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PAMA and AME news

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reducing maintenance errors

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The Blackline Solution

A new employee-worn gas detection monitor could be key to saving lives.

For companies who take pride in being cutting-edge when it comes to the safety of their employees, a Canadian firm is now offering a product that's worth consideration. Calgary-based Blackline has tailored its standalone employee-worn device with replaceable gas detection cartridges to the Aerospace and Aviation industries.

Used for personnel working in paint booths, on-the-ground manufacturing as well as maintenance, repair and operations, Blackline's G7c is a combined safety monitoring and communications device. It continuously monitors the concentration of hazardous gases or fumes and — should an incident occur — immediately communicates the employee's identity and location to Blackline's live monitoring team in real-time.

Blackline's Safety Operations Center follows the unique emergency protocol for each corporate client to manage alerts as they are received. Two-way voice calling, and a messaging interface enables monitoring agents to communicate with the employee to assess the situation and respond accordingly.

Launching early in the New Year is a new photoionization detector (PID) that will monitor volatile organic compounds including methyl propyl ketone, jet fuel and cleaning solvents such as acetone and isopropyl alcohol. Blackline's single-gas and quad-gas cartridges will support a PID sensor, giving customers the choice to be equipped to detect anywhere from one through four different gases simultaneously.

"Our indoor location technology allows us to identify immediate health and safety risks to employees and communicate with them directly or send help to their exact location," says Kirk Johnson, Product Manager for Blackline Safety. "All of our safety-monitoring products connect to our cloud-hosted portal where customers can message employees, initiate voice calls, view usage trends and map their risks geospatially."

He added, "As a new member of the Aerospace Industries Association of Canada Association (AIAC) we look forward to helping the international aerospace community protect their teams." ■

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Features

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Upcoming Events

Massive MRO coming to Alberta

Canadian North announces upcoming launch of multimillion-dollar Aircraft Maintenance Facility at Edmonton International Airport.

In late November Canadian North Airlines announced the establishment of its own Manufacturing, Maintenance, Repair and Operations (MMRO) facility, which will open during the first quarter of 2018 within its 90,000 square foot hangar at Edmonton International Airport. The facility, which represents a multimillion-dollar investment, has been made possible through strong support from Inuvialuit Development Corporation, Canadian North's parent organization. Once operational, Canadian North will have the capability to fulfill all of its maintenance and manufacturing requirements for its fleet of Boeing 737-300, Boeing 737-200 and Bombardier Dash-8 aircraft.

By utilizing its own people, equipment and facilities to complete these essential functions, Canadian North will significantly reduce its maintenance costs while gaining full control over maintenance planning and scheduling. Canadian North will further leverage this investment by offering cost-effective and efficient maintenance services to airlines throughout North America and beyond.

"Canadian North's establishment of its own MMRO facility at EIA is a major step forward for both Canadian North and Edmonton," said Steve Hankirk, President of Canadian North. "We will now be able to maintain our Boeing 737 and Bombardier Dash 8 aircraft more efficiently, and by offering access to our highly trained team members and well-equipped facility to other airlines, we'll be helping to position Edmonton as a leading aerospace maintenance hub, stimulating even more economic activity in the region."

Canadian North is a member of the Edmonton International Airport community and a founding member of the Alberta Aerospace and Technology Centre, a partnership formed between Edmonton International Airport, Canadian North, Canadian Helicopters, Edmonton Economic Development Corporation (EEDC) and the Government of Alberta to build a cluster of activity in aerospace and technology at EIA.

HAI Heli-Expo
February 26 – March 01
Las Vegas, Nevada
http://heliexpo.rotor.org

Aerial Fire Fighting North America 2018
March 12 – 14, 2018
Sacramento, California
www.aerial-firefighting-northamerica.com

MRO Americas
April 10 – 12, 2018
Orlando, Florida
www.mroamericas.aviationweek.com

NBAA Maintenance Conference
May 1 – 3, 2018
Albuquerque, New Mexico
www.nbaa.org

Advertisers Index

STCs & new products

Corrosion-proof engine inlets from Quiet Technology

After having recently received STC approval, Quiet Technology Aerospace has now delivered its first two sets of upgraded corrosion-proof engine inlets for the Gulfstream G200. The light-weight carbon graphite composite engine barrels are solutions to aluminum inner-barrel engine inlet corrosion and acoustic screen degradation on the aircraft. The G200 was the second PW305 powered airframe to receive STC approval for QTA. The first approved aircraft in their program was the Lear 60. QTA has installed over 30 composite barrels for the Lear 60 in the last 12 months, and also has an approved solution for the Hawker 1000. **For information visit** www.qtaerospace.com

Schweiss straps replace cables

Convert your existing cable bifold door to straps. Now available from Schweiss Doors is the company's patented "lift straps" that take the place of aircraft cables to raise and lower doors. The lift straps make Schweiss doors faster, safer, simpler, easier, and quieter than any other bifold door. The Schweiss lift strap is durable, lasts longer than steel cables, requires less maintenance and is very easy to replace.

For information visit www.schweissdoors.com

Plug-and-Play display gets STC

Thomas Global Systems announced that its TFD-8601 AMLCD cockpit display has received a Federal Aviation Administration supplemental type certificate for installation in Dassault Falcon 50 aircraft. The TFD-8601 cockpit display is a plug-and-play, Active Matrix Liquid Crystal Display replacement for aging cathode ray tube displays installed in a variety of regional, business and military aircraft. A shipset of four displays saves over 12 pounds per cockpit and requires 70 percent less power than aging CRTs during normal operation. The display is already certified on a range of regional and business aircraft including Saab 340B and Embraer EMB 120. **For information visit** www.thomas-global.com

New EZ-RJ45 crimp tool from Platinum Tools

Platinum Tools' new EXO crimp tool can terminate multiple sizes of cables and conductors. The crimp frame highlights two interchangeable dies that work with EZ-RJ45 (Cat5e/6) and ezEX-RJ45 (Cat6/6A) connectors. The tool design allows for future upgrades by purchasing a new die. Additional enhanced features and specifications of the EXO crimp frame and dies include single cycle crimp and flush trim, reversible die for ambidextrous operation, and the ability to lock connectors into the tool for correct positioning during crimp.

For information visit www.platinumtools.com

One-man dolly designed to move aircraft

Merrick Machine manufactures custom dollys for all branches of the military. Chinooks, boats, and all types of equipment and material have been moved with the U.S.-made Merrick Machine Dollys. They were designed to allow one person to move airplanes and other heavy objects. **For more information visit** www.theindustrialdolly.com

Light Vest offers hands-free lighting

The LED's Work Light Vest provides hands-free, portable lighting for up to five metres in outdoor and other dark working environments. With seven settings for visibility and torch functions, the illuminating vest eliminates the need for a flashlight. The battery can be fully recharged within two hours, using a 110-240V AC charger or optional travel charger. The vests are available in yellow or orange with options for lighting on the front, back and shoulders of the vest. **For information visit** www.light-vest.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

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- Gulfstream G200
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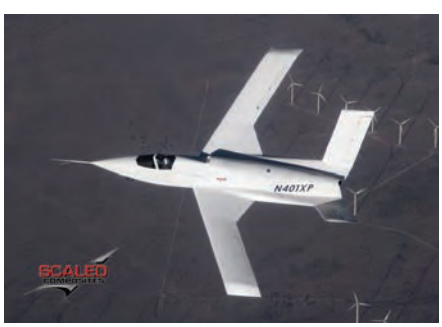
BOEING CERTIFIES GOODYEAR FLIGHT RADIAL TIRE FOR 777X

The Boeing Company has certified the Goodyear Tire & Rubber Company's ultra-lightweight Flight Radial aviation tire for its 777X airplane. With this designation, the Goodyear Flight Radial becomes the first product to receive Boeing system part certification for the 777X. In December 2015, Goodyear announced that Boeing had selected the Flight Radial for the nose and main landing gear of the 777X, which is scheduled for delivery in 2020."The Flight Radial earning the first system part certification for this advanced aircraft is a tremendous achievement and a testament to Goodyear's aviation tire technology and capabilities," said Richard J. Kramer, chairman, CEO and president of Goodyear.

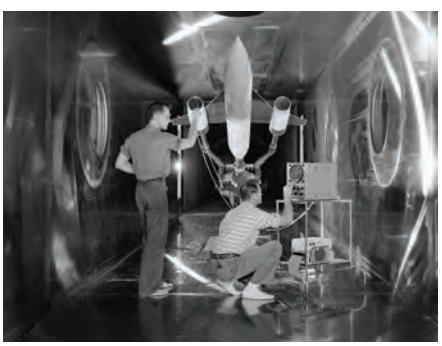
COMPOSITES OUTFIT LAUNCHES EXPERIMENTAL AIRCRAFT



This fall, California-based Scaled Composites launched the first flight of its experimental aircraft Model 401, powered by a single Pratt & Whitney JTD-15D-5D engine with 3,045 pounds of thrust. The aircraft is capable of flying Mach 0.6 with a service ceiling of 30,000 feet and has a wingspan of 38 feet and is also 38 feet long. It has an empty weight of 4,000 pounds and a maximum take-off weight of 8,000 pounds with an endurance of up to three hours. The initial flight is the beginning of the flight test phase for vehicle number one. The Scaled team plans to continue to expand the performance envelope on the first aircraft as they move toward first flight of the second Model 401 vehicle.

Scaled Composites is a specialty aerospace and composites development company offering design, build, and test capabilities. Founded in 1982 and located in Mojave, California, Scaled has averaged one first flight of a unique, new airplane per year.

BOEING FUNDS NEW WRIGHT BROTHERS WIND TUNNEL



Boeing and the Massachusetts Institute of Technology announced in November that with a funding pledge of $18 million Boeing would be the lead donor in the replacement of MIT's 79-year-old Wright Brothers Wind Tunnel. The new version is expected to be the largest and most advanced academic wind tunnel in the United States. The gift reflects the century-long relationship between MIT and Boeing, with a number of Boeing founding leaders having studied at MIT, including Donald Douglas Sr., James S. McDonnell, and the first Boeing engineer, Wong Tsu, who designed Boeing's first commercially successful airplane, the Model C, in 1916. Currently, Boeing employs more than 800 MIT alumni around the world. In addition, more than 50 Boeing executives as well as more than 60 members of the Boeing Technical Fellowship hold MIT degrees. The new tunnel will be constructed on the site of the current facility, which was dedicated in September 1938.

MAKO COMES WITH WHOLE AIRCRAFT PARACHUTE

The new Lancair Mako single engine aircraft will now offer the BRS Aerospace whole aircraft parachute system as an optional safety feature, the company announced in November. The system is similar to that offered as a retrofit to Cessna172/182 aircraft and as standard equipment on the Cirrus line of aircraft. The whole aircraft parachute system design calls for a parachute ballistic launcher to be installed in the aircraft with a pilot-initiated activator located in the cockpit. Upon activation, a ballistic rocket propels a parachute into the airstream to slow the airplane and float it down into a survivable vertical landing. The system is designed to be a last resort for pilots and passengers when all other attempts to recover the airplane in case of emergency or pilot incapacitation have failed. BRS Aerospace was founded in 1980 in South St. Paul, Minnesota.

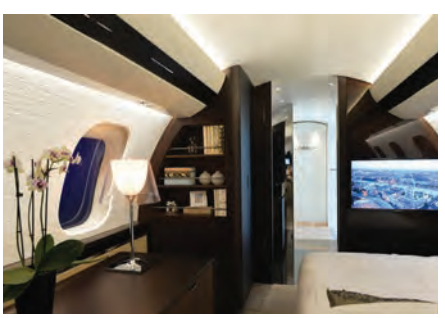
STANDARD-AIRBUS-VECTOR WORK OUT DEAL

StandardAero Aviation and Airbus SE announced they have finalized the acquisition by StandardAero of Vector Aerospace Holding SAS from Airbus. Vector is a global aerospace maintenance, repair and overhaul company, providing support for turbine engines, components, fixed- and rotary-wing aircraft. It generated revenues of over US$700 million in 2016 and employs approximately 2,200 people in 22 locations across Canada, the United States, the

United Kingdom, France, Kenya, South Africa, Australia and Singapore.

The newly combined company, which will maintain the name of StandardAero, has more than 6,000 employees in 42 locations across five continents, with annual revenues of approximately US$3 billion.

GLOBAL INTERIORS SPIKE HIRING SPREE



The Canadian Press reported in November that Bombardier plans to hire 1,000 workers over the next 18 months to complete the interiors of the Global 7000, which is scheduled to enter into service late next year. The hiring follows mass layoffs in recent years by the company as part of a five-year turnaround plan to regain its financial footing. It eliminated 14,500 positions around the world in its aerospace and railway divisions.

Aero Montreal, which promotes the city's aerospace industry, said 31,681 positions would need to be filled within the next 10 years including 8,816 newly created positions and 22,865 positions resulting mainly from retirements. Bombardier Business Aerospace employs about 5,500 people in the Greater Montreal area. Thousands more work on assembling the new C Series jet. At its peak, the Global 7000 is expected to employ more than 2,500 workers, including nearly 1,700 in Montreal and 800 at the final assembly line in Toronto.

SAFRAN UNVEILS ANETO ENGINE FAMILY

Safran Helicopter Engines has unveiled its new Aneto high power engine family designed for the super-medium and heavy helicopter market, with several models covering the 2,500 to over 3,000 shp power range. The first 2,500 shp model, named Aneto-1K, has been selected by Leonardo to power its twin-engine AW189K. The Aneto engine family offers 25 percent greater power (when compared to existing engines of same volume), contributing to increased mission capabilities requiring more power like offshore, search and rescue, firefighting or military transport, as well as better performance in "hot and high" conditions. Other aspects of the new engine family include higher reliability and safety. Its maintainability has been optimized with fewer scheduled maintenance tasks and longer maintenance intervals, and this new range will have connected features like health monitoring (predictive maintenance) and will be fully compatible with Safran's online engine maintenance management service. Safran has a tradition of naming its engines after features in the Pyrenees Mountains. Aneto is the name of the highest mountain in the Pyrenees.

TRANSPORT CANADA CERTIFIES P&WC ENGINE

Pratt & Whitney Canada reports that its PT6C-67A helicopter engine that powers the AW609 — an aircraft that flies both horizontally and vertically — has achieved certification from Transport Canada. FAA validation of the PT6C-67A engine is expected by the end of 2017 and supports FAA certification of the AW609 in 2018 as the first commercial tiltrotor to enter operation.

The engine has also been certified to allow for continuous operation in a vertical position.

"We were presented with a special challenge by Leonardo Helicopters: design an engine to power an aircraft that takes off and lands vertically, and flies horizontally well above adverse weather conditions at twice the speed and range of a helicopter," says Irene Makris, vice president, marketing, P&WC.

"The PT6C-67A eloquently answers that challenge with 2,000 shp output that provides exceptional power to weight ratio, and durability." ■

Do you have news about your company you'd like to share with readers of AMU?

Email your text and photos to our editor at amu.editor@gmail.com

Reducing and avoiding

BY JOE SCOLES

Everyone is human; we all make mistakes. But maintenance errors can be reduced and even entirely avoided if the AME can see them coming. Here we look at a group of trouble incidents, how they arrived, and how they were resolved.

Opposite page: McDonnell Douglas DC-10.
Above: Cessna 337.

maintenance errors

The following is a list of eight maintenance errors compiled by Robert Sargent, a maintenance human factors engineer at the Boeing aircraft company. After reading his list, I reviewed incidents of errors that were tabled in Transport Canada's "Aviation Safety Maintainer" articles back as far as 1982. As a result of my findings in these articles, I not only agree with Mr. Sargent's list, but also found very few new issues that could be added, though you will note I did eventually add three more at the end of the inventory (items 9-11). Mr. Sargent did an excellent job in his research and he also brings to light the importance of those very simple maintenance items that cause so much trouble. (Could it be that shift change and work practice often enter the picture?)

01. Incorrect installation of components
02. Electrical wiring discrepancies
03. Inadequate lubrication
04. Fuel or oil caps and fuel panels not secured
05. Fitting of wrong parts
06. Loose objects left in aircraft
07. Access panels/fairings/cowlings not secured
08. Gear pins not removed before departure
09. Pitot/static covers and/or tapes not removed after maintenance
10. Inadequate inspection or faults missed during inspection
11. Work not in accord with standard or accepted practice

Above: Cessna 172.

Although AMEs are aware of these simple human inadequacies, they still end up getting caught out on a limb occasionally. Let us imagine that typical errors are tied to a chain with a noose on the opposite end, which is looped around the neck. As you read the incident examples below, think about how the outcome might have changed if the noose tightened around the subject's neck every time he or she walked away from an aircraft when simple but important items were missed during inspection and maintenance.

Boeing B737

The crew declared an emergency and returned for a safe landing after the No. 1 engine failed shortly after takeoff. After landing, the crew shut down the engine and, during taxi, they observed fuel leaking from the engine cowling. Maintenance reported that the engine had spooled down owing to a large fuel leak near the dump valve.

Further examination revealed that the leak had occurred because a ferrule was missing from the coupling that secured a high-pressure fuel line to the dump valve. Maintenance installed the ferrule, secured the fuel line coupling and returned the aircraft to service.

McDonnell Douglas DC-10

Shortly after takeoff, passengers reported fuel leaking from an outboard wing fuel panel. After verifying the report,

Above: Boeing 737.

the pilot decided to dump fuel and return to the airport.

Maintenance found the source of the fuel leak to be two large screws that had been incorrectly installed in the leading edge of the wing and had punctured the fuel tank.

The aircraft had been on lease to a foreign operator when the oversize screws were installed. The correct size screws were installed, the fuel tank was resealed, and the aircraft was returned to service.

Cessna A-185F

During cruise flight, the engine (Continental IO-520-D) quit. The pilot was uninjured and the aircraft undamaged during the forced landing on a pond. Inspection of the aircraft revealed that the bolt connecting the throttle cable to the throttle had become dislodged. The report indicated that the cotter pin had failed and the nut had come off.

(The report did not explain how it was determined that the cotter pin failed. — JS.

Above: De Havilland DHC-8-102.

Cessna 337

The pilot declared to air traffic control that both engines had failed, and subsequently reported that he had restarted the engines. He landed safely at a nearby airport. Further investigation revealed that both engines were operating from one fuel tank. The gauge for this tank was indicating over half full at the time the engines stopped. An inspection revealed that the fuel tank was empty, and the gauge was reading incorrectly.

(The one time that a fuel gauge is supposed to be accurate is when the tank is empty. — JS.)

Cessna 172

The aircraft departed on a local VFR training flight and, shortly after takeoff, the pilot reported a very rough running engine and returned to the airport, making a safe landing. Maintenance declared there were no discrepancies with the aircraft

Above: Cessna 421.

and it was ground run with no problems. Maintenance suspects that the fuel selector was slightly off the detent for one of the tanks and that this may have interrupted the fuel flow. Maintenance went on to state that there is some "play" in the selector switch and it is possible the selector may have been positioned incorrectly.

(From my experience with Cessna aircraft, I do not entirely agree that "play" is part of a correctly functioning and rigged fuel selector. What we seem to be discussing is excessive wear somewhere in the fuel valve control. The inexperienced student may have focused on the pointer not realizing the selector could be off the detent. — JS.)

De Havilland DHC-8-102

The aircraft diverted to an alternate airport because of a radar failure. Before landing, the crew reported an unusual odour in the cockpit, which may have indicated an electrical problem. Company maintenance discovered a shorted-out No. 1 advisory display panel. The advisory display panel was replaced, the system checked and the aircraft returned to service.

(This raises a broader issue: did the circuit protection devices work as advertised or did the advisory display panel simply burn itself off-line? This point was not discussed in the incident report, but it is important to keep in mind whether electrical systems always function as required to cut off the flow of current when a short occurs. — JS.)

The importance of pre-flight

I'll close with a couple of cases that reflect the old classic involving items pilots often miss during pre-flight. Maintenance people can help pilots prevent such incidents through awareness and vigilance.

Cessna 421

The aircraft departed Thompson, Manitoba, on a medical transportation flight with two pilots and a flight nurse on board. Shortly after departure, the pilots noticed oil on the cowlings of the left engine. They shut it down, declared an emergency and returned to Thompson. Examination of the aircraft indicated that the oil had come from the engine oil filler, whose cap had been left unsecured after the pilots' pre-flight check.

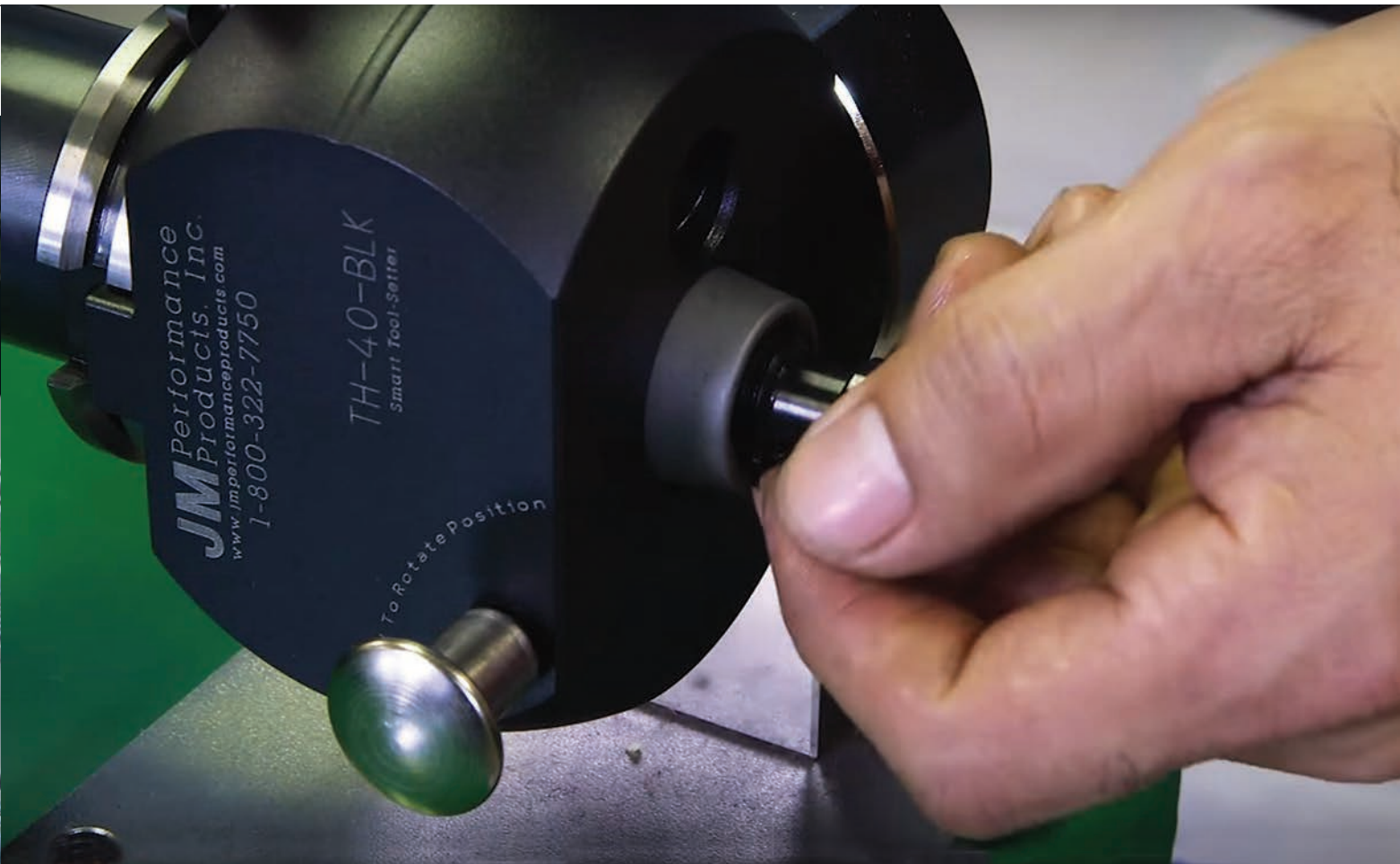
Cessna 310

The aircraft departed Sioux Lookout, Ontario, but declared a Mayday and returned shortly thereafter owing to an open exit door. Inspection after landing revealed that the door was not properly secured before departure.

(This article was originally published in Aviation Safety Maintainer and is republished for its enduring value as a safety promotion tool.) ■

The weakest link:

Aerospace machinists are increasing productivity and reducing tooling costs by addressing an often-overlooked flaw.



Above opposite: Cling's Aerospace specializes in multi-axis machining.
Above: Machinist setting up a Toolholder Touch Off Test.

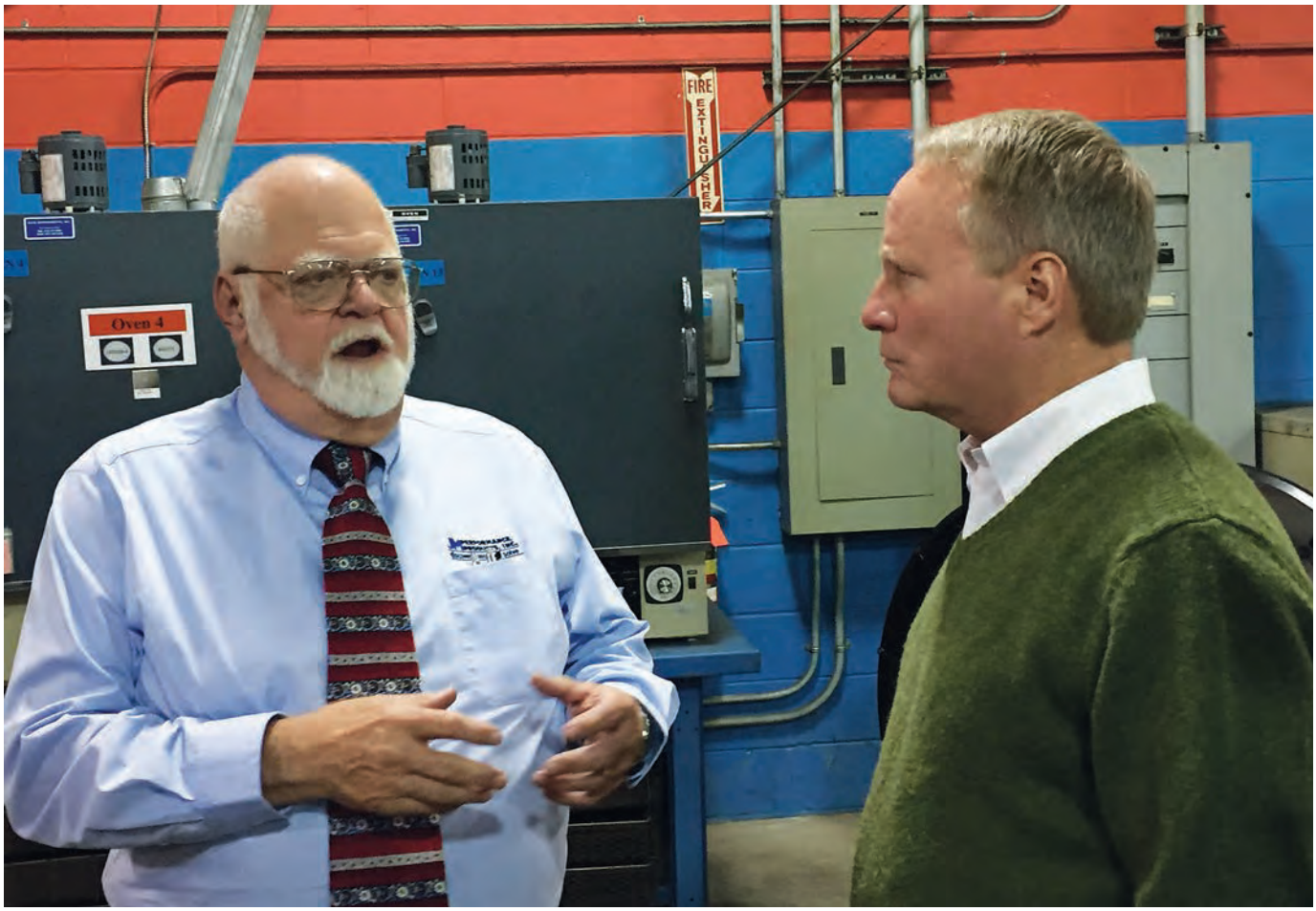
machining at high speed

High speed machining in excess of 20,000 RPMs is often utilized in aerospace when machining exotic alloys and harder metals like titanium. At these rates of speed, the precise and secure seating of tapered toolholders in the spindle becomes even more critical. So much so, that failing to pay attention to this single detail can lead to decreased productivity, less precise machining, reduced tool life and even damaged workpieces.

However, that is precisely what is occurring in aerospace machining due to an often overlooked, even ignored, link in the chain: poorly designed retention knobs that – when tightened – create a bulge in the small end of the taper that prevents full contact and proper seating in the spindle. Yet despite widespread evidence of uneven wear patterns and simple "touch-off" tests that immediately identify it as a widespread issue, the industry has largely ignored this aspect of machining and, unwittingly, is paying a significant price for it.

The flaw in the system

Although the shank of tapered toolholders is ground to a fine finish within very precise, established tolerances, and are also threaded at the narrow end to accept a retention knob, the knob is designed to engage with the drawbar, which exerts



Above: CEO John Stoneback and Congressman David Joyce in the Shop at JM Performance Products, Inc.

a pull force that holds the toolholder firmly in the spindle. The problem is poorly designed, traditional retention knobs – a less than $30 part – when tightened create a bulge in the taper that prevents proper seating in the spindle. Once this expansion occurs, the toolholder will not pull fully into the spindle and so cannot make contact with upwards of 70 per cent of its surface.

The results are manifested in a wide range of CNC milling issues often attributed to other causes: vibration and chatter, poor tolerances, non-repeatability, poor finishes, shortened tool life, excessive spindle wear and tear, run-out, and shallow depths of cuts.

"A lot of aerospace work is really tight tolerance," says Rex Ausbun at Cling's Aerospace, a company that specializes in complex four- and five-axis precision machined parts. "When you see chatter or vibration,

Above: As well as multi-axis manufacturing, Cling's Aerospace does manual turning and milling.

you know there is an issue with the toolholder."

According to Ausbun, who is responsible for purchasing all the inserts, tools and other machining accessories for Cling's Aerospace, "with a tapered toolholder, you want to 'marry' it as tight as possible to the spindle to get as much contact across the entire taper as possible. That way, you are not just hitting at the top of the angle."

To accomplish this, retention knobs are used. However, Ausbun says that newer CNC milling machines exert significantly more drawbar pressure on the knobs than in the past. This is compounded by the fact that most retention knob manufacturers provide little information on the proper torque required, a factor that can lead to the improper seating already described above.

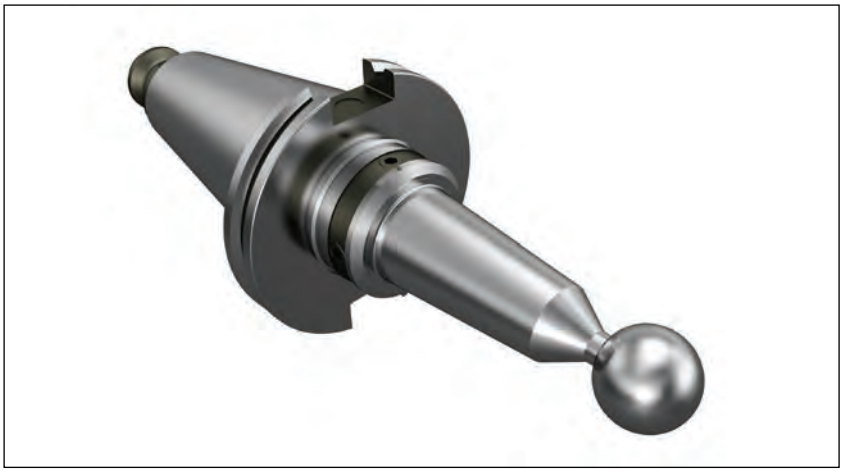
As a result, Ausbun says several of the retention knobs literally pulled apart during operations. "As drawbar tension continues to increase in CNC machines, it puts so much pressure on the weakest link, the retention knob, that it's bound to come apart," says Ausbun. "It's a significant issue because if the retention knob comes apart while the machine is running it could cause considerable damage. You are talking spindles that cost $10-$14 thousand a piece today, not to mention the downtime. That's a lot of money."

High Torque retention knobs

To find a solution, Ausbun did some online research and found JM Performance Products, Inc. (JMPP). In 2009, the company introduced its High Torque retention knob. Invented by the company's founder, John Stoneback, the product works with all existing toolholders including BT, DIN, ISO, and CAT toolholders from 30 taper to 60 taper.

The High Torque retention knob is longer by design to reach deeper into the threaded bore of the toolholder. As a result, all thread engagement occurs in a region of the toolholder where there is a thicker cross-section of material to resist deformation. It also includes a precision pilot to increase rigidity, and is balanced by design. Since even over-tightening of

Pictured below: Machined aerospace components range from small to large, from simple to complex, but what they have in common is the need for precision.



Above left: The manufacturer says that the return of investment on its High Torque retention knob can be realized in a week or less. Above: High Torque retention knobs work with all existing toolholders including BT, DIN, ISO, and CAT toolholders from 30 taper to 60 taper. Below: CNC BT toolholders.

the High Torque retention knobs can still create a bulge, the company provides specifically calculated torque specs based on drawbar pressure. By combining the High Torque retention knob with the correct torque, spindle contact with the taper is improved to close to 100 percent every time.

After finding out more information about the product, Ausbun says he decided to order a few and give them a try. In addition to having high hopes for the product, he says he was also impressed that JMPP had researched the appropriate torque settings for installing the retention knobs as well.

"When you start checking out different manufacturers as to what they recommend for torque specs on the retention knobs, everyone seems to have a different opinion," says Ausbun. "I thought it was pretty impressive that [JMPP] went the extra mile and put a lot of research into determining the ideal torque."

Tool life

By increasing the rigidity of the toolholder at higher RPMs, the High Torque retention knob can also increase tool life. Perhaps more than some other industries, aerospace manufacturing can take a toll on the carbide cutting tools used when machining exotic alloys and hard metals. The result is that cutting tools must be changed out more frequently as they dull or break.

"In aerospace every shop is trying to machine parts faster and aggressively remove more stock, just to stay competitive," says Ausbun. "This just puts more pressure on the tool."

With higher-end technical carbide inserts, the cost of tool replacement, not to mention loss of production time due to frequent changeover, can add up quickly.

"Since we changed to the High Torque Retention Knobs, we are not going through inserts like we used to and we haven't had any more issues with retention knobs pulling apart," says Ausbun. "I'm also not seeing any distortion in the toolholder taper either."

Ausbun estimates that tool costs have been reduced by as much as 20 percent as a result.

Although manufacturers are already benefitting from implementing the High Torque retention knobs, others remain unaware – even dismissive – that improper seating of tapered toolholders is even a problem. For those that are not entirely convinced, JMPP suggests a "touch off" test that can be found online: www.jmperformanceproducts.com/toolholder-test.aspx. More sophisticated measurement of toolholder expansion (bulge) can also be taken using a taper shank test fixture. ■

WESTERN

Western AME Association

2018 Airworthiness Tradeshow & Symposium

This event runs March 21-23, 2018 at the Coast Plaza Hotel in Calgary, Alberta. The Board of Directors and Planning Committee are looking forward to this unique opportunity for aircraft maintenance professionals, organizations and operators to assemble, network and learn. As a key participant in keeping aircraft safe and protecting the flying public it is important that we stand united and have our voices heard. Visit www.wamea.com/symposium to learn more & register.

Recap: what WAMEA has recently done

- Obtained admission for an industry representative to attend the TSO Workshop in Ottawa held by TC, the FAA, and EASA on September 13-14 2017.
- Obtained exhibitor passes to attend MRO Europe October 4-5, 2017 as well as a tour of Bombardier's facility near London, UK.
- Placed a volunteer to sit on the SAIT aviation maintenance program advisory board.
- Planned a panel session for business, government, and organizations to discuss industry and the current business environment.
- Planning the 2018 symposium with a focus on high caliber information sessions and quality courses, program announcement pending the confirmation of details
- Started process for creating a mentorship program to connect people entering the industry with experienced AMEs, discussion with other regional members to create a nation-wide network.
- Gave a warm welcome to M1/M2, B.Comm. Vic Chaudhary as our new addition to the Board of Directors. We look forward to having him as a part of the WAMEA team!

Student Support

Pretty well everyone remembers their first job. From the practical jokes on the newbie to the menial tasks that you thought were beneath you and not until years later did you realize that the seasoned veterans were actually teaching you work ethic and familiarizing you to the work place. Us lucky ones will always remember the one person who took us under their wing so to speak, and made sure we didn't hurt anyone. As I remember at the time I did not need advice, as I knew everything. Oh, how I wish I were young again, knew everything and had all the answers.

Sitting here one night, thinking of ways to spark interest in the association an idea hit me. How about "Adopt a Student?" Having older engineers post their profiles on the regional and national websites could do this. A student in a technical school could view these and pick a person with the specialized areas they may be interested in. This would also give the student someone to hang with at symposiums, trade shows, and specialized training.

For most of us we have forged lifelong friendships and still keep in touch with workers from decades ago. There is a huge experienced base knowledge pool in the industry to- day that is very under utilized. One of the things that kept me going to symposiums was the chance to see colleagues and network with others in the lounge or over a supper.

Those of us in our sixties had very few people to ask about problems that came up at work as aviation was in its infancy in the 1950s and Sixties. Today maintenance has shifted from simple instrumentation to multi-integrated systems. The theory of flight and mechanical systems has not changed too much over the years and no one knows all the answers.

Anyone interested should give Jarrah our new president or a member of the executive an email and we will set it up. These people are posted on the Western Aircraft Maintenance Engineers Association website (www.wamea.com).

— Rod Fisher
WAMEA Past President

www.wamea.com

PACIFIC

Pacific AME Association

Pacific Air Maintenance Engineers Association

About us

PAMEA is a non-profit association comprised of aircraft maintenance engineers, aircraft maintenance personnel and aviation industry corporate members. PAMEA is an active member of the Canadian Federation of AME Associations (CFAMEA).

pamea@telus.net

www.pamea.ca

Central AME Association

About CAMEA

The Central Aircraft Maintenance Engineer Association is an organization dedicated to maintaining and enhancing the standards, rights and privileges of all AME members in the central region of Canada. Our chapter is one of six similar associations across Canada that collectively supports the national body CFAMEA (Canadian Federation of Aircraft Maintenance Engineers Association).

Our organization works with Transport Canada in the formulation of new rules and regulations and provides a collective viewpoint for all AMEs. CAMEA is a not-for-profit organization run by a volunteer group of AMEs. We elect members of our organization to be part of our Board of Directors. Members of CAMEA are comprised of AMEs, AME apprentices, students, non-licensed persons working in the industry and corporate members.

Save the date

March 26-27, 2018 Manitoba Aviation Symposium
Canad Inns Destination Polo Park
Hosted by Manitoba Aviation Council and Central AME Association

www.camea.ca

AME Association of Ontario

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

2017 AME Conference

The 2017 AME Conference was held on November 1st and 2nd at the Hilton Meadowvale Hotel in Mississauga, Ontario. A record was set as attendance was close to 700 attendees. This year's theme was "Our Profession, Our choice, Our future."

Air Canada/Jazz was on hand with a new video promoting the AME profession within their company and several employees were modeling their new uniforms for maintenance personnel. Thirty-eight one-hour seminars were scheduled over the two days with subjects ranging from the Boeing 737Max, to leadership skills, to Transport Canada requirements for aircraft importation and exportation. More than 60 exhibitors' booths were set up with companies promoting equipment, parts, tooling, specialized training and insurance. An exciting addition for this year was a Skills Competition. This had teams competing in a broad-range of events that highlighted technical skills.

Annual General Meeting

Our Annual General Meeting was held during the AME Conference. President Sam Longo and VP Steve Farnworth brought the members up to date on the many projects and activities of our association in the past year as well as discussing future plans.

Our Treasurer Jasper Megelink reviewed the association's finances and auditors were confirmed. Members approved an annual individual dues increase to 70 dollars.

Two bylaw changes were approved. The first aligned the bylaws to the recommended practices for gender neutrality. The second removed the requirement for charging an initiation fee to new members and allowed the anniversary date for membership renewal to be based on the date of initial enrolment rather than our association fiscal year.

Mark Ward was voted in as the new area director for South East Region.

2017 Awards

The association awards were presented at the conference Cocktail Reception and this year's winners were:

- Dan Quesnelle: ROBERT MCCOMBIE AWARD – presented to an Aircraft Maintenance Engineer whose work is considered by his/her peers to be outstanding.
- Robert Horne: GORDON B. RAYNER AWARD – recognizes a Canadian whose career will always remain outstanding as an Aircraft Maintenance Engineer, a teacher, or a public servant.
- Paul Carter: CLARE LEAVENS AWARD – given to a member of the Aircraft Maintenance Engineers Association of Ontario who, in the opinion of the directors and members, has made an outstanding contribution to the continued success of the association.
- Stephen Farnworth: 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.
- Elton Townsend: AIRCRAFT MAINTENANCE ENGINEER HALL OF FAME.

— Submitted by Stephen Farnworth
For the Board of Directors

CENTRAL OHIO

Central Ohio PAMA

The National World War II Memorial Plaza

On Saturday, November 11th, we joined in thanking all our veterans that have served our nation. The news channels were loaded with individual stories of these men and women who gave a portion of, if not their life to maintain the freedom that we enjoy.

2018 Ohio Aviation Maintenance Symposium: Save the date

Thursday, March 15, 2018. The Ohio Aviation Maintenance Symposium. The Location will be the same as last year:
CSCC Main Campus
The Center for Workforce Development
315 Cleveland Avenue, Columbus, Ohio 43215

Because of increased cost for the venue, the booth fee this year will increase to $175 and not be collected until January, 2018. Reserve a booth by sending an email to; gsprang@cscc.edu. Booth forms and payment instructions will be sent out in January.

If you wish to give a presentation, please send a request to Mark Harden: mark.harden@faa.gov

Please direct questions about the Symposium to Gene Sprang, Associate Professor, Aviation Maintenance Technology, 5355 Alkire Road, Columbus, Ohio 43228. (614) 287-7101. With your support, the 27th Ohio Aviation Maintenance Symposium will be another success!

2018 General Aviation Award Nominations

Safety Inspector Mark Harden has posted a request for nomination of candidates to receive the 2018 General Aviation Awards.

2018 Scholarships

The deadline for Aircraft Maintenance Technician Students to submit applications for the 2018 Certification Testing Scholarships was November 7, 2017. Good luck to all who submitted applications.

www.copama.org

SOCAL

PAMA SoCal Chapter

ADS-B, FANS & NextGen Technology

The SoCal Chapter thanks Mark Francetic, Regional Avionics Sales Manager (aka "ADS-B Czar") Alfredo Garcia, Southwest Regional Manager, Tony Russo, Satellite Manager-Van Nuys and all at Duncan Aviation for their time and generosity in hosting the September 2017 Chapter dinner meeting, and excellent technical presentation on "ADS-B, FANS & NextGen Technology" at the 94th Aero Squadron Restaurant inVanNuys, California.

To learn more about ADS-B, NextGen Technology and all of Duncan Aviation's offerings, visit www.DuncanAviation.aero or contact tonight hosts: Mark.Francetic@DuncanAviation.aero; Alfredo.Garcia@DuncanAviation.aero and Tony.Russo@DuncanAviation.aero.

www.socalpama.org

Advertising space is now available on AMU's new website!

For availability and rates, contact AMU at:
(604) 214-9824 • amumag2015@gmail.com

High Hopes

Engines have now been fired on the world's largest aircraft. All six of them. It would seem that Microsoft founder Paul G. Allen is nicely on track for the planned 2019 flight of his massive "Stratolaunch" air-launch platform with the intent of "normalizing" operations in low Earth orbit.

Earlier this past summer, the world's largest plane emerged for the first time from its sprawling hangar at the Mojave Air and Space Port in California. It is part of a mobile launch system with three primary components: a carrier aircraft being built by Scaled Composites, a multi-stage payload "launch vehicle" which would be launched at high altitude into space from under the carrier aircraft, plus a mating and integration system by Dynetics.

To many observers the carrier aircraft seemed an odd duck (and for many it still does) but the development team behind Microsoft founder Paul G. Allen's "Stratolaunch" aircraft has crossed another milestone by completing the first round of engine testing, continuing the groundwork needed to get the vessel into the air in 2019.

Founded by Allen in 2011, Stratolaunch is one of several companies around the globe racing to develop an air-launch platform to make access to space more convenient, reliable, and routine. The company has a mission statement: "We believe that normalizing access to low Earth orbit (LEO) has the potential to redefine our lives by creating more

opportunities for commercial, philanthropic and governmental organizations to collect rich and actionable data and drive advancements in science, research, and technology from space."

LEO is an orbit around Earth with an altitude of 1,200 miles or less, and an orbital period of between about 84 and 127 minutes. Objects below approximately 99 miles will experience very rapid orbital decay and altitude loss due to atmospheric drag. Except for the Apollo program, all human spaceflights have taken place in LEO or below. The International Space Station conducts operations in LEO.

Lofty rhetoric aside, in essence Allen hopes the deployment of the Stratolaunch will offer an easier and more efficient way to get satellites into orbit. The plane is designed to carry a rocket high up into the sky. The rocket would then disengage, fire its engines and head off towards space with the aim of reaching LEO. To accomplish its mission, the Stratolaunch carrier plane is powered by six Pratt & Whitney PW4000 thrust-range jet engines, sourced from two used 747-400s that were cannibalized for engines, avionics, flight deck, landing gear and other proven systems to reduce initial development costs.

The carrier is designed to have a range of 1,200 nautical miles when flying an air launch mission. Tipping the scales at 500,000 pounds spread across 28 wheels, it is 238 feet from nose to tail and stands 50 feet tall from the ground to the top of the vertical tail. It also has the world's largest wingspan, measuring 385 feet – by comparison, a National Football League field spans only 360 feet.

It has a twin-fuselage configuration, similar to the Scaled Composites White Knight Two. The centre section of the high-mounted, high aspect ratio wing is fitted with a Mating and Integration System (MIS), and each fuselage has its own tail with horizontal and vertical stabilizer, leaving a clear area behind the payload – the engineering theory being to reduce the risk of interference during flight. Three engines are positioned on pylons outboard of each fuselage, with the cockpit positioned within the starboard fuselage.

Designed for a max takeoff weight of 1,300,000 pounds – meaning it's capable of carrying payloads up to approximately

550,000 pounds – it was announced last fall that it would initially launch a single Pegasus XL vehicle with the capability to launch up to three Pegasus vehicles in a single sortie mission. The Pegasus is an air-launched rocket capable of carrying small payloads of up to 977 pounds into LEO. Pegasus first flew in 1990 and has flown 43 missions since then, including carrying the NASA Interstellar Boundary Explorer (IBEX) satellite. The vehicle is released from its carrier aircraft at approximately 40,000 feet and its first stage has wing and a tail to provide lift and attitude control while in the atmosphere.

This past fall, the all-composite Stratolaunch aircraft hit another milestone with the completion of a three-phase engine testing program – the first phase saw a dry motor run using an auxiliary power unit to charge the engine; a "wet motor" run introduced jet fuel; and finally an idling test was conducted in which each of the six engines were observed to ensure they were all operating properly. In these initial tests, each of the six engines operated as expected, the company reported.

The team also completed testing all six fuel tanks to ensure proper operations. Each of the fuel tanks was filled independently to ensure proper operations of fuel mechanisms and to validate the tanks were properly sealed. In addition to fuel testing, Stratolaunch engineers began testing the flight control system, and have so far exercised the full limits of motion and rate of deflection of control surfaces on the wing and stabilizers. And prior to the engine tests, prerequisite testing of the electrical, pneumatic, and fire detection systems were completed successfully. Over the next few months, engineers will continue to test the aircraft's engines at higher power levels and varying configurations, culminating to the start of taxi tests.

Theoretically being capable of delivering payloads to multiple orbits and inclinations in a single mission, Stratolaunch's reusability and air-launch capabilities enable its operators to take an airport-style approach to operations for launch services. The company says that, "Stratolaunch will take off from a runway, rather than a logistically vulnerable fixed range, which allows us to avoid hazards such as inclement weather, airborne traffic and heavy marine activity." The launch platform translates into a "significant" risk reduction in terms of the costly delays or cancellations that have plagued conventional launch programs of the past. Stratolaunch says the aim is to be fully operational by the end of this decade. ■

Engine Failure at Low Altitude

Questions are raised when it's discovered that a downed aircraft was the subject of improperly documented modifications.

On September 25, 2016, the privately operated Cessna U206F floatplane (registration C-FWBQ, serial number U20602785) was flying under visual flight rules from Kuashkuapishiu Lake, Quebec, to Ra-Ma Lake, Quebec, near the Manicouagan Reservoir, Quebec, with the pilot and two passengers aboard. After taking off at around 1400 Eastern Daylight Time, the aircraft began a climbing turn to the left while it was at the north end of the lake. A few moments later, the aircraft quickly banked to the right, lost altitude, struck the ground, and immediately caught fire. The fire consumed almost the entire cabin. The pilot was seriously injured, and the two passengers were fatally injured. No emergency locator transmitter signal was received.

The day before the accident, the pilot flew from Gatineau Airport, Quebec, with one passenger aboard, to Kuashkuapishiu Lake, where his hunting and fishing camp was located. Cessna U206F stopped at the airport in Trois-Rivières, Quebec, to refuel and take on a second passenger. After dropping off the two passengers at Kuashkuapishiu Lake, the pilot made three more flights between Kuashkuapishiu Lake and Louise Lake, Quebec, to transport luggage and freight and to pick up two other passengers, who had arrived at Louise Lake by car, and

Weight	Headwind	QNH (ybc)	Alt.	Press. Alt.	OAT °C
3700	10	30.05	1334	1204	10

	Extrapolated TO Dist (at wt with Wind)					Extrap. TO Dist (STD T)			Extrap. TO Dist (act T)		
	PA	T °F	PA	T °F		Std T at PA			OAT °F		
	0	59	2500	50		54.7 °F			50 °F		
	Water Run	Total to 50ft	Water Run	Total to 50ft		Water Run	Total to 50 ft		Water Run	Total to 50 ft	
Data from float supplement --->	1146	2108	1573	2865	-->	1352	2473	-->	1320	2415	

Flight manual float supplement

Extrapolated data (at wt no wind)			S.L. @ 59°F Water Run	S.L. @ 59°F Total to 50ft	2500@50°F Water Run	2500@50°F Total to 50ft
3700	--->	0	1675	2839	2270	3822
	--->	10	1146	2108	1573	2865
	--->	20	703	1474	993	2032

Data

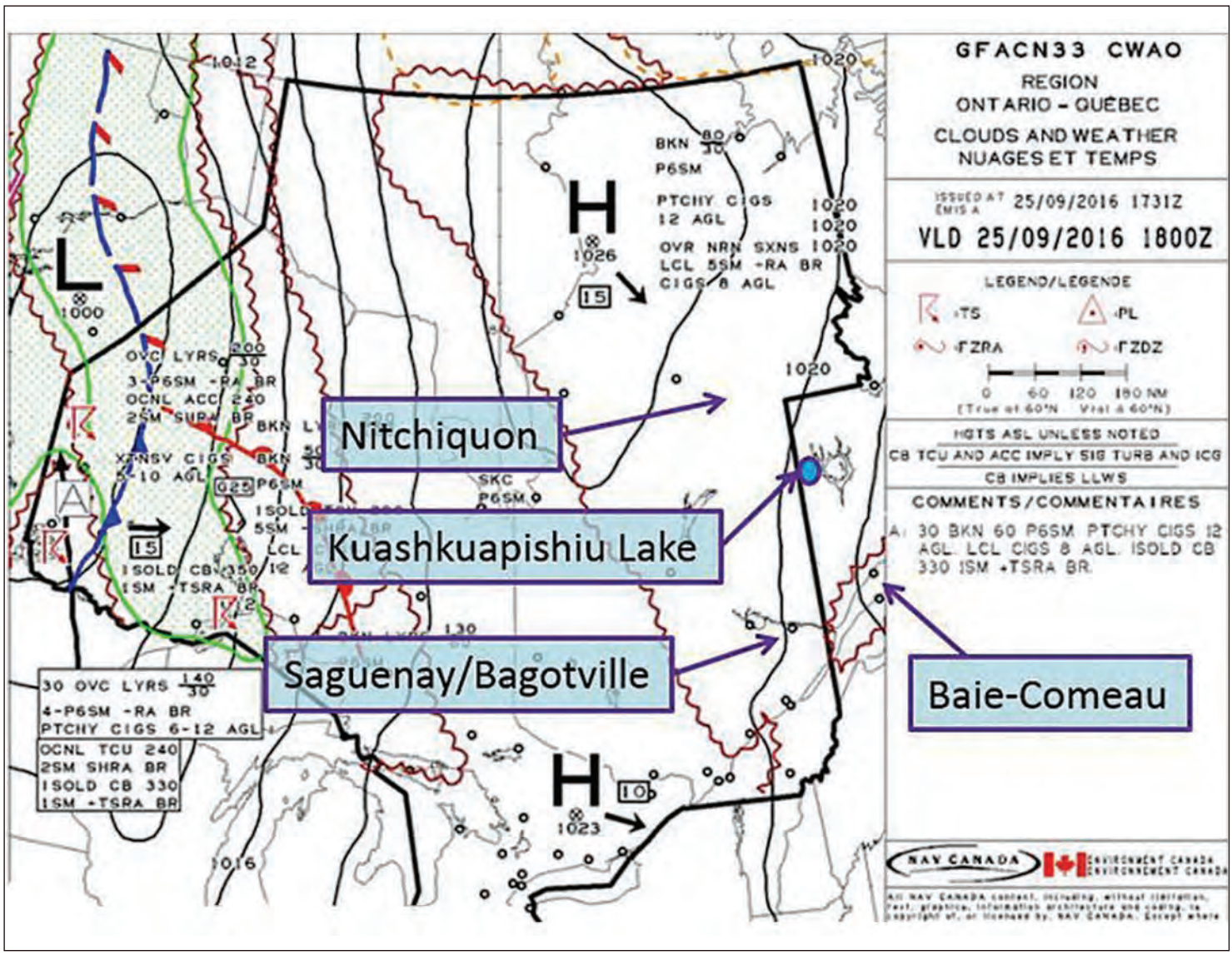
3500	73	0	1445	2475	1940	3290
		10	980	1830	1335	2455
		20	595	1270	835	1730
3000	68	0	870	1565	1115	1960
		10	565	1135	740	1430
		20	325	760	440	975

Calculation of takeoff performance

bring them to Kuashkuapishiu Lake. The aircraft was refuelled twice between flights.

The pilot made a return flight to Louise Lake on the morning of the accident. The fuel transaction record from Louise Lake indicates that the pilot obtained 278 litres of aviation fuel at 1217 Eastern Daylight Time. After returning to Kuashkuapishiu Lake, the pilot made pre-flight preparations to fly to Ra-Ma Lake, with two passengers. The aircraft was loaded with food supplies, a 20-pound propane gas cylinder, three firearms, ammunition, an outboard motor and fuel, and luggage. One passenger was in the right-hand seat next to the pilot, and the other passenger was in the seat behind the pilot. The pilot gave a safety briefing that included a description of the seat belts, emergency exits, and lifejackets.

At around 1400, the aircraft, equipped with Wipaire 4000A amphibious floats, left the dock and taxied over the water toward the south end of the lake. After warming up the engine, the pilot selected 20 degrees of flap, raised



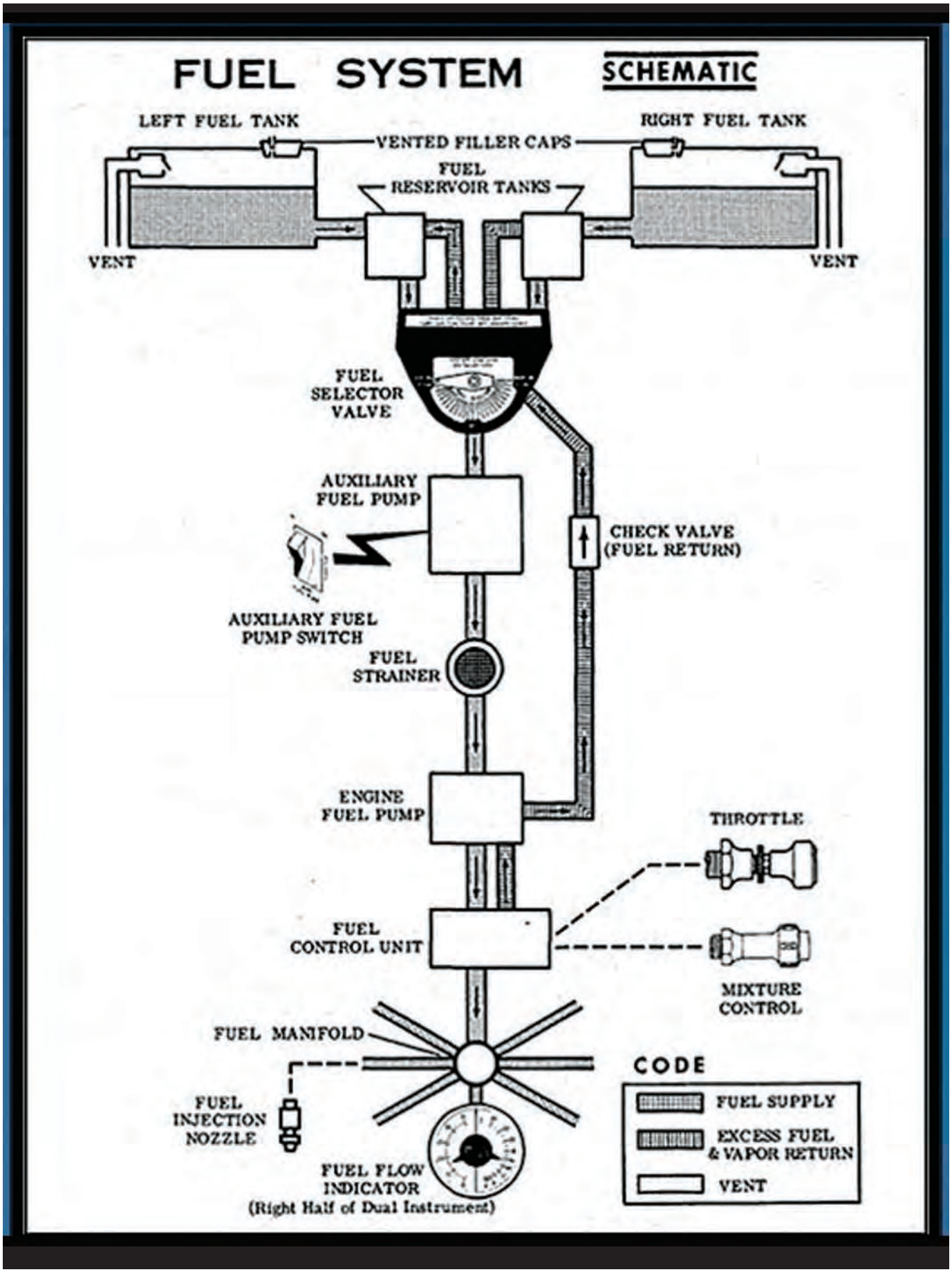
Above: Graphic area forecast for the Ontario Quebec region valid at the time of the occurrence.

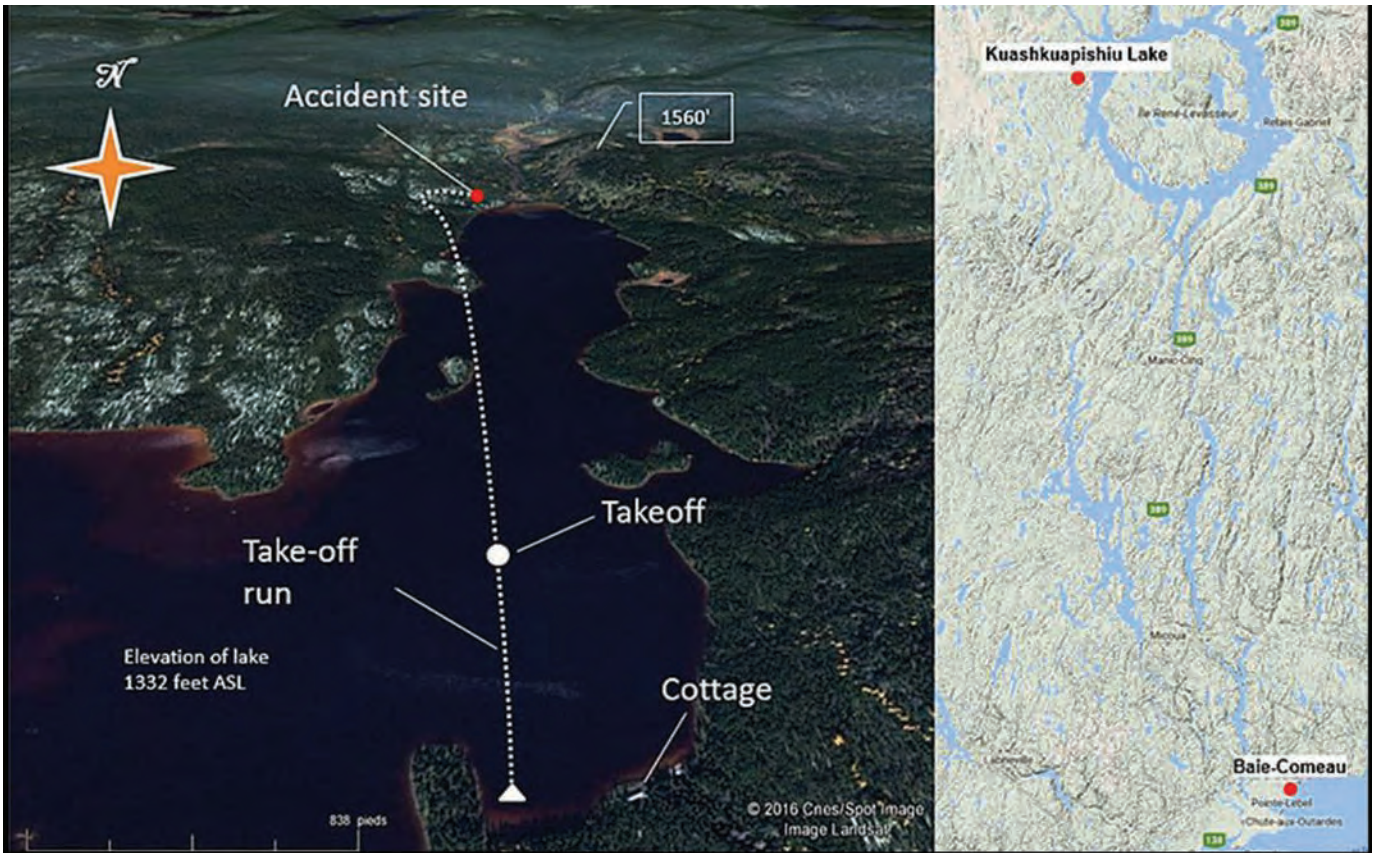
the water rudders, turned the aircraft into the wind, and applied full throttle. The aircraft then began its takeoff run northwards and became airborne mid course, about 1600 feet from the starting point. The aircraft began a climbing turn to the left when it reached the north end of the lake. The aircraft was then lower than the surrounding terrain, the elevation of which was 228 feet higher than the elevation of the lake.

A few moments later, the engine stopped and the pilot felt a reduction in the response to elevator and aileron control input, and at the same time noticed a 20-knot reduction in airspeed. The pilot decided to return to Kuashkuapishiu Lake and began a right turn by applying the right rudder pedal. The stall warning alarm then began sounding. The right wing dropped, and the aircraft nosedived. The pilot pushed the control yoke forward. The aircraft lost altitude and crashed into a forested area a few metres from the lake tributary (51°30'58.95" N, 069°12'2.92" W). An intense fire broke out immediately upon impact. Only the pilot, whose clothes were on fire, was able to escape from the wreckage and dive into the river.

No emergency locator transmitter (ELT) signal was received by the COSPAS-SARSAT satellite system, and no other aircraft in the area reported receiving an ELT signal. The post-impact fire completely destroyed the cabin of the aircraft. Two eyewitnesses at the cottage observed the takeoff and the column of smoke that appeared after the aircraft descended out of sight behind the tree tops. They rushed to the scene of the crash to provide assistance.

Back at the cottage with the survivor, one of the eyewitnesses provided first aid and used a satellite phone to request assistance. A helicopter from the private ambulance service Airmedic arrived at the Kuashkuapishiu Lake cottage at around 1835 with two nurses to administer first aid. The Joint Rescue Coordination Centre (JRCC) Halifax deployed a Cormorant helicopter. At around 2100, the survivor and the nurses were winched aboard the Cormorant and taken to the hospital in Sept-Îles.


FUEL SYSTEM
SCHEMATIC
LEFT FUEL TANK
RIGHT FUEL TANK
VENTED FILLER CAPS
FUEL RESERVOIR TANKS
VENT
VENT
FUEL SELECTOR VALVE
AUXILIARY FUEL PUMP
CHECK VALVE (FUEL RETURN)
AUXILIARY FUEL PUMP SWITCH
FUEL STRAINER
ENGINE FUEL PUMP
THROTTLE
FUEL CONTROL UNIT
MIXTURE CONTROL
FUEL MANIFOLD
FUEL INJECTION NOZZLE
FUEL FLOW INDICATOR
(Right Half of Dual Instrument)
CODE
FUEL SUPPLY
EXCESS FUEL & VAPOR RETURN
VENT



Above: Trajectory of the aircraft during takeoff at Kuashkuapishiu Lake.

The Cessna 206 was initially certified in the United States, in 1964, with a 285-hp engine and a two-blade propeller. The U206F variant, certified in 1971, is equipped with a three-blade propeller. The owner's manual describes, among other things, the normal operations, the emergency procedures, and the limitations and performance parameters of the Cessna Stationair, certified as model U206F. A supplement to the owner's manual contains information for Cessna Stationairs equipped with floats or skis that is not found in the flight manual.

The aircraft was imported into Canada in November 2010 by its previous owner. The pilot/owner of the aircraft at the time of the accident had acquired it in July 2015. The aircraft underwent an annual inspection pursuant to CARs 625.86 and appendices B and C of CARs Chapter 625, on 20 April 2016, and oil changes were performed on July 6 and September 15, 2016. All of this work was carried out by a certified aircraft maintenance engineer.

The aircraft was certified, equipped, and maintained in accordance with existing regulations and approved procedures. The journey logbook was on board the aircraft and was destroyed in the post-impact fire. The information gathered during the investigation indicated that the aircraft had accumulated 6,855 hours of flight time as at December 31, 2015.

The technical logbooks, which were not on board the aircraft, contain no entries later than February 19, 2015, and no document was found to indicate the certification of the aircraft's maintenance work or time in service. The investigation

determined that the annual inspection had been performed in the spring of 2016.

The aircraft maintenance engineer was not required to keep a copy of the certifications; however, the regulations require the aircraft owner to transcribe technical entries in the journey logbook into the appropriate technical logbooks for the airframe, engine, and propeller within 30 days after completion of the maintenance work. Because the journey logbook was not found and the technical logbooks were not up to date, it is estimated that the aircraft had accumulated approximately 6,963 hours of flight time at the time of the accident.

Aircraft modifications

The occurrence aircraft, built in 1975, included several modifications approved by supplemental type certificates (STCs). Some STCs involve modifications to flight characteristics that can sometimes change the aircraft's operating limits. These new limits are added to the flight manual as supplemental aircraft flight manuals.

The aircraft had four modifications made while it was registered in the United States: a Horton Inc. short takeoff and landing (STOL) conversion kit; Wipaire Inc. wing extensions; a Teledyne Continental 300 hp engine and a McCauley three-blade propeller; and Wipaire Inc. 4000A floats.

The aircraft had two modifications made when it was imported into Canada: a Sierra Industries STOL conversion kit and Micro AeroDynamics Inc. vortex generators.

The aircraft was modified in 2011 by installing a flap–aileron interconnect under STC SA1513WE. This system allows a certain amount of downward aileron deflection when the flaps are deployed. The increased wing camber obtained by lowering the flaps increases lift under the wingtips. This modification is part of a STOL conversion kit made by Sierra Industries that normally includes increased wing foil leading edge profiles, stall fences, and a flap–aileron interconnect.

However, similar stall fences and increased wing foil leading edge profiles had previously been installed on the aircraft in 1996 with the Horton conversion kit. As a result, only the Sierra flap–aileron interconnect taken from another aircraft was installed on the occurrence aircraft. Installing the Sierra conversion kit requires disassembling the Horton kit components, then installing all of the Sierra kit components. However, only a partial installation was performed: the Horton kit components remained on the aircraft, and only the components of the Sierra Industries flap–aileron interconnect were installed on the aircraft.

The aircraft technical records do not indicate that the Sierra conversion kit was only partially installed; they suggest that a full installation was done.

Vortex generators manufactured by Micro AeroDynamics Inc. were installed on the wings, horizontal stabilizers, and fin under STC SA00887SE. Vortex generators are intended to improve control at low airspeeds and high angles of attack by controlling airflow over the wings, horizontal stabilizers, and fin.

Above: Cessna C-FWBQ.01.

Transportation Safety Board of Canada safety concern

Further to its investigation of the October 2013 aerodynamic stall and collision with terrain of a Cessna A185E, the Transportation Safety Board of Canada (TSB) noted that TC currently requires the installer to evaluate all STC combinations and determine whether the combination of STCs maintains the aircraft's airworthiness. However, there are no regulatory guidelines to determine the scope or extent of this evaluation or the manner in which it must be performed and documented.

Most light aircraft in Canada, including commercially operated light aircraft, are maintained by smaller approved maintenance organizations with limited capability for aerodynamic testing or engineering evaluations.

As a result, the certification for compatibility and interaction between STCs is often made after only limited evaluation.

In conclusion, the Board issued the following safety concern:

The Board is concerned that, if multiple STCs are installed without adequate guidance on how to evaluate and document the effects on aircraft handling, pilots may lose control of the aircraft due to unknown aircraft performance.

Analysis

The aircraft was operating in favourable flight conditions and there is no indication that weather conditions could have caused this occurrence. The pilot was qualified to conduct the flight in accordance with existing regulations. An analysis of the aircraft's maintenance logs raised some concerns with regard to multiple modifications made to the aircraft since it was first manufactured. However, examination of the wreckage and various components did not reveal any signs of airframe failure, flight control problems, abnormal flap operation, or in-flight fire.

Examination of the propeller did not reveal any signs of rotation at the time of the impact, and examination of the engine revealed that the coupling shaft of the engine-driven fuel pump had sheared soon after takeoff while the engine was running at high speed, cutting off the engine's fuel supply and shutting it off suddenly.

The information obtained, such as the aircraft's trajectory in the trees, indicates that an aerodynamic stall occurred at the beginning of a right turn less than 200 feet above ground level (AGL). Consequently, the analysis looked at the various modifications made to the aircraft, the takeoff, the low-altitude engine malfunction, and post-impact survival.

Compatibility of modifications made according to STCs

Transport requires the installer to ensure that modifications to the aircraft will not affect its airworthiness. However, TC does not require the installer to document how it established compatibility between the new STC and previously installed STCs.

The aircraft's technical records did not indicate that the installer had conducted a compatibility assessment of the modifications to the aircraft. Consequently, it was not possible to know how the aircraft would have performed with these modifications. If there is no requirement to document the method used to establish the compatibility of modifications with the existing modifications, there is a risk that a compatibility assessment will not be performed and later, in routine flight, the aircraft will produce unexpected flight characteristics, increasing the possibility of loss of control.

Findings as to causes and contributing factors

1. The coupling shaft of the engine-driven fuel pump sheared soon after takeoff while the engine was running at high speed, cutting off the engine's fuel supply and causing it to stop suddenly.
2. Because the engine failure occurred at low altitude, the pilot did not have time to identify the type of failure, recall the various relevant procedures, and take actions that could have restored engine power.
3. The pilot did not maintain glide speed, and the aircraft entered slow flight, just above the stall speed.
4. The pilot attempted a 180-degree turn at low altitude, and an aerodynamic stall ensued at too low an altitude for control to be regained before the aircraft struck the ground.

Findings as to risk

1. If components related to the aerodynamics of the aircraft are not installed precisely as instructed in the supplemental type certificate, there is a risk that the installation will have an unexpected effect that might increase the potential for a loss of aircraft control.
2. If appropriate evaluations are not conducted after multiple modifications that change the aircraft's aerodynamic characteristics, there is a risk that the aircraft will produce unexpected flight or stall characteristics in the course of a routine flight when the pilot is not prepared to respond to them, increasing the possibility of loss of control.
3. If there is no requirement to document the method used to establish the compatibility of modifications with the existing modifications, there is a risk that a compatibility assessment will not be performed and later, in routine flight, the aircraft will produce unexpected flight characteristics, increasing the possibility of loss of control.
4. If pilots do not have takeoff performance data for the modified aircraft, there is an increased risk that the required takeoff distance will exceed the takeoff area or that the aircraft will be unable to clear obstacles.
5. If emergency procedures in the flight manual do not include relevant material contained in other procedures, there is a risk to the safety of flight if the crew is not able to take appropriate actions in time.
6. If aircraft in service carry emergency locator transmitters (ELTs) containing unapproved parts, the ELT may not work as intended in an accident, potentially delaying the arrival of search and rescue personnel and putting occupants at a higher risk of injury or death.

Safety action taken

In August 2017, Transport Canada issued a Civil Aviation Safety Alert entitled "Unapproved Parts Alert: Unapproved Batteries Installed or Intended to be Installed on Ameri-King Corporation AK-451 Model Emergency Locator Transmitters." The alert, which covers the same model of emergency locator transmitter installed on the occurrence aircraft, targets unapproved batteries that are sourced directly from suppliers and that do not conform to the approved design of the emergency locator transmitter. The alert is available on the Transport Canada website.

(This report concludes the Transportation Safety Board of Canada's investigation into this occurrence. The Board authorized the release of this report on 18 October 2017. It was officially released on 15 November 2017.) ■

Aviation Services

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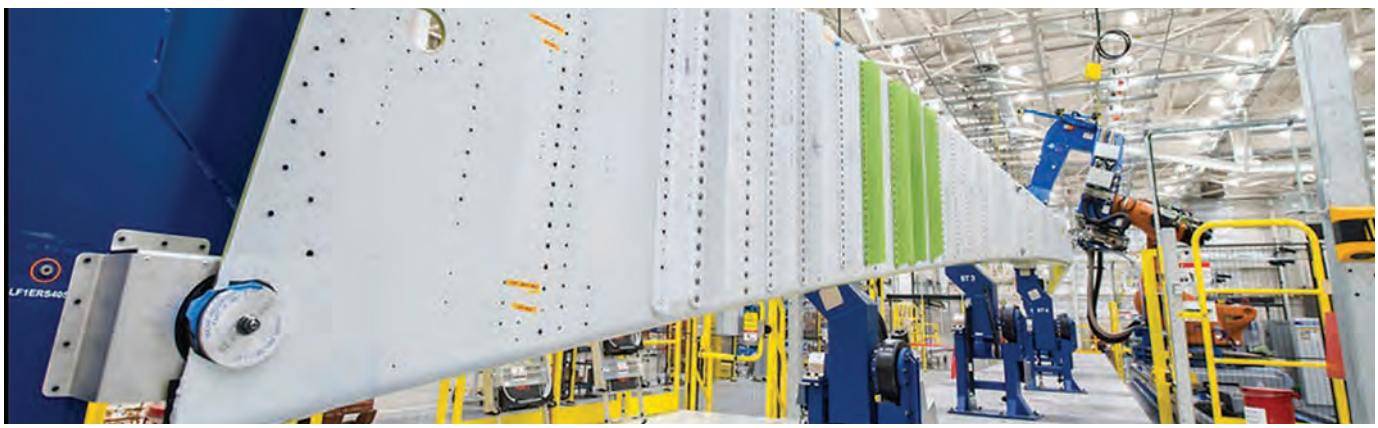
First flying Boeing 777X airplane enters production

New twin-aisle program's milestone streamed live on social media.



Bright lights from TV cameras glinted off the 108-foot long wing spar as an automated drilling machine performed its programmed maneuvers. Production had finally begun on Boeing's new 777X prototype but no human hands were directly involved. Here, a one-armed robot did the work. It was in late October when about 500 employees, members of the media and customer representatives joined an online audience to witness production of the first wing spar for the first 777X that will take to the skies.

The event, which was streamed live on social media channels, marked a major production milestone for the program — the first hole drilled in the first wing spar that will be part of a flying airplane. Employees expressed enthusiasm about the beginning of production.

"It's been exciting to see the first parts come through after years of preparing for the first airplane," said Paul Clark, 777X wing assembly mechanic. "We've got a great team, and all of us are eager to begin using the new equipment and processes."

Airline customers shared in the enthusiasm. "Actually seeing and hearing parts being made and parts being delivered is something very exciting," said Nicolas Zika, Etihad's representative to Boeing. "It means that this is something real that is being built, and it's [getting] closer and closer."

Fabricated in the Composite Wing Center in Everett, Washington, the front and rear spars had their first voyage to a new facility, the 40-02 building, housing 777X wing assembly.

"The 777X wing is a composite, so it is much lighter and maintains good strength characteristics," said Mary Manning, 777X design engineer. "This allows the airplane to be lighter, which results in greater performance and fuel efficiency. This will be better for our airline customers."

In anticipation of the 777X, the 40-02 building has been completely refurbished, with new tooling for the wing spars installed, tested and qualified. The first flying airplane is scheduled to roll out next year with test and certification to occur in 2019 and first delivery in 2020. ■

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