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AMT

Aircraft Maintenance Technology

*Written by aircraft maintenance professionals
for the professional maintenance team*

Official publication for AMTSociety

May 2012

Composites In AEROSPACE

A Maintenance Primer

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Turbine Technology:

More on RFID

Boeing describes its RFID
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The Boeing 787 production line in Everett, WA. The use of advanced composite materials when manufacturing new-generation aircraft now includes major structural portions of the aircraft. Photo provided by Ron Donner.

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A maintenance primer

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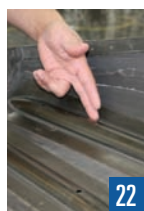


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Web: www.AviationPROS.com

Publisher.....Jon Jezo
jon.jezo@AviationPROS.com
Editor.....Ronald Donner
ron.donner@AviationPROS.com
Senior Editor.....Barb Zuehlke
barb.zuehlke@AviationPROS.com
Associate Editor.....Stephen P. Prentice
aerolaw@att.net
Field Editor.....Charles Chandler
cchandler@AviationPROS.com
Contributors: DeborahAnn Cavalcante, John Goglia, Dr. William Johnson,
Tim Kern, Clint Lowe, Nick Sergi, Jim Sparks, Tim Wright



JON JEZO



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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@tsluk.com
+44.1442.288287; Fax: +44.1442.219898
Julian Madocks-Born
julian@tsluk.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



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Composites in Aerospace

From fiberglass panels to the carbon graphite fuselage



Ron Donner, Editor

Ron Donner has held both technical and management roles in general aviation and during his 27 years with Northwest Airlines. He holds FAA certifications as an A&P/IA and a commercial pilot.

The use of composite materials in aircraft is not new, however aircraft manufacturers have transitioned from using composite materials in nonstructural components to more solid laminates in major structural portions including the fuselage and wings. Composite materials used for aircraft construction has significantly increased over the last three decades. Today both Airbus and Boeing use up to 50 percent composite materials in the latest generations of airliners.

In April while attending 2012 MRO Americas, I attended a seminar titled Composite Repair: Preparing for the Demand. A stellar panel comprised of John Welch with Spirit Aerosystems, Michel Bruet with Air France Industries, Dr. Roland Thevenin with Airbus, and Arne Lewis with The Boeing Company, provided their insights into preparing for the composite repair demand on new generation airliners.

Welch explained how 20 years ago many composite repairs were measured in square inches, and how today Spirit Aerosystems has accomplished repairs measured in square feet. One example of large area composite repairs was the inner and outer surfaces of thrust reversers. Welch went on to explain that large area composite repair goes far beyond just successfully performing the repair, having a heavy emphasis on repair substantiation, including repair method detail descriptions, inspection and testing, and development of comprehensive documentation for repair approval.

In order to accomplish this increased knowledge is required of the technicians accomplishing large area repairs: education, training, and practice. Using Welch's words, "Technician training must be more than generalities of repair to perform large area repairs. Technician training must teach the configuration being repaired ... Practicing the repair by methodically repairing, and repeating the repair, flushes out 95 to 96 percent of unknowns in performing large area repairs."

Maintenance programs for new generation aircraft are seeing a shift from traditional shop and hangar reliance to a more line maintenance philosophy. Michel Bruet suggested this shift means the competence for accomplishing composite repairs also needs to shift, bringing the competence to the line where it is needed.

Other topics discussed during the session related to bolted versus bonded repair philosophy for large areas, and whether the industry needs a certification recognized by global authorities for composite repair technicians. Arne Lewis of Boeing made this interesting point regarding maintaining a new generation airliner, "When and will the MRO industry become comfortable with working around and repairing a composite fuselage airplane?"

On page 22 of this issue I describe FedEx Express's recently completed composite repair shop at LAX, where they're responsible for repairs using advanced materials as well as some of the traditional bonding methods. As Tim Wright says on page 28, "If you see composites in your future, learn about them, and embrace them." *Ron*

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What About Those Diesels? Part 1

The first practical engine was built in 1897, yet in aviation diesel technology is still in its infancy



By Tim Kern

Tim Kern is an aviation writer, aircraft builder, and private pilot. He is based in Anderson, IN, and can be reached at info@timkern.com.

Diesel engine powered Cessna 182.

Diesels were there first
Diesels (compression-ignition piston engines) are among the earliest players in internal combustion, yet they win at LeMans, the premier 24-hour auto race. They are effective in sizes from tiny car use — maybe 30 cubic inches — to the oceangoing container ships that boast bores and strokes of 1 by 1.5 meters. They power about half of Europe's cars, most trains, virtually all the world's heavy long-haul trucking and ocean freight shipping, and ... hardly any airplanes. What's up with that?

Rudolph Diesel's first practical engine was built in 1897 and weighed 9,000 pounds; it produced 18 reliable horsepower. By 2008, the South Koreans built diesels that make 115,000 horsepower — at 88 rpm. (All the supergiant oceangoing diesel engines are today built in South Korea, by Hyundai or MAN.)

Diesels deliver horses

Efficiency, too, is a trademark, and comes with high reliability. Without spark igni-

tion, entire systems of spark generation and management are eliminated, but diesels can be hard to start, typically requiring "glow plugs" until the engine runs on its own.

Boosted intake air and fuel injection are required; a carburetor can't force the fuel/air mix into a pressurized cylinder. Sturdy components are required: pistons, cylinders, heads, connecting rods, and their crankshafts — all must be larger, heavier, and stronger than gasoline engines require.

High pressures generate a lot of heat. In today's high-efficiency diesels, which operate near 50 percent efficiency (two-stroke diesels are a couple points higher; four-strokers are a couple points lower), the exhaust gas carries off about 54 percent of the wasted energy; the cooling system (air or water) takes care of nearly 40 percent; the oil cooler handles about 6 percent. This screams for exhaust-powered performance-enhancers, otherwise known as turbochargers.

Allan Lockheed, who consults on high-performance engine designs, notes, "It did not



Photo by Ron Donner

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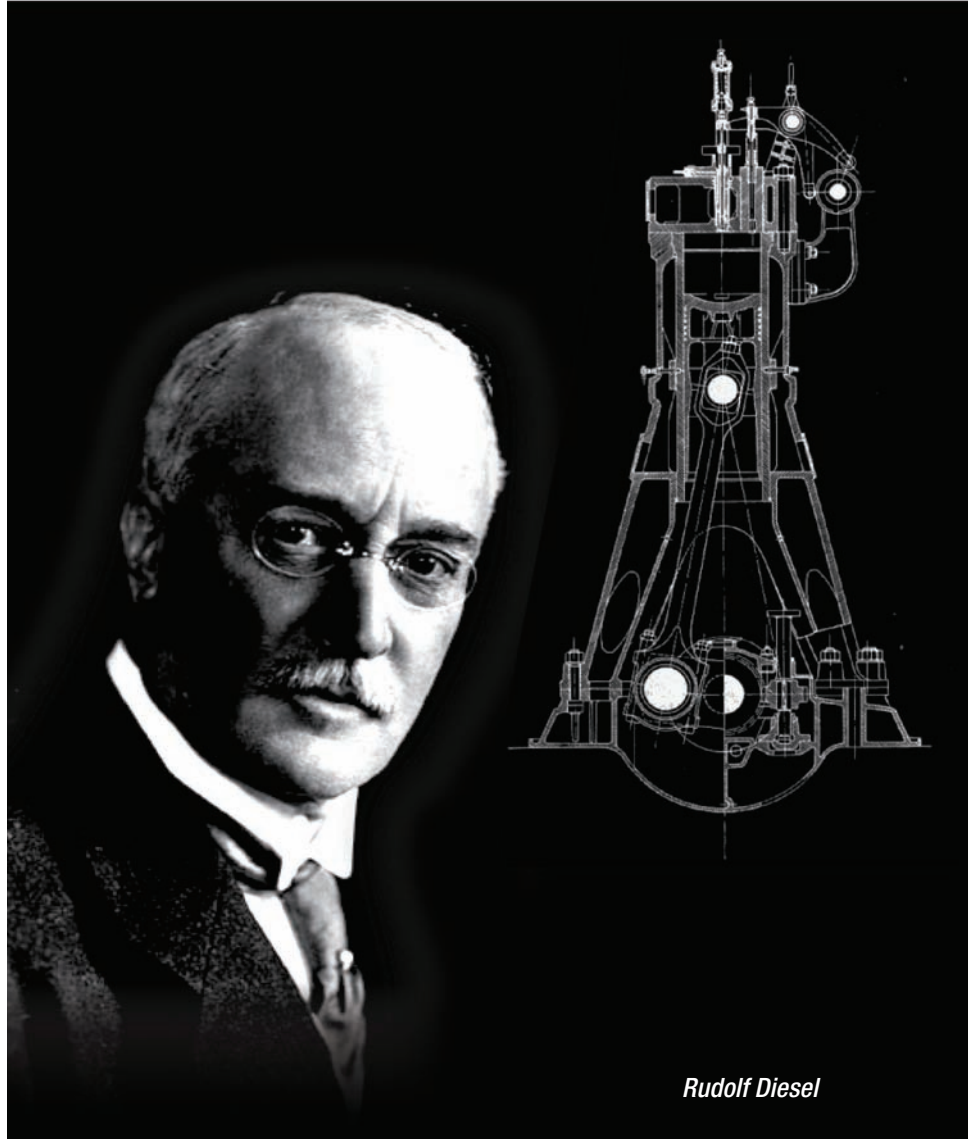
take too long before [piston-engine] designers realized that turbochargers were the real power-makers, so they developed better and better ways to drive the turbochargers, until they finally got rid of the piston engine altogether, and made the turboprop, which is basically a sophisticated, self-powered turbo-charger with a gearbox."

Still, diesel operation is intrinsically simpler than spark-ignition operation. Diesels need no controls, sensors, and circuits for making sparks, and there is no requirement for ignition electric power when running. A glow plug circuit for starting is not a big engineering challenge. A diesel's power is controlled, not by a throttle on its air supply, but by the amount of fuel it receives. Therefore, a diesel with a functioning fuel-delivery system will not over-rev, a welcome "safety valve" in the case of, say, a runaway prop. The "fuel injection vs. carburetion" debate will not be resolved here, but the general advantage of fuel injection is well-accepted, and all diesels are fuel-injected.

Diesels, relying as they do on compression for ignition, necessarily run high compression ratios. The stronger components needed to run 20:1 and up all day long weigh more than their typical gasoline/spark-engine counterparts. Heavier crankshafts, rods, and pistons are expected. Not always anticipated

are heavier valves and seats, valve springs, cylinders, heads, and engine cases. Also because the compression is higher and efficiency is greater, diesel power pulses are sharper and more powerful. These nastier pulses have frayed many an unsuspecting propeller and cracked unspecialized motor mounts, exhaust

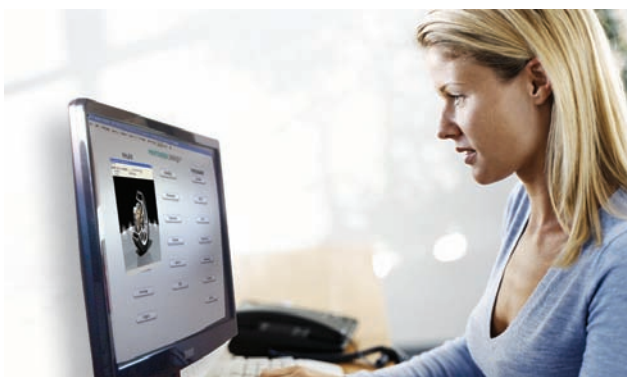
systems, and anything else that attaches to the engine, including starters, alternators, and intake components. The easiest response to all this destruction has been to add weight; but aero-designers at least are aware of the reduced usefulness added weight brings to an aircraft, and many novel approaches have been brought



Rudolf Diesel



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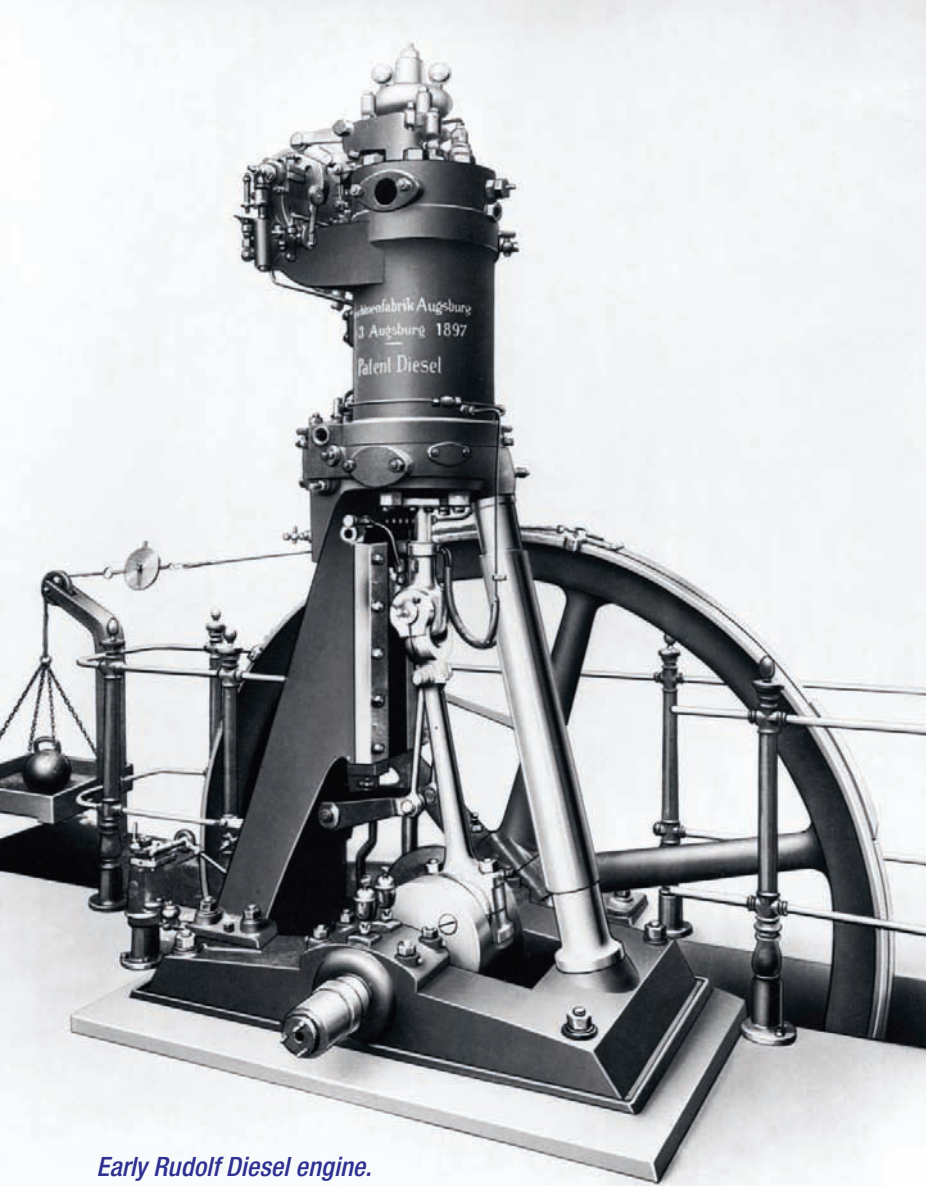


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Early Rudolf Diesel engine.

about to obviate the snappiness of diesel pulses.

Adding weight surely does that, but represents the least elegant solution. More-typical expediencies include incorporation of clutches or slipper washers

in the drive system (sometimes in conjunction with a gearbox, which can also be tuned), experimentation with firing order, and more-sophisticated control of ignition and burn rates within the combustion chamber.

Additional work has been done with materials — some are quite good at changing the harmonics, but cost a bundle. (Anyone seen titanium engine cases lately?) Lower-cost manufacturing sometimes involves higher-cost materials or processes and smaller or less-complicated parts.

As engine designers work through this calculus, we sit on the sidelines and ask,

“When can I have one?”

Several attempts have been made, and some have met a degree of success.

There are a lot of factors behind this: necessity is one. For almost as long as I can remember, we have heard of the imminent demise of avgas. Like the preacher who predicted the end of the world six times already, the doomsayers shout even louder: *“This time, we really mean it!”* And this time, they’re probably right, at least about leaded avgas.

Unleaded gas, the readily available alternative, is commonplace in cars, but cars don’t need 100 percent power settings for every takeoff, or 75 percent power settings for most of their lives. Worse for mogas in aviation is the ever-changing blending of different auto fuels and the inclusion of hygroscopic (water-seeking) Ethanol in the mix. Auto gas, because of its inconsistency,

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Photo by Tim Kern

Mogas, Avgas, Jet-A. What will the future hold?

changing formulations (usually dictated by unpredictable bureaucracies), uncertain storage and transportation, and lowered power content, does not offer a promising alternative to avgas. Additionally, the lack of lead in unleaded gasoline may pose problems for some engines' internals.

Aviation diesel fuel, commonly known as Jet-A, is regulated, relatively consistent, and of high power

ence fueled a lot of interest in the black-smokers; but the relative prices have recently closed or inverted. Relative fuel costs are no longer significant.

Diesel engines are more efficient than gasoline engines: they convert more of the available energy into useful energy; and they use a more powerful fuel. It stands to reason that diesels should be better at power production. As a byproduct of their thermal efficiency, they also emit less of many undesirable compounds into the

hour," knowing that diesel fuel is roughly 19 percent heavier than avgas. (This has implications for the airframer, too: what are the overall weight impacts on structure and payload? Are there possible CG effects in adding weight to fuel tanks?) Note, too, that there are significant differences in thermal expansion between gasoline and diesel. So, to get a more-valid comparison, think "pounds per hour" on fuel burn, but accommodate the weight difference and temperature/volume effects.

Diesel engines are more efficient than gasoline engines: they convert more of the available energy into useful energy; and they use a more powerful fuel. As a byproduct of their thermal efficiency they also emit less of many undesirable compounds into the air.

content. (Jet fuel contains more Btus per pound — more available energy — than even the best gasoline.) An engine built to use Jet-A will deliver more-consistent results, crucial in aviation. Further, jet fuel, because of the enormous demand, will be around for decades.

Not long ago, Jet-A was considerably less-expensive than avgas in the U.S., and that differ-

air. Although we all are familiar with diesel smoke, "aroma," and soot (as accumulates in exhaust pipes), these byproducts are considered less-harmful than many of the invisible pollutants produced by gasoline engines.

Still, it is the power to weight ratio of the *full system* that matters in aviation. Diesel advocates often talk about fuel burn in "gallons per

Where's the progress to be made?

Diesel technology in aviation is still in its infancy, while gasoline aero-engines are well-developed. There is simply more progress yet to be made in innovating with aero-diesels. Past achievements in gasoline engine technology actually work against innovation and further development in gas engines. Since improvements in gas engines will likely be small, there is less incentive to pursue them. Diesels face the opposite prospect: innovations will be rewarded by their use on large numbers of engines. **AMT**

In the concluding episode, we'll look at current and near-future aero-diesel technology.



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By Charles Chandler

Charles Chandler began his aviation career as a junior mechanic for American Airlines and retired after 27 years of service. After leaving American he held both line and staff positions in six other major companies. His positions with those companies included curriculum development specialist, manager and director for organizational development, management and leadership development, and maintenance training operations departments.

Read & Weep (for Joy)

Radio frequency identification (RFID) devices for aviation maintenance

Every now and again a technology comes along that is truly labor-saving and so simple to use that the beauty of it makes you want to weep with joy. As AMTs we spend a good deal of time documenting or verifying part numbers, serial numbers, expiration dates, and other maintenance data.

We know the challenge of reading small font numbers and letters with a flashlight and mirror while in various yoga positions. It is so very easy to transpose that 9 for a 6 and a shadow or small smear of grease will turn an S to a perfect 8. This data often creates extensive, sometimes redundant, paper files that must be stored and managed. RFID technology is good news for those who perform the endless routines of inspecting, researching, and recording critical data on components, rotables, and consumables especially in large fleets of airplanes.

RFID Integrated Solutions system

Automated identification technology (AIT) is the category of technologies used to automatically identify objects, collect data about them, and enter that data directly



RFID tags emit a radio signal which is interrogated by a hand-held reader/writer device. Photo courtesy of The Boeing Company.

into computer systems (i.e. without human involvement). It can be used to identify, store, read, and integrate information in a variety of applications. We are familiar with and use many of these applications when we shop or buy consumer goods and services. RFID tags (rectangular) and contact memory button (CMB) (circular) are forms of AIT being introduced into the aviation maintenance environment. Boeing's RFID Integrated Solutions combines RFID tags and CMBs installed on parts and components throughout an airplane. Boeing has contracted with Fujitsu to exclusively provide the hardware for the RFID Integrated Solutions program.

The passive RFID tags contain a microchip and antenna that emits radio signals

RFID solutions can be used in a variety of applications such as tracking electrical component history. Photo courtesy of The Boeing Company.



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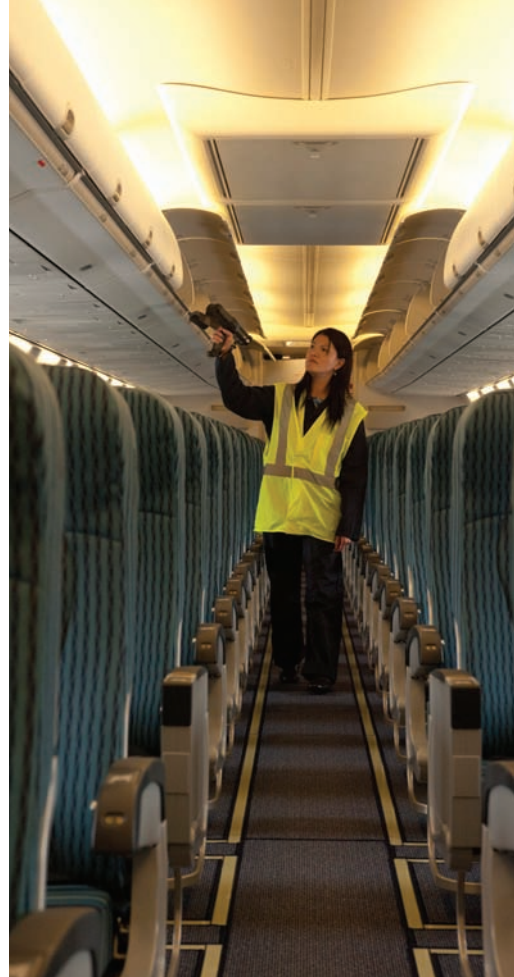
when interrogated by a reader/writer using internationally recognized standard radio frequencies. A reader retrieves the data stored on an RFID tag and then passes the information in digital form to a computer system.

The RFID tag is similar to a UPC bar-code but offers other significant advantages. For example, tags store data that can be read even if they are hidden from sight, have both read and write capability, and can be used to simultaneously identify and read multiple tags. The low-memory RFIDs are 512-bit devices used to store configuration, presence, security, and serviceability data. This data may include part and serial numbers, date of manufacture, expiration date, and location on the airplane. High-memory RFID tags range from 8 kilobytes to 64 kilobytes

RFID solutions can also be used to track emergency equipment typically stored in overhead bins or under passenger seats. Photo courtesy of The Boeing Company.

and contain the same data plus maintenance history and the ability to add as much as 500 characters of re-writable free text.

High-memory contact memory buttons (CMB) range in capacity from 8 kilobytes to 4 gigabytes and are accessed by direct contact. Information written to or retrieved from the CMB could be part and serial numbers, manufacturing dates, change in configuration, identity or maintenance history, such as actions taken and conditions noted, change in custody, accountability, location, consumption, and trend data like "no fault found."



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Technicians use a wireless handheld scanner to read or type in the latest maintenance information held within the maintenance history blocks or on the scratch pad, a rewritable function that can be used to enter text or store photos or videos. All this data then becomes an electronic, rather than paper, record that travels with the airplane.

RFID certification

Boeing and Alaska Airlines joined together in 2011 to develop, test, and validate the reliability of the RFID technology in the aviation environment. The fully integrated and comprehensive product is currently being offered and reached "service-ready" status earlier this year. Alaska Airlines is the tentative launch customer for the new program. Boeing also recently began offering a stand-alone emergency equipment management product.

According to Lois Hill, technical operations manager - RFID Integrated Solutions at Boeing Information Services and former American Airlines maintenance planner, the environmental and operational tests of RFID technology are exceeding expectations. Hill says, "Boeing installed 28 RFID tags and contact memory buttons in the harshest of test environments — APUs, engine integrated drive generators, landing gears, and other locations. They flew for 2,000 hours and were evaluated. Additionally they were put through a variety of other destructive and nondestructive tests related to component maintenance environments. All the RFIDs were functional, could be read and written to, and far exceeded specifications and expectations, showing no or very little signs of deterioration."

During an operational test, the oxygen generators on a B 737-800

were inspected, a job that would normally take about four hours to complete. With RFID tags affixed to the generators, "the inspector held the RFID reader at belt level and walked down the aisle from First Class past the last coach row. In one minute and 30 seconds, all the data from the oxygen generators was acquired and their status

read. The same test was conducted on a B 777. It took 15 minutes to inspect all the oxygen generators," Hill says.

It appears that the technology is appearing well and meeting regulatory requirements and industry standards. Boeing has performed system interference checks. Electromagnetic



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compatibility (EMC) and electromagnetic interference, or (EMI), tests have been conducted and “confirmed that there will be no interference between RFID and airplane systems in any ground-based configuration,” Hill says.

The RFID technology and implementation processes are straightforward. According to Hill, “It’s a minor change, an alternate part-marking method. Boeing has the necessary FAA approvals. The technology is ISO 18000-6C compliant, meets ATA Specification 2000, Chapter 9 RFID data standards, and meets SAE Aerospace Standard AS5678.”

RFID implementation

“Boeing offers five standard automated identification technology products to increase the efficiency and effectiveness of inspections, fault diagnosis, and repair. They are:

- Emergency equipment management
- Linens and tapestry management
- Rotables management
- Repairables management
- Airframe degradation management”

Their umbrella offering is RFID Integrated Solutions that allows operators to use non-line-of-sight RFID technology to automate inspections, change components at the appropriated time, and retrieve data at the point of use. This would certainly help maintenance operations managers and AMTs make better maintenance decisions.

Hill says, “A customer who subscribes to Boeing’s RFID Integrated Solution program will get a custom-tailored solution which will meet their specific maintenance needs. The Boeing support team would match the Integrated Solution implementation plan with the customer’s maintenance schedule and aircraft bill of work. They would get Boeing personnel at their site to help oversee hardware and software integration and implementation. This includes on-site technical and engineering oversight during airplane retrofits which can be done during overnight checks or during other routine maintenance.”

Benefits of RFID based maintenance programs

Obviously AIT technology and Boeing supported customer specific maintenance programs will enhance the efficacy of customer’s stores management, work planning, and aviation maintenance programs in general. When Hill was asked if the gains in maintenance efficiency could result in the need for fewer AMTs, she said, “Certainly not.”



RFID tags and the associated reader/writers are available in a variety of shapes and sizes. Photo courtesy of The Boeing Company.

The RFID maintenance programs will add capacity. In other words it will free up AMTs from the mundane, repetitive tasks to use their higher order skills like

trouble shooting, problem solving, and decision making. This will help their companies improve their bottom line and become more competitive and grow their

business. These RFID technology-based maintenance programs will also address some of the "Human Factors Dirty Dozen" by improving communication and accurate maintenance data entry and component tracking.

Truth be told, it will be a boon to those of us that are getting a bit creaky in the joints, are wearing bifocals, or have challenges with our short-term memory. Weep, groan and creak no more — RFID technology is on the way and it is our friend. **AMT**

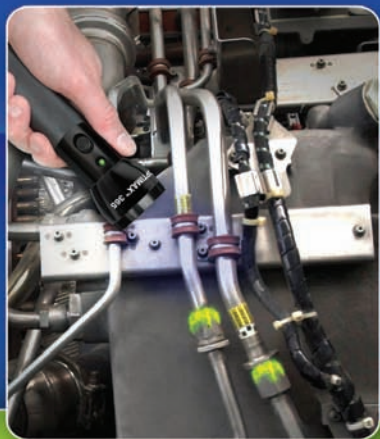
Field Editor Charles Chandler has a Masters of Science Degree in Adult and Occupational Education with a major in Human Resources Development.

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Wind Shear

Defense against this force of nature has several routes, most notably predictive and reactive



By Jim Sparks

Jim Sparks has been in aviation for 30 years and is a licensed A&P. His career began in general aviation as a mechanic, electrician, and avionics technician. Currently when not writing for AMT, 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. You can reach him at sparks-jim@sbcglobal.net.

Aviation, while not inherently unsafe is unforgiving." This is a statement of life in our world with the aircraft of today designed to improve the man/machine interface while reducing the impact of potential hazards. The majority of reported mishaps involves weather as either the stand-alone factor or compounded with other issues.

One of the most notorious weather phenomena is the micro-bust or wind shear. While a noted adversary to flight crews in all aspects of flight, it causes catastrophic results during critical phases such as takeoff and landing. A sudden updraft or downdraft routinely results in a rapid pitch change combined with a variation in airspeed. Strong

Wind shear detection and alerting systems compare inertial accelerations with air data information to provide a wind shear warning.

outflow from thunderstorms causes rapid changes in the three-dimensional wind velocity just above ground level.

Initially, this outflow causes a headwind that increases airspeed, which normally causes a pilot to reduce engine power if they are unaware of the wind shear. As the aircraft passes into the region of the downdraft, the localized headwind diminishes, reducing the aircraft's airspeed, and increasing its sink rate. Then, when the aircraft passes through the other side of the downdraft, the headwind becomes a tailwind, reducing lift generated by the wings, and leaving the aircraft in a low-power, low-speed descent. This can lead to an accident if the aircraft is too low to recover before ground contact.

The frequency of scheduled airline flights provides greater opportunity for wind shear encounters. Commercial flight data illustrates

pilots are faced with wind shears on average of once every 2,200 flights, and that certain wind shear "hot spots" exist.

Columbia, SC: 1 every 150 landings

Denver, CO: 1 every 2,300 landings

Dallas, TX: 1 every 7,100 landings

The question of defense against this force of nature has taken several routes. Terms such as predictive and reactive describe the different approaches to the dilemma.

As the result of the accidents in the 1970s and 1980s, most notably following the crash of Delta Air Lines Flight 191, the Federal Aviation Administration mandated that all commercial aircraft have onboard wind shear detection systems by 1993. Between 1964 and 1985, wind shear directly caused or contributed to 26 major civil transport aircraft accidents in the U.S. that led to 620 deaths and 200 injuries.

Since 1995, the number of major civil aircraft accidents caused by wind shear has dropped to approximately one every 10 years, due to the mandated onboard detection as well as the addition of Next Generation Doppler weather radar units on the ground (NEXRAD).

Predictive solutions

Predictive wind shear has taken on several forms. NEXRAD (Next-Generation Radar) is a network of 159 high-resolution Doppler weather radars operated by the National Oceanic and Atmospheric Administration (NOAA). Its technical name is WSR-88D, which stands for Weather Surveillance Radar, 1988, Doppler. The technology detects precipitation and atmospheric movement or wind. The principle uses a phase shift in transmitted versus returned signal.

This is like standing by the side of a road and when a car approaches, the sound waves compress the closer the vehicle comes and start to expand once it passes by. The returned data when processed is displayed in a mosaic map which shows patterns and movement. The radar system operates in two basic modes, selectable by the operator. The



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slow-scanning clear-air mode is for analyzing air movements when there is little or no activity in the area, and a precipitation mode, with a faster scan, is utilized when tracking active weather.

NEXRAD has an increased emphasis on automation, including the use of algorithms and automated volume scans to enhance

the accuracy of predictions. It has incorporated a number of improvements over systems previously used. The new Doppler velocity technology improves rapid air movement detection. It provides improved resolution and sensitivity, allowing detection of cold fronts, thunderstorm gust fronts, and micro-bursts. These charac-

teristics had never been visible on previous radars. The NEXRAD also provides volumetric scans of the atmosphere allowing operators to interrogate the vertical structure of storms and provide detailed wind profiles above the radar site. The radars also had a much increased range allowing detection of weather features at much greater distances from the radar site.

Reactive systems

Pilots need 10 to 40 seconds of warning to avoid wind shear. Fewer than 10 seconds is not enough time to react, while more than 40 seconds can be too long. Atmospheric conditions can change in that time. Three technologies are currently in use to provide flight crews a one-half to five-mile advance warning of wind shear.

NEXTGEN onboard Doppler radar sends a burst of energy ahead of the aircraft to seek targets such as moisture particles. The returning signal represents the movement which is translated into wind speed. Doppler radar works better than other systems in rain but less well in dry conditions. When the transmitted signal is directed toward the ground it does return ground reflection or "clutter." However, researchers are progressing in efforts to eliminate this interference. NASA's Langley Research Center has developed signal-processing algorithms and hardware for enhancing the wind shear application.

Honeywell has introduced IntuVue which is a general weather detection system based on flight path data with constant updates of the latest hazard assessments provided on the display screen. The system also improves cockpit efficiency by virtually eliminating ground clutter via an internal terrain database which also automatically corrects for the earth's curvature, to ensure

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Wind shear detection and alerting systems compare inertial accelerations with air data information to provide a wind shear encountered warning. By utilizing angle of attack and flight path angle instead of pitch angle in the calculation, the system will be responsive to vertical as well as horizontal shear conditions. An enhanced version of the system is also compensated for roll with the angle being derived from the rate of change of heading. The alerting system is capable of providing visual and aural warnings for a variety of wind shear conditions, such as, head shear, tail shear, head shear followed by tail shear and wind shear trend. The warning system is also capable of providing a wind shear warning which is a function of the radio altitude of the aircraft.

Enhanced ground proximity warning systems (EGPWS) frequently have the ability to sense and alert flight crews to a wind shear event. Knowing local terrain information coupled with radio altitude and vertical navigation enabled rapid and accurate recognition of vertical micro-bursts. Like most systems incorporating digital technology, built-in diagnostics will alert flight crews and maintenance personnel in the event of system degradation or failure.

Advisory Circular 120-41 is available at the FAA.gov web site

and provides criteria for the design of wind shear detection systems which includes wind tables and relative elevations.

In short, the one major difference between reactive and predictive wind shear systems: the normal procedure for a reactive alert is an execution of an escape maneuver while an

advance warning will enable the crew to initiate an orderly change of the flight path.

Technology does provide several means for contending with microburst but the most basic rule for wind shear avoidance is "Takeoffs are optional. Landings are mandatory." **AMT**



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Composite Repair at FedEx Express

AMT visits the new shop at LAX



By Ronald Donner

Ronald Donner holds FAA certificates as an A&P/IA, and a Commercial Pilot with Single and Multi Engine Land, Instrument Airplane and Glider ratings.

We regularly hear the predictions of continual growth in the use of advanced composites in aircraft manufacturing. However, the use of bonding as a method of fastening is not new to aviation. Decades ago nonstructural components such as fairings, closure panels, and floor boards were fabricated using fiberglass materials, aluminum skins with balsa wood core, and in some cases flight controls on airliners were fabricated using aluminum skins with aluminum honeycomb core bonded together. Eventually bonding would include advanced composite materials such as carbon graphite, synthetic aramid fibers, and hybrid fabrics, becoming more the norm for flight controls, engine nacelle systems, primary structure, and recently complete fuselages being fabricated using carbon graphite material.

Repair and overhaul of aircraft components using metal bond, fiberglass, and advanced composite materials requires facilities with specialized equipment and a well-trained staff. Airline shops, maintenance repair and overhaul (MRO) organizations, and their associated maintenance technicians these days need to be equipped and trained to accomplish these sometimes complex repairs.

Modern maintenance shops specializing in bonded repairs require purpose-built facilities having dust collection equipment, environmentally controlled rooms for layup, temperature-controlled storage units for material and adhesive storage, safety features for the skilled people doing the

FedEx technicians in the new LAX composite shop repairing the carbon graphite inner skin stiffeners on a MD-11 tailcone. Photos by Ronald Donner.



A closer look at the carbon graphite inner skin stiffeners on a MD-11 tailcone.



work, and all the specialized tooling and equipment necessary when repairing bonded components. No longer does the far corner of the hangar or remote shop location suffice for this sometimes dust generating preparation and highly sensitive processes.

The new shop at LAX

I had the opportunity to visit

the recently completed composite repair shop at FedEx Express Air Operation's maintenance facility at Los Angeles International Airport (LAX). The LAX maintenance facility has hangar capacity for two heavy maintenance lines of MD-10 and MD-11 aircraft, along with a variety of support shops; sheetmetal, welding, numerous component repair areas, and the recently completed new composite repair area.

The new composite shop is nearly 9,000 square feet, operates on two shifts with a current staff of 27 aircraft maintenance technicians (AMTs), two leads, and a manager. Additional technical support comes from the maintenance base's inspection and structural engineering groups. Like most composite shops, this one is no different and is responsible for a variety of work from paint touchup to advanced repairs using carbon graphite material.

Hector Chavez, manager of the LAX composite shop, says, "Currently we accomplish fiberglass and carbon graphite wet layup repairs, pre-impregnated (pre-preg) material hot-bond repairs, metal-bond repairs, and



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painting. We support the two heavy-check lines here at LAX for removed components and on-wing repair work, line maintenance support here at LAX, and we provide emergency support for the entire system when needed. We do it all from simple paint touchup, to on-wing repairs, to complex bonded repairs only capable in the shop."

When developing the new composite shop Chavez says, "The footprint of this shop is very similar to the FedEx Express composite shops in Memphis (MEM) and Indianapolis (IND). We have an environmentally controlled area for sanding and grinding, and a separate environmentally controlled "clean-room" for layup and



A variety of general tools and expendable supplies are required in any composite repair shop.

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curing of repairs."

The dedicated sanding room has downdraft airflow into the grated floor for collection of the dust and debris from sanding and grinding. But personnel safety begins well before you enter this area. Prior to entering the sanding room you first come through the Doff room which contains all of the personal protective equipment (PPE) necessary for working in this area. Once suited-up the technicians pass through the "air shower," a self-contained chamber that as the name implies, showers you with air blowing contaminants off your clothing and into a filtration system. You must pass through the air chamber both entering and exiting the sanding room.

During my visit to the shop one of the large components being repaired was an MD-11 tail cone assembly. The tail cone is the closure for the aircraft's auxiliary power unit (APU) and is located below the number two engine on the MD-11. After years of service the carbon graphite skins become

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damaged, the internal stiffeners and frames become cracked, and due to its location oil becomes ingested into the composite materials, creating additional challenges when repairing this unit.

The tail cone was completely disassembled in order to make the necessary repairs and to replace the inner skin stiffeners. Cracked inner skin stiffeners are carefully removed so as to not damage the graphite skin. Layers of carbon graphite pre-preg material are laid-up on a bond mold the shape of the stiffener and heat cured. After trimming the replacement stiffeners to size they were bonded in place on the inner skin of the tail cone.

When asked what the most complicated repair the shop accomplishes, the answer wasn't a carbon graphite component but the trapezoid panels on the MD-10 and MD-11 aircraft. The trap-panels as they are referred to are fastened to the aircraft on the upper surface of the wings near the wing root area. They are made using thin aluminum skins, aluminum doublers and frame, and fiberglass honeycomb core. The panels have

compound contours with various angles and shapes. Water ingestion eventually causes corrosion of the internal bond-lines and delamination occurs.

Generally, all new skins and doublers are fabricated and the original framework which contains the contours and curves is reused. All these detailed parts are care-

fully cleaned, etched, bond primer is applied, and assembled with film adhesive onto the bond mold or fixture to hold the shape. These particular panels are then vacuum-bagged, the vacuum bag being the clamp affect, and the adhesive is cured using a specific time and temperature curing profile. Once cured, the panels require a fair

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amount of cleanup, sanding, grinding, fitting, and eventually reinstalled on the aircraft and painted.

Training

Chavez explains the training program for new entrants into the composite shop. "We have a program of both on-the-job training (OJT), computer-based training, and classroom training. This includes being paired with a mentor. When someone new comes into the composite shop they first begin with paint. Everyone learns to paint. Part of this training is detecting the different types of paint used, what is normal paint wear and tear versus poor adhesion or paint quality problems. This also includes paint mixing and preparation, use of fillers, sanding, and paint removing — the entire paint process."

Next, new AMTs learn standard fiberglass repair using both wet-layup and eventually heat-cured pre-impregnated materials. Then they move on to learn metal-to-metal bonded repairs, followed

by metal-to-fiberglass bonding. Finally, after successfully making their way through these processes, they will learn advanced composite repairs using materials such as carbon graphite. During this time they learn how to use hot-bond control consoles, heat blanket selection and use, vacuum bagging techniques, and much more.

The entire OJT program for the composite shop takes nine to 10 months. Part of the monthly crew meeting agenda in the composite shop is "lessons learned." Discussions take place using maintenance manuals, photos, and other job-aids in an effort to mistake-proof repair processes and learn from errors.

FedEx core philosophy

When it comes to hiring technicians FedEx is very selective about hiring the best people. Steve Sobczak manages the composite, sheetmetal, welding, and tooling support shops at LAX. As an example, Sobczak explains they recently had openings for five

The "air shower" is a self-contained chamber that showers workers with air to blow contaminants off clothing and into a filtration system.

sheetmetal technicians at the LAX location. Sobczak says, "So far we have 125 resumes, we will select 15 to interview, and hire five. And hiring the best people goes way beyond a candidate having great technical skills alone."

With all of the options available these days for having specialized repair shops accomplish this type of work, I asked the question why continue to develop and invest in the new composite shop instead of outsourcing to one of the many specialized repair stations authorized and capable of this type of work.

Sobczak explains, "It starts with the FedEx core philosophy: People-Service-Profit. We feel we have the best people in the industry, and that no one can do it better." Sobczak went on to say, "We and our customers are better served doing as much as we can with our own people, and this is yet another way of taking care of our people by helping create job security with FedEx. We believe when we take care of our people, our *people* take care of our *service* and this takes care of FedEx (*profit*).

It became very clear how FedEx feels about its people. In fact LAX was one of three FedEx teams participating in the recent *AMTSociety* Maintenance Skills Competition. Chavez reminded me the vice president of maintenance from Memphis was one of the senior leadership staff that spent the entire time at the MSC, strongly supporting this type of participation and celebration. Given the tough times the airline industry AMTs have seen in recent years, it was refreshing to hear the focus on this company's AMTs, and the explanation of the FedEx core philosophy of *People-Service-Profit*. **AMT**



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Composites In AEROSPACE:



By Tim Wright

Tim Wright has been working with aerospace composites for 13 years as a technician and technical trainer. He is currently on the faculty at Northland Community & Technical College in Thief River Falls, MN. Previously, as a technical trainer at Cirrus Aircraft, he instructed more than 250 technicians, engineers, A&P instructors, and regulatory agents on Cirrus composite damage assessment and repair processes.

A Maintenance Primer

If you see composites in your future, learn about them, embrace them

National Institute of Aviation Research (NIAR): "The use of composites in modern aircraft designs is accelerating and will underpin a quadrupling of the aerospace composites market over the next 20 years."

While the many benefits of composite aircraft construction continue to be extolled in the press, it is human nature which makes it difficult for us to accept the unfamiliar or unknown. Despite the incredible advancement and growth of composites in aerospace over the past 20 years, many people within and outside the industry remain skeptical of the technology. It's time we all learn about this extremely durable and versatile class of

materials and what makes them so invaluable to aerospace.

First of all, what is a composite? A composite is a macroscopic (visible to the naked eye) combination of two or more materials which results in a material possessing structural properties none of the constituent materials possess individually. Because the materials are not soluble in one another, they retain their identity. Chemical compounds such as alloys therefore are not composites. The fact is we are surrounded by products meeting this description; automobile bumpers, bathtubs, cardboard boxes, diving boards, exercise equipment, fuel tanks, golf clubs, etc. Why not airplanes?



The Boeing 787 production line in Everett, WA. The use of advanced composite materials when manufacturing new-generation aircraft has dramatically increased to include major structural portions of the aircraft. Photo provided by Ron Donner.

Like their metal counterparts, composite aircraft utilize a variety of materials and construction methods. The most basic unit of composite construction is the laminate. The laminate is analogous to sheet metal and consists of one or more plies or lamina as they are called. A lamina combines a fiber component usually of fiberglass, carbon fiber, or aramid (Kevlar is DuPont's aramid product) and a surrounding matrix material, epoxy resin being the most common in aerospace. The fibers in the laminate may be chopped (short fibers with random orientation), woven cloths (long fibers in specific directions), or tapes (long fibers in a single direction) but in all cases must be saturated by the matrix material.

Boeing, on the 787 Dreamliner: *"Engineers are discovering that their composites are tougher than they initially imagined ... maintenance costs will be about 30 percent lower than for aluminum airplanes ... corrosion and fatigue*

benefits are going to be astounding."

Laminates vs. sandwich construction

More laminas result in stronger, thicker but heavier laminates. The principle advantages of laminates over sheet metals of equivalent strength are: less weight, high fatigue and corrosion resistance, and that they are formed in mold tools resulting in fewer, larger aerodynamically smooth parts designed and built to handle specific loading. The advantages of sheet metals over laminates are that metals are isotropic in nature (they are uniformly strong in all directions), less expensive, and generally have better part stiffness characteristics than laminates of equal strength.

To increase their isotropic characteristics, laminates are usually made with the long fibers of multiple laminas running in two or more directions within the

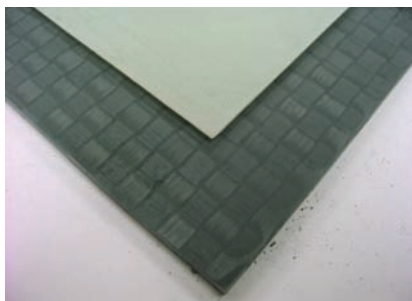
laminate. To overcome laminate stiffness limitations, a second type of composite construction is used, sandwich structure.

Sandwich structure introduces a core material bonded between two laminates or basesheets. The loading mechanics of sandwich structure act similarly to truss or beam construction. The core material carries and transfers the imposed loads to the basesheets perpendicular to the applied load just as stringers and frames do. Typical core materials include high density polymer foams, honeycombs (a hexagonal cell material usually made of aluminum or aramid oriented perpendicular to the basesheets), and cross cut balsa woods. Large composite parts frequently utilize both laminates and sandwich structures in their lay-ups.

When a core material is sandwiched between two basesheets, the part may become as much as 40 times stronger than the combined strength of the basesheets. It is the core's material and thickness which determine its ultimate strength. Because of the thin basesheets, sandwich structures have low impact tolerance, and once punctured are highly susceptible to moisture ingress.

The perfect composite airframe would consist of a one-piece lay-up using laminate and sandwich constructions. Because of tooling and material limitations, this is not yet possible and so like their metal counterparts, composite aircraft are an assembly of parts. Where metal airframes use mechanical fasteners to join parts, composite airframes use structural adhesive (or in some applications, combinations of mechanical fasteners and adhesives).

Remember building plastic model airplanes as a kid? This is approximately how composite aircraft are built except for the part about using advanced composite materials instead of polystyrene



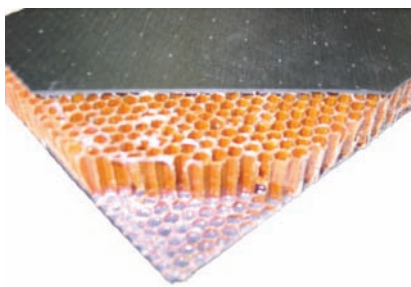
Black colored carbon fiber laminate and lighter colored fiberglass laminate.



Black colored carbon fiber cloth and lighter colored fiberglass cloth.



Example of a typical foam core sandwich panel.



Example of a typical honeycomb core sandwich panel.

plastic and glue. Because of their excellent adhesion and strength properties, epoxies are the most commonly used adhesives in aerospace. The bond mechanism created between adhesive and composite parts is referred to as a secondary bond. It is a complex molecular union which is nearly as strong as the composite material itself. When applied within allowable bond thickness limits, epoxy adhesives have very high shear strengths (shear is parallel but opposing loads applied to the joint).

Damage assessment

Whenever one is faced with the prospect of assessing damage to composite airframes, it is important to be familiar with the unique strengths and weaknesses of these constructions. Due to composite's very high strength, one must be cognizant of "point of



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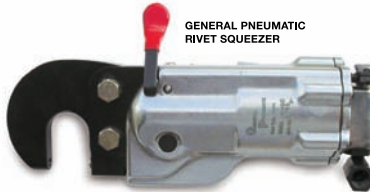
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impact damage" as well as "load path damage". It is not uncommon to have minor point of impact damage while sustaining major load path damage.

Damage assessment nearly always begins with a thorough visual inspection either as part of a scheduled inspection or as a special condition inspection which may arise from a reported (known) incident or event. It is important to discriminate between these two types of inspections. The amount of energy associated with damage from a known event may be used to determine the extent of the inspection(s), e.g., a fuel truck hitting a wing will have much more energy than a golf club hitting the wing. Ironically, both may result in similar point of impact damages. In the fuel truck scenario, analysis of the energy's load path would be reason to inspect interior wing structural components, bonded joints as well as attach points and adjacent structures.

Visual inspections

Visual inspections of painted surfaces are best accomplished by using a high intensity flashlight held at a low incident angle to the structure. Keeping your eyes at a low angle perpendicular to the light beam, sweep the structure with the beam. Circle all cracks, punctures, abrasions, and obvious shadows with a nonpermanent marker or grease pencil and complete the visual inspection. Using OEM publications or technical assistance, determine the structure of the encircled areas (laminate or sandwich).

Defects to laminates may be further investigated by visually inspecting the reverse or interior side. This may require the use of optical instruments such as flashlight/mirror or borescopes. Because of their translucent nature, all types of damage to fiberglass laminates will appear white. If you cannot make a determination of damage in this manner, it may become necessary to remove the exterior paint finish.

Sandwich basesheet punctures and cracks will be obvious and must be repaired. Less obvious defects may be further investigated by use of the "coin tap" test. Coin tapping can be highly subjective and requires practice as well as a consistent tap frequency and intensity to be effective. Nonpuncturing impacts often cause the basesheet and core to disbond. An area of disbond will have a distinctively dull timbre when tapped. It is important to tap in all directions around the suspect area for confirmation, shape, and size of the disbond. Surfaces adjacent to punctures and cracks should be similarly investigated. Damage to secondary bonds will appear as a crack in the adhesive joint. The crack will appear evident from both sides of the joint and will produce a dissonant sound when tapped.

Training and support

FAA AC No; 65-33; Composite Maintenance and Repair: *The maintenance of composites is complex and requires knowledge and skills to assure the continued airworthiness of these products ... Experience, classroom training, hands-on on-the-job training, and assessments all work together to ensure that the skills are developed to perform safe composite maintenance and repair.*

The authority to repair composite structures lies in the hands of the airframe OEM. Information about classification, size, and location limitations may be found in the aircraft maintenance manual (AMM) or by phoning its technical support line. Repairs to composites should be undertaken by trained, qualified personnel only. In fact, most OEMs require training or certification to perform repairs on their products. While there are many composite training opportunities available, one of the biggest industry problems is that there is no standardization of process among the OEMs. Having said that, I can tell you that fundamentally, the differences are not that great; many of the basics are the same (or at least similar). While OEM training will be specific to their type, there are also schools and companies which offer training tailored to the industry. So, if you see composites in your future, learn about them, embrace them. **AMT**

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Aircraft Mechanics Are Different

They understand aircraft maintenance is a nonstop learning experience



By Clint Lowe

Clint Lowe holds an FAA A&P certificate with Inspection Authorization and a commercial pilot certificate with instrument and multi engine ratings. He has spent most of his aviation career with the U.S. Air Force and Air National Guard in a variety of roles including maintenance, safety, training, oversight, and accident investigation. He currently is a QA inspector/QA representative with the North Dakota Air National Guard in Fargo, ND.

For a couple of years, our aircraft maintenance unit was commanded by a Colonel who'd done most of his time in civil engineering (CE).

As most with a military background know, CE sees to the construction and maintenance of the base infrastructure, ranging from oversight of new buildings to ensuring the air conditioning work. CE runs the bulldozers, the road graders, circular saws, and ensures the lights work.

The Colonel had trained as an engineer in college and, given a projected major conversion of facilities to accommodate a new aircraft we were to receive; it seemed a good fit to have a fellow with a lot of experience with buildings and construction to guide us through this facility upgrade. Under the Colonel were several other officers and a host of NCO's to continue the aircraft maintenance effort, so little changed from a maintenance standpoint.

To be sure, nothing in the military is constant and changed plans are typical. So it went with the change of aircraft; budget issues saw the cancellation of the new aircraft we were to get. With that announcement, our good commander was re-tasked to another place to continue his career. On his last day, with cake in the background and the traditional plaque in hand, the Commander's remarks included an observation that we seldom think about in aircraft maintenance.

An infinite difference

The Colonel noted that, from the other places he'd been around, the aircraft maintenance section (hangars and ramp area) were like a black hole not ventured into or well understood by those working elsewhere on the base. Only after interacting with aircraft maintenance supervision and mechanics did he now understand there's an infinite

difference between people working with their hands on buildings, vehicles or HVAC systems and those working on aircraft.

Our world of aviation, which we see as the normal way to approach maintenance, is radically different from all other pursuits. Without detailed exposure to it, the best

Aircraft mechanics educate themselves thoroughly on the task by reading technical information, getting technical training, and asking questions of others with experience.

automotive mechanic or carpenter can't know this world of ours or understand the standard to which we must hold ourselves.

What makes this culture of ours so observably different from that of the forklift mechanic, plumber, or carpenter? It's not because we're smarter ... I've found plenty of people smarter than me working in other disciplines.

Different consequences

No, it's more the limitations within which we work and the terrible consequences that come of error. If a carpenter's wall isn't built correctly, cracks may develop in sheetrock or the floor tiles may not come out looking right. If an automotive mechanic installs an oil filter wrong, the vehicle may roll to a stop on the interstate with an engine that's wasted. If an aircraft mechanic makes a mistake, there's a very good chance a mother will become a widow or a grieving parent will ride in a funeral procession.

Aircraft mechanics understand that from the time the airplane departs the earth's sur-

face until it lands, it needs to work perfectly. Even if you're a pilot blessed with maintenance skills, trying to fix an airplane at 7,000 feet is impractical at best because almost everything that can go wrong is out of reach.

Nonstop learning

To do things correctly, aircraft mechanics educate themselves thoroughly on the task by reading technical information, getting technical training, and asking questions of others with experience. Aircraft mechanics always understand aircraft maintenance is a nonstop learning experience, from the day they enter the business to the day they retire from it.

Aircraft mechanics know the equipment they work on is built to exacting standards, whether the aircraft is a fabric-covered Aeronca

or a Boeing 747. They know the designers managed to get this contraption to fly only through a careful design process (even if they forgot that maintenance is part of that design) and the design can't be changed unless the mechanic wants to be responsible for the new, unapproved design.

Most importantly, the aircraft mechanic understands his/her responsibilities and develops a working personality that embraces that responsibility. Instead of using the terms "maybe" or "I think I can shore that up," we use terms like, "No. It's illegal and I cannot let you fly it like that." "I won't sign it off in that condition because it's not safe." And so it goes.

An example

To illustrate, I'll relate an experience of mine.

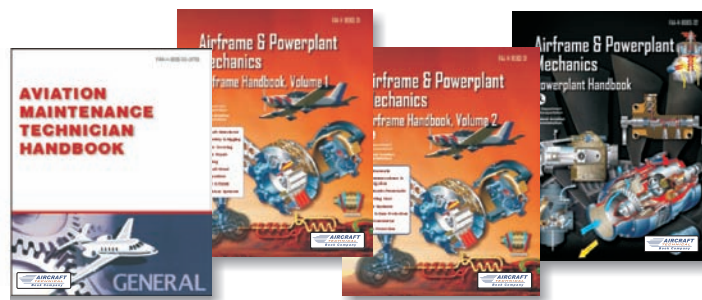
It's been 18 years since I decided to build my own house, a large four-level split. Why? It was a challenge and I wanted to take advantage of my own "sweat equity." While some things I simply didn't have time to do, I found wiring the house pretty straightforward and ended up getting my work inspected by the city electrical inspector, who knew I'd legally accomplished my own work. "Where did you learn how to run electrical wiring?" he asked.

"I'm an airplane mechanic."

He responded, "That's about the most thought-out wiring job I've ever seen ... it's not common to find wire run in an attic where it won't get stepped on." At which point I asked him if he could show me the proper way to install a circuit breaker.

Aircraft mechanics are different. **AMT**

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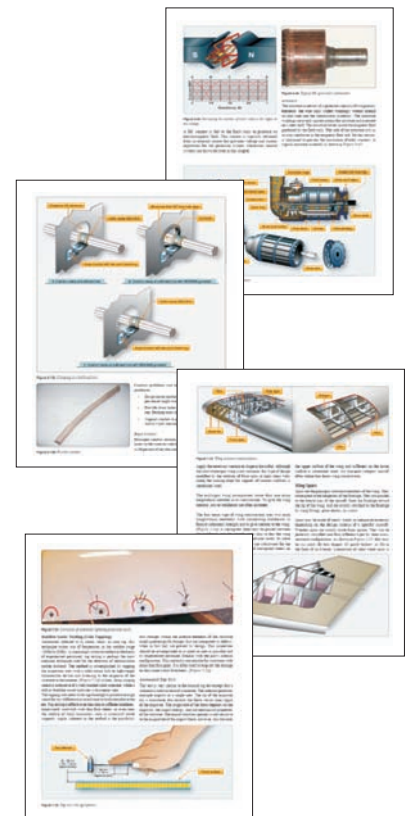
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Safety Tip

We all have heard the saying, "Cool it." It is slang for relax, calm down, take it easy. And, in this sense, it is safe to say we all need to do this from time to time — to avoid making mistakes — especially when feeling the pressure and stress from our work environment. But to you folks who maintain and operate aircraft engines, it takes on a whole different meaning. Many engines may require you to "cool it" down before shutting it down. Improper cool down could lead to sudden damage or even latent damage resulting in future failure. Whether you operate engines frequently and have tremendous knowledge about them or you only operate engines infrequently, always use the engine run checklist. Whether you operate turbine and/or piston-powered engines, and especially if you operate a variety of make and model engines, the bottom line is to understand and comply with the manufacturer's current operating procedures. And always heed the "Notes, Cautions, and Warnings" for the engine you are working on.

As a result, when you "cool it" properly, you will be able to relax, calm down, and take it easy!

— Stay safe, Tom Hendershot

AMT Day

AMT Day, or Aviation Maintenance Technician Day, was created to recognize Charles E. Taylor who was the Wright brother's mechanic and aviation's original "Unsung Hero," or otherwise referred to as the "Father of Aircraft Maintenance." Having built the first aircraft engines, by hand no less, which enabled mankind to conquer controlled powered flight is a remarkable accomplishment. Recognizing

Charlie's rightful place in aviation's history, which history almost forgot, is just and warranted. But how did AMT Day start? Why was it created? What does it mean?

To begin with we need to go back to 2001 when an FAA Inspector from the Sacramento FSDO named Richard T. "Dilly" Dilbeck first decided that Charles E. Taylor needed to be remembered. Charlie's accomplishments were recognized by the FAA with the creation of the Charles E. Taylor Master Mechanic Award thanks to another FAA Inspector, William F. "Bill" O'Brien. Bill created this award for AMTs who had served at least 50 years in aircraft maintenance with a minimum of 30 of those years as a certificated A&P mechanic. This award is very prestigious and rightfully so. What Dilbeck did was expand the recognition Charlie deserved by having all 50 United States, Commonwealths, and Territories introduce and pass an AMT Day Resolution. OK, you ask, so what does this resolution do?

Dilbeck had then California Senator Knight introduce a resolution that officially recognized May 24th of every year as Aviation Maintenance Technician Day in honor of Charlie's birthday. This resolution remembers Taylor's place in history as being as important as that of the Wright brothers since it was Charlie who enabled the Wright Glider to become the Wright Flyer. But this resolution goes further and also recognizes the many skilled men and women who followed in Charles E. Taylor's footsteps in the craft Charlie created; the craft of today's AMT. In 2002 California became the first state to introduce and pass AMT Day.

May 24 is now recognized

officially as a day to remember Charles E. Taylor and an entire craft and profession of skilled aviation professionals that carry the heavy responsibilities of providing safe, airworthy aircraft industrywide. An industry that requires a high standard of knowledge, skill, continuing education, and integrity now had a day to say thank you to the men and women who care for commercial, general aviation, corporate, private, civil, military, or experimental aircraft.

Thanks to Dilbeck's efforts in having California lead the way in passing the first AMT Day Resolution there are now more than 47 AMT Day Resolutions passed.

Because of his nature Charles E. Taylor did not look to profit on his accomplishments and the rapid advances in aircraft technology had basically caused history to forget Charles E. Taylor and in turn forgot, or at the very least took for granted, the contributions of all the AMTs that came after Charlie. These resolutions were created to return attention to a significant individual as well as a group of individuals who take their responsibilities seriously but do not seek the limelight.

AMT Day is a day for an industry to recognize those who are the very "Faces Behind Safety" in aircraft maintenance. AMT Day is a day to acknowledge the dedication, professionalism, and sacrifices of a proud profession. AMT Day is increasingly being celebrated throughout the aircraft maintenance community. AMT Day is Charles E. Taylor's Day!

You can learn more about Charles E. Taylor by reading the biography Charles E. Taylor: 1868 - 1956 The Wright Brothers Mechanician written by Howard R. DuFour with Peter J. Unitt. This book can be bought through Wright State University, 3640 Colonel Glenn Highway, Dayton, OH 45435.

Last year there were more than 30 Charles E. Taylor Day celebrations across the United States. If you or your aviation organization are planning on hosting a program or party, please forward any pictures and your story to Barb Zuehlke, Senior Editor, AMT Magazine, 1233 Janesville Ave., Fort Atkinson, WI 53538-2738, or you can also email the information and photographs to her at this address: barb.zuehlke@aviationpros.com.

I sincerely hope that each of you and your families, as well as your co-workers enjoy a great and memorable Charles E. Taylor Day Celebration, and that you remember our U.S. military personnel, and have a safe Memorial Day holiday. (*Thanks to AMTSociety board member Ken MacTiernan for this article.*)

Blue Ridge Community College

The Aviation Maintenance Technology (AMT) program at Blue Ridge Community College (BRCC) is ready to expand operations to include the first FAA-approved distance education classes in aviation maintenance since Parks College of Aviation, Engineering, and Technology closed the oldest A&P program in the U.S. The AMT program features a modern computer laboratory as the foundation for all lecture classes, and a completely equipped hangar at the Shenandoah Valley Regional Airport for the laboratory portion of the curriculum.

The BRCC AMT program was established in 2008 to address a growing need for training aviation mechanics, especially to develop a skilled work force for local employers. Demand for employees with A&P certifications continues to grow, and BRCC hopes that the distance education offerings can help

facilitate more individuals get the training they, and employers, need.

BRCC has secured FAA-approval for its distance education internet manual and is one of three institutions from across the country chosen as beta test programs for distance education classes in aviation maintenance. Classes to be offered this summer via synchronous distance delivery include: technical mathematics, aircraft drawing, Federal Aviation Regulations, basic electricity, and materials and processes. Additionally, BRCC has a request in with the FAA to provide a distance education option for four of the five courses in its Light Sport Repairman Maintenance training option.

"We've worked hard to make BRCC a unique aviation experience," says Fred D. Dyen, associate professor. "Our graduates attend class right at the airport and are exposed to a strict attendance policy that simulates industry working conditions. In fact, one of the advantages, according to employers is that our graduates possess a strong work ethic and it takes less time for them to transition to a productive employee."

Currently, the majority of textbooks and all reference material are available online. The AMT class size is limited to 25 students; however, every effort is made to keep class size at 16 students for more individualized attention. Generally, students start their program with the fall semester, but open enrollment is available to students with previous experience in either aviation or mechanics. FAA oral and practical tests are available on site and written tests are conducted at the nearby CATS testing center.

For more information about the AMT program at BRCC, contact Fred Dyen at dyenf@brcc.edu, or (540) 453-2306. **AMT**

Procedures 101

A government and industry workshop tries to untangle the web of technical information and regulations and make it easier to follow procedures

By Dr. William Johnson, Chief Scientific & Technical Advisor – Human Factor, FAA

Dr. William Johnson has spent more than 30 years as senior executive and scientist for engineering companies specializing in technical training and human factors before joining FAA in 2004. He is also an aviation maintenance technician and has been a pilot for more than 45 years.

We hear it every day: “They did not follow procedures.” As a result, an aircraft is damaged ... someone is injured ... the baggage is lost ... the flight is delayed. The outcome is varied and infinite, but the overriding cause is that a procedure was not followed. The challenge is as old as aviation and the solutions seem to be elusive. Or are they?

A panel of aviation industry and government officials recently spent two days trying to get their hands and heads around the issue of following procedures.

The invited group was composed of OEMs (Boeing, Airbus, Gulfstream, and General Electric), airline and independent maintenance organizations, FAA inspectors, CEOs and organized labor leaders. All agreed that we have a problem.

Today, safety management approaches these problems not by merely looking for who or what to blame. Instead, proper safety management identifies and corrects the hazards that contributed to the risk.

The workshop participants decided that the word “documentation” is too limiting. The focus must be on “information.” It can range from traditional written text to graphics to animations and more.

Carol Daniels, CEO of Aircraft Technical

Publishers and chairman of the General Aviation Manufacturers Association, emphasized that “information must be delivered in a usable format, at the right time, on the appropriate device.”

According to Daniels: “Users should specify their information requirements. What works for an airline on the Atlanta ramp may not be suitable for a helicopter operator in Alaska. If we do our job right, mechanics are more likely to access the information.”

John Goglia, former NTSB member and long-time airline mechanic, talked about the culture that heralds safety as “No. 1,” but then drives decisions, actions and rewards with on-time performance.

According to Goglia: “When a crew is rewarded for meeting the schedule rather than for reading the instructions, the technical information availability and access lose priority.”

Many of the FAA inspectors lamented the fact that they are forced to take administrative action against individual mechanics who fail to use the technical documentation. These inspectors were once mechanics themselves so they know that the individual is faced with inadequate documentation systems in a “hurry-up” culture. The mechanics are often victims of documentation, corporate culture, and uncompromising FAA regulations.

Industry professionals from airlines, general aviation, rotorcraft, corporate, and regulatory all agreed that we have a problem. Photo courtesy of the FAA.





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The workshop broke into five working groups that focused on quantifying the challenges and possible solutions. Here's a quick look at the top challenges and solutions from each of the five groups:

Human issues

The group identified a lack of involvement by mechanics to create and validate written procedures. The members suggested the OEMs and the airline engineers must do more field-testing of the written procedures. The process must be streamlined to modify poor procedures identified by on-the-job users. Either this must improve or mechanics will continue to bypass or ignore procedures.

Information quality

This group said the greatest challenge was the government's inconsistency and nonstandardized

requirements. The members called for new FARs and internal training that is matched to current technologies and user requirements. Government acknowledged that they are traditionally understaffed in the offices that oversee technical documentation.

Industry responsibility

While industry responsibility and measurement are two separate groups, the members were like-minded in their conclusion. According to both, there is not a sufficient business case to improve technical information. In the trade-offs among production, quality, and compliance, the technical information is seldom top priority. The solution is to provide additional detailed error data when "failure to follow instructions" is the cause of a loss. More information related to root cause analysis is necessary.

Regulatory

The top issue is the inconsistent communication of expectations regarding technical information. The solution must emerge with new regulations and guidance materials. Such materials must be created in concert with industry groups. The members believed there must be increasing reliance on industry toward a process of internal validation and acceptance of information systems.

Perhaps the best finding of the workshop was the unanimous agreement that current technical information must evolve to today's working environment. There are many modern solutions to ensure that proper application of technical information can contribute to ongoing safety, increased work efficiency, and enhanced job satisfaction. **AMT**



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Ronald Donner, AMT Editor

Ronald (Ron) Donner is the current editor of Aircraft Maintenance Technology (AMT) magazine. He's spent his entire life devoted to aviation and he holds FAA certificates as an A&P/ IA, and a Commercial Pilot with Single and Multi-Engine Land, Instrument Airplane and Glider ratings. Ron has worked in a variety of maintenance related roles, both technical and management in general aviation as well as with a major airline.

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Positioning Your Company for a Sale

The ultimate goal is to enhance the company's value and marketability to prospective buyers, and to get the best price in the shortest possible time



By DeborahAnn Cavalcante

DeborahAnn Cavalcante earned her Master of Aeronautical Science, with a specialization in Safety Management from Embry Riddle Aeronautical University in Daytona, FL, and her Bachelor of Science from VA Tech in Business and Risk Management.

The economic downturn of recent years has brought focus to aviation business owners who are suddenly contemplating the sale of their FBO, flight school, aircraft maintenance, or other general aviation businesses. It is not uncommon to find that few have planned their exit strategy or how to best position the company for a sale. And, at a time when the average sales cycle for aviation businesses is in excess of 12 months, it is important to begin laying the groundwork well in advance of the decision to sell.

Understandably, over time, a business owner's attention is focused on building the business, improving sales, managing cash flows, and serving the customer.

All are critically important to the ongoing reputation and viability of the business. However, over the longer term, it is vital for any aviation business owner to devise a series of long- and short-term strategies to help position the company for a sale.

When it comes to positioning a company for sale, time is a valuable resource which must be used wisely. Over the years, our experience has shown that those business owners who've invested the time, and who've taken the steps necessary to ready their company for an eventual sale achieve far better results than those who haven't.

Make no mistake; in a time when the

average business sales cycle is lengthy, one's ultimate goal is to enhance the company's value and marketability to prospective buyers, and to get the best price in the shortest possible time.

Long-term strategy/ handling critical issues

As one reflects on the process of selling their business, it is important to view one's business and its operations from the buyers' perspective. Consequently for the business owner who is planning for that future date, an important part of the "positioning" strategy includes identifying and dealing with future issues which could

directly affect the business' value and buyer interest.

Future issues may include the need to renew a lease agreement with the airport or landlord, a requirement to refurbish or construct a hangar or other facility, the need to acquire

To properly position an aircraft maintenance business for sale in future years, any issue or relationship which may affect value, buyer interest, and the company's future profitability must be addressed and remedied as soon as possible.

or upgrade additional certifications, maintaining employee training and certifications, or the renewal of key contracts with customers or distributors. Simply put, to properly position an aircraft maintenance business for sale in future years, any issue or relationship which may affect value, buyer interest, and the company's future profitability must be addressed and remedied as soon as possible.

Consultants and experts in the sale of aviation businesses, frequently see circumstances where economic and personal issues suddenly arise which force an owner to pursue a sale immediately. This situation is generally a result of disagreements within partnerships, family issues, owner's health or death, declining financial performance, or a sudden desire to retire.

In these situations, timing may play a key role and may diminish the owner's capability to solve those outstanding, "future issues." When unforeseen events occur, the impact on the value of the business is usually negative, because those outstanding issues which one had always planned on eventually solving are now left undone.

Given the above, one's best long-term strategy is not to procrastinate. Even if the plan to sell is projected in three to five years, spend time now (once or twice yearly) to plan your exit strategy and solve problem areas. Work toward adding value and eliminating problem issues.

Is your business ready to sell now? The selling process

Spring is typically a busy time when many aviation business owners become re-focused toward improving their sales, pursuing customers, and developing opportunities for growth within their organizations. It is also during this time (from March to July) that many FBO and aviation business owners seriously entertain the idea of selling their businesses.

Once an owner has made the decision to sell, their attitude about how to approach the selling process is of critical importance. While some choose to take the path of least resistance, others accept that the process of

selling their business must be approached in the same way as any other important project or task. This approach may have a significant impact on the selling process and can determine one's success or failure in the effort to find qualified buyers and to facilitate the sale of their aviation business.

Though their reasons may vary, once the decision is made in the affirmative, an owner's first step must be to determine whether or not the business is indeed, ready to sell.

Here are three of the most obvious ways that one can gauge their readiness to put the business on the market and begin the selling process.

1. Identify the base of potential buyers

To the aviation business owner who hasn't experienced the process of selling their business, there is one undeniable fact: selling an aviation business (especially an aircraft maintenance operation) is not like selling real estate. Aircraft maintenance businesses are unique entities, with a limited base of qualified buyers, and the process of marketing, buyer screening, and presentation demands specific expertise and industry knowledge that the local real estate agent usually doesn't have.

While FBO acquisition opportunities tend to attract a wide range of potential buyers (some qualified and some not), the buyer demographic for aircraft maintenance businesses is typically much narrower. Buyers are generally from within the industry and knowledgeable about processes, regulations, and the scope of services they'll want to acquire and provide.

Knowing this, the business

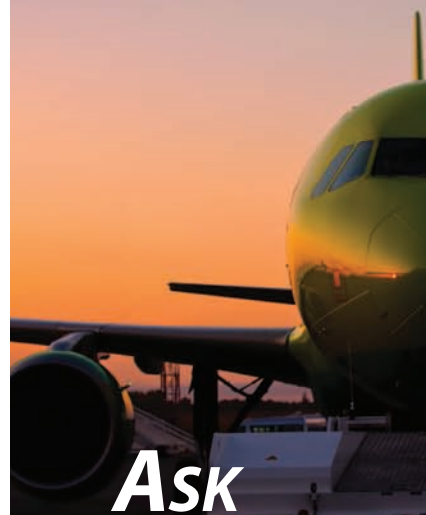
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owner's first step in the selling process is to honestly identify and determine who their base of potential buyers may be. These candidates may include the local FBO, an aircraft charter or flight school operator, competitors, senior maintenance employees or managers, or a larger regional maintenance operator.

2. Gather and organize key information

Once the potential buyer base is identified, the next step is to gather, organize, and develop a professional package that presents the company, its operations, financials, and other pertinent information. Whether this is accomplished "in-house" or by an outside consultant, the goal is to present the qualified buyer with information, data, and materials that portray the company in the best light possible. And, perhaps most important of all, the sales price of the business must be determined and included in the package before the first contact or exchange of information begins with any prospective buyers.

As one positions their aviation company for a sale, the type and quality of the information

buyers are interested in. In reality, nothing is further from the truth. Legitimate buyers want to know the details behind the financial picture. They're interested in the how and why of the business' success and they want to know where the future potential is. They're interested in information about the company's assets, facilities, FAA certifications, key personnel, airport and landlord relationships, owned aircraft, and validation of the customer base. All are essential to the buyers' decision-making process.

Until the owner takes the time to ensure that the informational package being conveyed to the buyer accurately describes the scope of their aircraft maintenance business, they're not ready to sell.

3. The final step: buyer-screening

One final key: During the selling process, confidentiality is usually a critical issue.

Before the business is ready to sell, the final step is to decide

absence of a buyer screening plan may risk the inadvertent release of information or disclosure about the potential sale to people who the owner may not want to know about the potential sale (airport personnel, key employees, bankers, customers, and others).

For those seeking additional information on positioning their aviation or maintenance business for sale, it may be best to consult an expert, who can provide assistance in both valuation as well as insight to potential buyers in the market. One such expert, Michael Dye is the president of Business Presentation Solutions LLC, a Denver-based company that owns and operates www.FBOsforSale.com and www.FBOConsultant.com, aviation-related web sites focused toward assisting aviation business owners and buyers with the marketing and sale of their aviation businesses. Dye was instrumental in the resourcing of this article. **AMT**

Many owners make the disastrous mistake of thinking that the "financials" are all that buyers are interested in. In reality, nothing is further from the truth. Legitimate buyers want to know the details behind the financial picture.

conveyed to the buyer will be the key to success in the selling process. Many owners make the disastrous mistake of thinking that the "financials" are all that

who will be involved in the selling process, and how those representatives will interact with prospects, screening, information exchanges, and followup. The

DeborahAnn Cavalcante leads Diversified Aviation Consulting (DAC) and along with her associates has firsthand experience in air carrier operations, private charter aircraft, general aviation operations, military/civilian interface, FBO management, maintenance repair station training, safety training, human factors training, and customer service training. For more information on DAC visit <http://www.dac.aero>.



Filing ASAP Maintenance Reports

The overall safety of the system needs the information that only mechanics can give us



By John Goglia

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.

Most major airlines have a maintenance ASAP — but far too many mechanics still hesitate to file reports of problems in the system, especially problems with maintenance manuals, engineering orders, task cards, and other maintenance documentation. Why is that?

Are mechanics not fully aware of the benefits of an Aviation Safety Action Program? It really is beyond dispute at this point that the greatest aviation safety gains will come from front-line workers reporting on problems they see from their unique vantage points. After all, management is likely not aware of many of the day-to-day issues mechanics face trying to do their jobs — until something unfortunate happens, like an accident or incident.

The overall safety of the system needs the information that only mechanics can give us — to improve system safety and perhaps prevent a catastrophic accident. (I have been told that some manufacturers are keenly reviewing data on manuals and other maintenance procedures with an eye toward correcting problems identified. Now therein lies a definite system-safety benefit potential.)

But in addition to improving safety, many ASAP reports also improve the efficiency of the system. And improving efficiency can save the airline money. There is at least some hope, that a more profitable airline will eventually benefit the airline employees — either by preserving jobs or maybe some day restoring some of the give-backs of the last decade.

Fear of disciplinary action

A more likely reason that mechanics fail to file ASAP reports may be that they are just not convinced that no company disciplinary or FAA enforcement action will follow? From the airline mechanics I have spoken to, it may be a little of both — not really understanding

the safety benefits of the program and being unwilling to find out how nonpunitive the system really is. While I think employees just need to accept that they have information no one else has, I can understand their hesitation on the latter point. No one wants to admit an error — and end up losing their job or, worse, their license.

The problem is particularly tricky regarding paperwork signoffs — especially if the issue is whether a maintenance signoff was proper or not. While most errors would be treated nonpunitively under ASAP, there is always the possibility that improper paperwork signoff would fall within one of the exceptions for “immunity,” if some overzeal-

The greatest aviation safety gains will come from front-line workers reporting on problems they see from their unique vantage points.

ous FAA inspector decided that the improper signoff somehow constituted falsification. So, I agree that mechanics need to be careful in reporting errors in signoffs.

But that does not mean that mechanics cannot report problems with incorrect or confusing manuals or other documentation. I would suggest that the types of errors that lead or can lead to improper signoffs be reported independently of any actual maintenance work performed. Or even better through a union rep or other employee representative. The important thing is to make sure the information of a potentially unsafe situation gets to the people that can make the necessary changes before a tragedy occurs. **AMT**

Stanmore Cooper vs. FAA Et Al

The Supreme Court ruled that the Privacy Act allows recovery against the government for actual damages and not for mental or emotional distress



By Stephen P. Prentice

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.

You probably recall my previous articles about Cooper and his travails on the way to the Supreme Court. He lost in the District Court and won on appeal to the Ninth Circuit Court of Appeals in San Francisco. The FAA appealed to the Supreme Court ... Cooper, however, lost his case in the Supreme Court.

We should all be concerned about the result in this case because it clearly seems to go against the spirit and intent of the Privacy Act of 1974 which protects all citizens from unlawful conduct by the government. In some ways, many would suggest that it is even more important than the coming result in the Obamacare Case, now pending before the court. The Cooper case should be of particular interest to technicians who are also pilots and take medical exams to renew their fitness for flight.

Cooper sued the FAA and the Social Security Administration and others, alleging that they all had violated the Privacy Act of 1974 by unlawfully disclosing his private and confidential medical information, (without his permission) causing him great mental and emotional damages. The Ninth Circuit Court of Appeals decision in his favor was recently reversed by the Supremes.

The Privacy Act

We should keep in mind, that you can-

not sue the government for just any alleged unlawful action ... the government only allows itself to be sued in very few instances and then only when *it says so*, as in the Privacy Act and other statutes, such as the Federal Tort Claims Act.

The Privacy Act, 5 USC 552a, allows recovery against the government for *actual* damages and does not *specifically* authorize an award of money damages for mental or emotional distress. For intentional or willful violations of the Act, the government is liable for *actual* damages.

Justice Alito delivered the majority opinion.

The court concluded, after much discussion, that, the Act does not waive the federal government's sovereign immunity from liability for such injuries that are described as *mental or emotional*.

Justice Sotomayor wrote the dissent concurred in by Justices Ginsburg and Breyer: "Congress enacted the Privacy Act of 1974 for the stated purpose of safeguarding individual privacy against government invasion. To that end, the Act provides a civil remedy (lawsuit) entitling individuals adversely affected by certain agency misconduct to recover "actual" damages sustained as a result of the unlawful action (of the government agencies), ..."

The strong dissent continued ... "Today the Court holds that actual damages is limited to pecuniary loss. Consequently, individuals can no longer recover what our precedents and common sense understand to be the primary, and often only, damages sustained as a result of an invasion of privacy, namely mental or emotional distress. That result is at odds with the text, structure, and drafting history of the Act. And it cripples the Act's core purpose of redressing and deterring violations of privacy interest."

The gist of the Privacy Act is simply a requirement that the government agency get

The FAA can easily track your medical problems and if found not reported will consider filing criminal falsification charges under 18 USC 1001.

the permission of the party concerned and disclose to him or her what they intend to do ... *before* they disclose anything that might hurt the person. In this case, they failed miserably to comply with this requirement.

Some history, investigation of 45,000 pilots

In 2002 the Department of Transportation (FAA) started a joint criminal investigation called "Operation Safe Pilot" with the Social Security Administration (SSA). It was designed to identify medically unfit pilots who had obtained FAA approved medical certificates indicating they were fit to fly. The FAA gave the SSA a list of the names of some 45,000 pilots located in the general Bay Area of San Francisco and northern California. SSA compared the list with its records to see if any of the pilots were receiving benefits for any disabilities. SSA's records turned up the name of Cooper ... among others, and it revealed that he had a current FAA medical certificate but had also received disability benefits for HIV and other relevant medical infirmities. FAA medical examiners revealed that they would not have issued the medical certificates (there were five in all) had they known his true condition.

Cooper's private pilot license was revoked. He was also indicted by the U.S. Attorney in San Francisco on three counts of making false statements on his medical applications to a government agency (FAA) in violation of 18 USC 1001. He pleaded guilty and was sentenced to two years probation and fined \$1,000. In his lawsuit under the Privacy Act he alleged that by sharing his personal medical information, without his permission or knowledge, he was "humiliated and embarrassed, suffering mental anguish, fear of social ostracism, and other severe emo-

tional distress." He did not list any money damages like loss of wages or other pecuniary damage. This was a fatal flaw to his claim! If he had been an airline pilot and also had loss of wages then he might have prevailed.

The Court of Appeals on the other hand found that the word "damages" did include the mental distress and other emotional damages and therefore found in his favor but of course the Supremes reversed it.

Court reasoning

The Supreme Court admitted in its decision that the term "actual damages" does change depending on the specific statute in which it is found. The term does sometimes include such damages as Cooper alleges ... nonpecuniary damages. However, in his case the court said that it is clear that the intent was to provide only for pecuniary damages, i.e. money damages, generally referred to as "special damages." Sadly for Cooper he alleged none.

This decision illustrates the point that to use this statute you must point to some specific thing such as loss of a job or something that is an actual out of pocket money damage incurred as a result of the unlawful disclosure of the government. Cooper's lawyer maybe could have done this in his complaint. Surely there was some out of pocket expense that could have been tied to this unlawful disclosure?

Mechanic/pilot warning

Mechanics who also hold pilot certificates should keep in mind that there are ways now with the click of a computer mouse to check on your statements on your medical applications. There is almost total automatic sharing of medical information due to the waivers that you sign on these applications and the authorized medical people can find your complete medical history with little difficulty.

You must put down everything on your application ... any history that you have not reported, medications not reported, etc., etc. They can easily cross check and find that you have not reported a previous history that is in some other medical record in the medical care system. Even outside of government records, many medical insurance and hospital plans now provide for computerized sharing of your medical information freely between each other and the government, simply because somewhere on a form you have given your permission for them to do so.

Be forewarned ... the FAA can easily track your medical problems and if found not reported will consider filing criminal falsification charges under 18 USC 1001. In addition, of course, it will revoke all of your FAA airman certificates, including your A&P. Cooper was put through the federal grinder for what was thought to be a minor failure to report issue on his form. He stated for example that he did not think he had to report HIV because it was a particularly private matter and did not have to be reported ... he was wrong of course. Don't bother asking your AME if you should report it ... his opinion is not controlling and will not help as an excuse ... just report it.

On the other hand, the conduct of these agencies, their employees, and agents, in this case, was particularly egregious and should have been discussed by the court ... it was not, of course. Perhaps some sort of punitive award could have been given. The record in the District Court and the Ninth Circuit Court of Appeals sets out in detail how poorly he was treated by the government agents concerned. Of course, they still all have their jobs ... none of the government agents were sanctioned for their actions. **AMT**

Listen Closely; Persistence Pays Off

Noise is one means of locating worn/bad components



By Clint Lowe

Clint Lowe holds an FAA Airframe and Powerplant certificate with Inspection Authorization and a Commercial Pilot certificate with instrument and multi engine ratings.

With all the pulleys, bearings, fairleads, etc., flight control systems have, the task of locating one or two misbehaving components can be assisted by simply listening and feeling the system as you operate it. Wings and fuselages are fairly good echo chambers that pass noises pretty well, which gives us one effective means of locating worn/bad components. Validating or backing up your inspection is to take a moment, once before the work begins and again after everything is done, to slowly move the surfaces through their travel while intently listening and feeling the surfaces through your fingertips.

I found a misrouted aileron cable while doing this on a freshly repaired Cessna 206. The right aileron cable had been routed through a lightning hole rather than the cable routing hole in the rib; the resulting rubbing was caught because a slight sawing sound could be heard when the ailerons were moved and the condition was caught early before damage could occur to the structure.

A recent example was found during a progressive inspection. While slowly moving the ailerons during the phase inspection, a very slight roughness almost eluded detection.

A second, slightly quicker



movement caused a little vibration to be noticed toward the end of the aileron travel. The mechanic now waited a moment for surrounding noises to quit and tried it again. There ... a slight grinding noise or something. He had another person slowly move the Lear's aileron in another quiet time and heard it coming from over by the right aileron. Now homing in, the once-barely noticeable grinding and roughness revealed itself in a bearing with a little reddish, rust-colored stain. Persistence paid off. If it seems weird, it probably is. **AMT**

Clint has spent most of his aviation career with the U.S. Air Force and Air National Guard in a variety of roles including maintenance, safety, training, oversight, and accident investigation. He currently is a quality assurance inspector/quality assurance representative with the North Dakota Air National Guard in Fargo, ND.



A black and white photograph of a woman with long hair, seen from the side, looking at multiple computer monitors in what appears to be an air traffic control or aircraft maintenance control room. The monitors display various technical diagrams and data. In the background, another person is visible, also working at a console.

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AMT Editorial Staff

AMT Editors and Writers Gathered at the 2012 Cygnus Aviation Expo

AMT is proud of the long-tradition of having dedicated staff and writers with diverse aviation backgrounds who regularly write the articles that fill the pages of our fine magazine. Most of these folks have made, or still make their living in the aviation industry, have hands-on experience, or regularly participate in any number of industry



Left to right: Charles Chandler, A&P, former American Airlines, FlightSafety International, management and leadership instructor, currently writes any number of technical and industry related articles; Ronald Donner AMT editor; and Steve Prentice, ATP rated pilot, A&P/IA, and aviation attorney who currently writes our Staying Legal column.



Left to right: Barb Zuehlke, AMT Senior Editor, has been in the publishing business for nearly 35 years and part of AMT for more than 10 years; Ronald Donner, AMT Editor for over two years, A&P/IA, commercial pilot certificate, has worked in the aviation industry for 35 years including 27 years with Northwest Airlines; John Goglia, A&P, former US Airways, former NTSB member, is known throughout the industry and regularly writes an Industry Outlook column; DeborahAnn Cavalcante, principle of Diversified Aviation Consulting, IS-BAO accredited auditor, safety and customer service instructor, commercial pilot, currently writes the AMT Management Matters column.

activities. In March during the Cygnus Aviation Expo in Las Vegas, AMT was pleased to have present most of these fine people.

Jim Sparks, who holds an A&P certificate and manages aircraft maintenance for a private company, regularly writes the AMT Avionics feature; Tim Kern, pilot, aircraft builder, and long-time aviation journalist who regularly writes for AMT; and Nick Sergi, former director with FlightSafety International who writes an Industry Outlook column, were not present at the 2012 Cygnus Aviation Expo.

The list of occasional contributors to AMT is very long and we thank you all very much! **AMT**



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Charles Taylor Master Mechanic Award

In honor of AMT Day and Charles Taylor, here are a few of the recent winners



By Barb Zuehlke

Senior Editor Barb Zuehlke has been in publishing for 33 years and part of the AMT editorial team for 11 years.

The Master Mechanic Award is named in honor of Charles Taylor, who served as the Wright Brothers' mechanic and is credited with designing and building the engine for their first successful powered flight. To be eligible for this award, a recipient must have served at least 50 years as an aviation mechanic and also have been an FAA-certified mechanic for a minimum of 30 years. Along with a beautiful plaque, their names will be recorded in a permanent leather bound book in Washington, D.C.

Garrett "Jep" Williamson

While Garrett Williamson was interested in aviation as far back as he can remember, and being born on Dec. 24, 1919, that goes back a few years, he received his A&P in 1954. He served in WWII as an Army Air Force B-17 gunner for three years, three months, and three days of active service. He served for three years on active reserve and 10 years on inactive reserve. During his career he worked at Chicago & Southern Airlines, Memphis Aero, Aero Electronics, and Aeroframe Airepairs as an A&P mechanic.

He received the Charles Taylor Master Mechanic Award in 2005.

The real story is that he is still working as an A&P at Aeroframe Airepairs in Memphis, TN. And his comment when asked how long he'll continue, he says, "Till death do us part, or as long as I can maintain my end of the bargain or other unknown events ..."

He has three children, eight grandchildren, and seven great grandchildren. In his off time he likes vegetable gardening, camping, and dancing – ballroom, swing, and Latin.

James "Red" Leslie, Bill Earnest, Glenn Hobbs

US Airways Charlotte, NC-based line

maintenance supervisor James "Red" Leslie, Tampa, FL-based lead mechanic Bill Earnest and San Diego, CA-based mechanic Glenn Hobbs received the FAA's Charles Taylor "Master Mechanic" Award for their 50 years of dedication in aviation maintenance.

"Red, Bill, and Glenn have exhibited mastery and leadership in the field of aircraft

"After more than 60 years in aviation I still get a thrill every time I see an airplane land or take off."

— Lynton Scott

maintenance," says David Seymour, US Airways' senior vice president, technical operations. "We are grateful for their service and proud to have them represent our outstanding team of 3,600 maintenance and engineering professionals."

Leslie began his aviation career with Piedmont Airlines in 1962 as a mechanic's assistant in Roanoke, VA. In 1998, he joined the Charlotte-based team where he works as a line maintenance supervisor at US Airways' largest hub.

Bill Earnest joined Mohawk Airlines in Utica, NY, as a mechanic in 1962. In 1967, he transferred to Buffalo, NY, where he was promoted to line mechanic. Earnest's career brought him to US Airways' Tampa, FL, station in 1989, where he was promoted to his current role of lead mechanic.

Glenn Hobbs will receive his award on June 5. He began his aviation career in 1960 with the U.S. Air Force as a mechanic. Five years later, he was hired by PSA as an



Garrett "Jep" Williamson

aircraft mechanic in San Diego. He was transferred to Los Angeles for a period of time and has since returned to San Diego where he serves as a line mechanic.

Lynton Scott

Involved in aviation for more than 60 years, including

51 years as a licensed aircraft maintenance technician, Lynton Scott of Trinity Center, CA, received special recognition from the FAA in March when he was presented the Charles Taylor Master Mechanic award during the FAA's annual Airworthiness Inspector Certificate Renewal symposium in Reno.

Lyn Scott started his aviation career as a gun turret system mechanic on B-50 bombers in 1951 at Walker AFB in Roswell, NM. He later became an A&P mechanic, earned a bachelor's degree in aircraft maintenance engineering from Northrop Aeronautical Institute in 1959, and obtained his A&P mechanic license from the FAA the same year.

He worked for United Airlines as a mechanic when the airline was transitioning from props to jets and also taught mechanics to

adult students in San Francisco. In his hometown of Trinity Center, he operates an airplane repair facility at the Trinity Center airport. In addition to his mechanic's license, he holds a commercial pilot's license with instrument rating and a ground instructor's license.

Scott says he considers receiving the Charles Taylor award a great honor in memory of "a true mechanical genius" and that after more than 60 years in aviation "I still get a thrill every time I see an airplane land or take off."

We congratulate the winners for their dedication to the aircraft maintenance industry. If you or someone you know has achieved this milestone, let us know. Send name, history, and photo if available to barb.zuehlke@AviationPROS.com. **AMT**

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Hawker files Chapter 11

Hawker Beechcraft has reached an agreement with a significant number of its senior secured lenders and senior bondholders on the terms of a financial restructuring plan that will strengthen the company for the future and eliminate approximately \$2.5 billion in debt and approximately \$125 million of annual cash interest expense.

It and certain of its subsidiaries have filed voluntary petitions under Chapter 11 of the United States Bankruptcy Code in the U.S. Bankruptcy Court for the Southern District of New York. The terms of the prearranged restructuring agreement will take effect when the company's reorganization plan is confirmed by the Court and the Chapter 11 case is concluded.

As part of the prearranged restructuring, Hawker Beechcraft obtained a commitment for \$400 million in Debtor-in-Possession (DIP) financing, which will enable it to continue paying employees, suppliers, vendors, and others in the normal course of business. The company will comply with all Department of Defense acquisition and maintenance contracts, as well as agreements with international air forces including, but not limited to, the recently announced sale of T-6C trainer aircraft to Mexico. It is also committed to moving forward with its bid to provide the U.S. Air Force with the AT-6 in support of the Light Air Support contract.

New training technology

The U.S. Air Force awarded Lockheed Martin (NYSE: LMT) a \$156 million contract to provide new training devices to accommodate the growing pipeline of C-130J aircrews and maintainers. Lockheed Martin will develop 24 new training devices and provide program management and engineering services under the U.S. Air Force's C-130J Maintenance and Aircrew Training System II, referred to as JMATS II. The devices include weapons systems, enhanced integrated cockpit systems, loadmaster fuselage and loadmaster part-task trainers along with enhanced cargo handling system training aids. Lockheed Martin has managed the C-130J Maintenance and Aircrew Training System since 2000 to provide a comprehensive range of training devices and support services, including aircrew and maintenance personnel instruction, program opera-

tions and engineering services. The work will be managed at Lockheed Martin's Marietta, GA, and Orlando, FL, businesses.

Gama expands U.S. base

Gama has been intensively building the infrastructure for this effort since 2009 with the creation of three separate FAA and EASA approved Part 145 certified repair stations located in Bridgeport, CT (BDR), Teterboro, NJ (TEB), and West Palm Beach, FL (PBI). Each of the repair stations has expansive authorizations to perform base and line maintenance on most models of Gulfstream, Falcon, Bombardier, Cessna and Hawker aircraft, as well as all of the associated powerplants. Gama is focusing its growth initially at the West Palm Beach site, with the creation of a number of new technicians (engineering) jobs to service the increasing demand from aircraft operators in search of a 'concierge' level service.

Cirrus jet is back

Almost five years after starting work on a prototype, the Duluth, MN-based company has landed financing to finish developing the new plane. Designed for the personal aircraft market, it's an integral part of a strategy to expand Cirrus' current product line of piston-engine aircraft. The funds from China Aviation Industry General Aircraft Co. (CAIGA) will be used for further testing and to build tooling needed to manufacture the new plane. Dale Klapmeier says the jet could generate more than 100 jobs, where production is expected to begin in 2015. He says the company already has added engineers and technicians to finish work on the plane, called the Vision SF 50.

Aerostar to double MRO capacity

Aerostar S.A., the leading Romanian aerospace company, is building a new hangar at its Bacau location that will double its commercial aviation MRO capacity. The hangar, which is now substantially complete, is having its utilities and equipment installed and will be ready for opening in May. The new 5,000-square-meter hangar can accommodate four bays for regional/narrow-body aircraft. Currently its MRO activities are carried out in an earlier four-bay hangar, so the addition brings total capacity to eight aircraft in more than 10,000 square meters of space. Aerostar can supply

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360,000 man-hours a year for commercial aircraft MRO work. It has 32 Part 66 licensed engineers and more than 150 technicians in avionics, mechanics, and structures.

University research

Eaton Corp. has entered into a creative new relationship with Purdue University as a founding member of the Center for Technology Development. Eaton was one of three companies that signed a charter to officially launch the Center for Technology Development at Purdue University on Jan. 11, 2012. Each founding member will contribute \$50,000 a year for the next three years to help start the center, which provides members with a diversified set of resources to carry out research and development, direct problem-solving and feasibility studies for future products.

New book on avionics

The second edition of "Avionics: Systems and Troubleshooting" by T.K. Eismin has been published by Avotek Information Resources. Updated to focus on new technologies and the latest aircraft developments, it provides a practical guide to advanced avionics for aviation maintenance schools and current avionics technicians. It has been redesigned and numerous color photos and illustrations have been added. Topics cover transport category power distribution systems, electronic panel displays, synthetic vision, electronic flight bags, satellite weather systems, and ground proximity systems. It is a valuable tool in preparing for NCATT certification testing. More information is available at www.avotek.com or by calling (800) 828-6835.

ATP adds Avidyne pubs

ATP adds the digital avionics technical publications from Avidyne Corporation to its extensive database of technical and

maintenance libraries. All Avidyne avionics libraries from ATP now can be accessed via the new ATP Aviation Hub online service, as well as the NavigatorV desktop platform. Avidyne is a leading provider of integrated flight deck and safety systems for general aviation aircraft, based in Lincoln, MA. This is the first time Avidyne's technical documents have been made available via ATP's comprehensive content services and software applications. The publication is the result of an agreement announced between the two companies in January 2011.

Chinook training facility

The Boeing Company and its Dutch partner the Rotary Wing Training Center (RWTC) officially opened a state-of-the-art CH-47 Chinook helicopter maintenance training facility near Royal Netherlands Air Force base Gilze-Rijen in April. The RWTC is a subsidiary of the Netherlands' World Class Aviation Academy (WCAA). The training includes current technical information and courseware tailored for CH-47 mechanics, technicians, pilots, and crew members. The full training program covers theory, troubleshooting and fault isolation, as well as maintenance and servicing. Students receive practical training on a retired Chinook airframe, providing a more realistic learning experience.

AAR goes to Duluth

Illinois-based aircraft repair giant AAR Corp. has agreed to take over most of the vacant former Northwest Airlines maintenance facility and bring as many as 225 jobs to the city of Duluth, MN. The signed letter of intent with the city, will let AAR's maintenance, repair, and overhaul group occupy 152,000 square feet of the former Northwest hangar. AAR said it plans to hire up to 225 people once the Duluth

hangar is operating at full capacity. Duluth beat out several other cities for the selection.

Helicopter support in Spain

Eurocopter España has acquired an 80 percent stake in the new company Sabadell Helicopters Service Center (SHSC), which brings together the aircraft maintenance and repair activities of the Catalanian company TAF Helicopters SL. This platform positions Eurocopter as a provider of technical assistance and logistics support services for the Spanish helicopter sector. With an initial staff of 35 technicians based at Sabadell Airport, near Barcelona, SHSC will enable Eurocopter to provide direct, specialized support for all civil helicopter fleets. There are currently more than 700 civil helicopters registered in Spain and this number has steadily increased over the last 20 years at an annual rate of 5 percent, with Eurocopter products accounting for 60 percent of the Spanish fleet.

CTS Engines opens new facility

CTS Engines, a leading independent engine MRO, opens its state-of-the-art engine service center. The 60,000-square-foot building, located next to Fort Lauderdale-Hollywood International Airport, is a full-service engine overhaul facility capable of performing the vast majority of all engine repairs in-house. The facility includes 10 full-service engine bays with gantries, full cleaning and FPI capabilities, weld shop, plasma booth, coordinate measuring machine, high speed blade tip grinder, vertical machining center, horizontal and vertical balancing machines, bearing room, and gearbox room. The shop is capable of performing approximately 70 percent of all repair services in-house.



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Training

Moving ahead to keep up with the demand



By Nick Sergi

Nick Sergi has a rich background of aviation experience. He retired as Director of Maintenance Training Services for FlightSafety after more than 34 years of service with the company. He served in the U.S. Marine Corps as an aviator, both fixed wing and helicopter rated.

There is encouraging news for aircraft maintenance personnel from the world of training suppliers.

Going back in time, I recall when attending a maintenance course was a big deal for most technicians, not so much initial systems but any kind of refresher or self-improvement lesson. Remember when the boss said, "I'll send you to training, but what will you give me in return." Of course, many a manager learned the hard way that it was, to coin a phrase, pay me now or pay me later. Hopefully those days are gone and your organization accepts the costs in time and money to train.

According to the latest figures, there are, approximately, 223,000 operating aircraft in the U.S., 204,000 needing a licensed tech or MRO for sign off. These aircraft range from J-3s to A-380s and 787s. Putting aside the dope and fabric gen, current and future aircraft require technicians to be knowledgeable on subjects that include — fly by wire, glass cockpits, AMS (aircraft management systems), electronic documentation, human factors in the workplace, composite structures, alternate fuels, and high-tech metallurgy.

Unfortunately, the deficiencies in courses taught at 147 schools and the needs of modern maintenance will continue until the FAA commits to rewriting Part 147. Look at some of the differences between U.S. requirements and EASA. EASA necessitates practical training to work on specific equipment and all approved U.S. EASA repair stations must incorporate human factors training.

For the future

What should today's technician training include beyond the standard systems courses? Try the following: critical thinking skills, human factors, fatigue management, communications — the ability to convey ideas both verbally and in writing, and appreciation for quality, integrity, and efficiency.

With the previous in mind, why be excited about the future? To begin with, it is clear more organizations are learning that training is a necessity and that there is a payback.

Look at the recent study related to fatigue management done by Dr. Bill Johnson, chief scientific and technical advisor to the FAA. His study proved that the ROI for the investment in fatigue management training was in excess of several hundred percent producing significant savings in personnel and aircraft accident experience. As management realizes financial gains, more investment will be made in training. As training companies recognize profit from costs to develop more sophisticated learning tools there will be greater program improvement. As Dr. Johnson stated "... investment in training is market driven."

Relating to the previous, predictions call for a need for some 33,500 new airliners by 2030, and another 10,000 business aircraft by 2018. That's a bunch of new, sophisticated airplanes that require expert, cost-efficient maintenance. And a lot of it will be done in the U.S. My friend, John Goglia, informed me that there will be a need for some 10 to 12,000 licensed technicians in the U.S. in the next five years.

This demand for well-trained technicians will require better, more cost-efficient training courses. Current and on the horizon, are:

- Courses that use desktop computers to replicate systems. For example, see what happens throughout the hydraulic system when the gear is lowered.
- Interactive 3-D programs that enhance realism and learning by doing.
- Virtual aircraft courses that enable technicians to enter compartments and check or replace components, just as if they were in a real aircraft.
- E-Learning, used to deliver courses to disparate audiences worldwide at the same time, bringing greater economies of scale.
- Greater use of simulators for engine run up and taxi practice. This results in less risk to the aircraft and powerplant and provides a better learning environment.

In summary, there is a growing need for smart, qualified technicians. Aircraft maintenance training is moving ahead to keep up with the demand. There are fewer reasons for inadequate preparedness in maintaining aircraft. **AMT**



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