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AMT

Aircraft Maintenance Technology

Written by aircraft maintenance professionals for the professional maintenance team

Official publication for AMTSociety

February/March 2012

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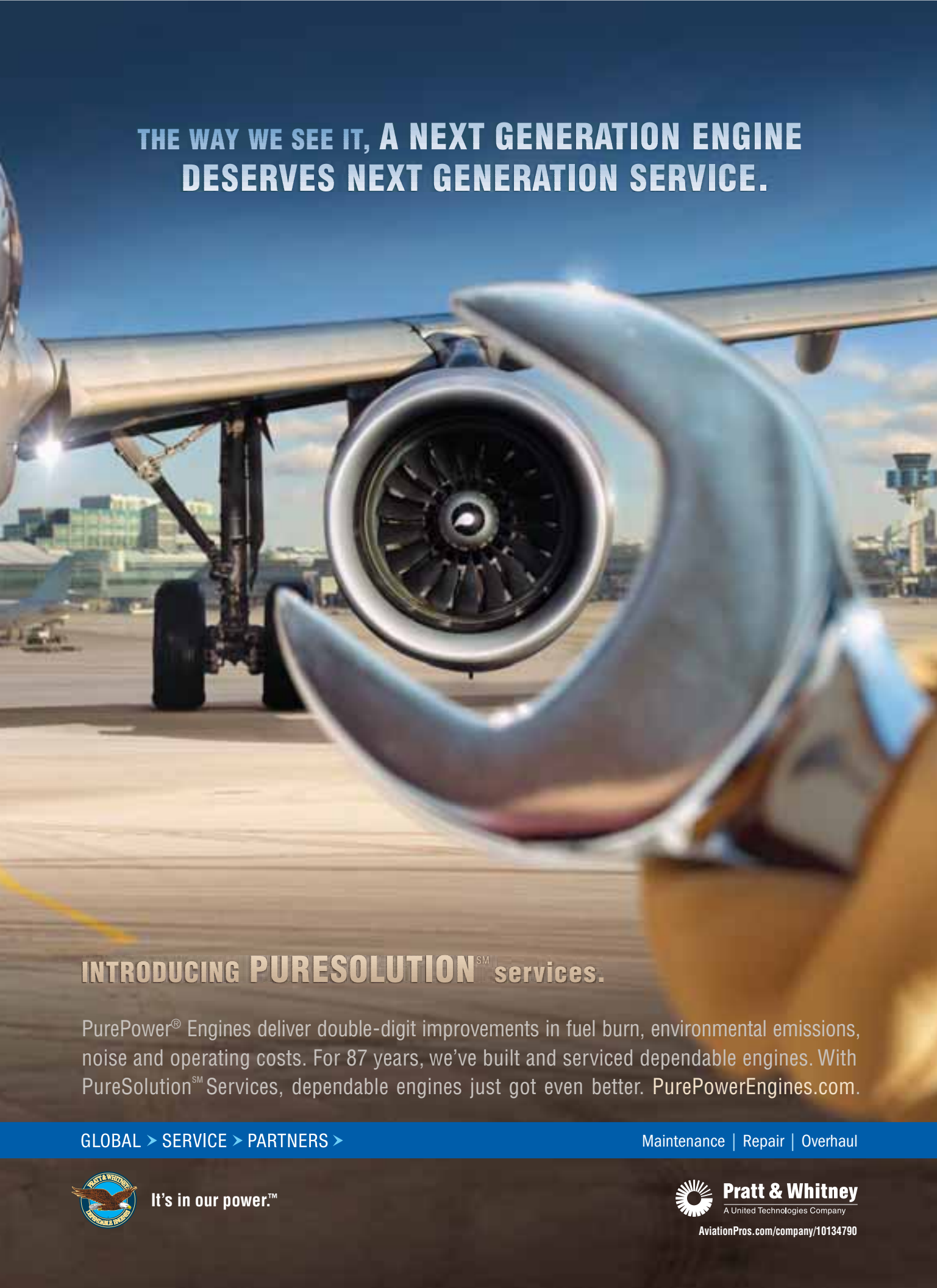
Turbine Engine Technology Focus

Special Supplement Inside: Tools & Equipment

Removal of CFM-56 Low Pressure Turbine (LPT) in Turkish Engine Center, Istanbul, Turkey. Photo by Chip Yates, courtesy of Pratt & Whitney.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Focus on Turbine Engines

February/March 2012

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Published By Cygnus Business Media
1233 Janesville Ave., P.O. Box 803,
Fort Atkinson, WI 53538-0803
Phone (920) 563-6388 · Fax (920) 563-1699
For Product Information: (920) 563-1762 · Fax (920) 563-1704
Change of address or subscription information:
Toll Free: (877) 382-9187 or Local: (847) 559-7598
Email: circ.amt@omeda.com
Web: www.AviationPROS.com

Publisher.....Jon Jezo
jon.jezo@cygnusaviation.com
Editor.....Ronald Donner
ron.donner@cygnusaviation.com
Senior Editor.....Barb Zuehlke
barb.zuehlke@cygnusaviation.com
Associate Editor.....Stephen P. Prentice
aerolaw@att.net
Field Editor.....Charles Chandler
cchandler@amtonline.com
Contributors: Timothy Bednarz, Charles Chandler, John Goglia, Jim Sparks, Brent Williams, Del Williams


JON JEZO


RONALD DONNER


BARB ZUEHLKE

Sales
National Accounts Manager.....Michael Sasso
michael.sasso@AviationPros.com
National Accounts Manager.....Randy Graper
randy.graper@AviationPros.com
Classified Sales.....Kimberly Jorgensen
kimberly.jorgensen@AviationPros.com

International Sales
Benedict Hume
benedict@itsluk.com
+44.1442.288287; Fax: +44.1442.219898
Julian Maddocks-Born
julian@itsluk.com
+44.1442.219898; Fax: +44.1442.219898

Production
Graphic Designer.....Meredith Burger
meredith.burger@cygnuspub.com
Media Production Rep.....Carmen Seeber
carmen.seeber@cygnuspub.com
Production Director.....Steve Swick


MICHAEL SASSO


RANDY GRAPER


KIMBERLY JORGENSEN

Circulation
Group Circulation Manager.....Jackie Dandoy
Circulation Manager.....Debbie Dumke
List Rental.....Elizabeth Jackson
ejackson@meritdirect.com · (847) 492-1350, Ext. 18

Cygnus Aviation
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Cygnus Business Media
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Maintenance Repair and Overhaul

Innovation, new technology, and specialized MRO

Ron Donner, Editor

Turbine engine OEMs are seeing their order books fill as a result of new aircraft orders being placed by airlines and leasing companies around the world. More aircraft, more engines, eventually this means there will be more turbine engine maintenance repair and overhaul activity. As we all know, turbine engine MRO includes many specialized technical processes, some of which continue to advance in both process and repair equipment technology. One of these highly specialized processes used to repair aircraft including turbine engine parts is welding. Welding processes continue to evolve and in this issue Miller Welding provides information on TIG inverter technology.

Also in this issue Del Williams describes how Hi-Tech Furnace Systems' dynamic fluoride ion cleaning process provides turbine engine MRO technicians the ability to prepare an ideal surface prior to brazing.

One of Pratt & Whitney's more recent innovations in turbine engines has been the PurePower Geared Turbofan engine or GTF. This new technology engine has been chosen by many operators, and promises to be quieter, burn less fuel, and be friendlier toward the environment. Although there's little to say yet relating to maintenance repair and overhaul, this issue of *AMT* does provided a description of this new turbine engine technology with some hints of what to expect when maintaining these new engines.

Not all the pages of this issue relate to turbine engines; but most do relate to MRO. *AMT* field editor Charles Chandler spoke with Craig Rose vice president of operations with Aircraft On Ground Inc. (AOG), a repair station specializing in finding and fixing fuel system leaks in large aircraft.

As we continue to provide editorial content relating to the MRO segment of aircraft maintenance, *AMT* magazine will be exhibiting at MRO America 2012. Held this year April 3 to 5 at the Dallas Convention Center in Dallas, TX, stop by booth #3025 meet the staff and say hello.

Cygnus Aviation Expo

March 7 to 9, 2012 will be the Cygnus Aviation Expo held in Las Vegas, NV. This year's expo is promised to be better than ever. We've put together several education sessions that will peak the interest of aircraft maintenance technicians, managers, service providers, and leaders, including a day long pre-show training session directed toward technical and operations personnel moving into their first supervisory or managerial role. Other sessions of interest will be a discussion on the subject of "actively engaged" for Inspection Authorization holders, and unmanned aircraft as an emerging industry, with a focus on unmanned aerial systems (UAS) training and education for aircraft technicians. I will be hosting a roundtable discussion with several leaders in the business aircraft FBO and MRO segment, discussing the challenges and best practices of managing multiple locations, including how to attract and retain good technical staff. For more information visit www.cygnusaviationexpo.com. I hope to see you there. Ron

Aircraft Maintenance Technology (USPS 004-989; ISSN 1072-3145 print; ISSN 2150-2064 online) is published 10 times annually in January/February, March, April, May, June, July, August, September, October, and November/December. Periodicals postage paid at Fort Atkinson, WI and additional entry offices. POSTMASTER: Please send change of address to *Aircraft Maintenance Technology*, P.O. Box 3257, Northbrook, IL 60065 3257. Printed in the U.S.A.

Canada Post PM40063731. Return Undeliverable Canadian Addresses to: *Aircraft Maintenance Technology*, Station A, PO Box 54, Windsor, ON N9A 6J5.

Volume 23, No. 3, February/March 2012

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Pratt & Whitney PurePower® PW1217G geared turbofan engine first engine to test.

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Innovations in Turbine Engines

Pratt & Whitney's PurePower Geared Turbofan Engine

By Charles Chandler

A common definition of innovation "is the creation of better or more effective products, processes, services, technologies, or ideas that are accepted by markets, governments, and society." An innovator can be an organization that is first to introduce something better than what exists, which often opens up a new area for others to build on.

Examples of innovative aircraft engines are the R1340 Wasp, the JT-3, the PT-6, and the JT-9. Pratt & Whitney would be considered an innovator of aircraft engine technologies. After 20 plus years of research and development the PurePower PW1000G geared turbofan engine family is operational. It appears that the PW1000G engine is new from the spinner to the tail cone.

According to experts, this engine is a model of innovation and not another of P&W's traditional turbofan engines with a few incremental improvements. AMTs always want to get their hands on a new engine, to look under the cowling and learn more about mounting, servicing, maintenance, and overhaul. The PW1000G is a new engine that has not yet seen continuous airline service.

Innovative design

The fan drive gear system (FDGS) is the fulcrum of the innovative design for the PW1000G. P&W took years and spent about a "billion dollars in research and development" to prefect this geared system. The robust "star gear system leverages the basic laws of physics to improve propulsive efficiency." The reliable gearbox

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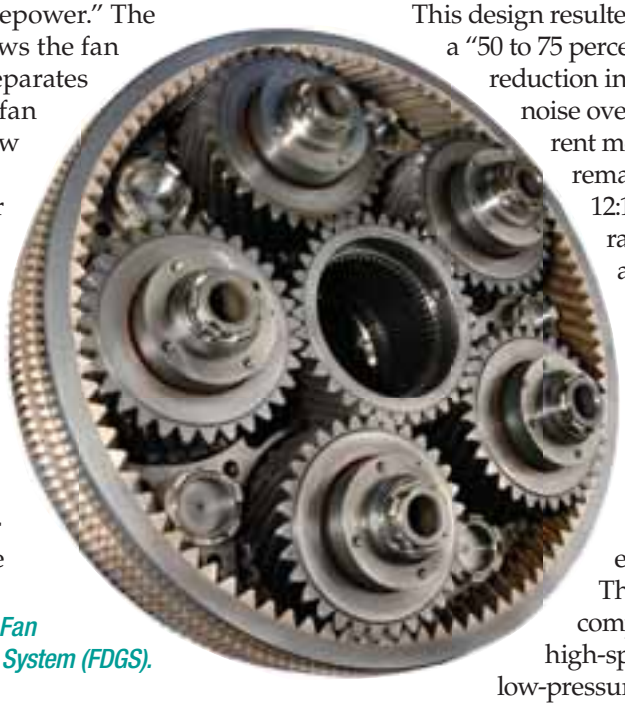
is, lightweight, about "20 inches in diameter, and transmits about 30,000 horsepower." The FDGS follows the fan shaft but separates the engine fan from the low pressure compressor and turbine. The "fan rotates at a slower speed and the low pressure compressor and turbine operates at a higher speed. This allows each engine module to operate for optimum efficiency."



PW1000G Fan Drive Gear System (FDGS).

This engine has significant improvements in aerodynamics, application of lightweight materials and efficiency gains with the high-pressure spool, low-pressure turbine, the combustor, engine controls, and the engine health and maintenance monitoring systems. These improvements are made possible by the step change in the basic engine architecture of the fan drive reduction gear. The engine has a lightweight composite fan case and low-pressure fan that move more than 90 percent of inlet air around the core engine.

This design resulted in a "50 to 75 percent reduction in engine noise over current models, a remarkable 12:1 bypass ratio, and an expected 16 to 20 percent better fuel burn over today's engines." The compact, high-speed low-pressure system runs cooler and accomplishes more work with fewer stages, a design feature that helps reduce the number of airfoils and life-limited parts. "The high bypass ratio and the efficient Talon X combustor help reduce fuel burn and carbon and nitrogen oxide emissions."

Maintenance and overhaul

From the information published about the PW1000G, it appears the P&W engineers have been very considerate of the maintenance community. The interviews suggest that the engine has many features that facilitate maintenance and reduce time and cost while the engine is in overhaul. P&W also offers a "PureSolution Service" maintenance plan customized to the scope and scale of the owners' operation.

The health of the PW1000G engine is monitored by a P&W maintenance team, 24x7 regardless of location. It does this by using "enhanced diagnostics that will enable a considerable increase in the level of data with improved speed and reduced operating costs for the airline." Once the data is in and analyzed, the P&W support team provides the best solutions to address on and off-wing trouble shooting and engine repair or exchange.

Bob Saia, vice president of the Next Generation Product Family, provides an additional level of detail. According to Saia, the PW1000G has the "latest generation FADEC" engine control and typical cockpit controls and operating displays. The engines are "top mounted with a high level of integration between the engine, the nacelle system, and the aircraft. This resulted in fewer parts and easier maintenance. The nacelle system is designed for quick access during line maintenance activity. The bypass ducts and cowl also have separate side openings to minimize overall line maintenance time. The oil filter is mounted on the engine core and the location of the oil servicing port is to be determined by the airframe OEM." Saia indicates

that "there are no special service requirements for the engine and P&W has incorporated advanced diagnostics and health monitoring features in the electronic control which will eliminate several of the traditional engine servicing tasks. The FDGS design had been proven and has demonstrated a high level of reliability."

There are no special maintenance requirements for the FDGS. It has only seven moving parts which are not life-limited. How's that for simplicity. It is "lubricated with engine oil, has no special vibration monitoring requirements, and has a standard compartment chip detector. The inspection requirements for the FDGS are similar to those the accessory gearbox gets during a major engine overhaul shop visit." The accessory gearbox had a complete makeover, a simpler design, containing fewer parts, and a cleaner look. The gearbox is core mounted, its components are modular, share functions, and are located close to the modules they control. The core engine mount reduces the number of wire bundles, tubes, and connectors which facilitates accessibility and reduces the overall maintenance effort.

"This engine does not require any special equipment to transport, mount, overhaul, or test. It is a highly efficient 17-stage modular engine. The modules are: fan, fan case, a three-stage LPC, intermediate case, an eight-stage HPC, diffuser and combustor, a two-stage HPT, mid turbine frame, a three-stage LPT, and TEC. The reduced number of stages means a huge reduction in the number of blades and vanes. The engine is initially disassembled horizontally then depending on the bill of work can be worked horizontal or vertical. There are eight major assembly flanges that facilitate more efficient bills of work and reduce time spent in overhaul. Maintenance and shop manuals will be available online, on CD-ROM or in hardcopy depending on the customer's need."

Customer acceptance and recognition

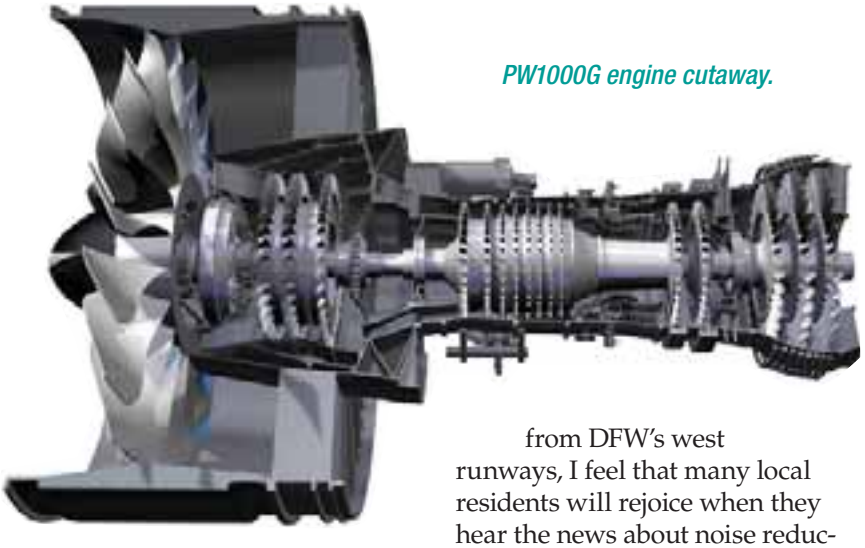
It appears that aircraft operators have readily accepted the innovations that the PW1000G represents. Currently "there are more than 2,000 PurePower engines on order, including options, by customers around the world." The engine has been selected for the Mitsubishi Regional Jet (MRJ), the Bombardier C-Series, and Irkut MC-21 aircraft. Airbus announced it will offer the PW1100G-JM engine as an option for the A320 neo family of aircraft. Once these engines are in opera-

PW1500G mounted on the P&W B747SP flying test bed.

tion the owners and operators must maintain these engines to OEM specifications.

The PW1000G engine was recognized by *Popular Science* magazine with a 2009 "Best of What's New Award," a "2009 Aviation Week Laureate Award for outstanding achievement in Aeronautics and Propulsion," and the "2008 Technology Breakthrough Award from the China Aviation Association and AVIC Science and Technology department." In November, *TIME* magazine named the PW1000G engine as one of "The 50 Best Inventions of 2011," describing it as "the most important development in aviation in 2011."

The PW1000G was also one of the six green inventions honored because test data suggests that it "can cut carbon emissions by more than 3,000 metric tons and NOx exhaust gases 50 percent below CAEP/6 (Committee on Aviation Environmental Protection)." P&W states that the "PW1000G can achieve a 50 to 75 percent reduction in operating noise." After years of living a stone's throw from DFW's west runways, I feel that many local residents will rejoice when they hear the news about noise reduction. For other airports and operators this translates to "efficient aircraft flight paths, extended curfew operation, and quieter crew and passenger cabins." For operators and AMTs this means fewer restrictions on test cell operations and flight line trim runs, and could equate to a savings of about "$1,000,000 per aircraft per year."



PW1000G engine cutaway.

Benefits of innovation

The innovative PW1000G engine addresses "the whole picture —fuel, emissions, noise, and maintenance to give their customers the lowest operating cost with architectural simplicity and low risk." The improvements in fuel economy, lower emissions, and engine noise are substantial and quite timely considering that the beleaguered aviation industry is coming under increasing scrutiny due to global pollution and subsequent environmental changes. These improvements will provide immediate benefits to the environment, engine and aircraft operators, and the general public. To Pratt & Whitney, the innovator — thanks for a job well done. **AMT**

For more information visit www.purepowerengine.com.

Charles Chandler is an AMT field editor and A&P based in Michigan. He received his training from Spartan College of Aeronautics.

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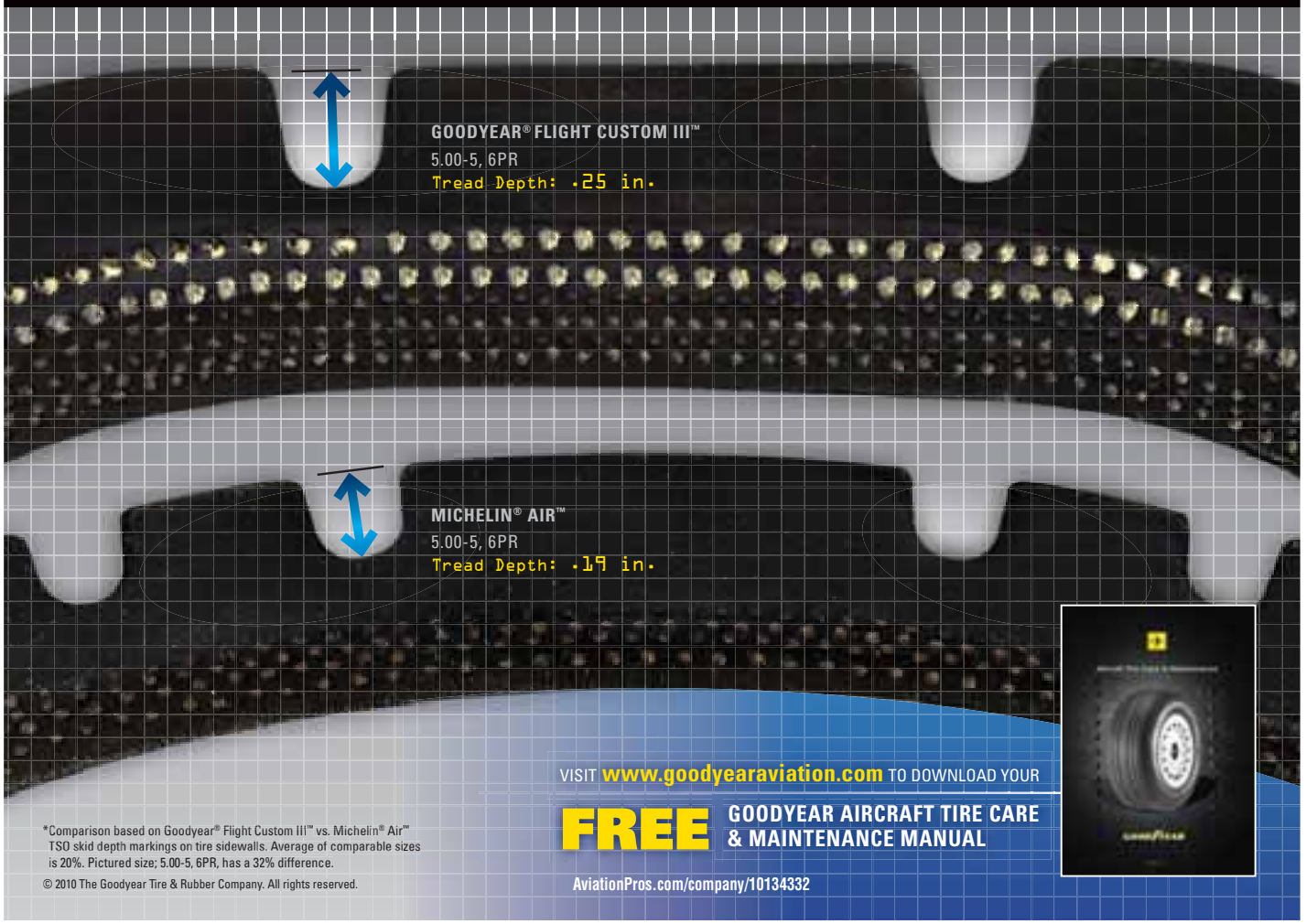

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Dynamic Fluoride Ion Cleaning

DFIC for preparation of turbine engine part brazing

By Del Williams

In the turbine airfoil refurbishment business, brazing cracks in investment cast parts made of expensive alloys is routinely required as hot section jet engine components are damaged due to oxidation, sulphidation, hot corrosion, fatigue, or foreign object damage.

However, proper brazing requires that all oxidation first be thoroughly removed from airfoil component surfaces, cooling passage, and cracks, which can be very narrow and deep.

Oxide scale in airfoil cracks

While a jet engine is in service, oxide scale forms on the mating faces of cracks that occur in the airfoils. These cracks become packed full of scale, all the way to the tips. It is the goal of the service shop to repair the airfoils by filling the cracks with a braze alloy, but braze alloy cannot flow into cracks that are full of oxide scale.

To complicate matters, the alloys used to make turbine airfoils are nickel (Ni) and cobalt (Co) based superalloys that usually contain aluminum (Al) and titanium (Ti) to improve strength. The presence of these elements causes the resulting scale to contain complex spinels that are extremely difficult to remove.

In the turbine airfoil refurbishment business, brazing cracks in investment casting parts made of expensive alloys is routinely required. Proper brazing requires all oxidation first be thoroughly removed.

"At the narrow tip of a crack, scale forms during service. The scale occupies a larger volume than the metal from which it formed. This results in the narrow spaces at the tips of cracks being totally packed with scale," says Donald Bell, chief engineer at P&WC Component Repair, a division of Pratt & Whitney Canada. "You cannot fill the crack with braze alloy if it is already filled with oxide scale."

With the DFIC process, the reaction temperature, fluorine concentration, pressure level, and duration are all independently controlled variables.

Traditionally, fluoride ion cleaning has been performed at atmospheric pressure to remove oxidants from components, but metallurgical studies have shown it only works well when cleaning wide cracks. Plus, it can add extra steps to the oxide cleaning process that result from chromium fluoride or chromium carbide buildup during the process.

More recently, however, an innovative dynamic fluoride ion cleaning (DFIC) process has offered turbine refurbishment professionals the ability to clean deep, narrow cracks of oxides by cycling between negative, atmospheric, and positive pressure for more ideal surface preparation prior to brazing.

Beyond fluoride ion cleaning

The DFIC process, also known as hydrogen fluoride (HF) ion cleaning, results from the reaction of fluorine with various oxides.

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HF gas can be toxic if it escapes into the atmosphere. However, improvements in gas monitoring sensors and digital electronics, resulting from its widespread use in the semiconductor industry, have made it safe and reliable for parts cleaning.

At temperatures greater than 1,750 F (950 C), the fluoride ion reacts with oxides that have formed on the crack faces in turbine airfoils, converting them to gaseous metal fluorides. This allows them to be easily removed. They depart through the off-gas stream of the reactor.

There are significant drawbacks to the early fluoride ion cleaning processes developed in the 1970s, which utilize fluoride compounds in powdered form and perform the work at normal atmospheric pressure. Besides having difficulty penetrating into deep, narrow cracks, the early processes were less flexible and not continuous. They relied on a single charge of powder to produce their HF gas. This often resulted in parts having to be processed through more than one cleaning cycle.

"When compounds are in powdered form, such as chromium-fluoride, aluminum-fluoride, or PTFE, there is a finite amount of reaction that can occur," says Bell. "When they're done, they're done, and if the parts are not yet clean, the cleaning process often has to be repeated."

Flexible and repeatable

Fortunately, the DFIC process has been proven to be more effective, flexible, and repeatable. What separates the DFIC process from first generation fluoride ion cleaning equipment is that the reaction temperature, fluorine concentration, pressure level, and duration are all independently controlled variables.

The sophisticated digital control systems that come with today's equipment can be programmed with hundreds of "recipes" for cleaning specific alloy types, widths of cracks, and levels of scale and oxidation.

During the cleaning process, HF and H_2 gas are introduced into the system through precision metering, so time and gas concentrations can be precisely controlled. For example, a typical cleaning cycle may begin as 94 to 96 percent hydrogen. But within that cycle, it may be changed to a 92:8 or 86:14 H_2 to HF ratio, depending on the substrate material.

Some DFIC systems, such as those available from Hi-Tech

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Furnace Systems, are designed to perform the cleaning process at sub-atmospheric pressures from 100 to 650 Torr (133 to 867 Millibar) while at processing temperature.

By varying the pressure between positive, negative, and atmospheric levels, the DFIC system "pulses" HF in and out of cooling channels, deep cracks, and small holes to more effectively clean oxidized, hard-to-reach areas.

Current users

In recent years, the Lufthansa Technik Turbine repair facility in Shannon, Ireland, added a DFIC furnace from Hi-Tech Furnace Systems. The DFIC furnace is used to prepare hot section engine parts, such as LPT/HPT vane and combustor parts, for brazing.

One of only a few DFIC manufacturers in the world, Hi-Tech Furnace's customers include General Electric, Pratt & Whitney, Snecma Services, Lufthansa Technik, Chromalloy, Goodrich, and others.

"The DFIC works equally well on a variety of alloys, and allows us to cycle between positive and negative pressure to get component surfaces as well as deep cracks and crevices extremely clean," says Philip Kelly, a process engineer at Lufthansa's Technik Turbine Shannon repair facility.

Pratt & Whitney Canada Component Repair's Donald Bell concurs. "We use the DFIC process to modulate atmosphere from low to high to pneumatically push the fluoride ions down into the tips of the cracks and hold them there for a while," explains Bell. "We can cycle back and forth as needed for the best cleaning results."

Bell adds that by performing the process under vacuum, not only is surface oxidation removed, but aluminum and titanium are depleted from the substrate, creating a denuded zone approximately 0.0005 inch deep.

During processing, HF and H2 gas are introduced into the system through precision metering so time and gas concentrations can be precisely controlled.

"This gives us a buffer. During furnace brazing, residual oxygen in the vacuum chamber can re-oxidize a clean part. The denuded zone gives us time to get the braze filler to flow and wick into the cracks before re-oxidation occurs," explains Bell.

Added benefits

As an added benefit, the use of HF at sub-atmospheric pressure often eliminates extra steps in the brazing preparation process.

Cobalt-based alloys, used to make jet engine turbine airfoils, contain a significant amount of chromium. This can react with fluorine during the process to create a chromium fluoride film on the surface of the parts. Chromium fluoride is the most refractory (temperature-resistant) compound of all the metal fluorides. As a result, it does not volatize at the usual temperatures used in FIC.

Without the vacuum capability in the cleaning process, the part must then be moved to a vacuum furnace where the part is subjected to the higher temperature and lower pressure required until the chrome fluoride volatilizes.

However, the resulting fluorides can contaminate the brazing furnace or the vacuum pump, which should be kept very clean and are not designed to handle acidic gases.

According to Bell, at pressures of about 150 Torr absolute, chrome fluoride will remain gaseous, "so we're able to clean without depositing a residue on the joint." If any chrome fluoride is created during the process, the control system can be set to subject the part to the higher temperature and appropriate pressure to remove it.

"With the DFIC equipment, we are able to clean components in one shot, instead of the multiple cleanings typically required with more traditional fluoride ion cleaning," adds Bell.

Another benefit of the dual vacuum process is that it uses significantly less HF, because oxides are volatilized at a lower temp and concentration of HF when performed sub-atmospherically. Using less HF also reduces the risk of inter granular attack (IGA), which could otherwise chemically alter the microstructure of the metal being cleaned. **AMT**

For more info, call (586) 566-0600; Fax (586) 566-9253; email info@hi-techfurnace.com; visit www.hi-techfurnace.com; or write to Hi-Tech Furnace Systems Inc. at 13179 West Star Dr., Shelby Township, MI 48315.

Del Williams is a technical writer based in Torrance, CA. He writes about health, business, technology, and educational issues and has an M.A. in English from C.S.U. Dominguez Hills.

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Finding and Fixing Fuel System Leaks

Finding and fixing leaks calls for excellent systems and good detective work

By Charles Chandler

Leaks, drips, seeps, bubbles, streaks, and stains make AMTs nervous. We all have read the allowable limits for these events and while that is good information, the truth is it usually doesn't matter. These items are an affront to our quality code, our beliefs, and who we are.

To most AMTs a leaking, dripping, bubbling system or a stained and streaked fuselage, pylon, or cowling tells us that something is not quite right with our airplane. These things make us suspicious because we feel they could be indications of something coming that would be unpleasant, expensive, or affect normal aircraft operations or safety.

We worry about them, we think about them when we are away from the job, and sometimes we become obsessive. We check that B-nut one more time, wipe the bottom of that valve again, look on the ramp under the cowling again, or shine our flashlight on the bottom of the wing just to be sure. Often the drip will run and drop far from the source.

Jim Schmidgall is working on an Airbus A330-300, center dry bay fuel leak. He shows the flexibility required in this center wing box, accessed through the main landing gear areas. Photo courtesy of Scott Orloff.

Fuel leaks

Finding and fixing aircraft fuel tank leaks has always been an arduous and time-consuming process, many times best left to a specialists. Generally, the aircraft is pulled from service and parked in a hangar or designated safe area. The general area of the leak is marked; the tank defueled, opened, vented, and allowed to dry. Next the AMT dresses in anti-static clothing, ensures that the tank environment meets safety standards, and enters the tank. The area in question is located, sealant removed, and fasteners replaced if necessary. The worked area is cleaned and prepped for the reseal. The sealant is allowed to dry and openings are closed. The tank is pressurized with shop air and the suspected area is sprayed with a soap solution. AMTs watch for telltale bubbles. If they do appear, the process is repeated and oversized fasteners are installed and or another round of sealant is applied. If no bubbles appear the tank is refueled and put on watch for leaks. If no leaks appear the aircraft can be returned to service. Fixing leaks is a big part of an AMT's professional life. It is also big business.

NAAS and AOG

In 1985 two Dallas, TX, aviation entrepreneurs founded Aircraft On Ground Inc. (AOG) and began servicing the business and corporate market. Recently AOG and North American Aircraft Services (NAAS), both FAA certificated repair stations offering specialized services, partnered in order to better serve their customers in the commercial, MRO, defense, and corporate markets.

Today their headquarters is in San Antonio and they have offices in 25 locations around the U.S., and in the U.K., Panama, Canada, and Spain. Their combined aircraft maintenance service offerings have expanded to include structural repairs and modifications, engineering, NDT, line and heavy maintenance, and training. NAAS and AOG have global repair teams that can be dispatched to all customer work locations. Aircraft fuel system maintenance is one of their core specialties. They are the experts in

NAAS specialist preparing to seal a KC135 wing fuel tank.

aircraft fuel system troubleshooting, fault isolation, and fuel tank repair. NAAS and AOG have a combined staff of more than 300 employees who are very passionate about finding and fixing fuel leaks.

Craig Rose, vice president of operations, has about 20 years with the AOG and provides some of his expertise on the subject. He explains why NAAS and AOG deserve their reputation. According to Rose, their fuel tank specialists are absolute experts at quickly finding the fuel leak path and pinpointing the exact location and root cause of the leak. When asked about their leak-finding process he said that it all begins with good analysis. "The specialists use our Work Order Management System that contains fleet trend modules, electronic wing maps, and repair histories," he says. Next they conduct both positive and negative pressure test to find the leaks.

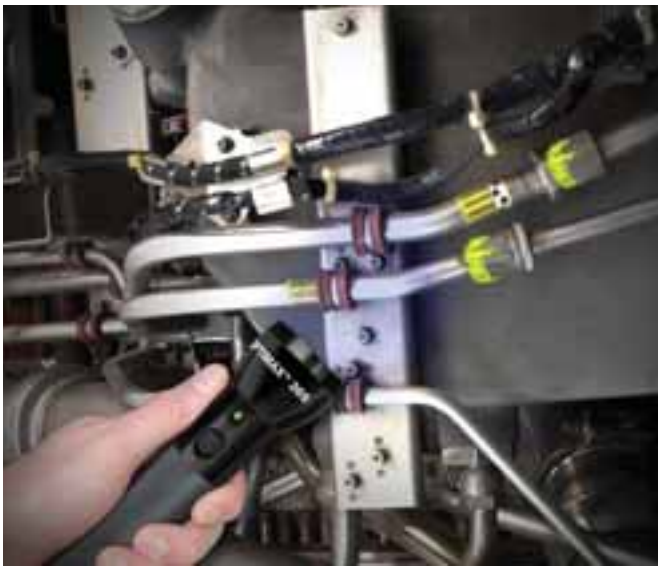
The negative pressure test process requires three specialists — one inside of the tank, another outside to run the pressure test equipment, and one safety attendant. They manage their safety procedures by following the guidelines, notes, warnings, and cautions listed in ATA Chapter 28 of the specific aircraft maintenance manual.

"Before entering the fuel tank our specialists use a gas detector to test the atmospheric conditions to ensure the tank is within the safety limits," Rose says. They also use the required safety clothing, tools, and explosive-proof lights. Once the specialist is inside the fuel tank and in position, a vacuum is pulled on the tank. Rose recommends that "a good place to start troubleshooting is to look for previous repairs that have multiple layers of sealant." In his experience, "integral wing tanks leak most often and common root causes are loose or deteriorating sealant, worn fasteners, and cracks in the wing structure and previous repairs."

I asked Rose to tell me about their fuel tank maintenance specialists. What motivates them to work day in and out in a confined, explosive, toxic environment, chasing, and fixing problematic fuel leaks? "We usually recruit staff with former fuel tank maintenance experience. Some have A&P certificates, others don't, but all attend in-house training programs. AOG has very low turnover and our specialists have the time and opportunities to develop their skills and personal expertise. In my opinion they are motivated to perform fuel tank maintenance because they are experts in their field. They have a lot of pride and respect for their team members because they do what others often cannot."

Spectronics Corporation

Recently another group of leak-finding experts has given aircraft owners and operators and AMTs another product to help pinpoint aircraft fluid leaks. Spectronics Corporation has been a good friend to a variety of maintenance departments for a long time. It invented fluorescent leak detection and has provided us with ultraviolet dyes and inspection lamps for over a half a century. The 200-employee company headquartered in Westbury, NY, manufactures and distributes more than "1,000 different UV, UV/Blue and LED products that are used to find flaws and leaks in a



Aero-Brite universal fluorescent leak detection dye used to locate fuel leaks shows a yellow color for easy identification of leaks.

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Special session on unmanned aircraft systems (UAS), an emerging industry that is moving into the civilian sector of aviation. This session will explain the outlook and projections, focus on the need for trained technicians in the industry, how to get training, and the employment outlook.

FBO/MRO ROUNDTABLE: CHALLENGES FACING MULTI-FACETED SERVICE BUSINESSES

This roundtable will consist of representatives from Fixed Base Operators and Maintenance/Repair/Overhaul organizations from the business and corporate aircraft segment. Topics that will be covered include challenges, lessons learned, and best practices when managing multiple locations/facilities, consistent application of policy, procedures, and quality for the maintenance organization, ramp operations, on safety/SMS, human factors/human error management, including implementing technological advances, and how to compete with other industries for good technical people.

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multitude of mechanical systems."

It produces the Aero-Brite universal fluorescent leak detection dye that can be used to locate leaks in all petroleum- and synthetic-based aviation fluid systems. Aero-Brite is "safe to use in aircraft fuel, hydraulic, and lubricating systems" and "safe to use in turbine and reciprocating engines." Using the Aero-Brite for leak detection is about as easy as it gets. You add a prescribed amount of fluorescent dye to the leaking fluid system and let it circulate.

It can be used under all normal operating conditions and temperatures. When the mixture escapes at the leak site it glows a bright fluorescent yellow-green color when illuminated with a Spectroline high-intensity UV inspection lamp. The Aero-Brite comes in three different quantities and the OPX- 365 VV LED flashlight with a 20-foot inspection range can be used to check for leaks in those hard-to-get-to places.

According to Daniel Cooper, sales account manager at Spectronics Aviation Division, the MAXIMA aviation leak detection kit would be a better solution for specialty shops and crews needing a more robust system. Cooper suggests that "using the fluorescent leak detection products will help decrease the number of aircraft grounded for repair work." As a tip to AMTs using Aero-Brite, the company recommends that "wherever possible, leak sites should be scanned with the UV lamp under low ambient light conditions in order to enhance the fluorescent response of the dye."

Most AMTs that I have worked with have a personal zero-tolerance for leaks, drips, bubbles, streaks, and stains. Finding and fixing leaks calls for excellent systems and structural knowledge, safe tools and equipment, and time to do good detective work. Success usually comes to those AMTs that have patience and persevere. Often the only tactic that works is watchful waiting. Waiting until the loose B-nut, worn rivet, or pinched O-ring finally gives up its secret location. Good hunting. **AMT**

More information can be found by contacting: North American Aircraft Services Inc. at (210) 805-0049 or visiting www.naasinc.com; AOG at (214) 350-5334 or visiting www.aoginc.com; Spectronics Corporation at (800) 274-8888 or visiting www.spectroline.com.

Field Editor Charles Chandler is based in Michigan.

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Technicians with Lufthansa Technik in Hamburg, Germany use welding to repair the combustion chamber outer lining from a PW 4000 Series engine.

All photo courtesy of Lufthansa Technik.

Aircraft Welding & Repair

By Brent Williams

TIG Inverter technology provides advantages to aircraft welders

Aircraft are designed to meet certain standards in terms of flight hours and service life. Each aircraft contains millions of parts and miles of wire and tubing, all housed in a high-strength aluminum frame that undergoes the daily stresses of flight. Maintenance — both routine and unscheduled — is critical throughout the service life of an aircraft, and welding plays a major role in the process.

Welding keeps aircraft in service as a cost-effective method for increasing the service life of many aircraft components. Replacement parts can be extremely expensive and not readily available, with some having lead times of more than a year. Welding helps control the cost of aircraft maintenance and avoid long periods of downtime. The gas tungsten arc welding (GTAW, or TIG) process was developed specifically for aircraft welding.

In the 1970s, welding manufacturers pioneered squarewave TIG welding technology and incorporated it into the transformer-based power sources of the time: large, bulky welding machines that weighed hundreds of pounds and became a permanent fixture in the shop. As welding technologies become more advanced, and the alloys being built into planes become more varied, it may finally be time to investigate new welding power sources that substantially improve the quality, productivity, and efficiency of your work. This article gives an overview of modern TIG welding technology and how it advances aircraft maintenance and repair.

Why TIG welding?

Materials used in aircraft design are anything but ordinary, ranging from stainless steel and aluminum to nickel, magnesium, titanium, cobalt, and niobium. Critical tolerances, dimensional requirements, and metallurgical considerations all combine to create extreme welding challenges and potential mistakes that may result in defects such as cracking, distortion, and irreversible changes in microstructure that mandate the scrapping of parts.

TIG welding is the perfect process for such an application. Pinpoint control of the arc allows for accurate and precise weld placement and superior control over heat input. High current density provides a concentrated arc while an inert atmospheric gas protects the molten weld puddle from oxidation, porosity, and harmful inclusions.

Welding is used in all types of aircraft repair applications, from air-handling ducts to engine parts and components. Typical TIG welding applications in aircraft repair include dimensional restoration (buildup), crack repair, patch welding, and component replacement.

Advances in technology

New TIG welding technologies offer a number of efficiencies: reduced heat input, a narrowed weld bead and heat affected zone, improved directional control, and output ranges and capabilities extended beyond traditional transformer products. Three specific elements achieve these efficiencies: arc starts, pulsed DC output and advanced AC waveshape controls.

Arc starts

Arc starting is the critical first step of every TIG weld. Conventional machines often generate a burst of current during starts that helps initiate the arc but could severely damage the part, especially in very thin applications such as blade and vane repair. Inverters have brought the ability to regulate the output down to a microsecond for the exact amount of starting amperage to light the arc but for such a short duration that any effect to the base material is eliminated. This reduces the need for copper start blocks and allows for direct starting on thin sections while protecting the base metal from burn-through and distortion.

Pulsed TIG welding

DC electrode negative puts most of the welding heat into the puddle, which provides good penetration and helps to keep the tungsten sharp. It's the preferred method for welding such metals as steel, stainless steel, nickel alloys, and titanium. The cone-shaped arc forms off the end of the tungsten. As amperage is increased, so is the diameter of the welding cone. This is somewhat dependent on the diameter of the tungsten and electrode preparation, as the arc is emitted from the electrode at 90 degrees to the grind angle.

High-speed inverter pulsing focuses and constricts the arc for faster travel speeds at reduced amperage levels, which narrows the heat affected zone and lowers heat input, helping to reduce distortion. This results from rapidly switching the current between the peak and background amperage — at frequencies ranging from 100 to 5,000 hz (compared to only 1-20 hz with older, conventional technology). Pulsing at such a high rate doesn't give the arc enough time to fully expand to its maximum width before the current is switched to the background setting.

The results of high frequency pulsing are profound for the heat sensitive alloys and stringent weld requirements in aircraft repair. Reduced amperages control heat input for a better as-welded microstructure with reduced distortion. Added benefits include penetration control, preventing burn-through and reduced cracking. The focused arc allows the operator to more accurately place the weld, control bead width and heat affected zone, reducing the chance for the most common causes of weld rejection.

TIG welding is perfect for aerospace applications. Pinpoint control of the arc allows for accurate and precise weld placement and superior control over heat.

Alternating current and advanced waveforms

AC is commonly used for welding aluminum and magnesium components. As with DC, the width of the arc is determined by welding amperage, tungsten diameter, and electrode preparation. Aluminum and magnesium are challenging to weld. While AC provides some key benefits for these materials, it's not without issues.

As we look at aluminum, it's important to note that formation of a high-melting surface oxide is a trait that separates this material from other alloys. All metals form oxides, but in most cases they melt at a lower temperature than the base material. This is not true for aluminum, as the invisible surface oxides melt at approximately three times the temperature of the base metal. Therefore, the oxides must be removed for welding.

AC balance control describes the ability to adjust the ratio of time spent in electrode negative (EN) compared to electrode positive (EP) in the cycle. Inverters allow much higher EN settings (up to 99 percent) compared to conventional maximums of approximately 70 percent. The balance can be adjusted to provide adequate arc cleaning without the severe balling action produced by excessive EP time in the cycle. This reduction in balling action reduces arc wander, pulls

in the etching zone and directs more heat into the work for faster welding speeds. In addition, sharpened alloy tungsten electrodes can be used for welding aluminum and magnesium to provide better arc starts and control.

The effects of AC balance are illustrated by the extremes of EN percentage in the AC wave. Very little EN results in greater cleaning action, shallow penetration (a benefit on thinner materials), and severe electrode balling because most of the heat is directed up, onto the tungsten. At the other end of the spectrum, a high amount of EN places most of the heat into the work. Cleaning is minimized along with the balling action of the electrode. This extended balance range allows the arc to be fine-tuned according to base metal conditions in each application. It achieves greater penetration, faster travel speeds, narrows the weld bead, extends tungsten life, produces a smaller etched zone, and permits the use of a smaller diameter tungsten to more precisely direct the heat into the joint.

AC frequency control is a newer adjustment made possible by inverter technology. Older TIG technology is typically locked in at the line frequency: 60 hz in North America and 50 hz in other locations around the globe. New inverter technology gives operators the ability to dial that in between 20 hz and 400 hz. Current alternating at 60 hz produces a relatively wide, lazy arc that lacks directional control. This can be seen in a typical T-joint application where the arc wanders between the toes of the weld and lacks the focus to drive into the corner.

The ability to increase the AC frequency has a dramatic effect on the arc characteristics as well as the weld bead. Higher frequencies of alternation limit the time that the arc expands on each half-cycle. This creates a narrow, focused arc that has significantly better directional control, helping the arc to reach the throat area of a weld and ensuring adequate penetration. Arc wander is virtually eliminated, which saves important features in aircraft components that may otherwise be affected. The improved directional control of higher AC frequencies is also very helpful when welding sections of dissimilar thickness.

The synthetic AC output of the inverter allows the operator to further control the bead profile and effects of the arc by setting the EN and EP amperage independently. This independent AC amperage control enhances the effect of AC balance control and can be used to fine tune arc etching and reduce

the tungsten size required for some applications. While the base metal may require a certain amount of time in EP for adequate cleaning, it may not require the full amperage of the output settings.

AC waveshaping options found in modern inverters further optimize arc characteristics. Depending on the waveform selected — advanced squarewave, soft squarewave, sine wave, and triangular wave — users can tailor the arc for such characteristics as a hard, driving arc, a smooth, soft arc with good puddle control and wetting action, or a punch of peak amperage with minimized overall heat input to reduce distortion.

Summary

New inverter technology has elevated its capabilities to give aircraft welders more control over the entire welding process.

TIG welding is particularly effective on thin materials commonly found in ducting and other air-handling applications.

Precise arc starts and refined arc controls contribute to weld quality and help to reduce weld costs and eliminate scrap. In addition, inverter power source designs are smaller and lighter weight — so they take up less space in the work cell and are easier to move around. They also account for a much more efficient power draw than older systems. As quality requirements and standards become more stringent in the interest of safety and reliability, TIG inverters present a compelling case for those who perform aircraft welding and repair. **AMT**

Brent Williams is a product manager with Miller Electric Mfg. Co. For more information visit www.MillerWelds.com.

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Next Generation

Data-based communications is the future for aircraft and maintenance technicians

By Jim Sparks

We in aviation technical fields are used to change and do diligence to anticipate the impact they may have on our profession. By many accounts our ranks are dwindling and the intrigue with aviation as a career has waned. The good news: today's aircraft are state of the art when it comes to electronics and most young people today don't understand life without electronic stimulation.

Today's avionics includes high definition video systems, rock 'n digital audio systems, XM Entertainment and broadband connectivity and that doesn't even touch on "fly by wire" or "automatic thrust control."

Maintenance interaction with digital aircraft systems includes monitoring and diagnosing problems when an aircraft is in flight.

Maintenance interaction with digital aircraft systems includes mastering many skills associated with a PC and is now no longer limited to connecting a cable when the aircraft is on the ground. Yes, it is possible to monitor and even diagnose problems when an aircraft is in flight. Even documentation has evolved from paper to electronic media.

Next Generation in this case does not specifically address passing the wrench to those maintaining aircraft in future years. It does deal with the way we control air traffic.

In the United States, the air traffic control (ATC) network has been in play without significant change since the end of World War II. The plan for the future includes more of an air traffic management concept utilizing airborne rather than ground-based equipment.

NextGen will open skies to continued growth and increased safety while reducing aviation's environmental impact. These goals will be accomplished through the enhancement of widely used technologies, such as the global positioning system (GPS) and innovations in weather forecasting, data networking, and digital communications. New airport infrastructure and procedures will be coupled with certain decision-making responsibility from the ground to the cockpit.

NextGen will allow more aircraft to safely fly closer together on more direct routes, reducing delays, and providing benefits for the environment and the economy through reductions in fuel consumption and noise. The NextGen Nucleus consists of both systems and procedural transformations including:

ADS-B and more

Automatic Dependent Surveillance-Broadcast (ADS-B) is FAA's satellite-based successor to radar. ADS-B makes use of GPS technology to determine and share precise aircraft location information, and streams additional flight information to the cockpits of properly equipped aircraft.

Transitioning from a terrestrial based air traffic control system to a celestial concept is a significant undertaking. Transponders as we know them will be true digital communications devices.

ADS-B, which consists of two different services ADS–B Out and ADS–B In, will be replacing radar as the primary surveillance method for controlling aircraft worldwide. In the United States, ADS-B is an integral component of the NextGen National Airspace strategy for upgrading/enhancing aviation infrastructure and operations. The ADS-B system will provide traffic and government generated graphical weather information through Flight Information Service - Broadcast (FIS-B), Traffic Information Service - Broadcast (TIS-B) applications. ADS-B enhances safety by making an aircraft visible, real time, to ATC and to other appropriately equipped ADS-B aircraft with position and velocity data transmitted every second. ADS-B data can be recorded and downloaded for post flight analysis. ADS-B also provides the data infrastructure for inexpensive flight tracking, planning, and dispatch.

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The system relies on two avionics components — a high-integrity GPS navigation source and a datalink (ADS-B unit). There are several types of certified ADS-B data links, but the most common ones operate at 1,090 MHz, essentially a modified Mode S transponder, or at 978 MHz (USA only). The FAA would like to see aircraft that operate below 18,000 feet use the 978 MHz link since this will help alleviate further congestion of the 1,090 MHz frequency. To obtain ADS-B capability at 1,090 MHz, requires a new transponder or modified device (if the manufacturer offers an ADS-B upgrade). A certified GPS will also be required.

NextGen Network Enabled Weather (NNEW) is part of an interagency effort to provide users of the National Airspace System with quick, easy and cost-effective access to timely, accurate weather information. Through the sharing of common weather data, NNEW will enhance safety and support collaborative decision making.

Systemwide Information Management (SWIM) is the network structure that will carry NextGen digital information. SWIM will enable cost-effective, real-time data exchange and sharing among users of the National Airspace System.

Collaborative Air Traffic Management Technologies (CATMT) is a NextGen transformational program that provides enhancements to the existing traffic flow management system (TFMS).

National Airspace System Voice System (NVS) will supplant FAA's aging analog voice communication system with state-of-the-art digital technology. NVS will standardize the voice communication infrastructure among FAA facilities, and provide greater flexibility to the air traffic control system.

Atlantic Interoperability Initiative to Reduce Emissions (AIRE) is a cooperative agreement between the United States and the European Commission to promote and harmonize environmental initiatives and procedures in European and North American airspace.

DataComm Data Communications will enable controllers to send digital instructions and clearances to pilots.

The term universal access transceiver (UAT) refers to a data link intended to serve the majority of the general aviation community and is approved for use in all airspace except class A (above 18,000 feet MSL). UAT is intended to support not only ADS-B, but also Flight Information Service - Broadcast (FIS-B), Traffic Information Service - Broadcast (TIS-B), and in the future is capable of communicating supplemental range and position information. UAT will allow aircraft equipped with "out" broadcast capabilities to be seen by any other aircraft using ADS-B "in" technology as well as by FAA ground stations. Aircraft that are equipped with ADS-B "in" technology will be able to see detailed altitude and vector information from other ADS-B "out" equipped aircraft as well as FIS-B and TIS-B broadcasts. The FIS-B broadcast will allow receiving aircraft to see weather and flight service information including AIRMETs, SIGMETs, METARs, SPECI, National NEXRAD, Regional NEXRAD, D-NOTAMs and PIREPs, Special Use Airspace Status, Terminal Area Forecasts, Amended TAFs, Winds and Temperature Aloft.

The FIS-B broadcast will allow receiving aircraft to see weather and flight service information.

These broadcasts serve to provide early adopters of the technology with benefits for more pilots to use the technology before the required 2020 date. Aircraft receiving traffic information through the TIS-B service will see other aircraft in a manner that is similar to how all aircraft will be seen after they have been equipped by 2020. The availability of a non-subscription weather information service, FIS-B, provides general aviation users with a useful alternative to other monthly or annual fee-based services.

The UAT system is specifically designed for ADS-B operation and is the first link to be certified for "radar-like" ATC services in the U.S. Since activated in 2001, it has been providing 5 nm en-route separation in Alaska and is the only ADS-B link standard that is truly bi-directional. Users have access to ground-based aeronautical data and can receive information from local traffic through a service providing reports for enhanced surveillance transponder equipped aircraft and non-ADS-B equipped radar traffic. This is planned to allow users to observe each other directly with high accuracy and minimal delay.

A big part of the good news for aviation maintenance will be the review and revision of need to know information to become a licensed technician able to maintain future aircraft. NextGen will also serve as a spring board to launch us into regulations more in tune with the digital world. **AMT**

Jim Sparks has been in aviation for 30-plus years and is a licensed A&P. He is the manager of aviation maintenance for a private company with a fleet including light single engine aircraft, helicopters, and several types of business jets. He can be reached at sparks-jim@sbcglobal.net.

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For more information about Greenwich AeroGroup and its companies, visit greenwichaerogroup.com

MRO Mechanics

Making the labor shortage pay for you

By John Goglia

It's no secret that aviation mechanics are in short supply and that the shortage is growing. The growing shortage is due to a confluence of factors: retirement of senior mechanics, fewer A&P students in the pipeline, and the airline layoffs of the last decade.

Many mechanics laid off from the airlines have found other work — some for better pay, some for better hours and some for both; but for whatever reason, they aren't returning to the aviation maintenance work force.

This presents opportunities for better pay for MRO mechanics that are traditionally paid less than their brothers and sisters at the airlines, especially the majors. Usually the economics of supply and demand mean that a commodity — whether a product or a service — that is in short supply will command a premium. For some reason, that has not always been true for mechanics, especially MRO mechanics.

Properly assess your level of skills and abilities against what the market values and needs. Mechanics with avionics and electronics knowledge are particularly desirable.

So, how does a mechanic go about getting paid what he or she should be worth in the current labor market? Here are my top five suggestions:

1. Know the aviation maintenance market.

Find out what airlines — both 121 and 135 operators (passenger and cargo) — and other aviation maintenance providers in your area are paying mechanics with your knowledge, skills, and abilities. Find out what particular skills and abilities are valued by these maintenance providers.

2. Assess your own knowledge, skills, and abilities.

It is important to properly assess your level of skills and abilities against what the market values and needs. You may be very skilled in a particular area but if it's not a skill that's needed in the marketplace, it will not help you augment your salary. (For example, I knew a mechanic who spent many years working in a seat shop. He was a whiz at his job — which is an important job; but it was not until he was laid off that he found out, to his chagrin, that there was no market for his skills.)

3. Add to your digital knowledge.

There's no question that mechanics with knowledge of avionics and electronics are particularly desirable. Adding these skill sets is a way to enhance your current pay, and could help you retain a job if a new round of layoffs hits your shop. (Mechanics I know with these skills who got laid off, did not stay laid off for long, as they were snapped up by other companies.)

4. Market yourself.

Most mechanics I know do a lousy job of selling themselves. But that's what you need to do to get noticed — and have your pay reflect your worth to the company. So make the time to meet with your boss and discuss opportunities for advancement. Of course, listen to feedback from the boss — maybe his/her assessment of your skills is different than yours. And always stay positive, no matter what the boss says!

5. If all else fails, look elsewhere.

If you can't get the pay you believe you deserve where you're working today, you may have to look elsewhere. Sometimes that requires relocating to a different city or even a different part of the country. These aren't easy decisions for people with families — I know I relocated a number of times in my career — but it may be what you need to do to get ahead.

The labor shortages are not good news for the aviation industry; but they could be good news for the individual mechanic. AMT

John Goglia has 40+ years experience in the aviation industry. He was the first NTSB board member to hold an FAA aircraft mechanic's certificate. He can be reached at gogliaj@yahoo.com.

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IA Renewal 101

The revised latest directive with broad definition of actively engaged

By Stephen P. Prentice

It took awhile, but the FAA finally expanded on its ill-fated initial attempt at "clarifying" the definition and understanding of the term *actively engaged*, as used in regard to new and renewal inspection authorization in FAR 65. Here we summarize and comment on this latest policy statement.

The problem

Initially, in the opinion of many in the aviation maintenance field, this so-called problem did not even have to be addressed. Some in the FAA however felt they had to add further complexity to an already simple process that has been going on for more than 40 years now. You would think that there are many other important issues that the bureaucrats (as FAA's Bill O'Brien called them) could spend their time with rather than this one. They said that the issue of actively engaged has caused confusion among ASIs and aircraft maintenance personnel and its definition has varied over time. Most in the business have never heard of any confusion at all … those of us in general aviation certainly haven't. The confusion issue appears to have been raised simply to address the subject directly for some unexplained other reason.

This alleged *confusion* developed simply because the renewal section includes an additional requirement to renew, other than the five clear ways cited in the part 65.93 regulation, any one of which for years has been the only one required to renew. They said that the renewal applicant must *also* comply with the additional requirements of the *new applicant*.

The language does not seem to recognize that the holder of the inspection authorization already had complied with these requirements when he applied initially for the authority. It seems redundant to many to require a renewal applicant to comply again and again with the initial requirement *actively engaged* when he has been performing or participating in aircraft maintenance using this authority in most cases for many years.

Of course, it does seem logical to include this in the *initial* application requirements, but that should be the end of it. Nonetheless, FAA felt compelled, at this late date, to attempt to further define actively engaged and to spell out in detail who can be considered actively engaged. The initial attempt failed completely to include hundreds of people who held the authorization and caused a flood of almost a thousand comments and objections to the proposal as then published in the *Federal Register* November 2010.

Policy, not regulatory change

We have to keep in mind that the FAA says this is not a *regulatory* change. It is simply a *policy* change and technically needs no publication and opportunity to be commented on. However, the fact that FAA felt it was required to publish and solicit comments on the proposal suggests clearly that it expected a loud objection to the change and the reasoning behind it. Some even commented that this was an attempt at regulatory change by the back door … FAA stated it was not.

However, problems can develop when administrative agencies attempt to not only create laws but interpret them as well. Supreme Court Justice Scalia said in a recent case that *"… though the adoption of a rule is an exercise of the executive rather than the legislative power, a properly adopted rule has fully the effect of law. It seems contrary to fundamental principles of separation of powers to permit the person who promulgates a law to interpret it as well …"* Talk America vs. Michigan Bell, 564 US__(2011). Although it was not the case here, Justice Scalia clearly states his general dislike with agencies attempting to create their own laws and also to interpret them any way they want. This type of analysis was a point of contention with some people who were vocal about the changes proposed.

Generally, maintenance people felt the regulation was already specific enough in requiring that … an individual must be actively engaged, for at least the previous two-year

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period, in maintaining aircraft, to be eligible to either obtain or renew an IA. The FAA felt that there was a need to further define and expand on just what actively engaged meant and who and what was done by the individual to comply.

The change

After discussing and listening to the hundreds of people directly concerned, the FAA published the most recent revised directive (*Federal Register* August 2011) which thankfully took into consideration most of the commentators' objections. FAA now says OK lets include many more people in the actively engaged definition … it is now much larger, as it said in the directive a *broad definition,* which seems to satisfy most of the concerns raised by the commentators. It would appear at this time that anyone presently holding an inspection authorization, must of necessity, be renewed because of this new *broad* definition, unless they died, or were seriously incapacitated.

There were other changes to the directive. One is the change to the seemingly automatic granting of inspection authority and renewal to FAA's maintenance inspector employees under the initial directive. In the first proposal it had "carved out" a specific exception for its own inspectors who would be granted automatic authority. This of course meant FAA employees could work on and annual their own aircraft only, since they are prevented from doing any "commercial maintenance" activity for *ethical* reasons (more likely government liability reasons). Therefore, working on their own aircraft was then the only real reason for the ASI to have inspection authority.

In the revised directive the "carved out" exception was removed because it was not necessary … most if not all ASIs would be actively engaged under the new *broad* policy as would any applicant, because of their inspectors job description. Of course, at the same time, by removing the *carved out* exception the FAA also removed any suggestion of special treatment for its employees, which could have had some specific legal problems down the road.

Examples of those included

The new policy directive continues and describes a listing of individuals who would be afforded renewal privileges and includes, but is clearly not limited only to such people as:

- individual IAs, like ASIs, engaged in their own personal aircraft inspection and maintenance
- retired mechanics providing occasional or relief IA and maintenance services
- individuals providing maintenance service in rural areas not serviced regularly by many IAs
- individuals providing specialized maintenance and IA services (fabric, composites, etc.)
- those who do part-time or occasional maintenance and IA work to inspect vintage or rare aircraft
- aviation instructors at Part 147 schools, public and private (they weren't included in initially)
- anyone directly related to airworthiness, i.e. technical representatives, instructors at seminars related to IA renewal and airworthiness, maintenance coordinators, (all on full-time, part-time, or occasional basis).

It seems clear that the policy is to include as many people as possible who have something to contribute to aviation safety, and or otherwise possessed of the requisite experience in the maintenance of aircraft.

There will be other questions that come up due to the great number of variations in the way people work. As the FAA said in its policy statement … *"It is problematic to list every situation that could be considered actively engaged and that approach may exclude situations where an ASI would determine meets the regulatory requirements. Additionally, as indicated in the proposed policy, the FAA values the* substantive nature of experience rather than a strict quantity formula."

Appeal available

In the remote event an individual feels that he or she has been unfairly denied either an initial or renewal IA authority because of arbitrary, capricious, or discriminatory action by the FAA, he or she has the opportunity to *appeal* such denial.

Although the issuance of IA authority is not certificate action and therefore has no formal appeal procedure, the individual can still raise his voice and seek redress through a form of an appeal to the *Aviation Safety Consistency and Standardization Initiative Office (CSI)* thru the AVS (Aviation Safety) office concerned. This procedure requires the review of any questioned or disputed action at *every* level of the AVS management chain. This is no more or less than a summary administrative review by the same people who are in the management chain, but it can bring serious attention to the individual problems with the bureaucrats.

This review by higher levels of FAA management, will be complete and thorough, without fear of any retribution. Keep in mind that this process can be used for *any* review you might have with any FAA action of any kind. This program was instituted Sept. 18, 2009 and through the process, sooner or later complaints should get the personal attention of the Administrator and his staff. **AMT**

Stephen P. Prentice is an attorney whose practice involves FAA-NTSB issues. He has an Airframe and Powerplant certificate and is an ATP rated pilot. He is a USAF veteran. Send comments to aerolaw@att.net.

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State of *AMTSociety* Address

The address this month will center on activities scheduled for *AMTSociety*, the biggest being the Cygnus Aviation Exposition on March 7-9 in Las Vegas. At this time we have 30 teams committed to the Maintenance Skills Competition with 15 events, which also includes the "bragging rights."

We also will make the presentations of the Scholarship Awards and *AMTSociety* Tom Hendershot Lifetime Achievement Award, plus the drawing of the Snap-on toolbox and tools for the scholarship raffle program.

The IA program will be held in the theater on Wednesday and Thursday, 8 to noon each day. There will also be presentations from NCATT and Operation Boot Strap. Come Friday morning at 10, the awards will be presented to the contestants in the Maintenance Skills Competition. A great time, sure hope you can attend.

Do you know your limitations?

Individuals often fail to realize that maintenance processes safety chains are made of complex tasks that are implemented and maintained by people. These people have different aptitudes, abilities, and training, and will operate under various conditions, organizational structures, procedures, and work scenarios.

The total composite of these elements, including the human component will determine the performance, safety, and efficiency of an organization. Safety chains are such that they ensure human capabilities are not stretched beyond limits. All aviation professionals should realize the important part they play in the safety chain.

— *Stay safe, Tom Hendershot*

2012 AMTSociety scholarship winners

AMTSociety is delighted to announce the winners of its 2012 scholarship programs. *AMTSociety* Scholarships were created to financially assist students in an approved AMT program, active duty military, reserve, and National Guard personnel, and those already certified in furthering their professional education and training. Academic and training scholarships are an integral part of *AMTSociety's* purpose and one way *AMTSociety* is committed to promoting future aircraft maintenance technicians in the highly skilled aircraft maintenance profession.

Each academic scholarship is valued at $1,500. The U.S. Military Scholarship is offered in conjunction with Baker's School of Aeronautics in Nashville, TN. This scholarship includes tuition for Baker's two-week A&P Mechanics Course, fees for oral and practical testing, hotel (11-13 days), and a $100 gift card from Kroger's.

Joe Hawkins, *AMTSociety* Director and Scholarship Chair, introduces the 2012 winners:

Charles E. Taylor Scholarship: *Jennifer K. Lawson, Tulsa Technology Center.* Lawson is a U.S. Army veteran with family ties to aerospace. Her grandfather worked in the Space Shuttle program at Rockwell International while her uncle retired from McDonnell Douglas. She grew up helping in the office of her family's aircraft rental business where she also learned to fly a Piper Cub. She volunteers each summer as a ramp rat at EAA AirVenture

and she plans to continue her studies in avionics and advanced composites after she completes her Airframe and Powerplant program.

Thomas "Tom" E. Hendershot Scholarship: *Chris A. Wilson, Aviation Institute of Maintenance.* Wilson is enrolled at the Aviation Institute of Maintenance in Kansas City campus pursuing his Airframe and Powerplant certificates. Outside of class, he is a ramp agent for Delta Airlines and he thoroughly enjoys everything about airplanes. Wilson has a sincere commitment to his studies which is indicative of his excellent GPA. His father is a senior AMT for an international corporation and Wilson plans to follow in his father's career path after graduation.

William "Bill" F. O'Brien Scholarship: *Webster L. Burch, Middle Tennessee State University (MTSU).* In addition to pursuing FAA certification as an Airframe and Powerplant maintenance technician, Burch is also working toward a Bachelor of Science degree in aerospace maintenance management. He is involved with church and community activities and a student worker in the MTSU Flight School Maintenance Department. Burch is active in the MTSU Aerospace Maintenance Club and along with other members, volunteers at Sun N' Fly each spring.

U.S. Military Scholarship: *Petty Officer First Class Thomas J. King, United States Coast Guard.* Petty Officer King is an aviation maintenance instructor at the Coast Guard Technician Training Center in Elizabeth City, NC. King earned a Bachelor of Science in Professional Aeronautics and is pursuing a Master's degree in Aerospace Management. He has more than 2,000 hours as HU-25 Guardian Dropmaster, instructor, and maintenance technician. As a flight crewmember, Petty Officer King is directly credited with saving 11 lives. King plans to continue his military service and advance into the Coast Guard Warrant Officer ranks.

AMFA Scholarship: *Brian W. Gallagher, Crimson Technical College, Inglewood, CA.* Aviation has always been Gallagher's first passion. He was introduced to airplanes in the second grade. A friend had built a balsa wood glider and they took it out for its maiden flight. From then on he was obsessed with aircraft. As a young teen he joined the Civil Air Patrol and earned the rank of First Lieutenant. He was Cadet Squadron Commander and attended several encampments at Air Force bases all over the country. After graduating from high school, he enlisted in the U.S. Army and was a UH-1H (HUEY) crew chief and mechanic. He obtained his private pilot license in 1990. He is married with two teenage children. He has completed one-third of the courses and holds a 4.0 grade point average. He is a two-time President's Award (100 percent grade, 100 percent attendance) and four-time AAA (Attitude, Academics, Attendance) Award recipient.

Need an IA?

FindanIA.com Inc., a global dot com company, just launched www.FindanIA.com. This is a global web site dedicated to helping aircraft owners, aircraft maintenance facilities, and technicians find FAA certified airframe and powerplant maintenance technicians with Inspection Authorizations (commonly known as "IA") anywhere around the world.

Mark Collins, who is a co-founder of FindanIA.com Inc., also serves on *AMTSociety*'s board of directors. He says, "One of our prime objectives is to work with the ever expanding Asian market, where there is an explosion of growth of FAA approved MROs." See more of the story on www.AMTSociety.org.

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With dozens of manufacturing facilities and distribution centers around the country, Kroger also has one of the largest privately owned truck fleets in the country. Trucks moving merchandise and supplies among its stores, warehouses, and manufacturing plants log more than 100 million miles annually.

The business principles that made the first Kroger store successful in 1883 – service, selection, and value – continue to guide the company's operations today. From one tiny grocery store in Cincinnati more than a century ago, Barney Kroger laid the foundation for what today ranks as one of the largest companies in America.

The Kroger Co. Aviation Department started in 1952 with a Lockheed Lodestar and within a year moved up to the venerable DC3. The Aviation Department now operates out of three cities and has a fleet of five aircraft that include the Bombardier Lear 35, Falcon 50, and Gulfstream Astra aircraft. **AMT**

Gary S. Goodpaster accepted the plaque from AMTSociety; he is standing in front of the left wing of one of The Kroger Company's Falcon 50's.

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Snap-on

Eight Ways to Improve Communication

Electronic communication has diminished the ability to effectively convey a message and gain feedback

By Timothy Bednarz

Every leader has room for improvement in the way they communicate with both their superiors and employees. The fast-paced workplace environment and immediate but impersonal nature of electronic communication has diminished many leaders' ability to effectively convey their message, gain valuable feedback, and lead their organization. Surveys often show employees are concerned with the quality of communications in the workplace. Many feel companies give lip service and are not sincere in the messages they communicate. Others feel the only way information is imparted is through memos on bulletin boards. Still others feel instructions or policies are vague and difficult to interpret and follow. This is important to recognize because ineffective communication begets

Rather than rely on electronic media, leaders should rely on personal exchanges and stress face-to-face meetings.

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poor cooperation and internal coordination, decreased productivity, and increased tension, absenteeism, and turnover. Voids in communication are then filled with extremely damaging gossip and rumors. These repercussions seriously undermine a leader's efforts to facilitate change within their organization, a crucial ability in today's business climate. The following is a list of proven concepts and techniques leaders can use to improve communications with both superiors and employees.

1. It's a two-way process

Leaders should understand that communication does not end when they are finished delivering their message. Whether with superiors or employees, it is a two-way process that involves both giving information and receiving feedback. It is an ongoing exchange as questions are answered, additional information is given, and further feedback and input solicited.

2. Emphasize personal communications

The convenience of voice and email has made impersonal communications a reality for many leaders. Rather than rely on these electronic media as well as bulletin boards, memos, and other like methods of communication, leaders should rely on personal exchanges and stress face-to-face meetings where possible. This helps eliminate miscommunication as leaders can readily interpret nonverbal facial expressions and body language.

3. Be specific

Vague statements or instructions cause most miscommunication by failing to clearly and concisely direct or inform employees/superiors. Since vagueness is open to a variety of interpretations, confusion quickly sets in. Every time a leader conveys a message or gives an instruction, they must ask if what they are communicating is clear, concise, and specific. If not, they must restructure the communication so that it is.

4. Information is … a service

"Information is power" is a widely used phrase. The problem is, instead of sharing information, many managers and leaders hoard it as a method of wielding power over others. Leaders should view the delivery and availability of information as a service to both their superiors and employees that enables them to be more productive and make

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better-informed decisions. It is in this service sense that information should be considered powerful.

5. Show respect

Effective and open communication demands that all parties respect one another. This means that leaders, superiors, and employees demonstrate respect for what each other has to say. They ask questions to show interest and further clarify key points. When this is done, all will feel an important part of a team and tend to be both more dedicated and productive.

6. An open-door policy

Leaders don't give lip service to an open-door policy, they practice it. They take the time to be among and interact with their employees. They keep their finger on the pulse of the organization by openly discussing needs and problems and allowing employees to disagree and contribute new ideas and insights. This practice demonstrates a sincere concern for employees — and builds an endearing sense of loyalty. The impact it can have on a leader's organization cannot be overemphasized. Actively and continually showing care and concern dramatically increases productivity and personal dedication.

7. One-on-one meetings

Where possible leaders should have one-on-one meetings with their employees to develop insight and ideas regarding how to increase productivity within the organizational unit. Discussions should focus on ways leaders and employees can help one another be more productive.

8. Build credibility

Without personal credibility, no matter how hard a leader tries he or she will fail to communicate. Unless leaders create a climate of credibility, they will not be trusted or believed by their employees. This destroys any ability or image of leadership. True leaders deliver on their promises and do what they say they will do. **AMT**

If you would like to learn more about effective communication methods and techniques, refer to Improving Communication in the Workplace: Pinpoint Leadership Skill Development Training Series. It is ideal as an informal training tool for coaching or personal development. For more information visit www.majoriumbusinesspress.com.

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How to Verify Control Cable Routing

Conceptually simple; in practice, considerably harder

By Clint Lowe

You look at the work order and sigh … change aileron control cables. You envision eye strain and poked fingers, reaching into nearly impossible places, past wiring and through inspection holes.

"Oh, just get it over with," you think. You've done it before and know the tricks of the trade. You look at the cable end points, check the routing, and determine what you'll need to do to pull the new cable through using the old cable. Conceptually simple; in practice, considerably harder. Especially with longer runs through several pulleys and long stretches of wingspan.

Cable as it should pass through the hole.
Photo by Clint Lowe.

Miss-routed cable inside in the center of the column assembly. Control movement caused it to cut into the magnesium casting.
Photo by Clint Lowe.

The technical data and maintenance manuals aren't a lot of help. They seem to almost always say, "Cable Replacement: Change cable." Sometimes they'll do a little more than that and sometimes they say nothing at all. In some table of the flight control chapter or at the back of the book, you'll find cable tension data. You'll likely find cable inspection criteria and maybe a word or two on rigging. But cable changes are so "obvious" they don't really seem to matter to the OEM.

Check routing before proceeding

This isn't meant to be a lengthy discussion on cable changes. It is a warning against being lackadaisical about cable changes … especially in hidden areas where it's hard to verify the routing. In being lackadaisical, a person assumes everything went well without the verification step.

An excellent example appeared lately on one of our Lear 35s. The aileron interconnect cable, between the pilot and co-pilot control wheels, was due a time change and the mechanic detached the old cable at one end and attached it to the new cable for the pull from one side to the other. About halfway through the exercise, the cables became jammed. They would pull backwards and forwards until the joint between the two reached about halfway.

A closeup of how cable movement can create damage by rubbing by not being in alignment.
Photo by Clint Lowe.

Using a flexible borescope, the mechanic followed the

cable routing between the two control columns and learned two things. 1) He figured out what was causing the problem and 2) he learned there is an almost-impossible-to-see-without-a-borescope pass-through hole drilled in a web within the control column assembly frame.

This should adequately illustrate the importance of checking the cable routing during control cable changes. Subsequent inspections have been conducted on a number of Lears and this condition was found in about 25 percent of those inspected. AMT

INDUSTRY NEWS

TAP Maintenance & Engineering Brazil receives 777 landing gear contract from Boeing

TAP Maintenance & Engineering Brazil (TAP M&E Brazil) is expanding its already extensive list of capabilities though a 777 landing gear overhaul service contract the company was recently awarded by Boeing. The contract includes inspection, repair, and overhaul of the landing gear axles of the Boeing 777, through a Service Bulletin released by Boeing, which will be incorporated by the airlines that fly this aircraft.

Savannah Tech breaks ground on aviation training

Savannah Technical College broke ground for its new Aviation Training Center, designed to develop high-level technicians for area jobs in aircraft assembly and maintenance. It's expected to be ready for students beginning with the spring semester next year. The 29,152-square-foot building will feature a 5,000-square-foot hangar plus labs and classrooms. The Aviation Training Center will feature four training labs; powerplant lab, airframe lab, aircraft structural lab, and composite lab.

Dassault Falcon's West Palm Beach satellite service

Dassault Falcon's newest satellite service station recently opened, one month ahead of schedule, at West Palm Beach Airport (KPBI) in Florida. DAS - West Palm Beach is authorized by the FAA to perform "A" inspections up to the "4A+" inspection on the Falcon 50, Falcon 2000, and Falcon 900 family of aircraft as well as the Falcon 7X. EASA approval is expected within the next 30 days. The facility in West Palm is part of a global support system which includes similar stations in St. Louis, Missouri; Luton-London, UK; Rome, Italy; Moscow, Russia; and Nice, France.

Sikorsky Aerospace Services and Danish Aerotech sign MOA for MH-60R helicopter support

Sikorsky Aerospace Services announced the signing of a Memorandum of Agreement with Danish Aerotech A/S to discuss the possibility of establishing a maritime helicopter logistic support capability in Denmark should the Danish Government acquire MH-60R Seahawk helicopters for the Royal Danish Navy.

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Jon Jezo, Publisher

Your favorite aviation maintenance magazine has teamed up with *AMTSociety* to offer you some really cool new programs in 2012! First up I'd like in introduce you to the *AMTSociety* Monthly newsletter. Direct to your email inbox every month, updates from *AMTSociety*; hear from the executive director about the latest IA Renewal training events, Member of the Month, meet the board of directors, get key industry news, and much more! You can subscribe now by joining *AMTSociety* https://www.amtsociety.org/join.jsp or by going online, logging in to your *AMT* magazine subscription and editing your preferences under: "Subscribe now to Aircraft Maintenance Technology E-Mail Products."

"Member of the Month"

AMTSociety is honoring members who have or currently are demonstrating the essence of the mission statement of the *AMTSociety*, which is, "*To actively promote and protect the professional aircraft maintenance technician's craft and profession, enhance the future of the profession, and to provide resources and benefits to its members.*" All selected Member of the Month honorees will be submitted to win the *AMTSociety* Member of the Year award. The award will be handed out at the Cygnus Aviation Expo in 2013. Of course there will also be some really cool prizes for achieving this honor!

Scan this code now to nominate an *AMTSociety* member!

AMTSociety is honoring members who have demonstrated the essence of its mission statement.

"Ask the Executive Director"

Tom Hendershot wants to hear from you! As we continue on the mission to enhance the future for you, the aircraft maintenance professional, we'd love to hear direct from you. Your feedback and questions are important to us and now you can easily submit them to us by using the link found in the *AMTSociety* Monthly newsletter or on our homepage.

Scan this code now to submit your questions to the director.

As we wrap up the last of the IA Renewal road show tour for this season, check out www.AMTSociety.org for all of the latest IA Renewal Roadshow event locations coming in fall 2012. (remaining IA renewal events will be held March 7 & 8, and March 21.) Each seminar meets the requirements contained in FAR 65.93(A)(4) for Inspection Authorization (IA) renewal training and is acceptable toward eight hours of training for IA renewal and the FAA AMT Awards Program.

Until next time we'll see you online!

Thanks for reading!

Jon Jezo

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