controlled by the pilot's anti-torque pedals; (don't call them rudder pedals in a helicopter). The pedals are typically connected to the pitch change mechanism by either push-pull tubes or by cables. From the standpoint of controlling pitch, a tail rotor requires collective pitch control, but not cyclic feathering as has been stated earlier. This makes the pitch control mechanism of most tail rotors much simpler than that of the main rotor system.

And with that, I am going to release you for today, because I want you to remain curious and return again. During our next session we will discuss tail rotor dissymmetry of lift in detail, and then get into the details of pitch control mechanisms. In the following lesson, we will wrap up our sessions on tail rotors by talking about the Fenestron tail rotor system and finish that session with a quick review of the MD NOTAR system.

So there you have it. You still have enough time for an adult beverage, and you have information regarding the subjects for our next two lessons. See, I am always thinking of your health and welfare. With that, class is dismissed, and remember: even the best pilot can't fly unless you say it is OK to fly.

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.* ■

We Spell "Parts" With 3 "R's"

Reliable
Responsive
Reasonable

Our parts service representatives are all "schooled" in the 3 R's of great service: Reliability, Responsiveness and Reasonably priced.

Any way you spell it Parts Support is critical to your mission. At West Star we provide full support for the aircraft we service including components, accessories, landing gear overhauls and spare avionics components. Most are available on an outright or exchange basis and in many cases such as landing gear overhaul we have loaner assemblies available to minimize your downtime.

For AOG Support, use our new *"Experience On Call"* iPhone App.

For your convenience, we offer an extensive inventory of spare parts for the full line of Cessna aircraft.

Go To www.weststaraviation.com

East Alton, IL
800-922-2421

Grand Junction, CO
800-255-4193

WEST STAR® AVIATION

WESTERN AME

Western AME Association

President's Message

This year's WAMEA symposium and trade show was very different for me. Usually, I'm a participant; this year for the first time, I attended as a committee representative and got to see events unfold from another perspective. It was great to see over 100 students from SAIT and their instructors, old and new friends, and visit with exhibitors.

Without getting into great detail, the one aspect of the symposium that I got the most out of was our Friday morning round-table discussion. The purpose of this was to find out what direction the WAMEA membership wanted the executive to go in 2013 and on. The greatest two objectives for us are to come up with a solution to the AME shortage and get together from a national perspective to arrange full-time representation in Ottawa. These are considered by the membership as mandatory objectives – to retain credibility and have a real lobby entity to deal with regulations that effect aircraft maintenance personnel/technicians. For example, NPA 2004-049 may be set for round-table discussion as to how to proceed and enforce this suspected new regulation for the implementation of fatigue risk management in aircraft maintenance. Yes people, duty days are coming for aircraft maintenance personnel. It may not even go to discussion format and may be implemented internally.

As president for another term, I needed to know what the membership thought about proceeding with trying to get AME recognized as a Red Seal occupation. I also sensed before going into a discussion on this subject that the majority of us did not fully understand what a true apprenticeship program is really all about. Red River College (Stevenson) put on a great presentation on this subject. Questions were answered and it was put to a vote. It was elected by the membership that this was not a priority item for the WAMEA executive to pursue at this time. This does not mean that I have dropped it from my agenda, and I will still be pushing for it in the western region.

There was one aspect of our symposium that bothered me. I was walking down the hall of the West Coast Plaza just as the Transport Canada forum on SI/SUR 001 R4 was getting out. I have sat in on these talks before and left slightly confused and frustrated. I was not prepared for all the negative comments coming from everyone. All in all, I did not hear one positive remark about the whole SMS process, and was left with the realization that perhaps a lot of TCCA inspectors still don't get it either.

As people responsible for maintaining aircraft, we are drilled from the beginning of our careers that "safety first" is priority. I feel that maintenance departments have been doing safety management and risk assessment quite well, and as they say " If it ain't broken don't fix it." What seems to have happened is that this is an operational issue, and either accountable executives do not know how to integrate this philosophy into the rest of the departments, or they have left it to the maintenance Q/A people to resolve. This seems to lead to what I laughingly call "shelf documents". These are documents that are so large, cumbersome, and so non-practical that no one uses them except for reference to complete an exam stating that we have read and understood these manuals. It's kind of like doing human factors training on line.

Our WAMEA website is up and we encourage everyone to visit. If every member could recruit one new member, our membership would double.

Everyone have a great summer and play safe. Create a safe day.

— Rod Fisher
President, WAMEA / Vice President, CFAMEA

PACIFIC AME

Pacific AME Association

Back to the Drawing Board
President's Report by Bob Rorison

In 1982, PAMEA was born to help AMEs promote professionalism in the aircraft maintenance industry. The founding members were from both the airline industry and YVR (south side) small fixed wing/rotary wing operators. The PAMEA directors have always been volunteers and have always tried to be non-partisan in their decisions, not affiliating with any union, political party, or company. PAMEA board members set goals, developed bylaws, and organized symposiums, which provided valuable training and networking to member AMEs throughout Western Canada.

Early on, only a small fraction of interested AMEs registered as PAMEA members, but we found that the association attracted a number of local corporate members who contributed a lot in time, money and other resources throughout the years to make the annual symposiums a success. During these annual events, many members received awards for major accomplishments, and many deserving students won bursaries to help with their education in aircraft maintenance.

Over time, PAMEA developed a legal defence fund, and a forum for the AME to participate in discussions about regulation (CARs) issues.

"What can PAMEA do for me?" Since PAMEA's inception, this question has been in discussion, and continues to be in discussion today extensively. In PAMEA's 30 years, there has never been a clear answer to that question. No director, member, or volunteer can stand up and say precisely "what PAMEA has done for me."

Is there a list of goals and objectives that you want to see PAMEA strive to achieve? Keep in mind, goals are long-term and may not be strictly measurable or tangible, and objectives are mid- to short-term and must be clearly measurable and tangible.

Using the examples below, please send the editor some goals that you, as a member, would like to see PAMEA strive to achieve.

Partial List of Goals and Objectives

1) Annual 3-day symposium
2) Annual 2-day symposium
3) Annual 1-day training session
4) Legal defence fund
5) Education forum
6) Aviation jobs on-line
7) Recurrent training on-line
8) Recurrent face-to-face training
9) Initial training: a) Human Factors, b) Safety Management Systems SMS, c) Basic troubleshooting skills, d) Basic Systems, e) Other
10) AME meetings in Abbotsford, Kelowna, Prince George, Sidney or other aviation centres in BC
11) Regular AME meetings in the YVR area
12) Student bursaries
13) Partner with WAMEA to form one regional AME association

Our current membership is dropping, and there are very few Transport Canada members. Why is that? They are still AMEs and could contribute greatly to the association. A few years ago, PAMEA received a promise from CFAMEA that all active AME names would be available through Transport Canada, and yet as of today, we have not seen that list. We do not even know how many AMEs are working in Canada or British Columbia.

Only a handful of Instructors at the local college are members, yet they continue to hold an AME license and they do set an example for their students. How do we get their involvement along with student involvement?

PAMEA membership fees have always been affordable ($55 per year) to help an AME who may be struggling financially. Setting a lower fee for students makes sense, but just making it cheap is not the reason to belong. Students need a job board and a way to network with potential employers.

Finally, there's training. Are we providing job-ready, enthusiastic students from our colleges that we can trust to work on an aircraft? Is there another model that we can use to get young people to enter the aviation industry? Other trades already use the apprenticeship model with a combination of formal training and on-the-job training. The aviation maintenance industry should attract both young and old aviation enthusiasts to enter the industry, and not have them accumulate debt from a long-term program that may or may not provide a job at the end of the course.

This type of apprenticeship model could have industry (AMOs) sponsor prospective candidates, have them attend school for a time, work for a time, then end up with the same result to achieve the number of training hours required by Transport Canada, and meet the objectives of Part 566 of the CARs.

The industry is changing, the AME work force is getting older, and young people are not entering the industry. Can PAMEA be a part of changing the tide? Can we attract new aviation enthusiasts and dreamers? Will we roll over and watch from the sidelines while change happens around us? It is up to you, the members, to decide the future of aviation. Your PAMEA directors are willing to work hard to keep our industry alive, but we need your input. Contact us and get involved: pamea@telus.net

— Bob Rorison
President, PAMEA

Volunteers Wanted

PAMEA Director at Large

- Location: B.C. (Sidney, Kelowna, Kamloops, Campbell River)
- Duties: Promote PAMEA in the local aviation community, participate in quarterly PAMEA meetings via Skype, and hold a local annual membership drive BBQ
- Qualifications: Registered PAMEA member
- Contact: Bob Rorison, President; pamea@telus.net

AME Association of Ontario

2283 Anson Drive, Mississauga, Ontario L5S 1G6
tel: 1-905-673-5681 fax: 1-905-673-6328
email: association@ame-ont.com website: www.ame-ont.com

Annual AME Workshop and AGM

Planning continues for our annual AME Workshop scheduled for October 30th to November 1st. Please save the date on your calendar. Again this year, we will be having two days filled with educational sessions as well as a full house of displays from industries supporting aircraft maintenance.

Status of the Aircraft Maintenance Engineer

Last newsletter, we discussed the status of the aircraft maintenance engineer and whether he or she should be called an engineer, a mechanic or a technician. No matter what we are called, the important thing to keep in mind is our "professionalism". This theme continues with this newsletter. Following is an article from our association's Director of Training "Uncle John" Longo. Enjoy!

Sincerely,
Your Board of Directors

Doing it Right the First Time and Every Time

What is it about human nature? In the effort to work on complex flying machines, most launch into tasks with a minimum of thinking,

planning, and research. There are rules and regulations that guide actions when working on aircraft and their systems, and we need to abide by them every time. We need to rise above our tendency to act before we think. CAR 571-2 is the bible for us all to follow, plus the manufacturers', and the operators' control manuals. Please be familiar with their contents and work to the rules.

Lock-out fixtures exist for a reason. Can we agree? The manufacturers have thought through the risks and included kits that are to be used, every time, to protect the equipment and the technicians. The short walk to the tool-crib to get the fixture will keep everyone safe, provided that it is serviceable with the red streamer and that you affix it to the hydraulic ram to hold the undercarriage doors open so you can safely work in the wheel well during a "B Check". Have you ever cracked a hydraulic line without zeroing the accumulator pressure? Pretty scary when your world becomes bathed in stinging fluid and you slip and fall on your pointy tools and your life flashes in your mind as to why you didn't accept the job in your father-in-law's recycle company. Ever moaned about going back to the flight deck to pull and collar circuit breakers, or to install tags on controls to prevent others from trying to operate them while the system is opened for maintenance? Stop complaining and do the right thing.

Prevention should be a universal principle that we apply every day in every way worldwide. Prevention means thinking before acting, asking for information, exploring choices based on sound business practices, and working safely. Procrastination is just delaying the inevitable. Leaving things for the day shift is a bad decision. Think of it this way: Not making a decision is a decision. While we may feel rushed and under pressure at times to "kick it out", we need to calmly assess situations, review the options, and take the safe economical next step.

We are not encouraging "analysis paralysis" or going for coffee while the passengers are on board and the flight crew are demanding a technician to deliver a "fix". There's an old saying that goes: "We don't take the time to do it right, but we always find the time to do it over."

Doing the task "by the book" is its own reward. A priceless, emotional feeling of accomplishment provides the focus to make it a habit. Taking the time to fill out work sheets and signing off logbooks is required to maintain the serviceability of the flying machine. Shortcuts are fine as long and they include all of the legal steps to safely complete the job. But this does not apply to logbook signing. This is always required, as is legible printing of the words in the logbook. This may no longer apply if an electronic logbook is used, but the entries still have to be logical and appropriate.

Have you been around when the flight is long departed and the aircraft's journey log was found in the maintenance vehicle? That bird is operating illegally, and steps have to be taken to re-join the logbook with the aircraft. Remember, doing it right the first time and every time is the only sustainable way to having a career in aviation. Maintenance Control is your solution (ex: the logbook), as they will authorize a temporary log to be initiated at the next station and boarded until the original can be restored to its rightful place.

Stop and think, take a deep breath. Think of your favourite family member or friend flying on the flight. If something catastrophic happened, your life as you now know it would be over. In a blink of an eye, things would change forever. The details count, just like breathing, in our business. "Double check" is our mantra, and jumping steps in a procedure is to be avoided.

My advice is this: train yourself to resist acting without thought. Conduct a quick review of the issue to confirm your understanding of the need. Call for help, enlist Maintenance Control, and delegate someone to order the part, to print the procedure, to advise operations of the delay, and more. If alone, be methodical to ensure no steps are missed. Call in help to ensure every time, every shift – wherever you are – that you are following the rules. Please do your part to maintain aviation safety by always following the rules that are in place to protect us all. This will also strengthen your professionalism.

— John Longo AME

About the author:
John Longo has AME certification and many years experience in technical operations as a mechanic, technical trainer, manager and facilitator/trainer. He is currently working as an aviation consultant with an international clientele and is volunteering as the Director of Training for the AME Association of Ontario.

Careers in Aviation Expo 2013

In an effort to promote careers in all aspects of aviation, Wings and Helicopters Magazines presented the first Careers in Aviation Expo on April 6, 2013. The function, hosted at the Holiday Inn at Yorkdale in Toronto, was well attended by many young men and women keen to pursue careers in aviation.

Four separate panel discussions were presented during the day, each manned with experienced individuals from all aspects of the broader aviation community. Each panel discussion was started with general questions of interest, and then opened up to questions and comments from the attendees.

I was pleased to be a member of the maintenance and manufacturing panel representing the Ontario AME Association along with Jim Passant, Coordinator Aircraft Technical Programs from Centennial College and Erika Kangas, Flight Test Engineer, from Bombardier Aerospace.

The discussions provided great insight into life in the field and potential career path guidance for the youth who attended, with many excellent questions from the audience. The questions and discussions continued once the panel concluded, which is always a good indicator that the topics were well received.

There were also great networking opportunities with the many exhibitors manning booths throughout the hall, with everything from airlines and manufacturers to excellent representation from various training organizations. As well, there was a shuttle service for a guided tour of the Flightsafety International Simulator Training Center.

Congratulations to Wings Magazine, for hosting this first-ever event, and kudos to the panelist/volunteers from the industry who participated to help promote a strong future in aviation careers. Mentoring and supporting future AMEs is an important part of the association's mandate, and we will continue to take every opportunity to participate in promoting our profession.

Here's hoping that this much-needed Aviation Career Expo continues and flourishes in future years!

— Very best regards
Sam Longo, Vice-President

PAMA SoCal Chapter

February 2013 Meeting Wrap

Thank You Jay Sumner, Battery & Hose Shop Manager, Van Nuys, CA

The SoCal chapter would like to thank Jay Sumner and all at Aviall Van Nuys for their time and generosity in hosting the February 2013 chapter meeting, dinner, an excellent technical presentation on battery and hose inspections and service techniques and an awesome scholarship raffle prize donations at the 94th Aero Squadron Restaurant in Van Nuys, CA. To learn more about Aviall, go to www.aviall.com, and to reach Jay directly: Jay.Sumner@Aviall.com, Telephone 818-997-5062 (Battery Shop).

February 2013 Scholarship Fund

Raffle Drawing $359. Thank you chapter supporters: Aero-Nasch/Jet Brella, Aero Distribution, Business Aerotech, Consolidated Aircraft, Extraord-N-Air, HRD Aerosystems, Idea International, Maximum Aero Support Inc., and Rotorcraft Support. 100% of the proceeds from raffle ticket sales and donations benefit the SoCal PAMA Scholarship Awards Program.

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 homepage, 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

SoCal PAMA Calendar 2013

- June 11: Chapter meeting, Scholarship Awards
- July/August: No meeting; summer recess
- September 10: Chapter meeting
- November 12: Chapter meeting
- December 10: Holiday Social

Industry Events 2013

- ALEA Convention: July 17–20; Orlando, FL; ALEA.org
- ALEA W. Regional Conference, TBA; ALEA.net
- Reno Air Races: Sept. 11–15; Reno, NV; Airrace.org
- AEA W. Regional Conference; TBA; AEA.net
- AOPA Aviation Summit: Oct. 10–12; Ft. Worth, TX; AOPA.org
- IA Training – Rotorcraft Support: Oct. 16 Burbank, CA; RotorcraftSupport.com
- NBAA Annual Convention: Oct. 22–24; Las Vegas, NV; NBAA.org
- AVM Summit/PAMA National Symposium: Nov. 21–22; Orlando, FL; AVM-Summit.com
- Western Museum of Flight Monthly; Torrance, CA; WMOF.com

The SoCal chapter offers aviation event postings free of charge to the aviation maintenance community worldwide.

FAASafety.gov

FAA Safety Team | Safer Skies Through Education
A&P Certificate Replacement
Notice Number: NOTC4449

If you have already replaced your paper A&P certificate, then this message is not for you. On the other hand, if your A&P certificate is still printed on paper, please read carefully.

The FAA is under a mandate to replace all paper certificates with plastic certificates. If you have not replaced your paper certificate, you are no longer able to exercise your privileges. All certificated airmen, including mechanics, repairmen, pilots, etc., are required to replace their paper copy with a plastic copy, or they will no longer be able to exercise the privileges of that certificate. The best way to get a new replacement certificate is to follow the instructions at http://www.faa.gov/licenses_certificates/airmen_certification/certificate_replacement/. The replacement cost is $2.00, unless you still have your social security number on your certificate and you ask to have it removed.

New Design for Mechanic & Repairman Certificates

Notice Number: NOTC4498

On January 1, 2013, the Airmen certification branch of the FAA began issuing Mechanic and Repairman Certificates with a new design on the back of the certificate honoring Charles Taylor. Since the introduction of the updated airman certificate in 2003, the mechanic and repairman community has requested that the FAA issue a certificate that represents the contributions of Mr. Charles E. Taylor, who served as the Wright brothers' mechanic, and was credited with building the engine for the 1903 Wright Flyer. The new design is printed on all original and replacement airman certificates issued after January 1, 2013, to mechanics, repairmen, repairmen (experimental aircraft builder), and repairmen (light sport aircraft).

Mechanic and repairman certificate holders are not required to replace their current plastic certificate. An airman may, if they wish, obtain the new style Mechanic / Repairman certificate with Mr. Taylor's likeness by submitting a $2.00 replacement fee and visiting the registry's website at http://www.faa.gov/licenses_certificates/airmen_certification/, by mailing a signed replacement request, or by completing an application for an added rating or other change. Instructions are on the registry's website.

SoCal PAMA Board of Directors

(2013 Elections Pending)

- Greg Potter, President; greglpotter@verizon.net
- Bill Johnston, Vice President/Topic Chair; wdjohnston@raytheon.com
- Dan Ramos, Treasurer/Broadcasts; danwramos@verizon.net
- Gail Erwin, Secretary/Newsletter; gailjerwin@verizon.net
- Tina Campos, Sergeant At Arms; nathan_chris@msn.com
- Chris Cancelosi, Meeting/Prize Coordinator Chair; chris@rotorcraftsupport.com
- Veronica Lozano, Meeting/Prize Coordinator; veronica@rotorcraftsupport.com
- Sabrina Baiocco, Raffle Ticket Sales Co-Chair; sbaiocco@claylacy.com
- Luisa Benin, Raffle Ticket Sales Co-Chair; lbenin@claylacy.com
- Nikki King, Website Advertising Chair; nikki@extraord-n-air.com
- Phil Samuelian, Chapter Photographer; psamuelian@me.com
- Warren Horton, Chapter Governance Advisor; wchorton@hotmail.com
- Glenn Beckley, Chapter Governance Advisor; coptrmd@aol.com
- Warren Horton, Emeritus: Chapter President, Vice President
- Glenn Beckley, Emeritus: Chapter Sergeant At Arms

Special thanks to SoCal chapter supporters

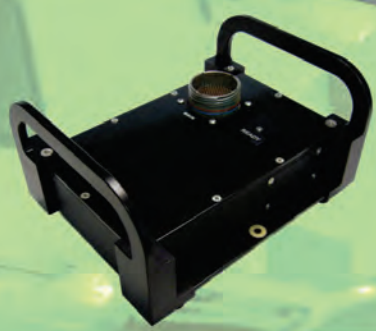
PAMA Mission Statement

The mission of PAMA is to promote continuous improvement in professionalism and recognition of the aviation maintenance technician through communication, education, representation, and support.

A SMOOTH FLIGHT STARTS WITH BALANCED ROTORS.

Zing
Vibrex 2000 Plus

Zing VXP



Zing Test Elite

PROPELLERS | WHEELS & BRAKES | NDT | **DYNAMIC BALANCE EQUIPMENT**

Hope Aero knows balancing from A to Zing

- Distributor for Honeywell Chadwick Zing Test Equipment
- Sales, Training, Technical Support and Equipment Function Testing
- Carry-On Systems and On-Board HUMS Systems

Visit us at HELI-EXPO booth N4635
Dana Ladd, direct line 416-618-7164
zing@hopeaero.com

1-800-268-9900

HOPE AERO
GOOD TO GO.

The Minister *does it again*

BY NORM CHALMERS
Pacific Airworthiness Consulting

I am providing this preamble

to clarify my usage of abbreviations, etc. These abbreviations are all commonly used in the aviation industry and you may come upon them in your day-to-day work.

Preamble and Acronyms

(Italicized type denotes a quotation.) **CAR:** Canadian Aviation Regulation, which is a law of Canada; **CofA:** Certificate of Airworthiness; **EASA:** European Aviation Safety Agency; **FAA:** Federal Aviation Administration; **FAR:** Federal Aviation Regulation (FAA); **ICA:** Instructions for Continued Airworthiness (including maintenance manuals et al); **STC:** Supplemental Type Certificate; **STD:** TC-approved standard; **TATC:** Transportation Appeal Tribunal of Canada; **TSB:** Transportation Safety Board of Canada; **TC** or minister or "tower of darkness" or "the Tower" indicates Transport Canada headquarters in Ottawa; **TC Data Sheet:** Type Certificate Data Sheet; **TC Holder:** Type Certificate Holder/Owner; **USA:** United States of America.

Here we go again. The minister of transport (TC, or the minister) has once again fulfilled my dearest hope for a topic. His latest Aviation Safety Letter (TP 185E, Issue 1/2013) includes, in its standard "Maintenance and Certification" slot, a composition about Canada's Bilateral Agreement with the USA and their FAA. The article does give some good general information, but highlights one of my constant issues with the minister's constant state of nescience radiating from the Tower of Darkness at 330 Sparks Street in Ottawa. From Sparks we receive no "scanty flame of the lamps that struggle against the darkness." (Edward Bulwer-Lytton).

From that article, I quote that famous and irritating advice emanating from the tower: *"Canadian AMO are encouraged to contact their local TCC or TCCA regional office regarding the procedures and requirements of the MIP should they be looking to perform maintenance on U.S. registered aircraft or components meant for installation thereon."* (The minister likes that word "thereon".)

That is TC's standard bureaucratese for "we don't know what to tell you but we are sure that the inspectors can figure out something". The minister has six regions, dozens of "centres" and a bountiful supply of "procedures and requirements". What information you get depends on where you live and which inspector you talk to. Always take doughnuts. The European Aviation Safety Agency (EASA) has guidance for a supplement but the FAA doesn't have anything I can find, nor does TC. In my humble opinion, the minister ought to step up and give us some help with a useful FAA supplement guide containing sample wording. The minister approves these supplements, so he ought to tell us in writing what he wants. Yes I know, the minister is not reading this, and I know that no one in TC is going to tell him anything about this. That's the "Plausible Deniability" rule that governs all communication in The Tower and government in general.

There is the "sample manual" that TC has on their internet site which is of minimal help, but that's another rant that deserves its own space.

Speaking of rants reminds me of another topic. Canadian Aviation Regulation (CAR) 571 and Standard (STD) 571 are in focus. The CAR is the law, and the STD is the minister telling you how to comply with the CAR.

CAR 571.09 states:
(1) No person shall install a used life-limited part on an aeronautical product unless the part meets the standards of airworthiness applicable to the installation of life-limited parts; and
(a) the technical history of the part within the meaning of Section 571.09 of the Airworthiness Manual is available to show that the time in service authorized for that part in the type certificate governing the installation has not been exceeded; and
(b) the history referred to in paragraph (a) is incorporated into the technical record for the aeronautical product on which the part is installed.

STD 571.09 Installation and Disposal of Life-Limited Parts states in part:

Pursuant to section 571.09 of the CARs, life-limited parts and assemblies incorporating life-limited parts shall:
(a) have a technical history that includes the total time in service of the life-limited part; and
(b) be installed in accordance with section 571.13 of this standard.
Information Notes:
(i) The technical history, referred to in (a), may be limited to providing the traceability of the part to the previous airframe, engine, propeller, appliance, or component from which it was removed, or from which the technical history was obtained.

Regarding paragraph (i) above, nobody with any significant aviation experience or knowledge would write that balderdash which contradicts the CAR. That pernicious advice could lead industry members directly to court a visit from the TSB and a session with the TATC. My advice to you is "DON'T DO IT" with emphasis. Always demand the full technical history and component card that goes back to zero. That has always been the standard procedure followed by all reputable people.

Another strange and contrary bit of advice is found in STD 571.10(4) the Types of Work table item (c) that states as follows:

Types Of Work

(c) Non-destructive Testing (NDT)
Information Note:
Where NDT has been performed, but where the inspection findings have not yet been assessed against the published limits, a maintenance release shall not be signed in respect to the NDT requirement. Hence, a maintenance release is only required where disassembly and reassembly were involved to provide the access necessary for the inspection.

Applicable Standards Of Airworthiness (related to the above)

That the inspection findings have been analysed and any defect or discontinuity noted in the inspection findings supplied by the person performing the NDT is within the manufacturer's published limits for that aeronautical product.

This means that NDT AMOs do not provide maintenance releases for any of the NDT inspections that they do. You, the AME or AMO first remove a part and send it to an NDT AMO for NDT inspection. You get the part back with a bit of paper with some statement that mumbles "NDT IAW ASTM etc." but without a maintenance release. After you reassemble the aircraft, engine or other product, you sign the standard maintenance release for the work entered into the record. So you are on the hook for the maintenance release for NDT. Likewise if you are a non-specialized AMO who hires an NDT AMO to X-ray a wing or do other on site work. When the NDT technician leaves, all you get is a nod, a wink and a "thanks for the tea and crumpets".

In my view, NDT is the same as any other inspection. An AME or AMO does a required inspection, records the findings, and "signs off" that inspection was done per the

applicable airworthiness requirements. Repair and modification actions are extra. The NDT AMO uses the instructions stated in the maintenance manual, service bulletin or airworthiness directive to set up the specialized equipment, to use that equipment, to record any discontinuities such as cracks. They then provide the record of that inspection with the noted discontinuities, followed by maintenance release. That is needed by the product owner, the non-specialized AMO, and required by all civilized nations.

We could ask the minister to get rid of this type of direction that is directly detrimental to safety. I would send a Civil Aviation Issues Reporting System (who-CAIRS) report to The Tower but I see that as more futile than reporting bogus parts or reporting that the sky is falling. We can't expect the minister to understand that because he is protected from reality by his loyal and upwardly mobile mandarins. TC can't even get its advisory material up to date.

Now for something completely different. In my previous article I went in depth explaining the "type certificate data sheet". To follow up on that, I examine some related points.

I have often seen it written and heard it stated, that an aircraft must comply with its type certificate. This assumption is very commonly held but is wrong. Very few aircraft literally comply with their type certificates. In our last issue I described how this certificate is issued to a person or a company that becomes the "certificate holder". Remember that term. The factory builds the aircraft to conform to that design specified in the type certificate. For the sake of this discussion, that new aircraft comes out of the factory and off to the new owner.

The new owner flies around a bit and decides to change something and installs an STC or after-market part. Now the aircraft no longer conforms to that type certificate that the TC Holder has. Likewise with after-market repair design approvals. In line with this view, the Canadian CofA application form now states:

I hereby certify that the aircraft described above has been inspected and found to conform to its approved type designation and is in a fit state for flight.

The term "type designation" has been loosely used in other documents but has not been defined. The term "type design" is defined in CAR 101.01 and refers to "aeronautical product", which includes aircraft and the aircraft parts. Loosely used, one might say it refers to all parts on the aircraft addressed in design approval certificates such as STCs.

That brings us to Airworthiness Notice B073 Documentation Required for the Installation of Parts onto Canadian Registered Aircraft. Specifically, I refer to the document that you receive with an STC. Some individuals have assumed that a copy of the STC document is what they needed. Wrong. All that certificate indicates is that the STC was issued. You must get a release document that indicates that it came from a company approved to manufacture the product.

In Canada, you can check on company approvals by going to the TC Applications web site at "http://www.tc.gc.ca/eng/civilaviation/opssvs/applications-537.htm". Then go to

"Approved/Accepted Organizations" and then to "Manufacturer" and look for the company that you want to check up on. I have not been able to find that same information at the FAA website.

I did contact one FAA office regarding approval of a company to manufacture a product, but that office couldn't tell me because the approved product list was in a letter sent to the company. If the FAA can't give you that approval information, then I suggest that you get the manufacturer to send to you some proof that it is approved to manufacture.

Your final and best line of defence is the manufacturer's Authorized Release Certificate for new manufactured products. Canada, the USA and the EASA all have rules and regulations in place regarding use of these documents. The Canadian Form One, the FAA 8130-3 and the EASA Form-One all follow the same agreed format.

For new products, box 11 states "New", box 13 contains the certification/release and box 14 is not used and must be struck out or darkly shaded. You ought to demand that the manufacturer send these certification forms with their products. You, I and the judge call that "due care".

On another note, some news reports at "canada.com" have been focussing on the evolving regulatory oversight, or lack thereof, of the aviation industry in Canada. Try to make sense of this statement by another government mandarin:

"We felt that it doesn't make sense to have one way of inspecting an SMS company and another way of inspecting a non-SMS company," Transport Canada assistant deputy minister of safety and security (name deleted) said in an interview.

Having been recently promoted from the TC Boats Branch he is just not familiar with the way aviation people hear. Nobody seems to know who is going to be thrown under the train when this SMS bologna fails. They just keep playing musical chairs until the music stops.

What is the reality of all this move to SMS? That it saves money seems to be the only known fact. Everything else is hot air for now. I agree with the concept of companies examining themselves for problems, but I do not agree with the opting out by TC.

My issue with the whole program is that it is a huge experiment. The program of normal government audits, inspections and other oversight is gone. They, whoever they are, have done away with safety oversight and have substituted SMS without knowing what the results are going to be. All we have is new and untried SMS "visits". Most experiments done in the modern world involve lab rats that will grow warts or die when things go wrong.

SMS is an experiment on a grand scale far too complex for lab rats to undertake, so the Canadian government uses humans. I don't like being treated like a rat. Unfortunately, most people don't understand or care – something that senior government leaders know this from experience. With the money that we save at TC, we can fund the recent pay increases for the members of parliament and senators.

Now for something completely different, we go back to the topic of type certificates, basis of certification, and aircraft categories. This affects those AMEs signing off work on medium- size aircraft.

Looking at the CofA for your aircraft, you will see a block for Category. Categories are specified in the TC data sheet and are usually listed as Normal, Commuter, or Transport. As I mentioned before, the TC data sheet will specify the aircraft category and the "Basis of Certification". Going to the basis of certification for most of you means going to the FAA website, although Canada has equivalent documents. In most cases, those in the Normal and Commuter category refer to FAR 23 for fixed wing aircraft and 27 for rotor wing, and in the Transport category FAR 25 for fixed wing and FAR 29 for rotor wing.

This can be most confusing in the commuter category. Our example here is the Beechcraft 300 series Super King Air. You will note that the Model 300 was certified in 1984 in the normal category under SFAR 41C (Special FAR).

The B300 was certified in 1989 in the commuter category under FAR 23. SFAR 41C was an interim regulation to allow the certification of larger aircraft without requiring them to meet the more stringent and demanding FAR 25 for transport category aircraft. In 1987, between the certification of the Model 300 and the Model B300, the requirements of SFAR 41C were incorporated into FAR 23. This became the commuter category. We now see aircraft that are in many ways identical but certified in different categories. This may answer some of the questions regarding TC's advisory AN C004 and AME licenses in the M1 category.

In the next issue of AirMaintenance Update, I will try to tackle the topic that I have heard proposed: "Log Books Made Easy". That's the same as everything; it's easy if you know how – just like the Space Station, the Large Hadron Collider, and good apple pie. We'll examine the authoritarian direction being implemented by Transport Canada, twisting and misusing the law to intimidate the aviation industry that they know so little about.

With that thought, I leave you until next time with the hope that you will all remain well and have the confidence that the minister of transport will continue to provide me with topics that I can gently point out and bring to your attention.

That's all for now, so until next time, study those Data Sheets and be skeptical.

Please be aware that I am not a lawyer or a 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 aviation matters that arise 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.pacific-airworthiness.ca.* ■

Summer 2013

BY SUE YOST

As we wait (oh, so impatiently) for

winter to finally withdraw its fangs and let us get into the familiar warm weather rhythm of grass-cutting, gardens, pools, and summer clothing, it is time to once again ponder the implications of summer temperatures, and their effect upon your performance. Summer means no more bundling up just to go out for a few minutes, no more winter tires, shoveling snow, and trying to work on aircraft outside, with cold tools, thick sluggish fluids, and frozen fingers/nose/toes (or whatever else you may have exposed). However, summer will bring its own set of problems, such as heat-induced fatigue, hot metal surfaces, asphalt and concrete ramps that accumulate heat, salt sweat that stings your eyes, and a whole list of heat related performance inhibitors.

Human factors have always been a combination of what can go wrong (errors), what will be the cause(s) (factors), and what you can do to prevent things from happening (safety nets). And since this seems to work quite well for prevention of errors due to the Dirt Dozen factors, let's use the same approach to overheating (may as well use what works).

You all know that heat will make you feel tired, sluggish, slow you down at work, and can make you feel physically as well as mentally baffled by the end of the day. This will affect the majority of the workforce, but there will be some of you who are more likely to feel the effects of summer temperatures, and will be affected sooner. People who will suffer the most will be those who:

- have high blood pressure or heart disease
- have poor circulation
- are dehydrated
- are overweight
- are on certain medications, such as diuretics, sedatives, tranquilizers, and antihistamines, as these affect your ability to perspire and cool down naturally (these are the most common, but this is not a complete list)
- Are engaged in high activity jobs, or working out in direct sun
- Need to wear heavy protective clothing that doesn't "breathe"

Also, when you are working into the evening, and sun goes down, it should cool off a little, but if you are outside on the tarmac, the heat that has collected there all day will start to release, and may

not give you the relief that you had expected (and looked forward to) so you'll be working at temperatures that are significantly higher than the surrounding area.

There are the common signs that you are overheating, such as sweating, headaches, feeling tired and sluggish, and taking longer to get things done. Management needs to recognize that this will happen, give you more frequent breaks, access to water, and longer time deadlines for work to be completed. But what about some of the other symptoms that you may feel?

- brain fog due to dehydration; there will be headaches, poor balance (really nasty if you are up on a wing), poor short term memory, and impaired decision making

- pain and joint swelling (also the result of dehydration), will affect the cartilage that protects the bone surfaces at joints, making movement awkward and painful
- muscle pain (dehydration again); water enables the body to dilute toxins that will remain trapped when the lymph glands become blocked due to poor circulation

- cravings: yes guys, cravings, and not ice cream and pickles; cravings can happen when you are chronically fatigued, and are most commonly for items such as alcohol, caffeine and sugars; drink at least 4 pints of water daily, and you will notice that you will have fewer cravings, and can more easily distinguish between food and thirst requirements.

- immune dysfunction: most common in those of you who suffer from chronic fatigue, dehydration results in excessive histamine production, which can trigger allergies, and also interfere with the body's ability to resist infections.

The message here? Not rocket science, is it? DRINK LOTS OF WATER! This will help with a multitude of summer-related issues, including thirst, memory improvement, increased ease of movement, better energy and cooling, and the relief of hunger pangs. Water is also good ON the body, not just IN it! Dunk your head under a tap, spray water down your arms and legs, wrap a cool wet cloth around your neck, and use a spray bottle to "mist" yourself regularly. It is much easier to stay cool than to cool down. And do not grab the coldest water buried in ice at the bottom of the cooler because your stomach will cramp. Try for room temperature water. Your body cannot absorb, and use, the water you drink until it comes up to body temperature.

Also important is eating. Brekky is an important meal, feeding your fuel-hungry brain that uses up to 30% of the day's calories. Eat proteins and carbs in combination, using whole grain and brown breads, muffins etc., to give you longer, lasting energy reserves. Protein-rich foods will also help with alertness, attention, and motivation.

Caffeine is the beverage of choice for most of you, so use it judiciously. Too much over time will make your system immune to that "jolt" that you want, and you have to use more and more to get the same feeling. Try coffee in the morning,

to get going, and follow it with water or juice to avoid the dehydration that will follow, and then maybe a cup for afternoon break, when that 12-hour cycle kicks in, and your circadian rhythm is falling, again chasing the coffee with a non caffeinated drink.

Last but not least are the non-food ways to stay cool. Loose, light-colored clothing that breathes, the use of fans, removing hats during frequent breaks and at lunch to allow heat to escape from your head (40-50% of heat loss), and getting out of the direct sun.

How do you know you are suffering from a heat-related emergency? Heat cramps and exhaustion will start with muscle cramps and feeling hot and tired, progressing to headaches, nausea, fatigue, and lots of sweat. These need to be addressed and the person cooled down, but if the person is hot with dry red skin (no sweating), and has bizarre, irritable behavior, rapid shallow breathing and a rapid and weak pulse, they are suffering from heat stroke, and could also have seizures. This is a 911 emergency. Have them take sips of water at room temperature, and cool them down as much as you can while waiting for the ambulance. Put covered ice packs in the groin, armpits and around the neck to cool down major arteries.

Heat-related emergencies are just that: emergencies of varying degrees. Prevention is the best thing, but when you are stuck in working conditions where you are likely to overheat, take the time to cool down, watch for signs and symptoms in yourself and co-workers, and have lots of the safety net that can help you – WATER!!

SUE YOST *is the owner and principal facilitator for HPA Consultants, based in SW Ontario. We offer Human Factors training both initial and recurrent, and HF for pilots doing elementary work. HPA also provides CARs training, CRM, SMS, QA, First Aid and WHMIS. We now have computer based training courses that include HF initial, update, for pilots doing elementary work, and QA. You can contact us at info@flysafe.ca (NOTE: the sympatico address is u/s) or call 519-674-5050* ■

Get on board with AMU

Give your company added exposure at NBAA 2013

AMU
AirMaintenance Update

As a sponsor of AirMaintenance Update's booth at NBAA, you get

- your company logo displayed at AirMaintenance Update's NBAA booth
- your company's promotional literature available at AirMaintenance Update's booth
- free display advertising in AirMaintenance Update magazine and on AMU's website

Sponsorship levels: Platinum: $3,000 Gold: $2,000 Silver: $1,000 Bronze: $ 500

amumagazine@outlook.com • www.amumagazine.com • 604.214.9824 • Fax 604.214.9825

Passenger Accommodation explained part 2

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

In Part 1 of this series on passenger accommodations, we looked at the importance of ensuring proper function and operation of the systems designed to provide creature comforts to the paying passengers aboard our high-altitude, people-moving projectiles. Making sure that our bleary-eyed travelers have hot coffee, reading lights and audio-visual entertainment to while away the hours of mind-numbing boredom that is modern air travel, is an important aspect of maintaining a passenger-carrying aircraft. In a highly competitive market, it is essential that we cater to the needs of our customers, and ensure that certain cabin snags are addressed as a high priority maintenance item. Passenger loyalty is very difficult to earn, and is very easy to lose.

In terms of in-flight entertainment systems, great advances have occurred in recent years. The microchip and internet-inspired revolution in electronic communications and entertainment media have also slipped the surly bonds of earth, and have expanded the scope of audio/visual distractions available to the flying public in a huge way. Personal video display screens at each passenger seat allow for the selection of a wide array of entertainment choices, including film, broadcast television, games, Internet access, moving map displays and more. Safety and service announcements of both an audio and video nature can also be displayed on these "Smart Video Display Units" (SVDU) initiated manually by the flight crew or automatically in the event of an in-flight emergency.

At the dawn of the wide-body era of passenger flight, the challenge, from a technical perspective, was to provide multiple channels of audio entertainment to hundreds of passenger seats without using massive amounts of heavy electrical wiring. Three hundred seats, each wired for 24 channels of audio entertainment would mean such a weight load that we'd need to have JATO bottles installed on 747s! (which would be great fun to see, but the airlines would NEVER buy in). The solution was to use multiplexing (MUX) to carry multiple channels of audio to the seats, on a single conductor. Instead of each audio channel being wired individually, all of the audio is chopped into pulses (digitized) and sequentially sent along a single conductor to the seats in the passenger cabin. When the passenger selects a particular channel on their armrest-mounted passenger control unit (PCU) the de-multiplexing circuitry allows only the requested audio pulses to be

routed to the listener's headset and disregards all other pulses. This same technology can be used for other passenger accommodations such as reading lights, flight attendant call buttons, and even oxygen delivery.

The keys to multiplexing are in the synchronized switching of the multiplexer, which digitizes or chops the signals into pulses, and the de-multiplexer, which selects only the desired pulses and "re-assembles" them into a useable form, such as entertainment audio, an illuminated passenger reading light, or a flight attendant call signal. Even the operation of the flush motors can be controlled by a multiplexed system on a larger aircraft with multiple lavs.

Earlier-generation passenger entertainment systems (PES) allow passengers to use this multiplexed form of audio to listen to various recorded programs such as music, comedy and spoken word, as well as the soundtrack for THE in-flight movie. That is to say, a movie is shown, typically on a screen at the front of the passenger cabin, and all passengers can tune their PCUs to listen

to the audio for that movie. The structure and operation of these MUX systems was such that the system provided access to the various channels of entertainment as they played in a continuous loop. For example, passengers listening to "Channel 5: Hits of the '70s" would all hear the same audio at the same time. The communication was unidirectional, from the source to the receivers.

Advancements in Ethernet technologies and the development of video and audio steaming allow newer-generation PES users (passengers) to select, on their own private SVDU, a wide variety of entertainment options, including a selection of films which they can control individually in terms of playback, fast-forward, pause, rewind, etc. The PES digital server units (DSU) act as information/entertainment providers, and the passenger's SVDUs act as "clients", receiving the streamed audio/visual content in an interactive (two-way) format through the Ethernet network.

Moving map displays are available on many PES, enabling the passengers to visually track the progress of their flight. Information from various avionics sources, such as air data computers and inertial reference/navigation systems provide input to what is commonly known as the airshow mapping feature of the PES. This enables the displaying of not only the moving map, but of flight information, such as airspeed, altitude, heading, time to destination, and so on. The maps themselves, in some cases, may boast high-resolution graphic imagery provided by an onboard data base.

Live television broadcasts and Internet access are becoming common features of passenger entertainment systems, as are interactive games. In fact, onboard communications with other passengers and interactive gaming amongst passengers are now offered as entertainment options on some flights.

Of course, we, the flying public, know that it's not all fun and games aboard the big 'Buses and Boeings. Important information must be communicated to the passengers before, during and after each flight. Technical information, such as how to fasten and unfasten a seat belt, must be conveyed to passengers, even if they are enjoying the wide selection of two-star movies available to them. To this end, the passenger

address (audio) and video address functions of the PES will override and disable the entertainment features of the PES, should a zone or full aircraft PA or VA announcement be initiated. These announcements may be made manually by the flight or cabin crew, or automatically, using prerecorded messages. A list of features available on a typical wide body PES would include:

- Audio & Video On Demand (AVOD)
- Passenger Announcement (PA)
- Video Announcement (VA)
- Moving Map Display
- Pre-recorded Announcement Machine (PRAM)
- Boarding Music
- Games
- Built-In Test Equipment

As maintainers, there is perhaps no better system to illustrate the changing nature of our business, than the passenger entertainment system. From running wiring on a DC-4 to discussing digital servers and Ethernet cabling on a 777, the job of avionics technician has evolved immensely during my time in the industry. The emphasis on passenger satisfaction and the shift towards a greater understanding of computer hardware, software, protocols etc. means the aircraft maintainer of today must be trained in such a manner as to have greater soft skills as well as a wider scope of knowledge in terms of general technologies not directly associated with aviation-specific applications. Testing, troubleshooting, and often even repairing aircraft systems in today's technological arena, is more about manipulation of software and user interfacing than it is about understanding the theory of flight.

Now, if I can just figure out how to save this article to my hard drive, without deleting it first…

Q: Name two sources of input data to the Airshow Mapping feature of a passenger entertainment system.

Answer to the question from the previous issue of AMU:

Q: What procedures should be followed when checking an aircraft's galley oven receptacles?

A: Oven power receptacles can be checked for correct voltages and ground connections as well as signs of overheating and misalignment. Switch and timer functions should be verified to confirm that the appropriate power is delivered at the appropriate time.

GORDON WALKER *entered the avionics industry after graduation 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 concerning the training and licensing of AMEs, being nominated to the CAMC Board of Directors, and being elected President of the National Training Association. (NTA).* ■

Cessna 421C Engine Failure

On July 9, 2011, about 1740 central daylight time, a Cessna 421C, operated by a private individual, was substantially damaged when it impacted terrain while on approach to the Demopolis Municipal Airport (DYA), Demopolis, Alabama. The certificated private pilot and six passengers were fatally injured. Visual meteorological conditions prevailed and an instrument flight rules flight plan was filed for the flight that departed the Creve Coeur Airport (1H0), St. Louis, Missouri, destined for the Destin-Ft. Walton Beach Airport (DTS), Destin, Florida.

According to information obtained from the Federal Aviation Administration (FAA), the pilot was in cruise flight at flight level 210 (21,000 feet), and in contact with the Atlanta air route traffic control center when he declared an emergency due to a rough running engine, about 1725. He diverted to DYA, which was located 12 o'clock and about 10 miles from the airplane's position. The pilot was switched to Meridian Approach and he reported descending through 17,000 feet mean sea level (msl) at 1727:55, with the airplane positioned about 2.5 miles northeast of the airport. The pilot further stated that he planned to orbit over Demopolis during the descent. At 1728:59, the pilot confirmed that he was experiencing a rough running engine; however, about 10 seconds later, he reported that he had just shut down the right engine. He also stated he did not believe he would require any assistance after landing. At that time, the airplane was about 6 miles east of DYA, at an altitude of about 14,500 feet msl.

The pilot reported the airport in sight, was cleared for a visual approach and then approved for a frequency change to the local common traffic advisory frequency about 1734. At that point, the airplane was about 2.5 miles northeast of the airport, at an altitude of about 7,000 feet. There were no further communications received from the airplane. The airplane's radar track was consistent with a left traffic pattern approach to runway 22. The airplane was descending from an altitude of about 2,300 feet msl, when it was abeam the runway threshold, on the downwind leg of the traffic pattern. The last radar target was observed at 1739, at an altitude of 700 feet on the base leg of the traffic pattern, about 3 miles from the approach end of runway 22, and about .5 miles northwest of the extended centerline.

The airplane impacted trees in a wooded area, about .8 miles north of the runway 22 threshold.

Personnel Information

The pilot, age 42, held a private pilot certificate, with ratings for airplane single-engine land, multiengine land, and instrument airplane. His most recent FAA third-class medical certificate was issued on July 19, 2007.

At the time of his most recent FAA medical certificate, the pilot reported a total flight experience of 642 hours.

The pilot's flight instructor reported that the pilot had practiced at least seven single-engine landings in the accident airplane, which included at least three single-engine landings from a VFR traffic pattern. The pilot completed Cessna 421 recurrent training on July 29, 2010, which included three practice single-engine landings at that time.

Based on the hours that the accident airplane had been operated, the pilot's total flight time at the time of the accident was estimated to be about 1,000 hours, which included about 500 total hours of multiengine flight experience.

Aircraft Information

The eight-seat, low-wing, retractable-gear Cessna 421C, was manufactured in 1978. It was powered by two Continental Motors, Inc., GTSIO-520-L, 375-horsepower engines, each equipped with a McCauley propeller assembly.

The most recent recorded airframe logbook entry was on February 10, 2011, with no change in flight hours since the annual inspection. At that time, the left engine hydraulic filter and right main landing gear strut were replaced.

The left engine was overhauled on August 31, 2007, at a total time in service of 3,780.7 hours. It was installed on September 28, 2007. At the time of the most recent annual inspection, the left engine had accumulated approximately 305 hours since overhaul.

The right engine was overhauled on August 24, 2004, at a total time in service of 1,595.7 hours. It was installed on September 30, 2004. At the time of the most recent annual inspection, the right engine had accumulated approximately 514.2 hours since overhaul. The most recent recorded right engine logbook entry was on February 10, 2011, and noted a reset of the engine fuel pressures.

An oil analysis report of oil samples collected from each respective engine on January 3, 2011, stated that the samples "appeared normal." Both propellers were overhauled on June 1, 2010.

At the time of the annual inspection, they had been operated for about 172 hours. According to a work order for a pre-purchase inspection, as of June 3, 2011, the airplane had been flown approximately 27 hours since the most recent annual inspection.

Wreckage Information

The airplane came to rest inverted in a wooded area with varied tree heights up to about 80 feet, in a flat attitude on a course of about 100 degrees. The cockpit, the cabin up through 40-inches forward of the tail cone, and the left wing were consumed by fire.

A series of tree strikes were observed about 50 feet above the ground, approximately 70 feet south of the main wreckage. A navigation antenna was observed about 200 feet south-southeast of the main wreckage. The course from the antenna to the main wreckage was about 020-degrees.

All major portions of the airplane were accounted for at the accident site. There was no longitudinal deformation of the fuselage noted. The radar dome on the nose of the airplane was observed installed and retained its shape. All three landing gear actuators were observed in the extended position.

Portions of the flaps that were not compromised due to fire and or impact damage were extended approximately 40 degrees. The entire right wing was separated at the root and came to rest against a tree adjacent to the main wreckage.

The left engine and propeller assembly remained attached to the left wing and were fire damaged. The left propeller was observed a low pitch position and displayed signatures consistent with rotation at impact.

Examination of the retained components retrieved from the right engine was performed by an NTSB materials engineer . . . Forty-five of the teeth were either fractured or crushed, two teeth were damaged and 13 teeth were intact . . .

On-site examination and a subsequent teardown of the left engine at Continental Motors, Inc. (CMI), Mobile, Alabama, did not reveal any preaccident mechanical malfunctions or failures that would have precluded normal operation.

The right engine and propeller assembly remained attached to the right wing. One propeller blade was separated from the hub. The remaining two right propeller blades were observed at or near the feathered position and did not display evidence of rotation. All of the cylinders and accessories remained attached to the crankcase. The top spark plugs were removed. Their electrodes were intact and exhibited normal operating signatures in accordance with the Champion aviation check-a-plug comparison chart. The fuel pump was removed. Its respective coupling was intact; however, the camshaft gear exhibited damage on its respective gear teeth when viewed through the fuel pump bay.

The right engine was disassembled at CMI under the supervision of an NTSB investigator. The disassembly revealed additional damage and several missing teeth on the cam gear, and intake and exhaust valve contact on all six piston faces. The safety wire securing a cam gear bolt was broken at the head of the bolt, and a corresponding piece of safety wire was found in the oil sump, which contained metallic debris. The No. 1 crankshaft main and connecting rod bearings exhibited damage consistent with lubrication distress. The remaining crankshaft main and connecting rod bearings were intact and did not display evidence of lubrication distress.

The crankcase halves, camshaft, camshaft gear with separated gear teeth, cluster gear, crankshaft gear, No. 1 main bearing, camshaft and crankshaft gear attachment bolts, safety wire removed from the camshaft gear attachment bolts, and contents retrieved from the oil sump were retained and forwarded to the Safety Board's Materials Laboratory, Washington, DC, for further examination.

A subsequent teardown of both propeller assemblies at McCauley, Wichita, Kansas, did not reveal any preaccident mechanical malfunctions or failures that would have precluded normal operation.

Tests and Research

Examination of the retained components retrieved from the right engine was performed by an NTSB materials engineer. According to the Materials Laboratory Factual Report, the camshaft gear contained 60 teeth. Forty-five of the teeth were either fractured or crushed, two teeth were damaged on the tooth flank, and 13 teeth were intact. Fracture features of the teeth with discernible fracture features were mostly uniform matte gray in the middle portion of the fracture with smeared features near the flank root surfaces. A smooth curving arrest line was observed on the fracture at the contact side of one of the teeth, with radial features emanating from the boundary. Additional examination of the fracture revealed features consistent with fatigue in steel under relatively high stress concentration. The respective adjacent gear teeth did not contain evidence of fatigue; however, another gear tooth displayed evidence consistent with surface spall.

No evidence of fretting was observed on the camshaft and cluster gear attachment bolts. Fracture features on the broken safety wire were consistent with overstress.

Examination of the crankcase revealed staining and impressions consistent with the application of silk thread around the through bolt holes on each side of the main bearing saddles at every main bearing location, and at the bolt holes at all of the camshaft main saddles. Teledyne Continental Motors Service Information Letter SIL99-2A, dated August 27, 2002, provided information pertaining to the application of sealants, lubricants, and adhesives during maintenance, overhaul, or component repair or replacement. Page 16 of SIL99-2A contained a threading diagram for the GTSIO-520, and included a warning that stated, "Apply thread and Permatex only as illustrated." Thread application locations were depicted at the edges of the crankcase and around the through-bolt holes in the saddle bosses for all the camshaft main journals; however, no thread was called for around the through-bolt holes at any of the crankshaft main bearing saddle bosses.

The crankcase from the right engine was returned to CMI for measurement of the main bearing bores with and without the application of silk thread in accordance with SIL99-2A. In both cases, the crankcase was assembled and torqued to the current CMI production procedures.

Measurement of the main bearing bores with the silk thread installed ranged from zero difference to +.0006 inches, with +.0004 inches observed on the No.1 main bearing bore.

According to a CMI representative, the main bearing in that location had a .006 minimum crush on each half when installed in the crankcase and the installation of silk thread alone would not result in the damage observed during the teardown inspection or affect engine performance.

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot's failure to maintain airplane control during a single-engine approach and his failure to fly an appropriate traffic pattern for a single-engine landing.

Contributing to the accident was a total loss of engine power on the right engine due to a fatigue failure of the right engine cam gear. ■

Aviation Services

Aviation Services

Do you have any story ideas for AMU?

By contributing articles to AMU, you are able to promote your skills and expertise; and you provide valuable information to the aviation and aerospace community.

AMU

Email ideas for articles to AMU's editor, Ian Cook, at: amu.editor@gmail.com

Aviation Services

Employment

BY SAM LONGO, AME A&P

Murphy's Mahem

Most of us in the aviation maintenance world are well aware of Murphy's Law. Its boiled down reality simply states that "anything that can possibly go wrong, usually does, often with catastrophic results". As aircraft maintainers we must be aware that Murphy's Law lies dormant in every task we undertake.

For those not acquainted with the history of this principle, it is generally believed that Murphy's Law was named after Major Edward A. Murphy Jr., an American aerospace engineer, while he worked for the US Air Force Institute of Technology. In 1949 he was working as an R&D officer at Wright-Patterson Air Force Base, where he was deeply involved with testing G-force effects on pilots using ground-based rocket sleds (USAF project MX981). Major Murphy had designed transducers for the sledge to accurately measure the g-forces, but after Dr. John Paul Stapp was subjected to a very high-g test, it was discovered that a technician had wired the transducers backwards and therefore no readings were recorded. After this intense ride, Dr. Stapp was not impressed, and it is this faux pas that caused Major Murphy to coin the famous phrase, "If there are two or more ways to do something and one of those results in a catastrophe, then someone will do it that way." The rest, along with all the variations and misquotes, is history.

A good example of this phenomenon occurred to me in the winter of 1977. I had returned to Toronto and landed a job at DeHavilland in Downsview. Despite the many trials and tribulations inherent in working for an aircraft manufacturer, this tale involved a Murphy's Law winter nightmare with a 1974 MGB sports car.

I had rented a room in a large house at the base of Dufferin Street in Toronto and consequently my previously pampered MG was relegated to the horrors of common street parking. Early one Monday morning after a heavy snowfall, it refused to start. After clearing and popping open the "bonnet" I discovered that someone who had parked in front of me had inadvertently filled the engine bay with snow, likely while clearing their own car. After much digging and fooling around without satisfaction, I caught the bus for the long ride up Dufferin Street, vowing to re-attack the situation after work that evening. When I returned, the weather had worsened, but undaunted in darkness with an extension cord running across the street, I continued my quest for internal combustion by the glow of a trouble light. Now the cars battery was getting low from the incessant cranking and cold temps, so I took it inside and charged it for the night. Next morning, it was another Public Transit extravaganza the length of Dufferin Street.

Tuesday night saw me out in the street once again, now with a freshly charged battery, but still no joy. I decided to remove and inspect the distributor cap. Murphy's Law seized the opportunity and my cold numb fingers allowed one of the distributor clips to ricochet into the snow-covered road below, never to be seen again despite hours of searching. Another bus ride on Wednesday with a detour on the way home to a British Leyland dealer to purchase a new clip resulted in an order being placed for pick-up the next day. A few more bus rides and the weekend arrived, the sun shone and the MG was running once again. I quietly cursed Murphy and smiled every time I passed a bus.

The second Murphy's tale resulted in an outcome that was much more serious than numb fingers and a bruised ego. A young but experienced pilot was looking to buy a float plane and had made arrangements to do a visual pre-purchase inspection on a very cold winter night. The aircraft in question was in a cold storage hangar for the winter. As part of his discovery, he decided to pull the prop through to get a sense of how good the compression was. He diligently checked that the magnetos were switched off and placed a plank across the floats for secure footing. Unfortunately, when he pulled on the prop, the engine kicked over and struck him with a fatal blow.

When the investigation began, the TC Inspector was baffled. The mag switches were off and the p-leads were properly connected. Both magnetos were grounded and harmless. How could this have happened? Digging a little deeper, he checked the facts of the date the catastrophe took place. It had been an exceptionally cold night. Being ever vigilant he took both magnetos and cooled them both to the same temperature they were exposed to on that fateful night. The results revealed a poorly soldered connection to the p-lead inside one of the magnetos creating an open circuit. That particular magneto was now live, but only in super-cold temperatures.

The two lessons to be learned here are obvious. On the lighter side of things, never expect a British sports car to get you to work on a regular basis, but if you must, always carry tools and transit fare.

On the serious side, never, ever trust a propeller. Always treat it as if it were live and poised to kill – for your own safety and preservation. Remember, in the aviation business, the mayhem created by Murphy's Law has no conscience or prejudice. Be cognisant that the results of your actions could just as easily end as a funny story or a fatal one. Vigilance and professionalism is our only known defence!

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

From Our Hands To Your Engine

H.E.R.O.S. Inc. — Helicopter Engine Repair & Overhaul Services

- Providing Quality Model 250 Engine & Accessory Support
- Specialized Repairs & Custom Overhauls

Website: **www.herosinc.com**

HYE-Tech Manufacturing, LLC— "A *Better* Part for A *Lower* Price"

Specializing in FAA Approved Replacement Parts:

- For the Model 250 Engine
- Honeywell Fuel System Components for the Model 250, PT6, & LTS-101
- Argo-Tech Fuel Pumps for the Model 250 & PT6

Website: **www.hyetechLLc.com**

H.E.R.O.S.
HELICOPTER ENGINE REPAIR OVERHAUL SERVICES

Helicopter Engine Repair Overhaul Services, Inc.
627 Ruberta Ave., Glendale, CA 91201
Phone: (818) 265-9730 Fax: (818) 265-9731

HYE-Tech Manufacturing, LLC

Hye-Tech Manufacturing, LLC.
627 Ruberta Ave., Glendale, CA 91201
Phone: (818) 291-0338 Fax: (818) 291-0339

Visit us at the RAA 38th Annual Convention (Booth #317)
May 6-9 in Montreal, Quebec

PT6A • PW100 • JT15D

A Fully Authorized Pratt & Whitney Canada Distributor & Designated Overhaul Facility

24/7

READY TO SERVE AROUND THE WORLD

MAINTENANCE
REPAIR
OVERHAUL

VECTOR AEROSPACE

Our reputation for superior customer service continues to grow at Vector Aerospace Engine Services – Atlantic.

We're proud of our past – working hard for your future.

Toll Free: 1.888.769.0999
WWW.VECTORAEROSPACE.COM