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AirMaintenance UPDATE

The Magazine for Aircraft Maintenance Professionals

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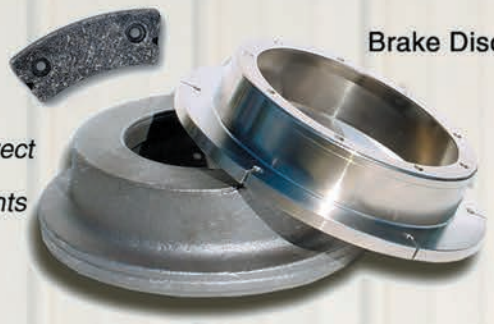

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Emerald City or White Elephant?

You have to hand it to the China Aviation Investment Group — they're not afraid to think on a grand scale. The Group is currently beating on doors hoping to attract investors with plans to build an estimated $8 billion US project called the World Aviation City in Ordos, Inner Mongolia. The city is the site of a former coal town in rural China and is planned to stretch eight square kilometres (about 2,000 acres). According to the International Air Transport Association, China is set to beat the US as the leading global air passenger market in the next two decades.

Consequently, the Ordos government wants to make aviation an important component of the city's income, and the project is a joint venture between Ordos and the China Aviation Investment Group. The idea of Aviation City is that it would be the world's first year-round, non-stop aviation exhibition featuring sales of aircraft and spare parts, a corporate aircraft FBO hub service, bonded warehousing of aircraft spare parts and aviation training. Promoters also envision a comprehensive aviation demonstration park with air passenger and freight transportation, manufacturing and maintenance, and aviation logistics components. Their plan calls for segments of the fashion, health, tourism and entertainment industries to co-exist with the aviation industry in the city where there would be nine sub-regions, including a general aviation base, international exhibition centre, educational facilities, a production base, and something called an "ecological community." The project would attract "10 million tourists, and hundreds of thousands of new business visitors after establishment," say the promoters, while the "annual business turnover is expected to reach $8 billion US, with annual taxation profit reaching $815 million US."

Staggering numbers and lofty ambitions: when something sounds too good to be true, it generally is. But underestimating the ability of the Chinese to bring mega-projects to fruition would be a mistake. Whether this is a Utopian Aviation City or simply another Pie-in-the Sky will depend, as it always does, on the ability of promoters to raise money.

— John Campbell
Editor

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Features

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Upcoming Events

2015 Safety & Quality Summit

Call for papers from industry and safety pros: The call is out to industry and safety professionals to submit papers for presentation at the 2015 CHC Safety & Quality Summit, which will be hosted in Vancouver, British Columbia by CHC Helicopter. Those interested may now submit abstracts for the event. The 11th annual summit will be held March 23-25 at the Westin Bayshore Resort in Vancouver. Last year's event drew more than 850 delegates from some 25 countries.

The 2015 summit will explore topics relevant to the theme "Integrated Safety Management Systems: Access All Areas" and how the principles and practices of the SMS can be effectively integrated into all areas and levels of an organization. Most sessions during the three-day conference will be 90 minutes, though some subjects may span one-half of or an entire day. Attendance at individual sessions typically numbers 50 or more people. The submission form for papers is available at: www.chcsafetyqualitysummit.com

UNITED STATES

Sci-Tech 2015
January 5 – 9, 2015
Kissimmee, FL
www.aiaa-scitech.org

PNAA 2015 Aerospace Conference
February 10 – 12, 2015
Lynnwood, WA
http://www.pnaa.net

ATW Airline Industry Achievement Awards
February 25, 2015
Washington, DC,
www.atwonline.com

Heli-Expo 2015
March 2 – 5, 2015
Orlando, FL
www.heli-expo.com

Aviation Week Laureate Awards
March 5, 2015
Washington, DC
www.laureates.aviationweek.com

Aviation Week Laureate Awards
March 5, 2015
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AEA International Convention & Trade Show
April 8 – 11, 2015
Dallas, TX; www.aea.net

Maintenance, Repair, and Operations Americas
April 14 –16, 2015
Miami, FL
www.mroamericas.aviationweek.com

INTERNATIONAL EVENTS

MRO Latin America
January 13 – 14, 2015
Buenos Aires
Argentina
www.mrolatinamerica.aviationweek.com

MRO Middle East
February 2 – 3, 2015
Dubai, UAE
www.mromiddleeast.aviationweek.com

Aviation Festival Asia 2015
February 12 – 13, 2015
Republic of Singapore
www.terrapinn.com

Australian International Airshow 2015
February 24 – March 1, 2015
Geelong, Victoria
www.airshow.net.au

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STCs & new products

Spiralock incorporates thread form design into key locking threaded inserts

Stanley Engineered Fastening now incorporates its self-locking Spiralock internal thread form design into key locking threaded inserts. When compared to a tapped hole or other threaded inserts, the key inserts will have the highest pull out strengths in all materials and can be used in plastic, aluminum, cast iron or steel parent materials. For aerospace applications, the MS51830-2/NAS1395 Spiralock commercially equivalent key inserts are said to provide the strongest thread option in softer materials such as aluminum as well as other materials. The key inserts are available with the Spiralock internal thread from as small as a 2-56 or M2 and as large as a 1-12 or M24.

For more information visit www.stanleyengineeredfastening.com

Cleaner work spaces, one wipe at a time

Kimberly-Clark Professional offers a full line of application-driven aviation wipes that are said to deliver superior cleaning, improved operational efficiency, reduced turn-around time and maximized productivity, while also meeting the precision standards and requirements of the aerospace industry. Kimtech Wipes for Aviation are available in three categories: surface preparation wipes; cleaning wipes; and a wet wipe system. To complement these wipes, KCP also launched the Kimtech large surface wiping applicator to address the difficulties of cleaning and preparing large, contoured areas and elevated assemblies.

For more information visit www.kcprofessional.com

Test electric motors from a long way off

The All-Test Pro 5 is a de-energized, non-destructive instrument for electric motor analysis including detecting stator and rotor faults in low-, medium- and high-voltage AC and DC motors, transformers and generators. The AT5 provides an immediate health status report, on the spot with on-screen guidance that is said to eliminate the need for instruction guides or manuals. A route-based testing option includes reference testing and trending on preconfigured list of motors with results that can be uploaded and downloaded for trending, reporting and comparison with other historical data. Testing can be performed from distances of 1000-plus feet for inaccessible or hard-to-reach motors.

For more information visit www.alltestpro.com

Aeropal LT fueling hose allows for trouble-free on-the-tarmac fueling

Aviation Ground Fueling Technologies is now selling the Continental ContiTech Aeropal LT aviation fueling hose, which is said to provide safe and reliable on-the-tarmac fuel handling. Meeting all the leading industry and military standards, the Aeropal LT brand is designed for long service life with an outer cover that offers good abrasion and environmental protection. These fueling hoses are optimized for operating temperatures ranging from -48 to -70C and are engineered to provide reliability, safety, long service life and trouble-free handling.

For more information visit www. agftparts.ca

Greener petrochem-free windshield wash available from Kafko

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

For more information visit www.oileater.com

VamPLIERS feature a long, hard bite

Vampire Tools' VamPLIERS have specially designed concave shaped jaws with vertical serrations on the inside jaws that make it possible to grab onto a stripped/ rusted/ corroded screw, bolt or nut for extraction. VamPLIERS are said to work even on screws with special, unique or tamper-proof heads. They are made from treated high quality carbon steel from Kobe in Japan, have smooth varnished finish, and environmentally friendly elastomer ergonomic handle grips.

For more information visit www.vampiretools.com

To announce your STC or new product, email a JPG photo and a product description to amu.editor@gmail.com or amumag2015@gmail.com

HARPER GOV'T INVESTS IN SASKATCHEWAN AEROSPACE SECTOR

Students enrolled in the Aircraft Maintenance Engineer (AME) program at the Saskatchewan Indian Institute of Technologies (SIIT) in Saskatoon will benefit from additional hands-on training thanks to a $2 million investment announced in early October by Michelle Rempel, Minister of State for Western Economic Diversification. This investment will allow SIIT to upgrade its training aircrafts, computer hardware and software, and corresponding infrastructure at the Saskatchewan Aviation Learning Centre (SALC). SIIT will convert AME training manuals to digital format and YouTube-style videos so students can review materials online and download applications to their laptops or tablets from on or off campus. Increased exploration and expansion activities in Saskatchewan's oil and gas, and mineral sectors, as well as growth in agricultural production, has resulted in greater aviation traffic in many of the province's airports including Saskatoon, Regina, Prince Albert, La Ronge, Yorkton and Swift Current. SIIT is expanding its training facility to help meet increased industry demand.

SALC opened in 2010 and 23 individuals have graduated from the AME program to date.

CESSNA CITATION X+ SETS COAST-TO-COAST RECORD

Cessna Aircraft Company used the opportunity of the National Business Aviation Association (NBAA) Convention & Exhibition in October to announce that its recently certified Citation X+ has now set several city-to-city speed records for its weight class including Seattle to Miami, making the 2,375 nautical mile trip in four hours, 52 minutes.

According to the National Aeronautic Association's certification, the Citation X+ set four speed records over a two-day period in weight class C-1h (12,000 kg to less than 16,000 kg). The aircraft was loaded to simulate a typical customer flight, including required crew and four passengers and luggage.

With a maximum aircraft speed of Mach 0.935, the record-setting effort generated an average maximum speed of Mach 0.916 during the two-day period.

The new Citation X+, certified by the US Federal Aviation Administration in June, has seating for up to 12 passengers, a maximum altitude of 51,000 feet, a maximum speed of Mach 0.935 and an increased max range of 3,408 nautical miles.

The most distinct difference with the evolved Citation X+ is the addition of winglets, allowing the aircraft to cruise efficiently at higher altitudes and to consume less fuel, as well as improving take-off and landing performance at higher elevations or on hot days. Powered by two FADEC-controlled Rolls-Royce AE3007C2 turbofan engines, the Citation X+ can fly above most commercial traffic and often above adverse weather at a maximum altitude of 51,000 feet.

More than 6,600 Citations have been delivered to customers around the world since the first Cessna Citation business jet was put into service in 1972. Citations are the largest fleet of business jets in the world and have surpassed 30 million flight hours.

ADVENT AEROSPACE TROTS OUT PATENTED ANTI-SKID BRAKING SYSTEM

Advent Aerospace's Aircraft Systems division has introduced an anti-skid braking system developed for lighter turbine aircraft, including the King Air B200 and B300, the Pilatus PC-12, Cessna Conquest II and several military trainers. It has already received a Supplemental Type Certificate (STC) for retrofit on the Eclipse EA500 and is standard equipment on the EA550. Advent Aerospace's current ABS was developed for aircraft with un-boosted brakes not originally equipped with anti-skid brakes or new aircraft in development. The Advent ABS is said to require no change to existing braking system components, and minimal downtime to install, either as a stand-alone procedure or during scheduled maintenance.

"We are very pleased by the level of interest and enthusiasm for our ABS," said Ron Roberts, VP/GM of the Aircraft Systems Division and the developer of the system. "In addition to the excellent experience we have had with Eclipse Aerospace, we have been very pleased with the collaboration we have enjoyed with the Beechcraft organization on the King Air and with Finnoff Aviation on the PC-12. We have systems in development for other aircraft types, including military trainers and a brake by wire system for aircraft with power brakes."

The system also provides better directional control, reduced tire damage and shortened stopping distances on dry runways or those contaminated with water, ice and snow, and will eliminate flat-spotted and blown tires during aggressive stopping.

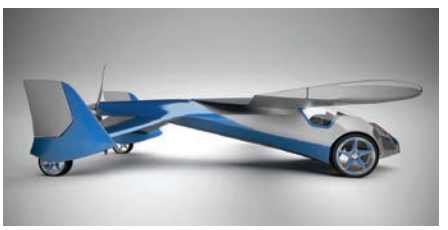
PACIFIC PROPELLER BEGINS ROBOTIC BLADE GRINDING

Pacific Propeller International has installed a very rare robotic propeller grinding tool in its Kent, Washington based propeller overhaul and repair facility. Designed and programmed by Acme Manufacturing of Detroit, Michigan, the automated robot—said to be only the second of its kind in the world—can reportedly provide complete grinding and polishing to a blade surface in a 20-minute cycle. Prior to this automated procedure, PPI propeller technicians needed more than four hours to grind and polish each propeller blade, with four blades necessary for each prop assembly.

The grinding arm has another very important benefit to PPI propeller technicians, says the company. It can provide a healthier work environment. Weighing more than 125 pounds each, blades had to previously be lifted by PPI workers and each blade had to be moved many times during the grinding and polishing process. The robot automates all of this, moving the blade into each position. In addition, grinding aluminum throws off metal dust, requiring blade technicians to wear breathing masks while grinding. Of course, the robot is not subject to this health risk.

LOOK UP THERE. IS IT A BIRD? IS IT A PLANE?

The Slovakian-built AeroMobil 3.0 flying car may sound like something out of The Jetsons, but a late prototype was unveiled in late October at the Pioneers Festival in Vienna. AeroMobil says the vehicle is comparable in size to a limousine; that it can make short take-offs and landings on rough terrain; and that it runs on standard gasoline. The vehicle is predominantly built from composite material, including its body shell, wings, and wheels. It also contains all the main features that are likely to be incorporated into the final product, such as avionics equipment, autopilot and a parachute deployment system.



Powered by a Rotax 912 engine, the two-seater AeroMobil 3.0 is said to be capable of 200 kmh (124 mph) as a top speed with a range of 700 km (430 miles). It has been tested in real flight conditions and entered a regular flight-testing program. In addition to having already been certified by the Slovak Federation of Ultra-Light Flying, the AeroMobil 3.0 has been designed to achieve certification in the EU as a car and light sport aircraft.

HARTZELL FUEL PUMP GETS GREEN LIGHT FROM FAA

Hartzell Engine Technologies has received FAA Parts Manufacturer Approval (PMA) for is new 202F series fuel pumps, the company announced in early fall. "We designed, developed and certified our new 202F series fuel pumps to fill a need in the market. The original Crane/Lear Romec RG9570 pumps required for certain Lycoming engines are no longer in production," said Mike Disbrow, president of Hartzell Engine Technologies (HET). "Now owners of these engines have a new alternative."

Disbrow explained that the HET 202F series pumps not only provide equal performance to the Crane/Lear Romec units they replace, the new HET pumps offer some significant design advancements. "One of the most significant differences between the new HET fuel pumps and the old Crane/Lear Romec pumps is that our units use new carbon vanes, whereas the prior-generation units use steel vanes," he said. "Because they are less abrasive than steel vanes, our new carbon vanes can dramatically reduce overall wear to the pump's liner, which is the heart of the pump and a very expensive component to replace.We are also able to tightly tolerance these vanes to improve pump performance and reduce pressure fluctuations."

The new 202F fuel pumps join HET's 200F (replacing various Crane/Lear Romec RG9080 series pumps) and 201F (replacing various Crane/Lear Romec RG17980 series pumps). HET fuel pumps are applicable for use on a wide variety of Lycoming engines.

PACAVI GROUP ROLLS OUT AIRBUS CONVERSION

The San Diego-based PacAvi Group is spearheading a new program for conversions of Airbus A320 and Airbus A321 aircraft from passenger-to-freighter configuration, with commercial deliveries expected to begin in 2017 or earlier.

"We view this as an exciting opportunity," said PacAvi Group CEO, Dr. Stephan Hollmann. "There are currently about 600 freighters of the size category of the A320 and A321 operating globally, and this market is set to grow rapidly in the BRIC countries (Brazil, Russia, India and China) and around the world."

AeroTurbine, Inc., a subsidiary of AerCap, one of the world's largest aircraft leasing companies, will join PacAvi Group in this program. AeroTurbine will perform freighter conversions at its Goodyear, Arizona facility. ■

Get your head out of your Apps

BY MIKE BRODERICK
Helicopter Engine Repair
Overhaul Services

Unplug your pod, cell, tablet, laptop, MP3, or any other electronic gizmo that competes for attention when there's an important job on your bench. Lives may count on it.

Well, here we are together again ready to communicate about some cool maintenance item which I hope you will find interesting, informative, and worthy of your time. As I was beginning this article I was struck by that word: 'communicate.' And being the curious old mechanic that I am, I did some research and found that the best definition of communicate is the "conveying or exchanging of information or news." The two operative words here are 'conveying' and 'exchanging.' So then, when we communicate we are speaking, hearing or reading information, spoken or written by another.

That makes sense, and I would say it stands to reason that if the conveying person and the receiving person are linguistically equal, the mental message projected and or exchanged should be totally understood by both parties. And if action is required, then that expected action should be the result. That sounds pretty simple right? Well, it should be, but unfortunately it is not, because strictly communicating does not guarantee understanding. This is particularly true with respect to verbal communication.

In times BP, (Before the Phone) people spoke to one another face-to-face. Or took the time to write a letter. Back then communications was a contact sport with understanding the message being the norm. Our ancestors did however have the advantage of facial nuances and body gesticulations to make sure the message was received and understood. Also back then writing was done with care and thought.

Then one Mr. Alexander Graham Bell invented a new way to communicate that didn't require face-to-face contact. Your voice was now transmitted long distance via copper wire. This meant that Aunt Bertha could now verbalize about her lumbago instantly from across the miles. And communications

degraded slightly as did the complete understanding of the verbal message. Now jump forward to what we have today for communication devices. Both written and verbal communications have taken a hit. We, the communicators, are cloaked behind the ear and mouthpiece of the phone or the printed words of our texts, tweets, and emails. Correct spelling is a lost art with advent of spellcheck, or even worse, we write and speak in shorthand: LOL, ROF, UR, IDK, BTW; etc …

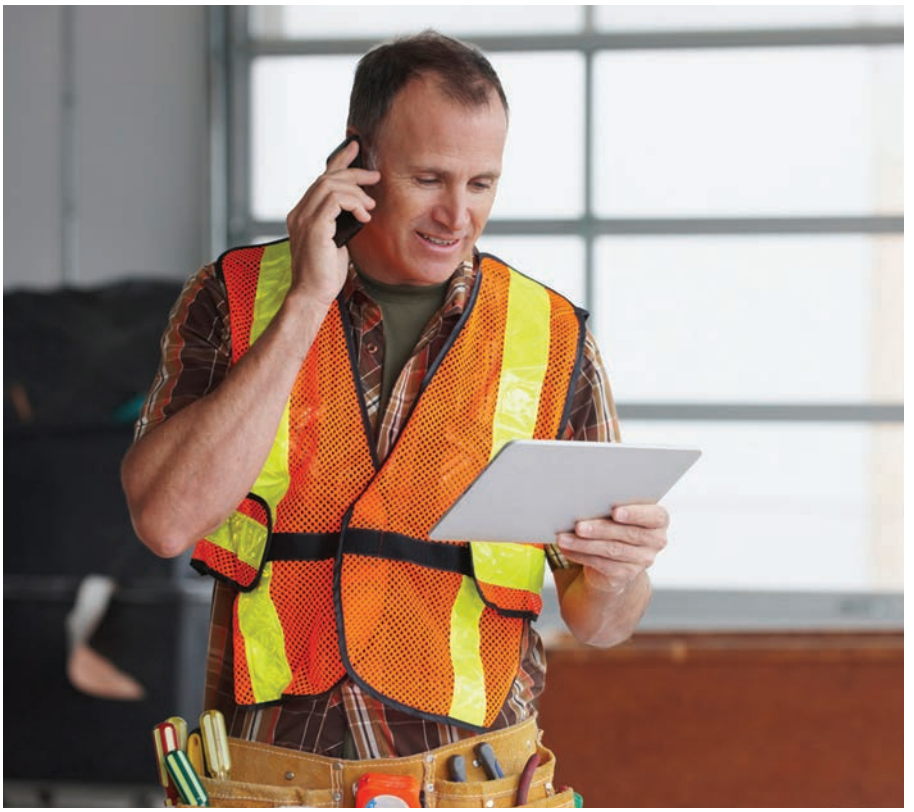
News from around the world is instantaneous. Some say that our communications have improved. I would disagree. We all know the hazards of cellphone use and texting while driving, but attend a meeting or go out to dinner and everyone is on their device. No one is speaking to the next person; no one is effectively communicating with each other. In my humble opinion I say that the constant use of electronic devices is the lowest common denominator of interpersonal communications and allows for more communications issues than not. Okay, so what does this have to do with maintenance? It's a good question that deserves an explanation.

> Effective communication is the single most important instrument in the symphony of aviation maintenance . . .

"Effective Communication": Wow! Great Human Factors term right? But Effective Communication is more than psychological hyperbole. Effective Communication can be defined as the successful conveyance or exchange of information or news. Effective Communication is the single most important instrument in the symphony of aviation maintenance. Without it our maintenance activity becomes a cacophony of disorganized activity, with the creation of a safe product difficult at best, and impossible in most instances.

I recently was walking through a busy hangar with over 20 technicians involved in various stages of maintenance on a variety of helicopters. I noticed that most had some form of electronic device shoved into their ears. Some were even speaking into hands free phone mics while working. Distracted? Ya think? I yelled "FIRE!" but most did not look up or stop what they were doing. They couldn't hear me. The Maintenance Manager who was with me gave me a look that was part surprise, mixed with exasperation, agitation and chagrin. The reaction of his crew was not lost on him, nor was the fact that there needed to be a revision of company policy regarding the use of personal electronic devices while working.

Aircraft and aircraft component maintenance requires our undivided attention. How can you be sure you torqued that bolt, or properly inspected that area that is known for fatigue stress, if you are listening to "The Greatest Hits of the '80s"? We sometimes forget that we have people's lives in our hands as soon as we open the cowl or put a wrench to that component. A distracted technician like a distracted pilot is



Tablets and cellphones can be effective tools at the worksite, but only if they're being used to access pertinent information or communicate with the project team.

dangerous. We also need to be aware of our work surroundings. After all, it would be sad to report that, "None of the maintenance crew survived the fire because they were all listening to their electronic devices and didn't hear the alarm."

Effective Communication begins with our post-flight conversation with the pilot. All of you students who have attended my classes before know one of our best troubleshooting tools is the pilot. Your questions should be clear and direct as to the information you want. Take good notes during the conversation. Don't depend upon your recollection of what they reported. Nothing will rightfully upset a pilot more than you returning an hour or so later with a question about their verbal description of the issue because you forgot the details of what was said. Their information is vital to the success of our maintenance and should be treated as such. Treat their input with the respect it deserves.

Effective Communication is a must when we are preparing or receiving our written instructions for maintenance. Another favourite saying of mine is: "maintenance by memory kills." The Original Equipment Manufacture (OEM) goes to great lengths to write precise instructions into their Operations and Maintenance Manuals and their Overhaul manuals. They have a distinct advantage when it comes to how and why a system should work and thus should be and are considered the experts on their product.

Next, they survey input from us when it comes to maintenance items we discover over the course of inspecting and repairing their aircraft or components. The OEM is constantly looking at incoming field reports and revising maintenance instructions as required. So keep sending in those reports when you find something not covered specifically in the manual.

Also remember that our employer pays big bucks for these manuals and the revision service that is included with them. So learn about them, and use them as required. Nothing is more impressive than walking into a hangar and seeing a well-organized library of well used, but not abused, Ops and Maint manuals. Now if a reported item becomes a safety

of flight issue that requires immediate attention, then your Federal Aviation Regulatory Agency becomes involved and when required will issue an Airworthiness Directive (AD). These also are or should be part of your work package and inspection paperwork.

Some companies will institute their own paperwork, which is usually verbatim from the OEM manual. This is a convenience for the company financially as this way they need only one set of manuals, thus allowing several technicians access to the information at the same time. Plus you don't have to carry that big ole' book up the ladder with you to complete an inspection. This in-house generated paperwork also provides us a checklist to work from which is an important part of proper maintenance communication. This list when used correctly keeps you focused on your place in the maintenance process and will allow everyone else to know your job progress in case you have to hand the job off to a fellow technician.

Finally, the checklist after the job is complete leaves a permanent record of what was done and who did it. Remember: completing the checklists are an "as you go" set of documents. The checklist is not to be finished as you are rolling the aircraft out of the hangar for its ground run.

One more thing to keep in mind about company generated paperwork: it is incumbent on you/me the technician completing the task to insure that the instructions within the paperwork are in sync with those in the manual. Any revisions to the manual must be incorporated into the paperwork. This also applies to the AD notes from our Friendly Aviation Agency as well. And although experience and tribal knowledge is important and should be shared, tribal knowledge is to be used in conjunction with, not in place of, the information from the OEM and the FEDS. These folks are the final authority when it comes to maintenance practices and policies.

Effective Communication is required when we are discussing a maintenance process with our peers or if we are the team leader when we are assigning the daily tasks. As rigid as the expectations are for safe maintenance, the act

Are you really ready to take on a tough maintenance job if your focus isn't completely on that job at hand?

of doing maintenance also has to have some fluidity and flexibility. Okay, that sounds conflicting, so let me clarify. You are assigned a 100-hour inspection for, let's say a Bell 206BIII. You have been given the list of normal inspection items required along with the summary of pilot comments and any current AD notes. You are now ready to begin your inspection. You, of course, remove all cowling and systems access covers. As you move along in your inspection you see that there appears to be some wear on the retaining clamps for some of the engine pneumatic lines. You note that the pilot squawked an inop anti-collision bulb on the vertical stabilizer for the second time within the last 25 flight hours. He also mentioned that there was a slight "buzz" in the control pedals prior to this inspection. There is a new crack beginning to propagate from the aft attach point on the engine cowl. So what is your plan of action?

Well, if you are totally concentrating on the task at hand you will of course address the issues as you find them, and you will investigate surrounding areas for stress. But all these items are just symptoms of something far more insidious going on ... some component is vibrating beyond acceptable limits. Although it is not called out on the inspection paper instructions you most likely need to complete a dynamic vibration survey of the engine and the rotor systems to find the source of the vibration. You discuss your findings and suggestions for further actions with your team leader and perhaps another team member who is more experienced in this helicopter's systems to get their input. You all agree there is an unusual vibration coming from one of the components, and collectively come up with a work plan to discover where the offending component is. In any event, the point I am making is you have moved beyond the "standard 100 paperwork." You were able to do this because you had your mind on your job, and you effectively communicated your inspection findings.

Now, I don't want you to conclude that I am against new and ever evolving electronic communications. These devices when used properly should enhance our communications. Emails are intended as a great way of keeping everyone in the loop, so to speak. But in today's work environment we are on email overload. It has been reported that less than 25 per cent of the email sent is opened or responded to.

Email is also becoming a less effective way of communicating. Sending an email should not be considered as "message sent delivered and received." Follow-up is required. So when our emails go unanswered we should reach for the ole phone and make a call. Hmm… voice mail, once again that electronic hiding spot for a lot of us. We hope the person on the other end will respond to the voice mail message. It is a sad fact that even less than 25 per cent return phone calls as a result of a voice message. So what are we to do? Keep calling and reaching out.

1. Make sure you get your message across.

2. Learn to hear, not just listen to what the other guy is saying—pay attention. Multi-tasking while talking on the phone is ineffective and insulting to the other guy.

3. Finally, when you are working on an aircraft or aircraft component keep your head into your job and out of your apps! Lives depend on you doing your job correctly. And remember, even the best pilot can't fly until you say it's okay to fly.

Over the past 35 years MIKE BRODERICK 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 currently working in business development for TRACE Worldwide Corp. Mike is a regular contributor to Air Maintenance Update. ■

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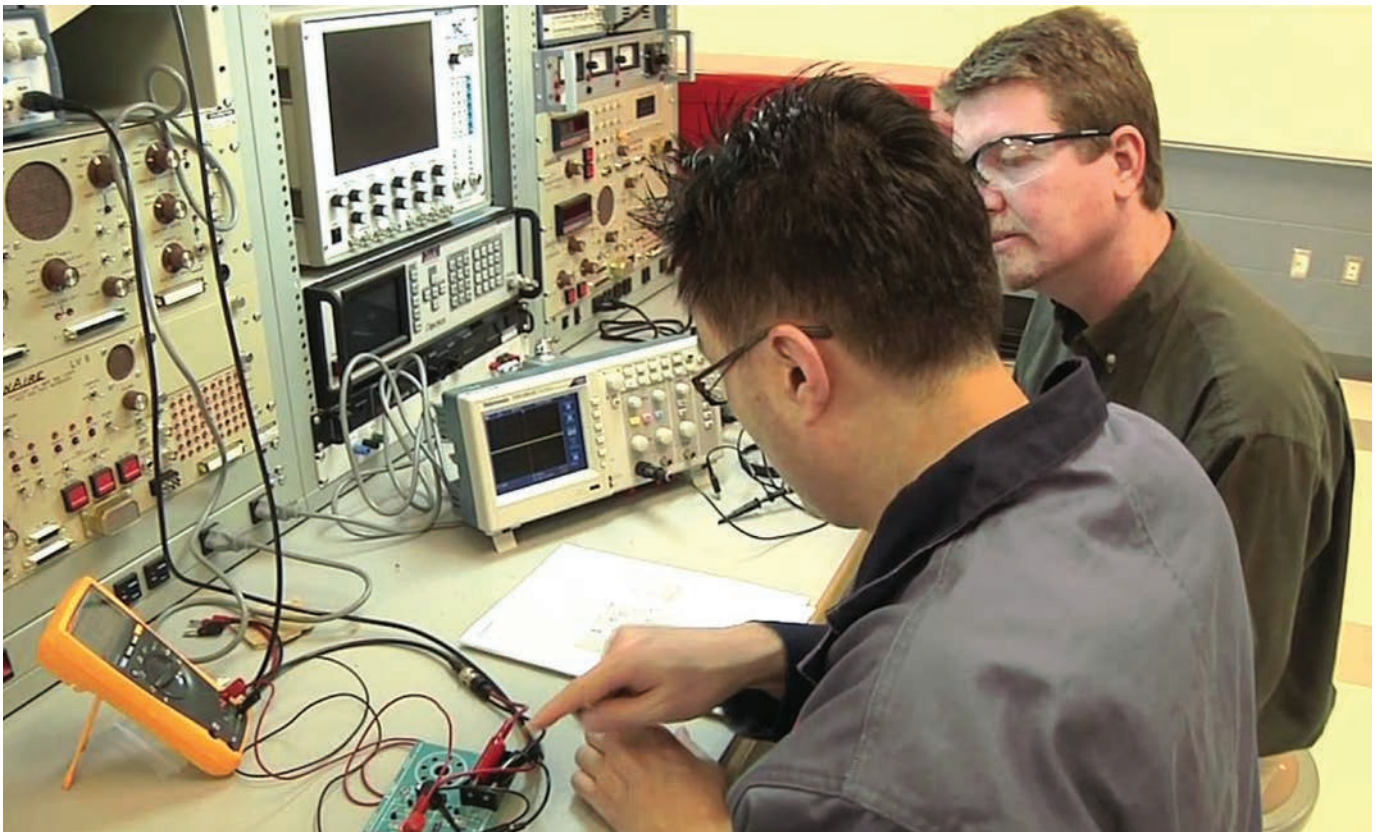
Learning the relevant stuff

Tech theory is all well and good, but if it's being taught at the molecular level then the lessons are probably missing the mark.

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

Aside from my desire to quarterback the Toronto Argonauts or replace Mick Taylor as the "other" guitar player in the Rolling Stones, there was no job in the world I would have preferred to that of being a flight line avionics technician: the excitement of working on the ramp at a busy international airport; interacting with cockpit and cabin crews from all manner of diverse cultures and nations; dealing with a variety of unique, interesting technical challenges, and a multitude of other factors would lead me to tell people "there is no other job I'd rather have than this." It's a great way to make a living. The financial rewards are not huge, but neither are they insignificant, and the wonderful perquisite of "Interline Travel" was a bonus that made my days on the flight line such a fantastic way to spend my young adulthood.

When my career path evolved into a teaching role, I was determined to do whatever I could to impart the required and relevant information to my students, such that they could enjoy the challenges of the flight line, armed with confidence in their skills and knowledge. I've always felt that a great deal of the technical training in the field of aircraft maintenance is geared to a level far beyond that which is truly required for an individual performing repairs on the aircraft. So much of the theoretical background is more appropriate to someone entering the design and engineering world, rather than the servicing and repair side of the business. Does a technician or mechanic need to understand the "atomic structure of matter" to realize that an electrical pump which isn't working needs to be replaced if its connector has both



Teaching students what they need to know to efficiently identify and fix a problem should be the main objective of any good AME course of training. Molecular theory can come later.

Above: A dash-mounted Automatic Direction Finder (ADF) in action as it tunes into a Non Directional Beacon (NDB).

power and ground? Probably not. Nor does that technician really need to chase electrons through complex schematics, or molecules of hydraulic fluid through prop governors. Most repairs performed by AMEs now involve modular parts replacement. While it might be nice to know all that is going on inside that constant speed drive, the reality is, if it's not turning the generator at the correct, constant speed…replace it. There really isn't a requirement to know about flyweights, swash plates, hydraulic motor pumps or any other aspect of the CSD's inner workings in order to perform a quick and efficient repair, using the appropriate manuals and troubleshooting guides.

As an educator, I'm aware of the value of knowledge. I also am aware that trying to force-feed knowledge is not just a waste of time; it's very detrimental to the learning process. Aircraft maintenance is a very "hands on" technical field. The job appeals to, and is best performed by individuals with mechanical aptitude and dexterity. Theory and academics may not be the forte of the young person wishing to pursue a career as a mechanic, yet we entice them into our system (of AME licensing) with the promise of a hands-on career, and then inundate them with theorems, formulae, equations and all manner of theory that, let's be honest here, nobody ever actually uses when they're on the flight line, or in the hangar fixing an airplane.

Whether I'm learning a new system myself, or teaching other people, I try to approach things from the perspective of someone who will actually be responsible for the repair and maintenance of that system. In asking myself, "what will the mechanic or technician working on this system really need to know?" I find that focusing on the following questions will provide the required insights.

1. What is the purpose of the system?
2. What are the indications associated with the system?
3. What are the major components of the system?
4. If it's a radio system, what is its frequency of operation?
5. How does the system work?
6. What testing, troubleshooting, and repair tips would be helpful when working on the system?

Above: An Automatic Direction Finder that has a Frequency Range from 200 KHZ to 10MHZ, and up to 99 Memory Channels for Spot Reception.

The Automatic Direction Finder is one of the older types of radio navigation. It uses a Non Directional Beacon that are simply AM-radio transmitters.

If you are able to answer these six questions, chances are you are competent and able to approach the task of maintaining the system in question. For example, let's work through the list dealing with an old stalwart avionics system, the Automatic Direction Finder.

What is the purpose of the ADF system?
The ADF is a radio navigation aid, which enables the pilot to determine the direction in which a transmitting radio navigation beacon is located.

What are the indications associated with the ADF?
A needle in a compass-card style instrument will physically point toward an ADF station selected by the pilot.

What are the major components of an ADF system?
The ADF system uses a radio receiver, two antennas, a frequency selector/control head, and associated wiring and coaxial cables. One of the antennas is a "loop" antenna; the other is a "sense" antenna.

What is its frequency of operation of the ADF system?
The frequency of operation for ADF receivers is in the range of 190-1750 KHz. This puts the commercial AM broadcast band within the ADF receiver's range, which is useful for tuning in known stations to test the clarity of reception. It's also handy for listening to ball games etc. when working in the cockpit.

How does the ADF system work?
The pilot tunes the ADF receiver to the frequency of a known transmitter on the ground. (Often referred to as "Non-Directional Beacons" NDB) The ADF loop antenna has directional properties and is able to determine the direction TO and FROM the NDB. The sense antenna is able to determine which of those two directions will take the aircraft TO the NDB. The mixing/combining of the signals from the two antennas is done within the ADF receiver, and an output signal is sent to drive the ADF needle in the indicating instrument. The needle will point toward the NDB transmitter.

What testing, troubleshooting, and repair tips would be helpful when working on the system?
ADF is a very old and not particularly precise navigation system. It is prone to inaccurate indications due to weather conditions (precipitation static) ionosphere shifts (night effect) signals refracting when reaching shorelines (coastal effect) and other terrain related obstacles. Noise and static in the ADF may be an indication that there is a problem with the aircraft's static discharge wicks.

While ADF theory lessons usually include discussion of antenna cardioid patterns and the addition/subtraction of sine waves from the loop and sense antenna signals, in order to establish the correct null, I think this only serves to confuse rather than enlighten 90 per cent of the people actually tasked with fixing ADF s systems.

At the end of the day, I think we need to keep perspective, and realize that we are fixers of airplanes — we're NOT rocket scientists. Let's provide our learners with useful insights and information, rather than baffling them with B.S.!

Question: Which ADF antenna has the directional sensing properties?

Answer to previous question:

Question: How does a voltage regulator control the output of a generator?

Answer: Generators and alternators control their output by controlling the amount of current flowing through the "field windings." This is the function of the "voltage regulator."

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

AME Association of Ontario

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email: association@ame-ont.com website: www.ame-ont.com

The Annual General meeting of the AME Association of Ontario was held at the Meadowvale Conference Centre in Mississauga on September 25. Approximately 50 members and observers were in attendance to receive the Board of Director's Annual Report and discuss the association's activities.

Association President Warren Couch welcomed everyone and introduced the directors and resource personnel. He congratulated the founding members and noted that this is the 30th anniversary of the Association and the 40th anniversary of the Ontario Workshop.

Vice-President Sam Longo briefed the attendees of the many activities and benefits of our association including: complimentary subscriptions to four aviation magazines; reduced AME related insurance rates; free admission to the Canadian Warplane Heritage Museum; and membership in a discount cost program called Perkopolis. In the area of education, we run several training courses, provide scholarships to students at the various college aviation programs and serve on the Program Advisory Committees of four colleges.

Our Treasurer Jasper Megelink presented the financial statements and we appointed auditors for the next fiscal year. It was confirmed that the changes required for the new Not-for-Profit requirements of the federal government was completed and the paperwork has been properly filed and accepted. Director Stephen Farnworth who, along with Director Jim Fowler, represented our association at the CFAMEA Annual General Meeting in Halifax on September 14-15 presented an update.

Certificates of appreciation were presented to members who have been with us for 20 and 25 years and plaques were presented to our 30-year members.

An invitation was made to all association members who wish to attend the monthly Board of Directors meetings and to assist in various association projects. The board's goals are to grow membership, educate, communicate and provide balanced finances with a disciplined budget.

Annual Workshop and Tradeshow

A very successful annual AME Symposium and Workshop was held at the Delta Meadowvale Conference Center in Mississauga September 25-26. Fifty-two booths were set up and over 400 people attended the two-day workshops. Twenty-eight sessions were scheduled ranging from one-hour general sessions to three-hour intense subject workshops. Thursday evening's Awards Banquet was sold out. We had an excellent dinner, which was followed by an entertaining audience participation show presented by The Drum Café.

Winners of this year's awards are:

- Dominic Lippa-GORDON B. RAYNER Award: Recognizing a Canadian whose career will always remain outstanding as an Aircraft Maintenance Engineer, a Teacher, or a Public Servant.
- Jim Fowler-CLARE LEAVENS Award: Given to a member of the Aircraft Maintenance Engineers Association of Ontario who has made a particularly outstanding contribution to the continued success of the Association.
- Will Boles-AVIALL HIGH ACHIEVEMENT Award: Given to an Ontario AME or individual associated with the Aircraft Maintenance business who has consistently shown a positive attitude, a high level of professional skill in their particular work and leadership attributes which serve as an inspiration to young people.

And the highlight of the evening:

- William (Bill) Peppler-AME HALL OF FAME: Awarded to an outstanding Canadian Aircraft Maintenance Engineer who has provided significant and distinct contributions to Canadian aviation.

Perkopolis: Our Newest Member Benefit

The Association has enrolled in a new member service called Perkopolis. This service offers reduced entry fees to cinemas, stage shows and events; reduced fees for phone services, hotels, meals, parking and numerous other products. Some of our directors who tested the service reported that it is easy to use and that they experienced savings of 20 per cent. These discounts apply in many areas throughout the country. There is no cost to enroll. They require only a minimum amount of personal information (i.e. your email address and the city you live in). You will require a special code to enroll as an AME Association member. Please email the membership director membership@ame-ont.com and we will send you the sign-up code.
Visit: www.perkopolis.com

Submitted by Stephen Farnworth
For the Board of Directors

Atlantic AME Association

Plan now to attend ARAMC 2015

Planning has now begun for the upcoming ARAMC 2015 Conference to be held at the Westin Hotel, In Halifax, Nova Scotia. The dates for the conference are April 15-17, 2015. The location for this upcoming conference is a new one for us.

We are looking forward to working with the Westin to provide our delegates and displayers with a new and exciting layout. In Halifax, we are lucky that many of our committee members are returning committee members. We do have a couple positions open should you be interested in helping out. The committee meets once a month and more often as we get closer to our conference date. Should you be interested in being part of the committee, please email: aramc@atlanticame.ca.

Displayer packages will go out before Christmas and the delegate packages will go out in January 2015.

If you would like more info on the conference, or want to be sure that we have your name in our displayer/delegate databases, please email:
Anneke Urquhart
ARAMC 2015 Committee Chair
ARAMC@atlanticame.ca

www.atlanticame.ca

Helicopter Association of Canada

Flight and Duty Time Update: The time to speak out is NOW!

As you can imagine, there has been a flurry of activity by the Commercial and Business Aviation Community in the wake of Transport Canada's most recent proposals for Flight and Duty Time reform. The Helicopter Association of Canada and our other nine Allied Associations have formed a Coalition to oppose the current proposals. Virtually the whole Commercial and Business Aviation community is standing shoulder-to-shoulder on this. Thank you to those companies who have offered up testimonials on the impact of the proposals. We have received dozens, and our scheduled plan was to present many of them in a Coalition submission to the Minister of Transport.

We have been working with the Minister's office to emphasize the fact that these proposals will NOT improve safety, but also to emphasize their catastrophic impact on our businesses, if they were to move forward in their current form. Our efforts for now, are being focused on urging Transport Canada to resolve our differences through a constructive dialogue, but with the other Coalition Associations we have crafted an Advocacy Campaign that could see this regulatory proposal become a campaign issue running in to next year's federal election. We do not believe that this "Business-Friendly government" wants a fight with business running in to an election year.

We are urging our Members and Associates to contact their local MPs and customers on the phone, by email, in writing—or smoke signals. Invite them to make their views known. If they plan to do it in writing, ask them to send a copy to fred.jones@h-a-c.ca. Make your views known! We are also suggesting that you may also want to use some of the 14 key messages and speaking points we have prepared in that dialogue. To access those points in PDF format, visit: www.multibriefs.com/briefs/hac/speakingpoints.pdf

Fred Jones
HAC President
www.h-a-c.ca

Central AME Association

CAMEA launches new website

Our site is now 100 per cent smartphone, tablet, and computer friendly and will dynamically display the content based on how you are accessing it and your screen size.
With easy navigation that is touch-screen friendly, we have plans to improve the user experience and to post relevant information that you will find helpful as well as photos, and other information that keeps you in touch with the rest of the AME community.

We encourage you to submit comments, suggestions, point us to relevant articles that we can re-post on our site, or even write an article yourself for CAMEA.ca! Just visit the contact page and let us know.

CAMEA Administration

www.camea.ca

PAMA National

PAMA launches new National website

After having issues related to hackers and some reorganization, PAMA National turned its new website on around the middle of October for their members and the public. Visit www.pama.wildapricot.org and check out the features, photos and information. The Board of Directors focused on making this new site easier to use with the information you need at your fingertips. There are features like the PAMA Forum for open discussions about our industry and the job search tool with new job offerings every day. These and more make the PAMA website a "must-come-back."

PAMA is your organization and this is your website, please provide us your feedback so we meet your needs as a professional in the aviation community.

Also, please review and update your Member Profile—we want to provide you with the best services and need to know as much information as possible about our members to do that. Select "Join Us" and provide PAMA your contact information.

For over 45 years, PAMA has been dedicated to promoting professionalism and recognition of the Aviation Maintenance Technician through communication, education, representation and support of continuous improvement in aviation safety.

PAMA's dedication and commitment to the aviation industry begins with providing the tools and support for ensuring a strong aviation maintenance infrastructure. PAMA effectively brings together maintenance technicians, manufacturers, suppliers, educators and students in successful pursuit of their goals in the aviation industry.

Return to your profession by becoming involved with a non-profit organization that is an advocate for the AMT by serving at a national or local level.

PAMA Board of Directors

www.pama.wildapricot.org

PAMA SoCal Chapter

Terrific night at the Chapter Dinner

The SoCal Chapter would like to thank Mr. Clement Lew, Southwest Region Sales Manager, Mr. Jorge Leal, Sales Manager and all at Herber Aircraft Service Inc. for their time and generosity hosting the September 2014 Chapter dinner and excellent technical presentation on "Rynglok vs. Permaswage Hard Line Tube Repair" at the 94th Aero Squadron Restaurant in Van Nuys, California.

To learn more about the latest in mechanically attached metallic tubing repair systems or the full line of Herber Aircraft products and services, contact Clement at (818) 309-6554 (clew@herberaircraft.com) and Jorge at (310) 877-1732 (jleal@herberaircraft.com).

www.herberaircraft.com

Scholarship Fund Continues to Grow

The September 2014 Scholarship Fund raffle drew $300! Thank you chapter supporters: Aero-Nasch/Jet Brella, Business Aerotech Consolidated Aircraft, Corporate Air Parts, HRD Aero Systems, JSSI, Rockwell Collins, Rotorcraft Support, and Universal Avionics.

Job Opening to Post?

Get the word out through SoCal PAMA. Send postings to SoCalPAMA@gmail.com.

Board of Directors

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- Bill Johnston, Vice President; bill@vlog.aero
- Dan Ramos, Treasurer/Broadcasts; socalpama@gmail.com
- Gail Erwin, Secretary/Newsletter; gailjerwin@verizon.net
- Tina Campos, Sergeant At Arms; tcampos@claylacy.com
- Chris Cancelosi, Meeting/Prize Coordinator Chair; chris@rotorcraftsupport.com
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- Melissa Saldana, Raffle Ticket Sales Co-Chair; luvmissmo@yahoo.com
- Nikki King, Website Advertising Chair; nikki@extraord-n-air.com
- Phil Samuelian, Chapter Photographer; psamuelian@me.com
- Warren Horton, Chapter Governance Advisor; wchorton@prodigy.net
- Glenn Beckley, Chapter Governance Advisor; cbowers@aviall.com

- Warren Horton, Emeritus: Chapter President, Vice President
- Glenn Beckley, Emeritus: Chapter Sergeant At Arms
- Sabrina Baiocco, Emeritus: Chapter Raffle Ticket Co-Chair

www.SoCalPAMA.org

Association for Women in Aviation Maintenance

On the Importance of Mentoring

Graceful, elegant, proper: these were never words to describe me. I've always been one that would rather play in grease and mud than dress up to go to functions. Nevertheless, during the recent Women in Aviation International (WAI) conference at the Disney Resort in Orlando, Florida I found myself in fancy clothing trying not to mess anything up on my "interviewing attire" as my colleagues described it. This was my first time at one of these events so I had no idea what to expect or what to say. The only knowledge I had to go on was that I had to take every opportunity to network and discover whom I needed to talk to about applying for a job.

I will not lie about this: I was anxious and somewhat frightened until I was able to finally relax into the confines of what I now call "My People" at the Association for Women in Aviation (AWAM) dinner. While there I realized that there were mechanics just like me with their quirky habits and geeky aviation lingo. I met many women that had the same interests at me. One such woman, Judi Grigsby, even let me tag along and help her as she performed a demonstration for many girls, their parents, and teachers during "Bring your Daughter Day" at the convention. She told me some amazing stories about her career in the military and at Air-Evac, which inspired me to reach further.

After the conference she put me in contact with other helicopter mechanics within her company to see what each mechanic does to maintain their craft at their base. Eventually, I was also allowed to visit her at the Air-Evac South East RMO (Regional Maintenance) in my home state of Georgia. While I was there, I learned about various procedures on how they inspect and perform more of the heavier maintenance.

She showed me their warehouse inventory; log book; and reporting systems that they incorporate into all of their bases. I was given the opportunity to utilize some of the skills I was learning in school. As a supervised demonstration, I was able to try out a boroscope and see how it is used to access areas where cracks and corrosion might otherwise be hidden, such as in an Allison 250 engine or within the overhead roof compartments in the cabin. Judi's colleagues showed me the lengthy process out of the Bell maintenance manual on how to ensure the blades are properly balanced while they are rotating. They also let me assist and learn how to troubleshoot an air leak found within the pitot system and showed me how to properly prepare the Teflon fittings that connect the tubing.

School only gives a brief overview of what is done in the field and if it weren't for the support of Judi I would have never had the opportunity to see that. She isn't just someone I met at the conference earlier this year; she is my mentor. When I am seeking guidance, she has been there to talk things out with me. It is good to know that there is someone who is compassionate and willing to assist the newcomers in this field, such as myself.

If you are new to the aviation industry don't be shy! I know that there are more people out there willing to help, just continue searching. Find someone that has the same interests as you. For those who are aiding someone already, please don't stop! I still don't know all the do's and don'ts of this field, but I am a fast learner.

It takes more than one interaction and two people to create a lifetime of learning. You will meet several people along your path who can improve your knowledge; never overlook that. There is networking and there are mentors who will help you grow into who you want to be. Find a group for that feels right in this madness they call aviation; for me it's my crazy women of AWAM!

— Mallorie Stafford
AWAM Member

www.awam.org

Rise of the Real-time Sensors

Sandia National Laboratories senior scientist Dennis Roach, centre, works inside the cabin of a B737 test bed, installing and acquiring data from Structural Health Monitoring sensors with Sandia mechanical engineers Stephen Neidigk and Tom Rice.

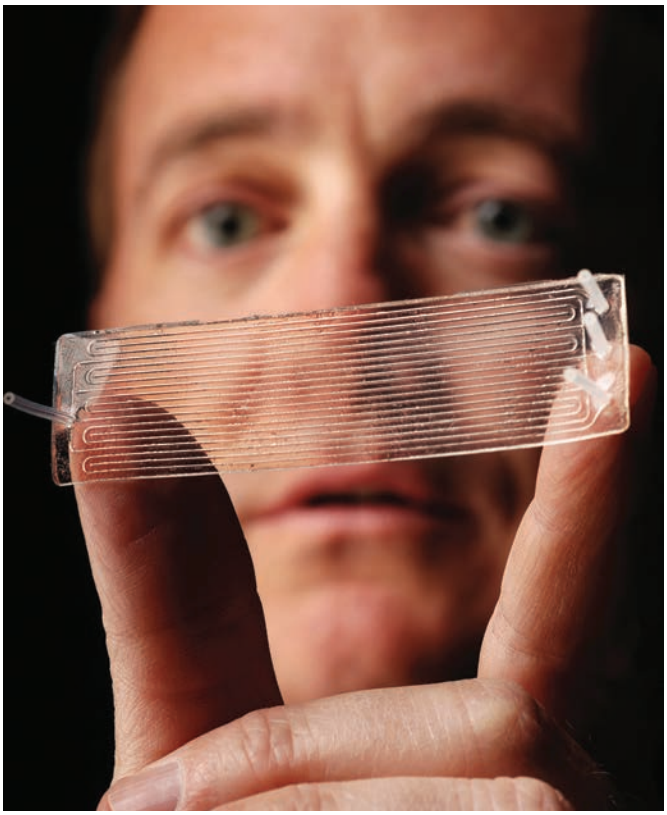
There's a study now underway involving onboard sensors and a series of field trials that may radically change current notions about fixed maintenance schedules and inspection routines.

Lockheed Martin Corp.'s Sandia National Laboratories has begun a series of flight tests on nine commercial aircraft carrying comparative vacuum monitoring and piezoelectric sensors to monitor their structural health, alongside the aircrafts' routine maintenance procedures. Sandia researchers who worked alongside maintenance technicians on installing the sensors say they have a lot of interesting information about moving from a laboratory environment to the real world with this technology, and that once the test results are completed, Sandia intends to present them to the FAA next year.

"The flight test program is underway," said Dennis Roach, a senior scientist in Sandia National Laboratories' Transportation, Safeguards & Surety Program who has worked in aviation safety for 25 years. "We have moved past laboratory research and are looking for certification for actual on-board usage. Our activities are proving that the sensors work on particular applications and that it is safe and reliable to use these sensor systems for routine aircraft maintenance."

Delta Air Lines Inc. and a foreign aircraft manufacturer have partnered with Sandia researchers in two separate programs to install about 100 sensors

The Structural Health Monitoring sensors are custom built to fit an aircraft's parts. They can be mounted in hard-to-reach areas of an aircraft so that mechanics can plug in to acquire data.



Dennis Roach with a Comparative Vacuum Monitoring (CVM) device showing galleries etched into the sensor's underside.

on their commercial aircraft. These teams worked together to provide the installation procedures for technicians and now oversee monitoring of the in-flight tests.

The flight tests complement laboratory performance testing at Sandia to provide the critical step in a decade-long journey to enhance airline safety through a more comprehensive program of Structural Health Monitoring. SHM uses nondestructive inspection principles — technologies that examine materials for damage without affecting their usefulness — and built-in sensors that automatically and remotely assess an aircraft's structural condition in real time and signal the need for maintenance.

Roach said the goal of monitoring the sensors installed on the aircraft is to accumulate successful flight history to show that the sensors can sustain the operating environment, while providing the proper signals for flaw detection.

> Among the projects to improve aviation safety, the FAA created the AANC, operated by Sandia, to conduct nondestructive inspection . . . and a wide range of airworthiness assurance areas.

SHM eventually could help airlines save money by basing maintenance on the actual condition of the aircraft, rather than fixed schedules and inspection routines that might not be necessary, and thereby reduce airplanes' downtimes, Roach said.

The team said so far, sensors installed on the aircraft are working as expected.

Next year, Sandia intends to present the flight and laboratory test results to the FAA for approval and certification. Should the FAA approve the sensors, they would be available for specific applications across the entire airline industry and the process for certifying future applications should be more efficient because of the research being conducted now.

In September, a team from the Airworthiness Assurance Nondestructive Inspection Validation Center (AANC) operated by Sandia for the FAA received the 2014 Airlines for America Nondestructive Testing Better Way Award for establishing the sensitivity, durability and repeatability of applying SHM solutions on commercial aircraft. The award honoured team members from the FAA, Delta, Boeing Co., Structural Monitoring Systems Inc. and Canadian-based Anodyne Electronics Manufacturing Corp. The award recognizes the year's most outstanding innovation for aircraft maintenance based on technology advancement and cost effectiveness.

Sandia began its work in aviation safety in 1991 when the FAA, in response to a number of aviation incidents, increased its research efforts to improve inspection, maintenance and

An aviation maintenance technician inspects the belly of a Boeing 737 using an eddy current scanner.

repair of commercial aircraft. Among the projects to improve aviation safety, the FAA created the AANC, operated by Sandia, to conduct research into non-destructive inspection (NDI), advanced materials, engines, structural integrity and a wide range of other airworthiness assurance areas.

The centre provides a way to develop, evaluate and bring new aircraft technologies to the airline industry, Roach said. "We work to make the technology viable and often focus on that last phase of technology validation and certification."

The current SHM program is testing two sensors: Comparative Vacuum Monitoring (CVM) sensors manufactured by Structural Monitoring Systems and piezoelectric sensor arrays produced by Sunnyvale, California-based Acellent Technologies Inc.

CVM sensors improve crack detection by monitoring "galleries," or 0.025-inch channels etched by laser into the Teflon sensor. CVM sensors are then mounted in areas of the aircraft known to experience fatigue. The sensors are bonded to the surface of the structure with an adhesive surface preparation that seals out the atmosphere, creating a vacuum inside the gallery. When a tiny crack intersects the gallery, the pressure changes, much like the pressure in a vacuum cleaner changes when the hose has a leak. The sensor records the pressure change and alerts inspectors well before the crack becomes a safety issue.

Piezoelectric sensors (PZT) are strategically distributed in polyimide films—called Acellent's SMART Layers—that adhere to an airplane's surface to monitor specific regions for damage. The array of PZT sensors communicates with one another by transmitting and receiving ultrasonic surface waves called Lamb waves. This creates a mini-communications network. Damage to the aircraft disrupts or changes the signal patterns from the baseline communication signals. Acellent's software measures and analyzes any changes, called the "damage index," and sends an alert to the inspector. Work is ongoing on the

Dennis Roach and Ciji Nelson examine piezoelectric sensors placed on a printed circuit board for mounting to an aircraft structure.

best spacing and placement for these sensors on aircraft, Sandia mechanical engineer Stephen Neidigk said.

Both of these on-board sensors must meet the same performance and reliability standards as those required for current maintenance inspections, Roach said. "The SHM systems also help eliminate some of the concerns about human factors associated with manually-deployed NDI," he said. "You have the sensor in place, you know it works and it's giving you a proper signal, whereas an inspector must manually orient the inspection probe properly each time and there are always concerns about human vigilance when inspections become time-consuming or tedious."

The sensors are custom built to fit an aircraft's parts, they are verified to be working before they are sealed inside the aircraft and the readouts provide inspectors with a "pass" or "fail" decision so the results can't be misinterpreted, the researchers said.

Sandia also is researching wide-area monitoring using piezoelectric and fibre optic strain sensors for composite materials used in today's aircraft. Impacts don't always show dents in composite materials, so SHM techniques are needed to find structural damage within what appears to be a smooth, undamaged surface, Neidigk said.

The field tests have helped fine tune the sensors, so they can withstand the harsh environments aircraft fly in and the environment aircraft mechanics work in, neither of which are as pristine as the laboratories where the sensors were initially tested.

For example, field-testing showed that mechanics working in the cramped bowels of an aircraft couldn't see well enough to connect the sensors' tubes together by hand, Neidigk said. So the team designed snap-clip type connectors for the CVM sensors, like those used to plug a telephone landline into a wall outlet.

"With the snap-click connectors, they are able to feel them click together, which is easier than the previous method of connecting tiny tubes individually by hand," Neidigk said.

Complementing the in-flight tests, Sandia is looking at the sensors' ability to detect cracks and how well they perform in extreme environmental conditions.

In the laboratory, Sandia engineer Tom Rice breaks things for a living, but that's not as easy as it sounds. The cracks he "grows" have to represent cracks found on an airplane. So, for example, he places a pale green wing box fitting on a load frame that mimics the stress conditions the part would experience on an aircraft. After about four hours of accelerated fatigue cycles, a crack begins to show.

"We literally have to grow the crack enough to where it stays open (without the load on it), so our sensors can detect the crack when the aircraft is in an unloaded state in the maintenance hangar," Rice explained.

Once the sensors detect an array of cracks, Sandia assembles various test scenarios and collects the data to calculate the statistical probability of detection for cracks of various lengths, typically fractions of inches. In hundreds of laboratory tests, the sensors have never issued a false call, Rice said.

If flight tests verify that the sensors can be used to help monitor airliners' structural health, the Sandia researchers hope to see a more comprehensive SHM program follow.

In addition to safety enhancement, SHM would save the airline industry time and money, particularly if sensors are mounted in hard-to-reach areas and used widely throughout an aircraft, Roach said.

With today's routine maintenance, inspectors often need to remove a cabin's interior seats or galleys to conduct inspections. But with the on-board sensors mounted in place, the mechanics can plug in from a convenient location to acquire the sensor data without the time and cost of removing items, Roach said. Such part removal also introduces the possibility of damaging the structure during disassembly.

Researchers hope SHM eventually will permit the real-time condition of the aircraft to dictate maintenance. "The ultimate goal is to monitor it in-flight and have it tell you 'I need some attention, I've got a problem here.' So you do condition-based maintenance rather than time-based maintenance," Roach said. "That's downstream a ways, but these are all building blocks working toward that."

Rice adds that with SHM, abnormal problems that show up prior to scheduled maintenance would be detected with real-time sensors. "With condition-based maintenance, you could find damage earlier than normal," he said. "It's rare that it happens, but it could."

Such early damage detection and repairs provided by SHM also are cost-effective because they reduce the need for subsequent major repairs, Roach said. ■

Aquatic regulations

Sea changes abound as the Ministry of Transport tackles flight safety over large bodies of open water.

BY NORM CHALMERS
Pacific Airworthiness Consulting

Good day good aviation people. In response to political need, the Minister of Transport is implementing some new changes to the Canadian Aviation Regulations (CARs) regarding flight over large bodies of water. Loyal readers of AMU will know that I am addicted to reading exciting websites looking for regulatory changes. The following proposed CARs changes are published in the Canada Gazette before they become regulations. The background material reminds us of the aviation tragedy that has precipitated new rules.

Background: On March 12, 2009, a Sikorsky S-92A helicopter (see footnote 1) operated by Cougar Helicopters departed from St. John's, Newfoundland and Labrador for the Hibernia Oilfield off the coast of Newfoundland with 16 passengers and two crew members on board. The helicopter suffered a catastrophic offshore accident and crashed in the Atlantic Ocean, near St. John's, N.L. All but one of the 18 occupants drowned and the sole survivor (a passenger) suffered serious injuries.

The impending regulatory changes will include the following:

CAR Subpart 101 - Interpretation:

"EUBA" or "emergency underwater breathing apparatus" means a self-contained supplemental air supply that is designed to prolong the breathing capability of a passenger or a crew member during the evacuation of a helicopter that has overturned or is sinking after a ditching; (EUBA ou dispositif respiratoire submersible de secours)

"offshore operations flight" means a flight that is conducted to or from an offshore location and that is

(a) a flight in support of offshore oil, gas or mineral exploitation,
(b) a sea-pilot transfer flight, or
(c) a search and rescue flight; (vol d'exploitation extracôtière)

In conjunction with those definitions, the following operation changes are coming:
CAR 602 – Operating and Flight rules 602.63(7):
(7) Where a helicopter is required to carry life rafts pursuant to subsection (4) or (5), no person shall operate the helicopter over water having a temperature of less than 10 degrees C unless
(b) a helicopter crew member transportation suit system is provided for each crew member on board; and
(c) the pilot-in-command directs all persons on board to wear their helicopter transportation suit system.
CAR 602.66 (1) No person shall operate a helicopter to conduct an offshore operations flight over Canadian waters unless (a) a EUBA is provided for each person on board;

The full text goes on with details regarding implementation. Any of you that might be impacted by these changes need examine this further to be prepared with whatever equipment and training will be mandated.

Now for another over-water flight safety issue. After years of fatal floatplane accidents, the Transportation Safety Board (TSB) has made recommendations as follows:

Example one: A11-05 - In 2012 a DHC-2 Beaver crashed with two fatalities. The related TSB recommendation A11-05 states: *The Department of Transport require that all new and existing commercial seaplanes be fitted with regular and emergency exits that allow rapid egress following a survivable collision with water.*
The related Transport Canada (TC) response started out stating that: TC has over the years taken steps to address floatplane safety through safety promotion and awareness campaigns. It goes on to promise nothing except more campaigns and training.

Example two: A11-06 - In 2009 a DHC-2 Beaver crashed with six fatalities. The TSB recommendation A11-06 states: The *Department of Transport requires that occupants of commercial seaplanes wear a device that provides personal flotation following emergency egress.*
The TC response boasts: "Transport Canada (TC) has over the years taken steps to address floatplane safety through safety promotion and awareness campaigns."
That TC response goes on to do nothing except to promise an updated floatplane safety campaign. Ottawa is known as the place of campaigns.

Example three: A13-03 - In 2012 another DHC-2 Beaver crashed with two fatalities. The TSB recommendation A13-03 states: *The Department of Transport require that all seaplanes in commercial service certificated for nine or fewer passengers be fitted with seatbelts that include shoulder harnesses on all passenger seats.*

The TC response states: *Transport Canada has not been able to identify any feasible and effective method to require "all new and existing seaplanes be fitted with regular and emergency exits." Findings indicate that the cost of adding or designating additional emergency exits does not justify the benefit, in that in the event of severe structural damage, existing or additional exits could be compromised. In some cases, it was found that perfectly serviceable available exits were not utilized.*

In that last sentence we see an example of TC's lack of understanding. They just don't understand why the exits were not utilized. The victims were strapped in with seat belts, smashed around, turned upside-down and submerged in cold water. They were then faced with door handles that were difficult to find and operate in that situation. I ask the Minister of Transport, what is so difficult to understand about this?

> The airlines praise SMS implementation because it keeps TC away from any real regulatory issues and they want the public to continue being complacent regarding their safety . . . This willful ignorance seems to be a chronic public ailment or place of comfort.

Since the dawn of water borne aircraft there have been related drowning and exposure deaths including those that affected me with the loss of friends in the 1960s and '70s. It is clear that the lack of political interest in aviation safety continues therefore we must expect TC abstemious interest in aviation safety to continue.

Moving on to another of our perennial topics, Safety Management System(s) [SMS] continues to beleaguer us. One of our loyal readers has written a letter to us expressing his observations and position:

"I am not down on SMS entirely either—just mostly," says our reader. "Maintenance and Manufacturing is by regulation and indeed by its nature a zero-defect environment, and has layers of Quality Systems. I cannot see any place for SMS in such an environment. In fact when I was AEA Chairman we did a survey of our members that had been dealing with SMS compliance as they were tied to 705 operations. The results were startling on several fronts. There was an additional 23 per cent in manpower overhead incurred in just dealing with SMS Compliance. And not one, but several members volunteered that they were having more quality escapes on the shop floor because all of the experienced pros that would normally be on the shop floor had been sucked off and were behind desks doing nothing but—you guessed it—SMS Compliance!

"And lastly SMS—or at least Transport Canada's myopic focus on SMS—has blood on its hands (and plenty of it!). Mr. ABC (name withheld) in his infinite wisdom parked both TCAS & TAWS rulemaking, clearly preferring to focus on the panacea called SMS. He got lucky in the sense that there were no mid-air collisions. Not so lucky with respect to CFIT accidents that TAWS would have prevented however. I believe we are at around 40 CFIT accidents that occurred between when the rulemaking was parked, and then eventually implemented under Mr. EFGH's (another name withheld) regime. And a body count that is around 200 I suspect. SMS will never likely show a benefit that would save lives. And it will certainly never recover the lives lost."

In a follow up letter our author says: *"There are lots of issues with SMS that nobody is speaking to. I still believe that long-term it will have a net-negative overall safety benefit for aviation, and at a huge cost to business."*

Unfortunately, he is correct. The airlines praise SMS implementation because it keeps TC away from any real regulatory issues and they want the public to continue being complacent regarding their safety. As I have stated before, the public prefers ignorance to knowledge. Sometime around the year 1750 Thomas Gray wrote "where ignorance is bliss, 'tis folly to be wise." This willful ignorance seems to be a chronic public ailment or place of comfort.

Note that I removed personal names from this letter to protect everyone. If anyone out there wants to contact the author of this letter please contact me and I will forward your request to him.

Moving on once again, we leave TC to carry on doing little or nothing for aviation safety. The Minister of Transport seems to place "safety" in order of priority somewhere below administrative conveniences.

And now for something completely different. These are good times for us macho Canadian guys. I see that Canadian Tire now sells Husqvarna chainsaws. Let's get out in nature and make some noise.

That's all for now folks. Until next time be good and do right.

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

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.* ■

Looking for Lost Cattle

ROBERT GARCÍA/The Daily Sentinel

Inadequate air speed at low altitude on a reconnaissance mission over Colorado spell trouble for a Piper aircraft and its passengers.

On December 12, 2013, about 1155 Mountain Standard Time, a Piper PA-24-250 airplane, N8037P, impacted terrain near Collbran, Colorado. The private pilot and two passengers were fatally injured. The airplane was substantially damaged. The airplane was registered to and operated by a private individual under the provisions of 14 Code of Federal Regulations Part 91 as a personal flight. Visual meteorological conditions prevailed for the flight, which operated without a flight plan. The local flight originated from the Mack Mesa Airport (10CO), Mack, Colorado, about 1115.

The pilot was flying two passengers to search for lost cattle when his airplane was observed by residents to be maneuvering at low altitude, though there were no witnesses to the accident sequence. The Piper was reported as overdue and an alert notification (ALNOT) issued but its wreckage was located about 0100 on December 13, 2013, after the airplane impacted a sparsely wooded area with rising terrain in the distance.

Personnel Information

The pilot, age 49, held a private pilot certificate for airplane single engine land. On October 17, 2013, he was issued an unrestricted third class medical. On his medical application, the pilot reported an evaluation for back pain that was resolved with no further pain and full function.

A review of the pilot's logbook showed he had accumulated 545.6 hours of total time with about 200-300 hours in make and model. The pilot's most recent flight review was accomplished on January 26, 2012, in the accident airplane.

Airplane Information

The single engine, low wing, Piper PA-24-250 airplane, serial number 24-3284, was manufactured in 1962. A 250-horsepower Lycoming IO-540-C1B5 engine, serial number L-388-48, powered the airplane and drove a two-blade, metal, Hartzell HCA2VK1 propeller. A review of airframe and engine logbooks revealed that the airplane's most recent inspection was a combined 100-hour and annual inspection performed on October 10, 2013, at a total airframe and engine time of 4,086.6 hours, tachometer time of 247.2 hours, and 177.4 hours since the engine's last overhaul.

Meterological Information

At 1153, an automated weather reporting facility located at the Garfield County Regional Airport (RIL), Rifle, Colorado, located 19 miles to the northwest, reported a calm wind, visibility 10 miles, a clear sky, temperature 16F, dew point 9F, and a barometric pressure of 30.43 inches of mercury.

Wreckage and Impact Information

The wreckage was located in a sparsely wooded area about 15 miles east of Collbran, Colorado, at a measured altitude of 8,188 feet. The airplane came to rest upright with the front of the airplane aligned on a 200-degree magnetic heading. The engine and propeller were submerged in the snow packed ground and could not be accessed on site. The fuselage was broken at the firewall but the remainder of the airplane remained intact. Both wings exhibited nearly symmetrical, rearward "accordion-style" crushing. The right wing, outboard of the flap, was bent upwards near 45 degrees.

The empennage was buckled in several locations and distorted about 15 degrees to the right. The vertical and horizontal stabilizers, rudder, and elevator were unremarkable. Flight control continuity was established from the flight control to all control surfaces. A majority of the cockpit instruments and controls were impact damaged. The mixture, throttle, and propeller control were in the full forward positions. The flaps were found in the retracted position. The manifold pressure gauge read 16.5 inches. The tachometer displayed 249 hours. The fuel selector was found selecting the left main fuel tank; however, impact damage to the fuel selector precluded determining the switch position prior to impact. The left main tank or left auxiliary tank was opened and no fuel was detected. An undetermined amount of fuel was found in the right main tank and right auxiliary tank. No fuel stain or smell was present underneath the airplane's wings. During recovery, months later, no fuel was found in any of the tanks.

Above: Piper cockpit.

The airplane was recovered to private property and was examined by the NTSB with assistance from a representative from Lycoming engines. Continuity and thumb compression were established to all cylinders. Both magnetos produced spark at each lead. All oil and fuel screens were found clear and unobstructed. No anomalies were detected with the engine.

Both propeller blades displayed leading edge polishing and chord-wise scratches. One of the blades was bent nearly 90 degrees aft just outboard of the blade root. The other blade remained nearly straight.

Medical and Pathological Information

The Pathology Group, Grand Junction, Colorado, conducted an autopsy on the pilot as authorized by the Mesa County Coroner's Office. The cause of death was the result of multiple blunt force injures and the manner of death was ruled an accident. The autopsy noted that found in the pilot's pants pocket was a small container of a "green, leafy material suggestive of marijuana." The substance was not tested to confirm its identity.

The FAA Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma, performed forensic toxicology on specimens from the pilot. Testing noted the following:

- Liver unsuitable for analysis of tetrahydrocannabinol (marihuana)
- 0.3474 (ug/ml, ug/g) tetrahydrocannabinol (marihuana) detected in lung
- 0.0039 tetrahydrocannabinol (marihuana) detected in blood
- 0.0628 tetrahydrocannabinol carboxylic acid (marihuana) detected in liver
- 0.017 tetrahydrocannabinol

Above: Collbran, Colorado, near the crash site.

carboxylic acid detected in lung
- 0.0096 tetrahydrocannabinol carboxylic acid (marihuana) detected in blood (cavity)

The specimens were not obtained from sources that could accurately determine the pilot's pre-mortem blood levels of the detected substances. The levels detected in the lungs suggest recent use, but an accurate time frame could not be determined.

Additional Information

According to an associate of the pilot, the flight was conducted in order to search for missing cattle. The flight was supposed to be conducted in a two-seat Piper PA-22-108 by another pilot and one passenger. For undetermined reasons, the parameters of the flight changed and the pilot flew the two passengers in the four-seat Piper PA-24-250. It is possible that the inclusion of a second passenger necessitated an airplane with increased occupant capacity. The pilot intended to be compensated for the flight, however the pilot did not possess a commercial pilot certificate.

A Garmin GPSMap 496 was found in the wreckage. The GPS was sent to the NTSB Laboratories in Washington, DC, for data extraction. The device contained numerous flights including the accident flight. Data points recorded the airplane as it departed the Mack Mesa Airport at 1115. The airplane flew east and remained about 4,000 feet above ground level as the terrain elevation increased. At 1138, the airplane crossed over the Vega Reservoir about 11,600 feet, and continued to the southeast about 10 miles before flying several north-south legs east of Porter Mountain. The airplane altitude varied between 300-500 feet above ground level and the airspeed between 97-139 knots.

The last recorded GPS point occurred at 1155:07 at an altitude of 8,525 feet, airspeed of 136 knots, and an approximate heading of 295 degrees. This last point was approximately 1.4 miles northeast of the accident site.

The National Transportation Safety Board determines the probable cause(s) of this accident to be the pilot's failure to maintain adequate airspeed while maneuvering at a low altitude resulted in an aerodynamic stall/spin and subsequent impact with terrain. Though toxicology testing revealed the presence of tetrahydrocannabinol in the lung and tetrahydrocannabinol carboxylic acid in the liver and lung, which suggested the recent use of marijuana; insufficient evidence existed to determine whether the pilot was impaired by its use at the time of the accident.

NTSB investigators either traveled in support of this investigation or conducted a significant amount of investigative work without any travel, and used data obtained from various sources to prepare this aircraft accident report. ■

Aviation Services

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Aviation Services

BY SAM LONGO, AME A&P

Whirling Wonders

I vividly recall my first class in Propeller Theory. Mr. Urch, our stalwart Aircraft Maintenance Professor, posed a seemingly simple technical question to our group. "What is the purpose of the propeller?" All the keeners raised their hands and one responded with the appropriate response "To provide thrust, sir."

"Wrong!" our wise instructor bellowed. "Its function is to keep the pilot cool … just watch him sweat if it ever stops!"

Perspiring pilots aside, the aircraft propeller is a complex whirling wonder that has evolved over the history of aviation to match and enhance the improvements in engines and airframes. Early attempts at propeller construction were crudely twisted metal akin to lawn mower blades bent to angles based more on whim and luck than science.

The Wright brothers figured out early on after testing wings in their makeshift wind tunnel, that propellers must follow the same concepts as airfoils. They were greatly disappointed to find very little concrete scientific data even when they researched marine propellers and so the seemingly black art of propeller design began.

With a wing or airfoil, efficient lift requires a somewhat narrow angle of attack (the angle in which the leading edge meets the airflow). This optimum angle can be controlled by the pitch inputs the pilot chooses with his control column. Too much angle and the wing stalls, destroying the lift and potentially the aircraft! Propellers, however, live in a much more complex combination and variation of airflows. Simply put, the speed of the rotating propeller blade creates one angle of attack and the forward speed of the aircraft creates another variable angle. The resultant vector angle is constantly changing with engine speed and aircraft speed. Add to all this, that blade tip speeds must be kept to subsonic speeds requiring a constraining check of blade length and max rpm. This in turn requires relatively low prop rpm (max 2,500, give or take) and/or multiple shorter blades and the whole scenario becomes an engineering whirling dervish.

The bottom line is that even a modern well-engineered wooden or metal fixed-pitch-propeller is a compromise by its very design. Ideally an aircraft would like a finer pitch for takeoff and climb and a coarser pitch for cruise flight. Once the pioneers figured this out many weird and wonderful moveable pitch propellers began to appear, some more successful than others.

Hamilton Standards' solution was simple and elegant. Their two-position counterweight propellers were a revolution. Engine oil pressure drove the blades to fine pitch and counterweights drove the blades to coarse pitch. By controlling the oil flow to the propeller via a selector valve the pilot now had the best of both worlds. Add to this the ability to fine-tune the high and low pitch stops within the counterweights and it was propeller bliss.

The Second World War was a watershed for aviation design. The large radials and high horsepower V-12 engines required a more sophisticated solution to greater thrust and faster aircraft speeds. The constant speed propeller was the next logical step. By using a governor to sense engine rpm the prop could now maintain a large variation of blade angles constantly changing to optimize aircraft performance. In essence it was akin to moving from a car with a two-speed manual transmission to one with a modern CVT. Again, Hamilton Standard produced the state of the art hydromatic propeller. Using a governor with boosted oil pressure working against the constant of engine oil pressure within its instantly recognized metal dome, it was reliable and efficient with the added benefit of feathering the propeller in flight. A feature that saved many aircrews lives while returning from bombing runs with damaged aircraft and engines out of service.

The hydromatic became the propeller of choice when hostilities ended and the golden age of piston-powered airliners began and flourished. Its roots and concepts soldier on today with state of the art composite blade propellers mated to modern turbo prop aircraft. While high bypass turbine engines reign supreme at high altitudes for long transcontinental flights, turbine-driven propeller aircraft still rule the low to medium altitude skies. They are also more efficient at slowing an aircraft on landing roll with the use of reverse pitch, another modern propeller enhancement that greatly improves STOL performance.

Propeller technology continues to improve. Just as in the latest airframes, modern composite materials are making them lighter, quieter and more efficient. Evolution is a wonderful thing, which brings to mind another propeller memory from my early days at Nordair.

As a young apprentice mechanic, I was getting an FH227 ready for departure at a gate at Dorval Airport. Its Rolls Royce Dart engines and large Dowty Rotol propellers were notoriously noisy, as many regular passengers knew. The ear-bleeding, high-pitched whine of the props at takeoff rpm could be quite uncomfortable. Fast forward to today, as a modern Bombardier Q-400 climbs skyward from Toronto's Island Airport, its passengers are barely aware of the rubber band-quiet composite propellers churning away — a testament to how good they have become.

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

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