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AirMaintenance UPDATE

The Magazine for Aircraft Maintenance Professionals

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The GE9X: One fan with serious power

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Boeing 737 MAX aftermath

Beyond the actual body count, it's nearly impossible to fully gauge the less tangible human impacts after software failure sent 737 MAX planes operated by Lion Air and Ethiopian Airlines crashing to the ground. Obviously, customer confidence in the new craft has been shattered, and that too is a situation difficult to assess in terms of precise cost. Or so you might think. Boeing, however, seems to have a bead on the actual dollar value of the tragedies and how they will impact earnings, numbers which the company released, July 24, in its second-quarter 2019 results.

Boeing will record an after-tax charge of $4.9 billion ($8.74 per share) in connection with an estimate of potential concessions and other considerations to customers for disruptions related to the 737 MAX grounding and associated delivery delays. This charge will result in a $5.6 billion reduction of revenue and pre-tax earnings in the quarter.

While the entire estimated amount is recognized as a charge in the second quarter, the company expects any potential concessions or other considerations to be provided over a number of years and take various forms of economic value. Additionally, Boeing's estimated costs to produce the aircraft in the 737 accounting quantity increased by $1.7 billion in the second quarter, primarily due to higher costs associated with a longer than expected reduction in the production rate. The increased 737 program costs will reduce the margin of the 737 program in the second quarter and in future quarters.

Boeing continues to work with civil aviation authorities to ensure the 737 MAX's safe return to service, but for purposes of the second-quarter financial results the company has assumed that regulatory approval of 737 MAX return to service begins early in the fourth quarter 2019. The second-quarter financial results further assume a gradual increase in the 737 production rate from 42 to 57 per month in 2020.

"We remain focused on safely returning the 737 MAX to service," said Boeing Chairman, President and CEO Dennis Muilenburg. "This is a defining moment for Boeing. Nothing is more important to us than the safety of the flight crews and passengers who fly on our airplanes." ■

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Upcoming Events

Person Responsible for Maintenance Control System Workshop

At the request of the Canadian aviation industry, the Canadian Council for Aviation and Aersopace (CCAA) has developed a workshop for individuals acting as the aircraft owner/operator's representative regarding maintenance control.

A strong understanding of the responsibilities of the Person Responsible for Maintenance Control will assist individuals to remain compliant with regulatory and company requirements, successfully complete Transport Canada's written and oral tests, and increase awareness of the key elements required for quality and safety.

Workshop Description

This one-day workshop provides participants with a comprehensive overview of the regulatory requirements for the Person Responsible for Maintenance Control System role and the responsibilities in this position. Content covered in this workshop includes:

1. Understanding the Owners' responsibilities and the basics of management systems
2. Understanding the role of commercial operators
3. Comprehensive overview of the regulatory structure
4. Understanding the responsibilities of certificate holders
5. Understanding the responsibilities of the Maintenance Manager (Person Responsible for Maintenance Control)

Upon successful completion of the workshop, participants will possess a thorough understanding of the regulatory requirements for the role of the Person Responsible for Maintenance Control.

Intended Audience

1. Individuals preparing to become the Person Responsible for Maintenance Control.
2. Individuals currently in the role of Person Responsible for Maintenance Control looking for a review of responsibilities.
3. Accountable Executives interested in understanding the roles of the Person Responsible for Maintenance Control.
4. Quality or Management personnel wanting to learn more about regulatory requirements for the control of maintenance and the responsibilities of the Person Responsible for Maintenance Control.

Note: This workshop is NOT intended for individuals employed by an Approved Maintenance Organization preparing to accept the role of the Person Responsible for Maintenance.

When: September 20, 2019
Where: Mississauga, Ontario
Visit: www.avaerocouncil.ca

Quesnel SkyFest
August 2-4, 2019
Quesnel, BC
www.quesnelskyfest.ca

Abbotsford Air Show
August 9-11, 2019
Abbotsford, British Columbia
www.abbotsfordairshow.com

Aerospace Big Data
September 11-12, 2019
Miami, Florida
www.flightglobalconferences.com

PRMCS Workshop
September 20, 2019
Mississauga, Ontario
www.avaerocouncil.ca

Careers in Aviation Expo
September 21, 2019
Toronto, Ontario
www.careersinaviation.ca

Peterborough Airport's 50th Anniversary Air Show
September 21-22, 2019
Peterborough, Ontario
www.PeterboroughAirport.com

NBAA Business Aviation Convention & Exhibition
Oct. 22 - 24, 2019
Las Vegas, Nevada
www.nbaa.org

Advertisers Index

New Garmin can charge two tablets

Garmin International's new GSB 15 is a small lightweight USB charger designed for a wide range of aircraft. A single GSB 15 contains two USB ports, supports simultaneous 18W (up to 3A) high-speed charging, and is capable of charging two full-size tablets while using them at full backlight. Two versions of the GSB 15 are available and allow for easy installation in space-constrained areas. One version contains a connector on the back of the unit, which is perfect for panel mount installations. A second variant is ideal for installations in depth-constrained areas, such as near cabin sidewalls. **For information visit** www.garmin.com

Snap-On drill dials in proper torque

The new 14.4-volt cordless in-line drill from Snap-on provides 65 inch-pounds of torque to tight, hard-to-reach applications in manufacturing, aviation and industrial environments. It features a powerful, free-speed range of up to 1,350 RPM; the variable-speed extended trigger allows the user to regulate RPM speed. The drill comes with a nine-position clutch to dial in the proper torque, and includes two 14.4-volt lithium batteries, for extended performance. This hand tool is ideal for drilling out pop rivets, drilling holes for exhaust hangers, and drilling in sheet metal, aluminum and fibreglass.

For information visit www.snapon.com

Nitrogen trolley can carry three cylinders

The Semmco Nitrogen SMART Trolley is designed for carrying three nitrogen cylinders, which are mounted on a cylinder cradle for safe, quick and easy loading and unloading. No lifting of the cylinders or lifting equipment is required. The loading and unloading can be carried out quickly and safely, while compliant with OH&S manual handling and requirements. The trolley provides nitrogen at low pressure for inflation of aircraft tires and high pressure for strut and accumulator inflation. It is supplied as a transport pack, disassembled on a pallet for easy shipping and is simple and quick to assemble. **For information visit** www.semmco.com

Charger desulfates lead-acid batteries

PulseTech's SolarPulse battery chargers have been replaced with more efficient versions that offer increased wattage to charge, maintain and desulfate lead-acid batteries in vehicles and equipment stored outside. SolarPulse works with all types of 12-volt batteries, including conventional flooded, gel, AGM and VRLA. It utilizes greater efficiency, higher quality monocrystalline cells that pack more power per square inch than standard amorphous "thin film" solar cell panels. It is protected with clear polyurethane plastic coating mounted on laminated aluminum, making it virtually indestructible. **For information visit** www.pulsetech.com

Welding helmet contours to operator's head

Lincoln Electric's new VIKING 2450 and 3350 series welding helmets feature industry leading 4C optics, innovative headgear to improve comfort and a low-profile external grind button to increase productivity. The new \X6 Headgear contours to the operator's head to evenly distribute weight across six key contact points. This improves balance, eliminates pressure points and provides a personalized fit for maximum comfort. The addition of an external grind button allows the operator to switch between weld and grind mode without having to remove their helmet or gloves. **For more information visit** www.lincolnelectric.com

Pink abrasives offer faster cutting

Saint-Gobain Abrasives has introduced new Norton Merit Pink R928, a selection of flap wheels and specialty abrasives, including cartridge/spiral rolls and square/cross pads that feature a superior ceramic grain for greater efficiency when beveling, blending, cleaning/detailing, deburring and finishing stainless steel and other hard-to-grind materials. Norton Merit Pink mounted points feature Norton 86A aluminum oxide abrasives, providing friability and form holding. For hard-to-reach applications, a poly-cotton backing on the flap wheels adds durability. **For information visit** www. www.nortonabrasives.com.com

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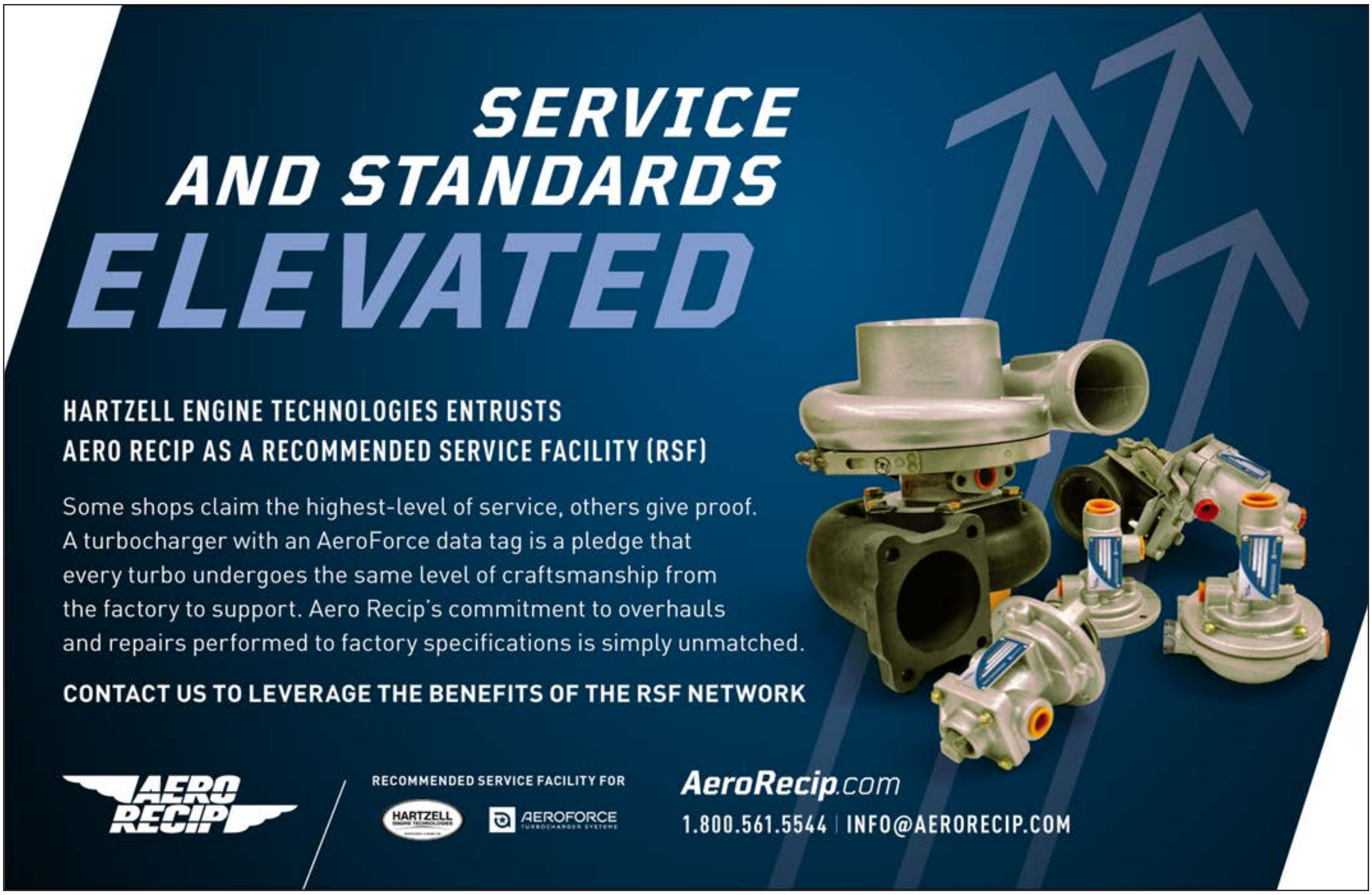
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VR TRAINING SLASHES ENROLLMENT TIME

MRO provider FL Technics announced in July that it has begun to implement VR modules for basic aviation mechanics training. The company says its first VR module details the opening of a Boeing 737NG's reverse thrust engine, and that a list of modules in the coming months will cover the full scope of maintenance training. This innovation is part of the company's strategy for reducing the enrollment time needed for new aviation mechanics. FL Technics is part of Avia Solutions Group.

IKE'S BIRD FLIES AGAIN

There can be only one Air Force One at a time, but many aircraft over the years have served the role of carrying the president of the United States. Unique among them is Ike's Bird, a 1955 Aero Commander 560A. President Dwight Eisenhower needed a small, reliable, fast aircraft to shuttle him from Washington, D.C. to his farm near Gettysburg, Pennsylvania. The Aero Commander fit the role perfectly, and Eisenhower often flew on what is sometimes called the "Smallest Air Force One."

This year at EAA Airventure Oshkosh, the freshly restored Aero Commander LB-26 55-4638, one of six Commanders used as Air Force One, in which Eisenhower flew and occasionally piloted, was on display with the Commemorative Air Force (CAF) in the Vintage Area. The CAF recently purchased the aircraft, and will use it to fly veterans who may have trouble boarding larger historic bombers and fighters.

NEW COMPOSITE PROP IS DESIGNED FOR BUSH WORK

Hartzell Propeller is developing a lightweight Pathfinder composite three-blade constant speed propeller with CubCrafters targeted as the launch customer for the new prop.

With updated aerodynamics and internal structure, the 44-pound aluminum-hub Pathfinder is intended for backcountry operations, and is an integral part of CubCrafters' newly designed firewall forward package, including a much more powerful engine from Lycoming dubbed the CC393i.

The new lightweight, fuel-injected engine delivers more than 215 horsepower and weighs only 10 pounds more than fuel-injected 180-hp engines.

BOMBARDIER SELLS CRJ PROGRAM TO MITSUBISHI

Mitsubishi Heavy Industries and Bombardier Inc. have entered into an agreement whereby MHI will acquire Bombardier's regional jet program for a cash consideration of $550 million USD, payable to Bombardier upon closing, and the assumption by MHI of liabilities amounting to approximately $200 million USD. MHI will acquire the maintenance, support, refurbishment, marketing, and sales activities for the CRJ Series aircraft, though the production facility in Mirabel, Québec will remain with Bombardier.

Bombardier will continue to supply components and spare parts and will assemble the current CRJ backlog on behalf of MHI. CRJ production is expected to conclude in the second half of 2020, following the delivery of the current backlog of aircraft.

PHS TAPS AIR ACCESS PROGRAM

Vancouver's downtown waterfront heliport has been granted $1.3 million in funding from the Province of British Columbia's B.C. Air Access Program.

The grant provided to Pacific Heliport Services Ltd. (PHS), the company that operates and manages the heliport, will be used for several improvements to the facility located on Waterfront Road next to the Vancouver SeaBus terminal. Improvements will include new ramp and bridge structures to the floating heliport. Upgraded dual fuel dispensing systems will also be fitted, along with permanent containment booms and fences in-between the heliport and shoreline to collect debris. The total project is valued at an estimated $1.7 million, with PHS intending to fund the balance of the project.

Q SERIES SALE CONFIRMED

Bombardier has confirmed the closing of the previously announced sale of the Q Series aircraft program assets to De Havilland Aircraft of Canada Limited (formerly Longview Aircraft Company of Canada Limited), an affiliate of Longview Aviation Capital Corp., for gross proceeds of approximately $300 million. Net proceeds are expected to be approximately $250 million after the assumption of certain liabilities, fees, and closing adjustments.

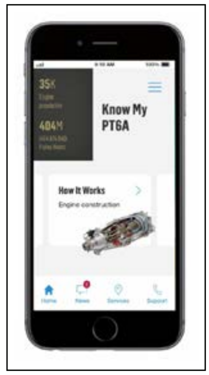
Longview will carry on the production of Q400 aircraft at the Downsview Facility in Toronto, and will continue performing aftermarket services for Q Series aircraft. Bombardier will provide transitional services and will license certain intellectual property to Longview to facilitate a seamless transition of the Q Series aircraft program.

GE9X BREAKS GUINNESS THRUST RECORD

The GE9X engine for the Boeing 777X set a new Guinness World Records title for thrust to become the most powerful commercial aircraft jet engine (test performance) after reaching 134,300 pounds. This achievement breaks the record held by GE's GE90-11B engine of 127,900 pounds set in 2002. The GE9X engine is in the 100,000-pound thrust class and has the largest front fan at 134 inches in diameter with a composite fan case and 16 fourth-generation carbon fibre composite fan blades.

The new record-breaking thrust occurred during an engineering test on November 10, 2017 at GE's outdoor test facility in Peebles, Ohio. Guinness World Records acknowledged the feat at a ceremony at GE Aviation's Ohio headquarters as part of the company's 100-year celebration.

PT6 ENGINE CONTAINED IN THE PALM OF YOUR HAND



Pratt & Whitney announced in late July the launch of Know My PT6: a mobile app that serves PT6-powered aircraft customers as a digital gateway to maintenance recommendations, services and facilities P&W offers for engine maintainers, owners, operators and pilots. The app includes relevant Service Information Letters, access to the P&W customer portal, immediate contact with the Customer First Centre, and an interactive world map to identify and reach authorized service centres and parts distributors. Customers can receive news alerts, view models of the various PT6 engines with descriptions and schematics of design features, engine controls and operational and maintenance recommendations. ■

Hangar foam fire

BY NICK METHVEN, GLOBAL AEROSPACE

Outdated regulations governing fire suppression systems in aircraft hangars have created their own set of dangers. Principally, the sudden and unwarranted activation of foam now has a history of extensive damage and even loss of life. Industry players are calling for revisions to existing codes.

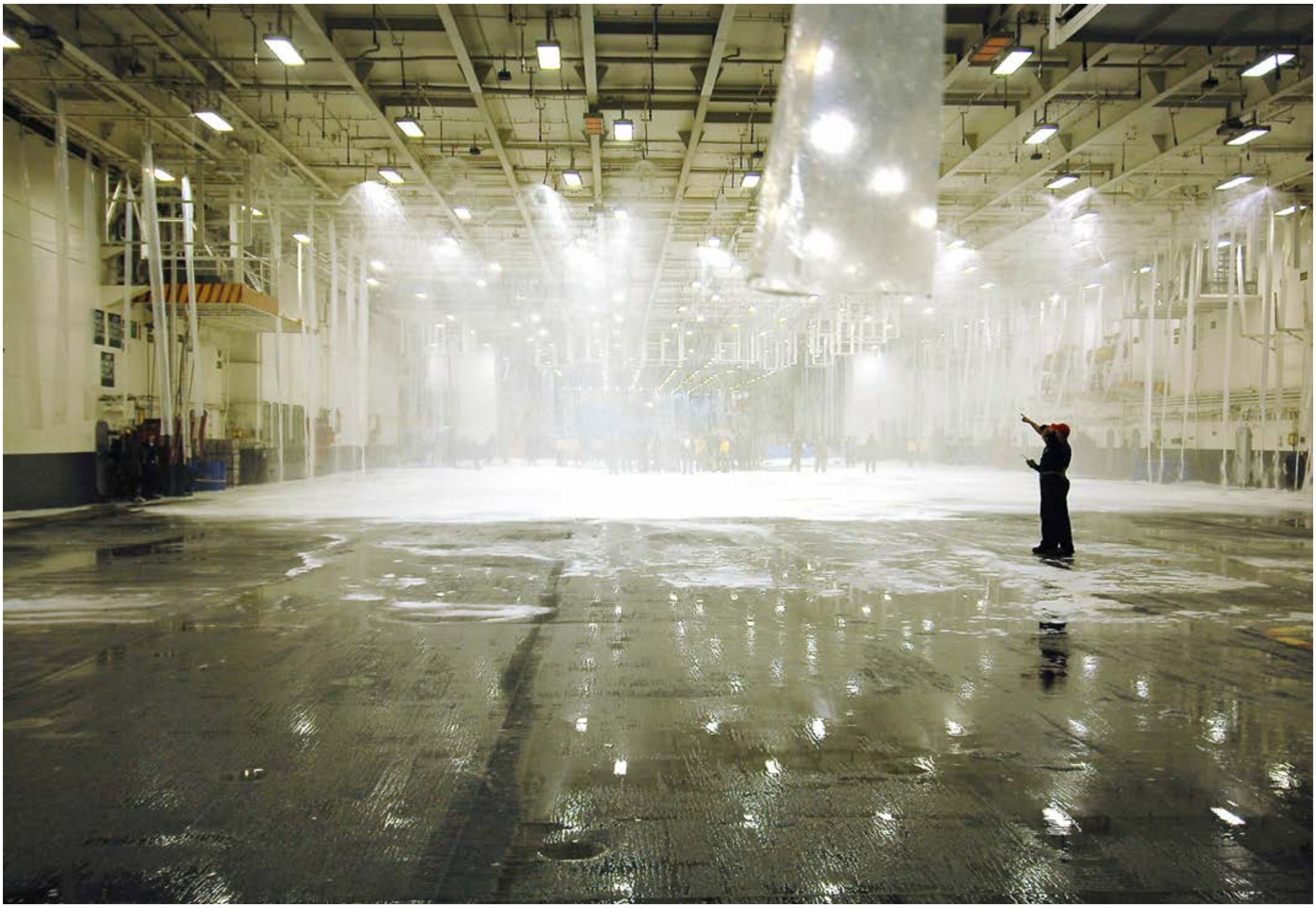
Opposite: Aircraft support apparatus can be in different areas in a hangar at any time, and contain possible fire ignition sources.
Above: The fire suppression system discharges foam at a rapid rate.

suppression systems

Aircraft hangars are unique structures with configurations and contents that can pose unusual hazards. Often very large with high ceilings, they typically house aircraft that are asymmetrical objects containing flammable or combustible fuel. Aircraft support apparatus such as tugs, maintenance equipment and vehicles, all of which are mobile and can be in different areas in a hangar at any time, contain possible fire ignition sources.

All of this can be disconcerting, and the concern around potential fires is understood. Yet personnel here at Global Aerospace have yet to observe a fuel spill fire that caused the activation of the hangar foam fire suppression system. We often see inadvertent foam discharges that, among other things, damage property, interrupt businesses and take aircraft out of service. However, the origin of these fires is not usually the aircraft fuel and the fires tend to occur in less sophisticated hangar environments.

It is very difficult to reconcile the fire loss history with the substantial fire code requirements for aircraft hangars. Some individuals in the industry argue that fire codes and standards, which were established in the 1950s before advances in chemical technologies made jet fuel less flammable, haven't kept pace with those and other technological and operational advancements.



Above: Hangar-Staff observe aqueous film forming foam (AFFF) fire suppression system in action.

Our goal is to raise awareness of issues around automatic fire suppression systems with a focus on the numerous risks associated with inadvertent foam discharges. Even without a fire, property, assets, human life, reputation and brand image – all the things so valuable to businesses – can be exposed to significant and arguably preventable risks. The circumstances of the following two claims were different but emblematic of issues around false activations of fire suppression systems:

1. Claim #1

It was 2:18 a.m. Security cameras were fully operational and recorded the entire event.

No one was in the hangar or on duty at the time. The security cameras suddenly recorded rapidly discharging foam being dispensed throughout the hangar. Within a few minutes, three aircraft were submerged in foam. There was no fire anywhere in the hangar. The foam continued to be discharged.

2. Claim #2

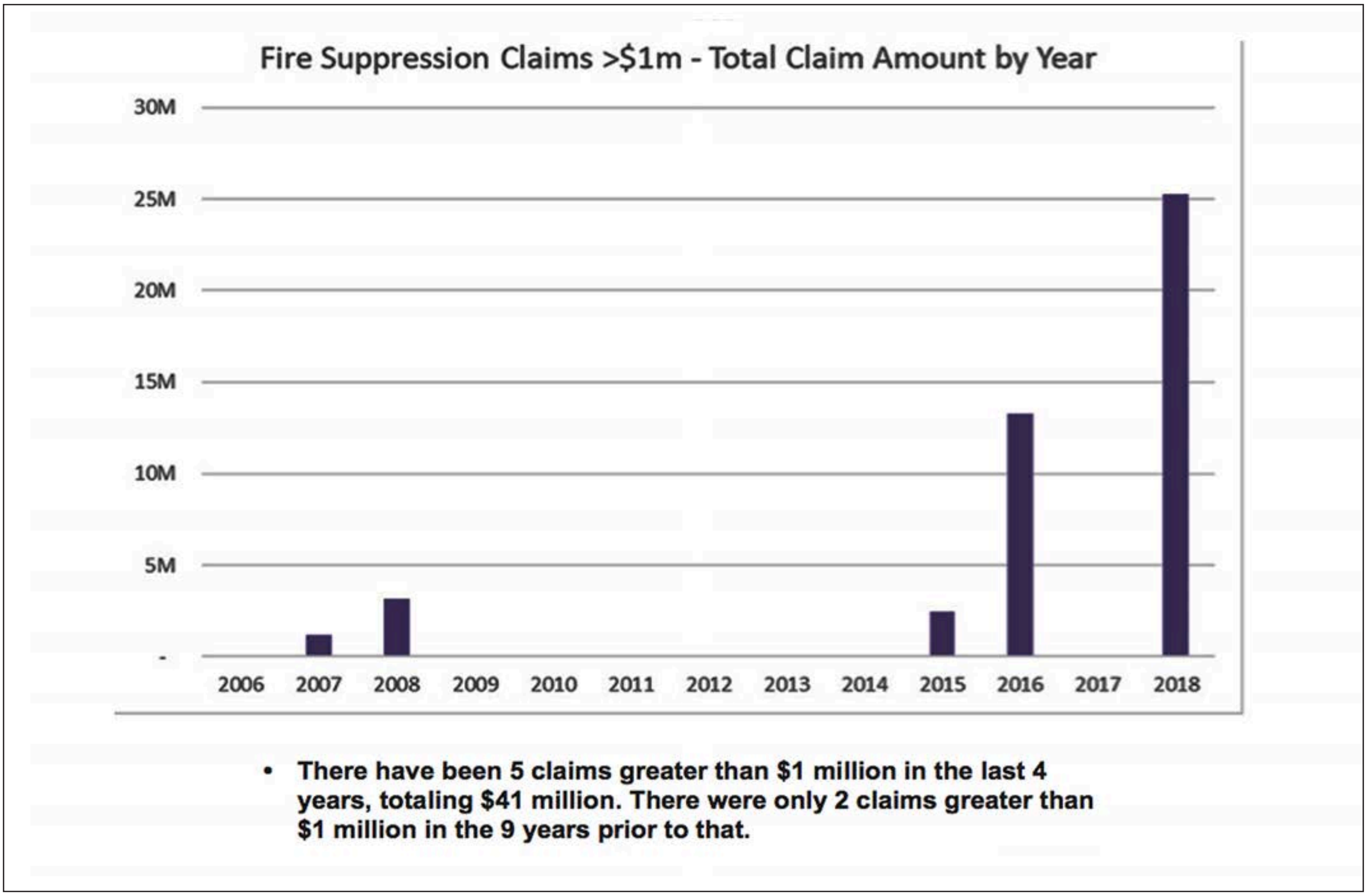
It was a quiet summer afternoon in a large private aircraft hangar. Some aircraft were out on trips while two remained in the hangar. A contractor and line maintenance employee were assessing a lavatory issue and were on board one of the aircraft. Sirens started to sound but there was initial confusion as to what was happening. The contractor and employee were finishing their conversation when suddenly foam began discharging from the ceiling. Foam was also being discharged from the side hangar walls directly onto the floor beneath the aircraft wings.

At that point, the contractor and employee had very little time to safely evacuate the hangar. They quickly were overwhelmed by the volume of foam rising from the floor and raining down from above and decided to retreat into the aircraft. The aircraft door remained open and the foam began to fill the interior. The men in the aircraft were quickly running out of options. Fortunately, another employee in the hangar realized there was no fire and invoked the manual shut off valve to terminate the foam release. It was a terrifying experience for those involved.

What is happening?

While no injuries resulted from the two aforementioned events involving our clients, there was a fatal event in January 2014 at Eglin Air Force base. There, a civilian contractor was killed after being trapped in a hangar filled with foam after an inadvertent fire suppression system discharge.

It should be noted that this person reportedly reentered the building after the foam system had discharged and after he had safely evacuated.



These events illustrate a troubling phenomenon that has been occurring for a number of years – inadvertent discharges of foam fire suppression systems that pose significant risks to life and property. This raises a few central questions:

- Are the codes and standards that call for sophisticated fire suppression systems disconnected to the risks in today's aviation world?
- Have the codes been adapted to account for technological progress in aviation equipment, fuels and operations?
- Is compliance too costly and burdensome in relation to the actual fire risks?

The NFPA (National Fire Protection Association) has no rule-making authority per se, but standards that are promulgated by NFPA are considered industry standards. NFPA 409 is the standard that calls for automatic fire suppression systems in many types of hangars. NFPA 409 protection requirements are referenced by many municipalities and airports have adopted NFPA requirements.

Hangar structures are usually located on airports and it is important to note many airports mandate adherence to NFPA 409 for hangar construction. The aviation industry in general views NFPA 409 as a requirement for doing business. However, many argue the requirement for foam is too burdensome in certain circumstances. In the quest to "safeguard life and property," has NFPA 409, however well-intentioned, gone too far with hangar foam requirements and not kept pace with changes in the aviation industry?

Above: Not only is the foam itself life threatening, but also the hangar environment can be very hazardous when trying to escape it.

NFPA 409 classifies hangars by size:

Group I Aircraft Hangars – access door greater than 28 feet in height or a single fire area in excess of 40,000 square feet. Think of these as large hangars that can accommodate airline-style aircraft.

Group II Aircraft Hangars – access door not greater than 28 feet in height and a single fire area below 40,000 square feet. Most general aviation business jets can be accommodated in a Group II-sized hangar. As a point of reference, Gulfstream G500 and G600 business jets are around 25 feet in height.

Group III Aircraft Hangars – very similar to Group II except for generally smaller fire areas depending upon hangar construction. These are smaller hangars that are commonly found in the general aviation – T-hangars, box hangars and shade hangars are examples.

Group IV Aircraft Hangars – any structure constructed of a membrane-covered rigid steel frame. This type of hangar can vary greatly in size from one to another.

NFPA 409 requirements call for automatic fire suppression without the need for human intervention. The systems in use today possess a means of fire detection, system actuation and delivery of an extinguishing agent (usually foam).

The types of fire protection systems for aircraft hangars are one of the following (based on hangar group):

- Foam-water deluge system (all sprinklers operate simultaneously);
- Automatic sprinkler protection (sprinklers can operate independent or in certain groups);
- Automatic sprinkler protection with automatic low-level, low-expansion foam system;
- Automatic sprinkler protection with automatic low-level, high-expansion foam system;
- Automatic sprinkler protection with foam mixed into the piping.

The advantages of foam are based on its chemical composition and how it binds to standing fuel on a hangar floor – it acts as a smothering mechanism. Foam can better extinguish high-challenge fires, uses less water, and reduces flammable liquid runoff.

The main disadvantages are system cost, the need to ensure proper foam runoff disposal and the risk of environmental damage if foam escapes its containment system and seeps into ground or surface water.

Above: A small sea of fire retardant foam was unintentionally released in an aircraft hangar, temporarily covering a small portion of the flight line at Travis AFB, Calif., Sept. 24, 2013.

There are two primary types of foam systems used for hangars. One is high-expansion foam (HEF). While effective, HEF poses the greatest risk to life safety as it is difficult to breathe and can be disorienting when engulfed in it. During foam deployment, fans or blowers add air to the foam, which makes bubbles. While the system is designed to provide foam to several feet in height, during discharge the foam can reach heights of eight to 10 feet.

The second type of foam is aqueous film-forming foam (AFFF), which creates a film that smothers fire and does not reach nearly the height of HEF. AFFF is frequently used for meeting the NFPA low-expansion foam requirement.

Automatic fire suppression requirements for NFPA hangar classification

The costs associated with conforming to the fire suppression requirements are substantial. Some estimates suggest the cost to equip a Group I or II hangar with an acceptable fire suppression system can be 30 or 40 percent of the cost of the hangar. Some of the systems can exceed $1 million in total costs.

Depending on where the hangar is located, it might be necessary to store thousands of gallons of water if the hangar is not connected to a municipal water system.

Fire pumps are an important part of the fire suppression system infrastructure and, depending on the size of the hangar, multiple fires pumps might be needed to ensure the correct water pressures flowing throughout the system.

Above: The most common damage seen in the aftermath of a foam discharge event relates to brake assemblies, avionics and engines.

Costs can spike if foam runoff needs to be captured (usually it does).

Does the loss data support NFPA 409 requirements?

Some in the industry argue we are over-engineering against a non-existent threat and there is a life safety issue associated with foam fire suppression systems. A growing chorus of industry players says the return on investment around fire suppression systems is a negative one.

"My goal is to eliminate foam fire suppression in Group II hangars," says Mercer Dye, founder of Dye Aviation Facility Architecture, LLC. Mr. Dye has been advocating changes to NFPA for at least a decade and serves as a backup member to the NFPA 409 Technical Committee. One of Mr. Dye's central arguments is NFPA 409 is not scaled to the relative risk of the general aviation industry. Another key point he makes is there are few if any known events where a fuel spill ignited thereby activating the foam system. Instead, there are numerous reports of false activations of fire suppression systems and a growing sentiment that it is happening too frequently.

At Global Aerospace, we decided to look at our own claims data over the past 12 years to test the hypothesis that fire suppression systems were triggered by false activations instead of actual fuel spill fires. Our study was conducted in December 2018. We discovered 51 claims around the world where the claims description involved "uncommanded activation," "unintentional dispersion of foam", "erroneous operation of fire suppression system" and "inadvertent discharge." We found no examples of an intentional discharge in response to a fire. The mean value of the resulting claims exceeds $1 million.

Keep in mind this data involves only Global Aerospace risks. While we are certainly one of the larger providers in the worldwide aviation insurance space, we do have insurance company peers who have their own market share so our data represents a partial picture of the overall market position.

We have been in discussions with various industry stakeholders on this topic, one of which is insurance broker Willis Towers Watson Aerospace group. Michael Petersen, a claims attorney for Willis Tower Watson, has recently studied the issue of inadvertent foam fire suppression events for his firm and clients.

Mr. Petersen commented, “In just 18 months, the Willis Towers Watson Aerospace group has seen seven clients suffer losses from inadvertent foam fire discharges. As a result, we have been studying this issue and trying to promote greater awareness of the problems with foam systems and develop strategies for our clients to reduce and mitigate the risks. In turn, this has led to our working closely with the National Air Transportation Association who is spearheading efforts to change NFPA 409.”

Global Aerospace has started taking a closer look at the ramifications of false activations. Among them are:

- Damage to aircraft: this involves direct physical damage and costs to restore the aircraft to its original condition;
- Consequential damages: lost business opportunities, missed flights, substitute lift costs, relocation to temporary space, employee time and distractions that detract from core mission;
- Reputation and brand damage;
- Cost to restore fire suppression system: $50,000 or more for certain systems;
- Environmental damage: We have handled claims involving faulty containment systems that allowed for the escape of foam remnants and residue from the hangar complex which have resulted in significant environmental contamination affecting local communities. This is especially true with older AFFF foams, which can be carcinogenic. Newer foams are less toxic thanks to improved chemical composition with certain protein-based foams now being biodegradable.

From an aviation claims perspective, the most common damage we see in the aftermath of a foam discharge event relates to brake assemblies, avionics and engines. When all these components are affected, repairs can easily exceed $1 million.

We have observed a great deal of variation in OEM protocols pertaining to repair scopes for aircraft subjected to a foam event. From a rinse down to a tear down, required repairs cover the spectrum and the costs can be substantial.

One of our biggest concerns at Global Aerospace is the life safety issue presented by a false activation foam event. Fortunately, our data is devoid of any bodily injury or death claims. In addition to the previously described Air Force high-expansion foam mishap, the industry has experienced some close calls with respect to life safety and some have affected our clients.

“It can be an extremely dangerous situation,” says Lance Toland, founder of Lance Toland Aviation Insurance Managers, when describing the scene in a hangar that is experiencing a foam discharge event. Mr. Toland has firsthand experience in foam discharge events, having assisted multiple clients through the ordeal.

Mr. Toland describes a scene in which a human chain was established within a hangar during an inadvertent foam deployment that nearly cost a life. The foam system discharged while aircraft maintenance personnel and cleaners were in the hangar. The hangar doors automatically shut when the system activated and an aircraft cleaner tried to exit the hangar but

Above: People underestimate the life-threatening sitation posed by a foam event, particularly in a hangar full of aircraft.

was stuck on the floor trapped within the rising foam. Nearly eight feet of foam had accumulated and a human chain was needed to rescue the panic-stricken worker.

People underestimate the life-threatening situation posed by a foam event. Think about a crowded hangar full of aircraft, supporting equipment and personnel. The fire suppression system discharges foam at a rapid rate. With HEF, as called for in NFPA 409, the foam accumulates in just minutes. Those who are caught on the hangar floor face very serious challenges. The foam itself is chief among them; it is a life-threatening substance. You cannot breathe through it, you cannot see through it and you cannot hear through it.

All of those things are especially dangerous for those caught out in the hangar during a discharge event, and just as importantly, it impedes the ability of first responders to assist victims.

The U.S. Air Force wrote a report about the Eglin Air Force HEF discharge event. Some of the feedback from victims and first responders was that they were "stunned when the foam became a life-threatening and panic-inducing substance." Trained first responders used adjectives such as "white out" and "frightening" to describe the scene that day.

Not only is the foam itself life threatening, but also the hangar environment can be very hazardous when trying to escape it with essentially zero visibility. Things such as ground support equipment parked in unpredictable places, static wicks, flaps and wings can pose serious bodily injury risks to victims of a foam event. Similarly, Mr. Dye has his own life safety concerns as well:

"Additionally, I believe that fixed foam systems create major life safety concerns for occupants and first responders. The combination of high decibel alarms and flashing lights in conjunction with foam while trying to clear a building and rescue survivors is anyone's nightmare. HEF releases obscure vision and obstruct FLIR type infrared, human imaging equipment. Foam is slippery, increasing the risk of falling and becoming unconscious.

"In an HEF event this can be deadly as you cannot breathe foam and the first responder is hampered from seeing or hearing the fallen victim. In general aviation hangars, aircraft wings and their static wicks are often at eye or head level. A collision with either could cause serious injury and possible death."

Would you or your team have the presence of mind to successfully escape a foam discharge event that is completely unanticipated? Will the initial reaction be one of startle and therefore cut into your time to safely evacuate?

Many industry observers lament that NFPA 409 has not kept pace with the modernization of aviation. For example, aircraft construction and manufacturing techniques have improved to the point where aircraft fuel leaks are a rare event. Mr. Toland says: "You could throw a match in today's Jet A fuel and it won't ignite," referring to advancements in fuel technologies that have raised the flashpoint of Jet A fuel.

Some also suggest the sophistication level of certain operations, particularly in Group I or Group II hangar environments, make automatic fire suppression questionable. Many experts believe that fire suppression system activation should be a manual process in sophisticated environments, which would allow for human confirmation of a fire instead of relying on sensors that might prove to be faulty or erroneous.

Why are there seemingly so many inadvertent foam discharge events?

One FBO manager with whom we spoke stated, "Advancements in fire suppression technology are actually causing more headaches. The systems are extraordinarily sensitive to a fault and we have had our share of issues including inadvertent foam discharges."

Industry observers say the most common reason for false activations is improper design, lack of proper commissioning, improper maintenance and failure to follow proper testing procedures. Based on insights from the experts with whom we have spoken, the issues manifest themselves for different reasons at different ends of the system's life cycle.

According to Doug Fisher, Principal Fire Protection Engineer from Fisher Engineering, Inc., inadvertent foam discharges tend to happen in two scenarios:

1. Early stage system existence – deficiencies and issues arising from poor design or improper commissioning at outset;

2. Late stage system existence – lack of maintenance, particularly near the end of system's life, or the lack of replacement of key components throughout the fire suppression system's life cycle.

Poor design and installation

We have multiple examples of these conditions in our claims data. We have seen cases where a manual fire suppression activation switch was situated near a hangar door and therefore exposed to the weather elements. This created an electrical short in the system that triggered a foam activation.

Cascading electrical failures are a regular contributor to false activations. It can take the form of a power surge after power comes back online, and we have seen inadvertent foam deployments attributed to an electrical spike resulting from lightning strikes. Less common triggers include infrared imaging sensors locking on to a heat source other than a fire. Heat associated with sunlight reflecting off glass or aircraft engine exhaust triggered deployment of fire foam suppression systems in two of our claim events.

Improper maintenance

We have observed sprinkler and valve corrosion trigger inadvertent deployments. These types of maintenance-related events raise questions around maintenance protocols.

- Are the inspections being carried out regularly?
- Should they be more frequent? Was the corrosion just overlooked?
- Who is responsible for inadvertent foam discharge events?
- What is happening in the industry today to address the inadvertent discharge problem?

Lately, some companies are making decisions to actively avoid foam requirements by building smaller hangars. This might mean losing efficiency in certain areas but it eliminates the substantial upfront costs of installing automatic fire suppression, the associated maintenance and operational costs, and false activation risks.

On the industry advocacy front, the National Air Transportation Association (NATA) in recent years has been trying to persuade the NFPA 409 technical committee to modify the requirements for aircraft hangars to a more risk-based approach in lieu of the seemingly arbitrary nature or randomness of certain portions of the standard.

NFPA 409 is currently in the midst of a revision cycle and we are optimistic that we will see a positive proposal for change this year.

(The above are excerpts from a White Paper written by Global Aerospace, a provider of aerospace insurance with offices in Canada, Cologne, Paris, Zurich, and throughout the United States.) ■

Atlantic AME Association

Annual General Meeting

Atlantic AME Association AGM was held on April 25th, 2019 at the Delta Beausejour Hotel in Moncton, NB. President Dave Hall tendered his resignation due to previous business commitments. We want to thank Dave for his term as president and his future support for the association.

Bob Pardy, a long time director and supporter, was elected as the new president. Bob has over forty years of experience in the industry and brings a wealth of knowledge to this position. There is no doubt he will do an excellent job representing our region at a federal level.

Members of the Board are:

Bob Pardy, President; Jason Crowell, VP; Anneke Urquhart, Secretary; and general directors Jacques Richard, Norbert Belliveau, Jeff Campbell, Mario Morales, Gerald Mallon, Peter Kwan, Owen Duffley, and Ben McCarty.

Bursary Committee: Bob Whittle agreed to chair this position. Other committee members are Jim Powers and Ian Albert.

Membership: We currently have 11 corporate members and 112 full members. This is consistent with our numbers over the years.

ARAMC 2020: will be held on April 22-24th, 2020 in St. John's, Nfld. Bob Pardy and Mel Crewe will chair the conference.

Training: Norbert Belliveau has prepared and presented several HF course through the region (on a cost recovery basis) in St. John's, Gander, Moncton, Halifax and Fredericton. He has two more scheduled courses for Fredericton and Moncton in the fall of 2019.

Hall of Fame: Congratulations to Jim Clack, recent inductee into the AME Association Hall of Fame. A list of recipients of this award is displayed on the website and on a computer at the Aviation Museum in Halifax.

CFAMEA/AMEA: AME Association-Atlantic will have two persons representing us at the national level. Owen Duffley has been our representative for some time and will be joined by Bob Pardy.

Membership Fees: will increase to $70 per year commencing January 1st, 2020.

Golf Tournament: The 2019 AME Association Annual golf tournament will be held at the Granite Springs Golf Club, Halifax, NS on Sept 22nd. Jason Crowell is the contact person for this event. Jason would love to have someone join him in managing this tournament. He can be reached at jason@aerotechengines.ca.

www.atlanticame.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 who collectively support 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.

Manitoba's Annual Aviation Symposium

We're looking forward to next year! Stay tuned for more information as we start planning the 25th Annual Aviation Symposium March 5-6, 2020.

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

ONTARIO

Ben McCarty named to the Order of Canada

On June 27th, Her Excellency the Right Honourable Julie Payette, Governor General of Canada, announced 83 new appointments to the Order of Canada. Among the various names is one that we all are so very familiar with, Ben McCarty. Mr. McCarty is the past president of the Atlantic AME Association, a position he held for many years. He was also the founder of our national organization, the Canadian Federation of AME Associations (CFAMEA).

In the early 1980s Mr. McCarty visited our Ontario Workshop and urged us to form our own AME Association. He was also instrumental in the establishment of other regional associations. The announcement of the citation reads:

Bennett McCarty, C.M.
Fredericton, New Brunswick
For his leadership in aircraft maintenance regulations, and for unifying aviation industry professionals.

We cannot think of another person that has given so much to the AME Associations either nationally or regionally and is highly respected by AMEs as well as Regulators. This is well deserved and we congratulate him on this prestigious award.

— Submitted by Stephen Farnworth
For the Board of Directors

Western AME Association

WESTERN

Showcase 2019 Tradeshow & Career Fair in Aviation

The Edmonton Airshow (www.edmontonairshow.com) in collaboration with the Alberta Aviation Council is entertaining its first Trade Show/Career Fair at the airshow held on August 17-18, 2019 at the Villeneuve Airport.

This year, the Edmonton Airshow brings the noise with world-class headliners and an all-new aviation career fair. There's no other event of its kind in Northern Alberta.

Edmonton has an exciting relationship with aviation. Throughout history, our pilots have defied gravity and pushed boundaries. During the Cold War, our city was a strategic location. Now it's home to a sky-high festival that brings families and neighbouring communities together.

The Edmonton Airshow is a not-for-profit event that raises awareness of the aviation industry and celebrates our local history of flight. RWE Events proudly produces this festival with an appreciative nod to our brave and courageous military.

Purpose and Objectives

The purpose and objectives of this association are to:

1. Promote and protect the profession of the Aircraft Maintenance Engineer.
2. Develop, maintain and improve representation and consultation with regulatory bodies that affect or may affect the profession of the Aircraft Maintenance Engineer.

3. Represent the views and objectives of the membership of the Association.

4. Promote and develop the knowledge, skill and proficiency of the profession of the Aircraft Maintenance Engineer through education, publication and research.

5. Cooperate and associate with groups, associations and organizations on matters of mutual interest.

6. Promote honorable practices among the membership and between persons in the aviation industry.

The Association is non-union, non-sectarian and non-partisan.

www.wamea.com

PACIFIC

Pacific AME Association

www.pamea.ca

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).

Mission Statement

The Pacific AME Association promotes and protects the professionalism of the AME, while developing, maintaining and improving our relations with regulatory bodies affecting our industry. We represent the views and objectives of our members, while promoting proficiency through educational collaboration with other groups on matters of mutual interest.

CENTRAL OHIO

Central Ohio PAMA

CSCC announces FAA Airman Knowledge Testing Center

Columbus State Community College's Testing and Talent Assessment Center would like to announce that they are a FAA Airman Knowledge Testing Center (FAA LAS#43201) through PSI/Lasergrade offering most of the written testing for FAA Airman Knowledge Tests. (At this time they are unable to test for the Inspection Authorization).

To schedule a test please contact PSI/Lasergrade at www.lasergrade.com or 800-211-2754. CSCC Testing and Talent Center at 614-287-5750 or act1@cscc.edu

The Testing and Talent Center is located on the second floor of the Workforce Development WD223) Building, 315 Cleveland Ave., Columbus OH 43215.

Local A&P sets up Columbus Model Rocketry School

Pete Bricker, a local Airframe and Powerplant technician, has changed his hobby of model rocketry into a training opportunity for students in Central Ohio. His classes range from beginner rubber-band launched rockets to large Level 1 and Level 2 Certification.

If you or your child have an interest in Model Rocketry as an individual or group event, check out the schools website by clicking on the link above.

Pete works for one of the regional airlines at Port Columbus and is the husband of Donna Bricker who was a long term board member and past treasurer of COPAMA

www.copama.org

SOCAL

PAMA SoCal Chapter

Who we are

The purpose of SoCal PAMA is to promote a high degree of professionalism among aviation maintenance personnel; to foster and improve methods, skills, learning, and achievement in the field of Aviation Maintenance; to conduct local meetings and seminars; to publish, distribute, and disseminate news, technical bulletins, journals, and other appropriate publications dealing with the trade of Aviation Maintenance; to collaborate with other organizations in aviation in the queries of governmental agencies pertaining to maintenance rules and guidelines.

The SoCal Chapter does not solicit dues. Donations are voluntary, appreciated and are used to help offset chapter expenses.

www.socalpama.org

PAMA Dallas – Fort Worth

About us

The DFW Chapter of PAMA is a non-profit association dedicated to promoting professionalism and recognition of the Aviation Maintenance Technician through communication, education, representation and support, for continuous improvement in aviation safety.

Since 1997 we have been coming together for a day of golf and fun in support of our local aspiring Airframe & Powerplant mechanics! Our annual PAMA DFW Golf Classic is a charitable event whose proceeds benefit scholarships for students pursuing a career in Aviation Maintenance at Tarrant County College. The chapter partners the Tarrant County College Foundation to offer a full scholarship to at least one student every year.

However, this goes beyond just the classes leading to the Airframe and Powerplant certificate. The scholarship pays for the tuition, student fees, textbooks, and all of the FAA examinations (written, oral and practicals). These are all accomplished at Tarrant County College Northwest Campus, Aviation Department.

The cost for a full scholarship is approximately $6,500. A selection committee set up by the college chooses the winner of the merit-based scholarships. The scholarship is open to anyone who meets the criteria.

Since the Foundation began administering this scholarship in 2009 we have collected over $97,000 and awarded 16 full scholarships. These successes are possible with the support of our aviation community, so we are always looking for hole sponsors and major raffle donors to support this just cause.

Our mission to educate, train, and provide encouragement to our industry's aviation technicians does not waiver.

www.pamadfw.com

GE9X: only one fan

BY GINA DAUGHERTY

So, how do you test the world's largest jet engine? GE's chief test pilot has the answers.

Opposite: GE90 engine. Above: "Mounting an engine of this size to our 747-400 is a challenge," Jon Ohman says. "The engine is mounted on a unique pylon that cantilevers the engine out in front of the wing and tilts it upward by approximately seven degrees."

but serious star power

The GE9X has only one fan, but that doesn't stop it from enjoying some serious star power. When GE brought the world's largest jet engine to the Paris Air Show earlier this year, visitors to its chalet mobbed it like a Hollywood actor and just couldn't stop taking their picture with it.

At roughly 11 feet in diameter — wide as the body of a Boeing 737 — the giant fan is the engine's most distinctive feature. It holds 16 sleek fan blades made from the latest generation carbon-fibre composite that is tough but lighter than titanium. The blades are so well engineered that New York's Museum of Modern Art included its first generation, which GE developed for GE9X's predecessor GE90 engine, in its design collection.

The fan and other technology inside the engine, including 3D-printed parts and space-age materials called ceramic matrix composites, allow it to generate 100,000 pounds of thrust — several times more than many fighter jets and the rocket used in America's first manned space flight. GE engineers developed the engine for Boeing's new passenger jet, the 777X. And as was reported on Industry Forum this issue, the GE9X engine for the Boeing 777X set a new Guinness World Records title for thrust to become the most powerful commercial aircraft jet engine after reaching 134,300 pounds.

Above: At roughly 11 feet in diameter the giant fan is the GE9X's most distinctive feature.

Above: The GE90 blade made its way to New York's Museum of Modern Art. Where the GE90 has 22 fan blades, the GE9X will have just 16 blades made from 4th-generation carbon fibre composite.

So what is it like to fly one of these giant engines? Jon Ohman, who flew F-18 fighter jets before becoming GE Aviation's chief test pilot, has firsthand experience with the GE9X. Ohman joined the Marine Corps, flying F-18s in Iraq and Afghanistan. But his fascination with flight-testing never waned. He spent the second half of his military career testing both the legacy F-18 and the Super Hornet, as well as the F-35, the Corps' new fighter jet. And he spent the last year testing it in the skies above Victorville, California. It's where GE keeps its Flying Test Bed, a modified Boeing 747 powered by three GE CF6 jet engines and, right now, the giant GE9X.

So, how exactly do Ohman and the test engineers account for the size, weight and thrust differentials? It's one of the questions GE Aviation's social media followers most wanted to know. We sat down with Ohman, the first person to fly a GE9X-powered jet, to find out the answer to this and other inquiries. Here's an edited version of our conversation.

Q: *How do you balance the test plane with something as big as the GE9X engine on the wing?*

Jon Ohman: We use fuel as ballast to balance the weight of the GE9X and the unique pylon that mounts it to the wing. Our 747-400 is modified with a manual fuel transfer system that we can control from the cockpit. With the GE9X on the left wing, we keep the number 3 reserve tank — in the right wing — full and the number 2 reserve tank — in the left wing — empty. This keeps the weight relatively balanced laterally.

Q: *Why does GE Aviation test engines on a 747?*

JO: The 747 is an ideal test platform for our developmental jet engines, big and small. With a test engine on the number two station, the three production CF6 engines and their associated engine-driven systems — fuel pumps, hydraulic pumps, bleed air, electrical generators — provide plenty of redundancy for safe operations. With a small test engine, the three production engines provide enough power to reach all parts of the operational envelope. With a large test engine, we can use the two production engines on the opposite wing to counter the thrust of the large test engine and keep the overall thrust relatively symmetrical. Likewise, the large tail of the 747 combined with the long length of the fuselage — therefore a longer lever arm — allows us to better control the aircraft during situations with asymmetric thrust from a large engine like the GE9X.

Q: *The GE9X is the largest commercial aircraft engine in the world. Is it louder than other engines?*

JO: Although the GE9X is the world's

Above: GE Chief Test Pilot Jon Ohman joined the Marine Corps, flying F-18s in Iraq and Afghanistan. But his fascination with flight testing never waned.

largest aircraft engine, it is designed to be quieter, cleaner and 10 percent more efficient than its predecessor, the GE90, which currently powers the Boeing 777. The massive fan of the GE9X actually helps keep it quieter.

Q: *How do you balance performance calculations with one engine producing differential thrust?*

JO: For planning purposes, Boeing provides us with performance calculations for the unique configuration of our 747 with the variety of test engines we fly. With the GE9X producing significantly more thrust than a production CF6 engine, our takeoff and climb performance is excellent.

With the GE9X and full takeoff thrust we actually have to reduce the thrust of the number one engine to ensure adequate directional control in the event of a failure of the number four engine. Cruise performance with respect to overall fuel burn is slightly higher than normal, mainly due to additional drag from our asymmetric configuration.

Q: *Is it possible for a Boeing 747-8 — the latest model of the iconic 747 jet — to operate on two GE9Xs? Are two GE9Xs more powerful than the four GEnx engines powering production 747-8 planes?*

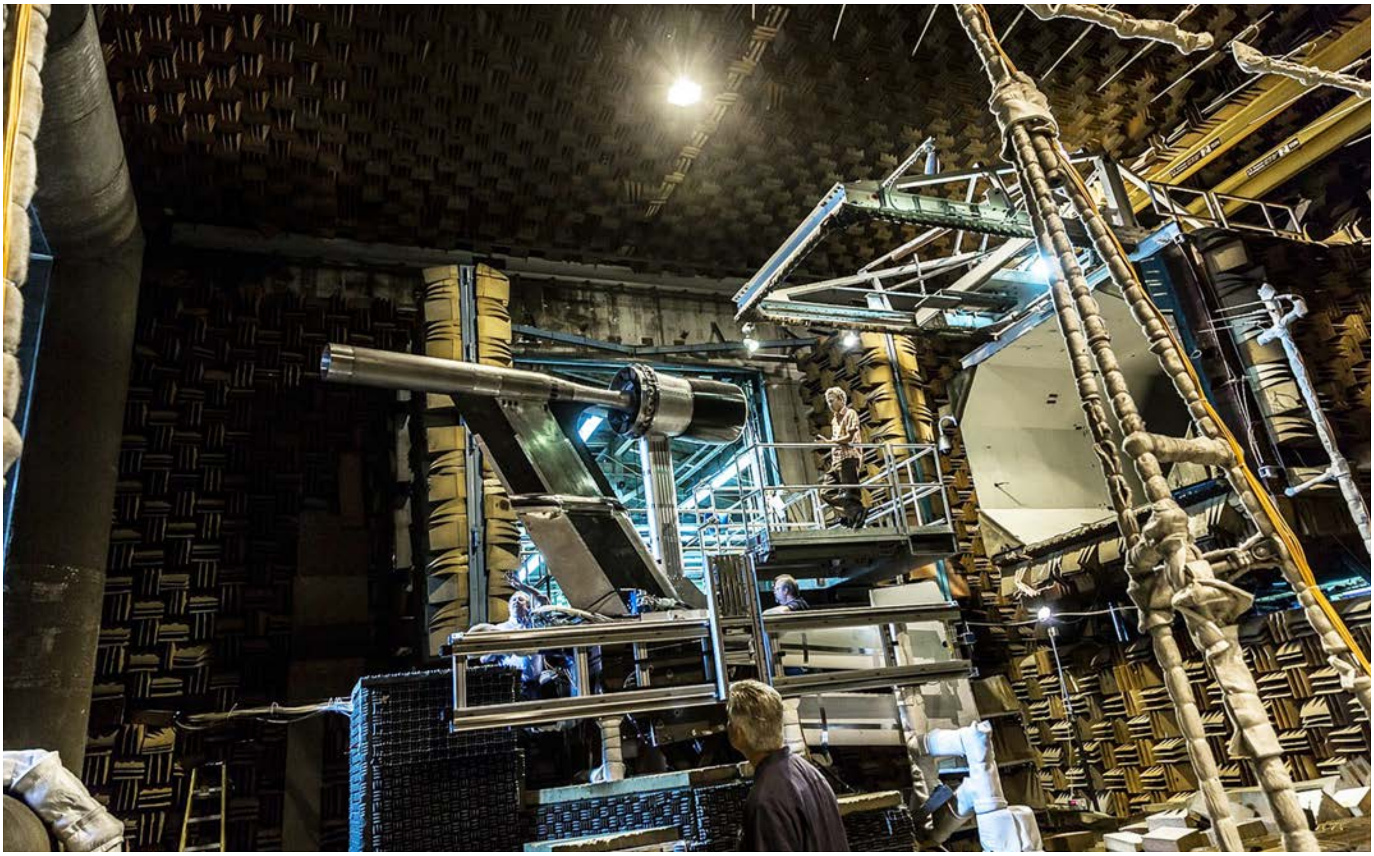
JO: *The GE9X is currently rated at 105,000 pounds of thrust. The four GEnx-2B engines on the 747-8 are rated at 66,500 pounds of thrust each, so two GE9Xs would not provide the same thrust. Also, the 747-8 is designed as a four-engine airplane with redundant electrical, hydraulic and bleed air systems powered by each of the four engines.*

Q: *The GE9X engine hangs low on the test plane. How does ground clearance work with this configuration?*

JO: Mounting an engine of this size to our 747-400 is a challenge. The engine is mounted on a unique pylon that cantilevers the engine out in front of the wing and tilts it upward by approximately seven degrees.

Also, we over-service our landing gear struts to extend them more than normal and provide an additional four inches of clearance. The result is about 18 inches of clearance between the bottom of the nacelle and the ground when the airplane is sitting stationary. Given the relatively small clearance, we are very careful during landings, particularly in crosswinds.

(Gina Daugherty is writing for GE Reports.) ■



Above: Testing the new design for the GE9X carbon fiber blades on a scaled-down testing rig at Boeing.

Creative thinker

Above: Davidson Nzekwe-Daniel, third from the left, collaborates with classmates.

When an Air Maintenance Tech student realizes the constraints of FAA-mandated curriculum, he devises a solution that helps him as well as others.

When he was just a kid growing up in Nigeria, Davidson Nzekwe-Daniel would build model airplanes out of paper, cardboard, and tape and power the plastic propellers with a small DC battery. Each time the primitive technology rolled off the table and failed to fly, he wondered why.

"I was in a world all my own," said Nzekwe-Daniel, who doubles as a student and mechanic at the Emil Buehler Aviation Institute at Broward College in Fort Lauderdale, Florida. "I needed to learn how these machines work."

That curiosity and a desire to dissect real turbine jet engines landed him at Broward College two years ago. At the end of the upcoming fall semester, he will graduate with an associate degree in Aviation Maintenance.

Finding a job that is responsible for keeping passengers and flight crew safe shouldn't be much trouble. A Boeing report estimates that the aviation industry will need 754,000 new aircraft maintenance technicians over the next two decades, more than 80 percent of them for the growing commercial sector. But, while the demand for aviation mechanics is at an all-time high, a headwind looms on the horizon.

Nzekwe-Daniel said Federal Aviation Administration regulations that dictate what aviation programs teach aspiring mechanics had not kept pace with sophisticated industry technology. He can attest. Nzekwe-Daniel needed three attempts to gain the FAA Airframe and Powerplant certification essential for employment.

> Part of the problem is that the FAA-enforced curriculum is time- rather than competency-based. Many companies that are scrambling for maintenance technicians have joined educators to urge Congress to legislate the first revisions to the federally authorized curriculum in some 40 years.

Airlines Scramble for Technicians

Part of the problem is that the FAA-enforced curriculum is time- rather than competency-based schools with aviation programs, like Broward College, have only so many credit hours to design an academic program. With little wiggle room to incorporate subject areas beyond those dictated in the 1,900-hour syllabus, Nzekwe-Daniel said some students are unable to reinforce the competencies they need to pass their qualifying exams for FAA licenses in Airframe and Powerplant. As a result, many companies that are scrambling for maintenance technicians have joined educators to urge Congress to legislate the first revisions to the federally authorized curriculum in some 40 years.

Above: At the end of the upcoming fall semester, Davidson Nzekwe-Daniel will graduate with an associate degree in Aviation Maintenance.

Above: "It's the most satisfying feeling to help someone get their FAA license and achieve their goals," said Nzekwe-Daniel.

Reluctant to wait for the government to step up to the plate, Nzekwe-Daniel, with support from Broward College faculty and administrators, took it upon himself to research a temporary solution. He created a refresher course of sorts, which he dubbed "Curriculum Practical Training, (CPT)" for Broward College aviation students who are determined to bolster their skills leading up to the FAA Practical Test Standards required for Airframe and Powerplant maintenance certification.

Temporary Solution Takes Off

Nzekwe-Daniel said 25 students at the Aviation Institute completed CPT in June, at no cost. Two students who completed the trial offering in January already obtained FAA Airframe and Power Plant certificates and entered the workforce. Fort Lauderdale-based GA Telesis and Xtreme Aviation in Doral are interested in offering CPT to their employees.

In the meantime, Nzekwe-Daniel relishes the opportunity to spread the word about CPT to other Florida colleges with aviation programs while he promotes the virtues of flight at campus events, job fairs and at K-12 schools in Broward County.

"It's the most satisfying feeling to help someone get their FAA license and achieve their goals," said Nzekwe-Daniel. "I love aviation and serving others. My passion is now my purpose." ■

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The nature of POWER LOSS

An overloaded aircraft with a newly installed fuel management system are the suspects in a tragedy over Lake Ontario.

At 0735 on October 9, 1993, the pilot, co-pilot, and two passengers in Beech B58P Baron C-FKSB departed from Toronto Island Airport, Ontario, for a pleasure flight to Walker's Key, Bahamas, with an en route stop at Wilmington, North Carolina.

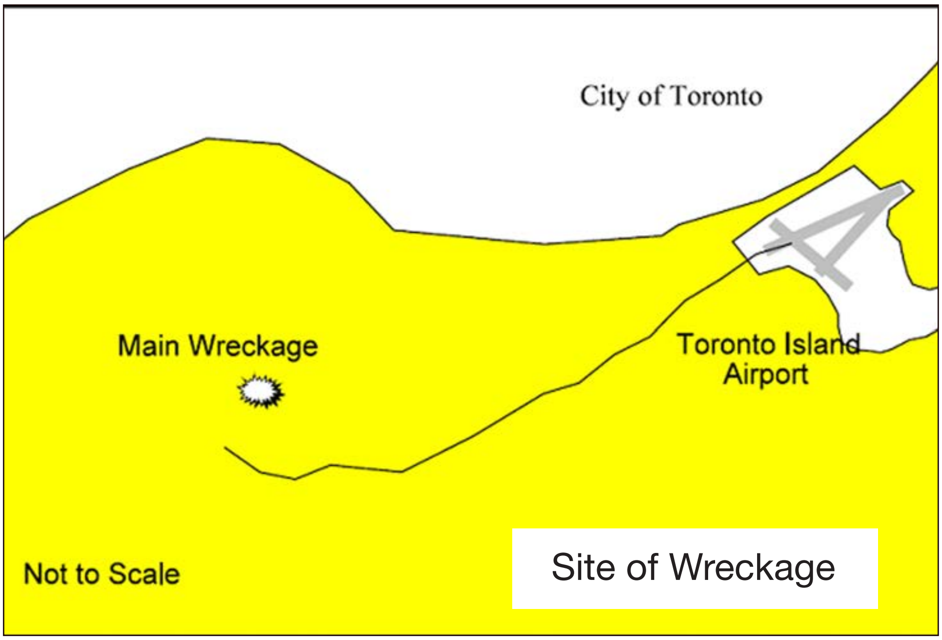
The trip was originally planned for earlier in the week but was delayed when the aircraft became unserviceable after the installation of a new fuel management system. When the first flight following the installation was attempted, the left engine ran roughly and did not produce full power; the aircraft was returned to maintenance.

On the night before the accident flight, the aircraft was successfully ground run and test flown after the maintenance and repairs were completed. Following the test flight, the aircraft was refuelled and parked in a hangar in preparation for the early morning departure.

At 0630, the aircraft was parked on the ramp. The pilot was observed loading his baggage at about 0645. Shortly afterwards, the co-pilot and two passengers arrived at the aircraft with their baggage and a small dog. At about 0720, the aircraft engines were started; after receiving his instrument flight rules (IFR) clearance, the pilot taxied for take-off at 0730.

Several witnesses observed the aircraft depart at 0735 and reported that the take-off appeared normal, with both engines operating smoothly and at what appeared to be full power.

Once airborne, the pilot contacted the Toronto Area Control Centre (ACC) departure controller and was given a departure instruction, which he did not acknowledge. When the departure controller repeated the departure instruction, the pilot responded that he had an engine failure and requested an immediate return to the airport. There were no further radio transmissions from the aircraft and it was observed in a steep nose-down descent when it struck the water at 0738 during daylight hours. Metro Toronto Police divers found the aircraft about 1.8 nautical miles (nm) west of the airport in 50 feet of water at latitude 4337’37”N, longitude 07926’41”W. There were no survivors.



Site of Wreckage

Aircraft Maintenance History

The aircraft had been maintained and serviced in accordance with existing regulations and it was mechanically and cosmetically well kept. There had been two recent modifications to the aircraft. On 11 June 1993, a vortex generator system was installed in accordance with supplemental type certificate (STC) SA4016NM. At that time, the aircraft had accumulated 1,866.7 hours total airframe time. The modification is designed to maintain laminar airflow over the wings and tail, and thereby enhance the handling and control of the aircraft at slower speeds as well as improve the stall characteristics.

The second modification was the installation of a Shadin Digiflo-L digital fuel management system on 04 October 1993. Part of this modification included the installation of a fuel flow transducer in the fuel lines of each engine. The second part of the installation included a light-emitting diode (LED) display instrument, which indicated the fuel flow of each engine. The Shadin Digiflo-L digital fuel management system is designed so it can be coupled with some models of global positioning system (GPS) units and used to calculate the fuel required to proceed to any selected waypoint or destination.

The GPS installed in this aircraft was not compatible with the Digiflo-L and therefore was not coupled to it. The selector switch on the LED display was found in the endurance position.

On the first flight following the installation of the Shadin Digiflo-L system, the pilot (not the accident pilot) rejected his take-off run because of a lack of engine power from the left engine. When the engine was examined by the aircraft maintenance engineer (AME), it was determined that there were two separate problems: first, that the engine was running roughly, and second, that the engine was not developing full power. In troubleshooting the first problem, the left magneto and ignition harness from the right engine were installed on the left engine. A new magneto and ignition harness were installed on the right engine. This corrected the rough running engine problem, but the left engine still did not produce full power.

The Bendix servo fuel units were exchanged between engines. The left engine still did not produce full power; the right engine did produce full power. A fuel flow check revealed that one of the fuel injectors on the left engine was partially plugged. When it was cleaned, the left engine produced full power and ran smoothly.

During the trouble shooting procedure, the right engine mixture control cable was found to be worn and was replaced. After all the work was completed, and after an extended ground run, the aircraft was test flown for approximately 30 minutes. There were no reported discrepancies during the ground run or flight.

Aircraft Weight and Balance

The maximum take-off and landing weight of the aircraft is 6,100 pounds, and the centre of gravity limits at that weight are between 78.4 inches and 84.5 inches aft of datum.

The calculated take-off weight for the flight was 6,445.3 pounds with a centre of gravity of about 80.1 inches aft of datum. At impact, the calculated weight was 6,337 pounds and the centre of gravity was virtually unchanged. The maximum weight of the aircraft was exceeded by 345.3 pounds at take-off.

Aircraft Performance

The aircraft flight manual (AFM) indicates that the take-off and maximum continuous power setting is 38.0 inches of mercury (in. Hg) of manifold pressure and 2,700 engine rpm. The normal cruise climb power setting is 34.0 in. Hg and 2,400 rpm. When leaning the mixture, the power is not to exceed the maximum cruise power settings of 33.0 in. Hg and 2,400 rpm, and a peak temperature of 1,650 degrees Fahrenheit, as indicated on the turbine inlet temperature (TIT) gauge, is not to be exceeded.

The AFM indicates that the climb performance for a normal departure with an indicated airspeed (IAS) of 115 knots, given the ambient conditions at the time of the occurrence and a take-off weight of 6,100 pounds, would result in a 1,600 feet per minute (fpm) climb with a climb gradient of 11.0 per cent. If one engine became inoperative and the pilot followed the correct one-engine inoperative procedures, the rate of climb would decrease to 230 fpm with a climb gradient of 1.50 per cent. Both climb performances are based on the power set at maximum continuous with the flaps and landing gear up, the cowl flap(s) open, and the inoperative propeller feathered. Any deviation from these conditions and procedures could reduce the aircraft performance. The pilot of the accident flight had a Digiflo-L digital fuel management system installed in his recently acquired Beechcraft B55 Baron aircraft. The pilot's B55 Baron aircraft is equipped with two Teledyne Continental IO 520-C, 285 Hp engines. The smaller 285 Hp engines operate on a lower fuel flow than the larger 310 Hp engines that were on the accident aircraft.

Aircraft Equipment

The aircraft was fully equipped for IFR flight. Additional navigation equipment installed in the aircraft included the following: an Apollo GPS receiver with a North America data card, a King KN 74 Area Navigation (RNAV) unit, a distance measuring equipment (DME) receiver, a Collins WXR-200 weather radar, and a two-axis autopilot.

Tests and Research

Both of the engines were recovered from Lake Ontario and examined. The initial examination of the engines revealed no evidence of any pre-impact airflow restrictions, which could have adversely affected the combustion and the engine power produced. There was no indication that either of the air filters was plugged, and the alternate air doors, which ensure adequate airflow to the inlet side of the turbo chargers, were functional. Both of the turbo chargers turned freely and without any restriction.

Most of the induction tubes on both engines had been damaged during the impact, but there was no indication of any pre-impact malfunction or condition in the induction system. The engine ignition systems, which consisted of four magnetos (two on each engine), ignition wiring harnesses, and spark plugs, were visually examined and were determined to be mechanically fit. It was then decided to conduct a test of both engines at the Teledyne Continental Motors manufacturing facility in Mobile, Alabama.

The damage caused by the accident was repaired, which entailed replacing the oil sumps, rocker covers, induction tubes, exhaust stacks, and welding on the left engine propeller flange. Both engines were then installed in a test cell and run. The engine runs were conducted without any repairs to either of the engine's fuel systems, ignition systems, or mechanical drive trains, which were tested in an "as recovered" condition.

In the test cell, both engines were successfully run to full power. The left engine ran roughly during the test runs, and this was attributed to moisture in the magneto and impact damage to the ignition harness.

Propellers

The aircraft had two Hartzell constant-speed, full-feathering, three-bladed propellers. The pitch setting at the 30-inch station is from 15.3 degrees (low pitch) to 84.0 degrees (high pitch), which corresponds to the feathered position. The propeller flange on the left engine had failed at impact and the left propeller had separated from the left engine. The left propeller was not found.

The right propeller was dismantled and examined. All three propeller blades were twisted towards a low pitch setting. Impact marks on the three propeller blade preload plates indicated that the blade angles at impact were 18, 18, and 19 degrees respectively. Although these blade angles are consistent with a take-off or climb power setting, they may also exist in a constant speed propeller system when engine power is reduced without a corresponding reduction in the selected propeller rpm.

The Power Loss

In consideration of the recent maintenance history of the aircraft, the engines were inspected and test runs were conducted to determine what could have caused a total or partial power loss on one or both of the engines. The engine test runs indicated that both engines were capable of producing full power even when tested in an almost "as recovered" condition.

Based on the inspection of the engines and their performance during the test runs, the cause of the total or partial power loss on one or both of the engines could not be duplicated or determined.

The examination of the left propeller engine flange, the right propeller, and available cockpit engine instruments indicated that neither propeller was feathered at impact and that the left engine was producing at least partial power. The impact mark on the right engine tachometer indicated that the right propeller was at 2,450 rpm at impact. It is most likely that the power loss experienced by the pilot was not caused by a mechanical malfunction of the engines.

Aircraft Performance

Although the nature and source of the power loss experienced by the pilot could not be determined, the examination of the radar data did reveal several key aspects about the aircraft's performance. The radar data indicated that the initial climb was normal to 1,050 feet asl, at which time the ground speed decreased. This could have occurred when the pilot was reducing to climb power. Since the aircraft's rate of climb was a constant 1,000 fpm, the airspeed would have decreased as a result of the lower power setting.

The aircraft momentarily levelled off at 1,200 feet asl. When the pilot made his first call to the departure controller through about 1,300 feet asl, he did not indicate that he was having any engine problems. Therefore, it is unlikely that the momentary level-off at 1,200 feet asl was a result of the engine failure or the loss of power.

Since the pilot had difficulty with IFR flight, he may have found it advantageous to use the autopilot at this busy time of the flight. The momentary level-off could have been caused by the pilot engaging the autopilot if the autopilot was set for level flight. If the pilot then activated the autopilot trim wheel for a climb, this could explain the climb from 1,200 feet asl to 1,500 feet asl with a constant rate of climb of 1,000 fpm while the airspeed remained low. If the autopilot was engaged, the pilot would have been free to call the departure controller, complete his after take-off checks, and adjust the power settings.

If the pilot or co-pilot leaned the mixtures using the newly installed Shadin Digiflo-L fuel management system during this part of the climb, a power loss situation may have inadvertently occurred. If the mixtures were reduced to a fuel flow setting appropriate to the smaller 285 hp engines of the aircraft that the pilot owned and was familiar with, then, given the greater fuel flow required by the 310 hp engines on the accident aircraft, it is possible that the accident aircraft could have lost partial or total power on one or both engines. If this occurred, and the aircraft autopilot was engaged, the pilot may have been distracted in dealing with the engine malfunction and not have noticed the airspeed decrease. The radar data indicated that, at 1,500 feet asl, the aircraft descended rapidly with no increase in groundspeed; this could have resulted from the overweight aircraft stalling.

The aircraft descended to 600 feet asl before the rate of descent was arrested, then a 1,000 fpm climb was briefly reestablished as the aircraft climbed to an altitude of 900 feet asl and the ground speed decreased to 83 knots.

Passing through 800 feet asl, the pilot informed the departure controller that he had an engine failure and wanted to immediately return to the airport. This was the last communication from the aircraft. The last radar target showed the aircraft was at 900 feet asl in a right turn. The overweight aircraft most likely stalled again, and the pilot had insufficient altitude to recover as it descended steeply out of control into Lake Ontario.

Findings

1. The aircraft was 345.3 pounds above the maximum gross take-off weight when the flight departed, and the aircraft was operating outside of the approved weight and balance envelope at the time of the accident.
2. Both the pilot and co-pilot were properly licensed and qualified to fly the aircraft.
3. The aircraft was maintained in accordance with approved procedures and regulations.
4. The aircraft experienced a power loss during the initial climb-out. The extent and nature of the power loss was not determined; however, the power loss may have been induced by one of the pilots.
5. The pilot lost control of the overweight aircraft at 1,500 feet asl, while operating in cloud, and descended to 600 feet asl prior to regaining control of the aircraft. This was followed by a second loss of control at 900 feet asl.
6. Since the pilot had weak instrument flying skills, the weather conditions at the time of the occurrence may have aggravated the pilot's ability to recover the aircraft.
7. The aircraft struck the water in a steep, nose-down, left-wing-low attitude.

Causes

After experiencing a power loss during the initial climb-out, the pilot lost control of the overweight aircraft while attempting to return to the airport. The cause of the power loss was not determined; however, both engines were found to be capable of producing full power when tested.

(The above are excerpts from the Transportation Safety Board's investigation into this occurrence. The Board, consisting of Chairperson John W. Stants, and members Zita Brunet and Hugh MacNeil, authorized the release of this report on 13 June 1995.) ■

Aviation Services

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The shop called. Your plane's ready.

How a portable scanning device helped fix a bird-damaged 737 in less than 48 hours.

Birds and planes can be an expensive and disruptive mix, costing airlines worldwide billions of dollars in damages each year. Bird strikes in 2017 cost the civil aviation industry at least 71,253 hours of aircraft downtime and the FAA estimates that $400 million in damages annually can be attributed to bird strikes in the United States alone.

Where there's an Aircraft on Ground (AOG), situation, the affected airline bears the cost of removing, repairing and restoring the damaged component, as well as the incurred cost of flight delays, cancellations, and missed connections.

Despite various preventative measures aimed at reducing the number of strikes, it is clearly a problem that will continue to cause considerable trouble for airlines; FAA data shows that US-based civilian flights reported 14,661 bird strikes in 2018 — or more than 40 a day.

In one case, a low-cost domestic carrier had suffered damage to one of its 737's wing ribs, requiring the aircraft to be grounded until repairs were made. Familiar with the aerospace work of the Texas-based optical scanning firm NVision Inc., the carrier sought the company's help. NVision's client list includes the likes of Bombardier, Delta, American, Southwest and Lockheed Martin.

NVision technicians traveled to the airline's facilities and scanned the damaged wing rib using the company's HandHeld laser scanner, collecting all the necessary data on the rib's exact geometry; its shape, size, and contours.

The NVision Handheld scanner is a portable scanning device that is capable of capturing 3D geometry from objects of almost any size or shape. The scanner is attached to a mechanical arm that moves about the object, freeing the user to capture data rapidly with a high degree of resolution and accuracy.

As a part is inspected, the scanner generates a point cloud consisting of millions points each with x,y,z coordinates and i,j,k vectors. Integrated software that comes with the scanner is used to convert the point cloud to an STL polygon and an optional tripod provides complete portability in the field.

Intuitive software allows real-time rendering, full model editing, polygon reduction, and data output to all standard 3D packages. After converting the rib's point cloud to an STL file, NVision technicians imported the file into specialized modeling software, where CAD engineers processed the data to an IGES/STEP model. Design engineers then created an insert to strengthen the rib and electronically transferred the manufactureable CAD model to the airline, where it was rapidly machined and installed, enabling the damaged plane to fly again just 48 hours after the strike. The rapid turnaround helped the airline avoid the financial losses typically incurred by grounding aircraft. ■

Top: Aircraft wing showing bird-damaged region close to fuselage.
Above: Aircraft undergoing maintenance inspection.