

**Aircraft Maintenance Technology**

# AMT

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

*Official publication for AMTSociety*

**October 2011**

## Tire Care and

# MAINTENANCE

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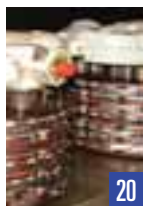
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# Partnering:

## Associated with another for mutual benefit



Ron Donner, Editor

**R**eading about business practices in the usual media outlets, aviation or otherwise, trade magazines, or textbooks describing best practices on the subject of business, you will undoubtedly come across writings about both successful and at times unsuccessful partnerships.

A quick search for the definition of partner revealed such results as a person who shares or is associated with another in some action or endeavor; a principal or a contributor of capital in a business; a joint venture; sometimes sharing in the risks and profits. This includes of course one of the very important relationships, the one with your spouse. Partnerships can come in all sizes and shapes, between all types of companies, organizations, and individuals.

### Business and academia

One type of partnership mentioned these days is the one between academia and the private sector for technical education. *AMT* provided examples of partnerships in our August focus on careers issue. The thought is the combined talents, experiences, resources, and lessons learned between the aircraft maintenance industry, an educational facility, manufacturing firms, and individuals can produce a better end result.

### Suppliers

Other typical partnerships found in aircraft maintenance are those between an aviation operation and its suppliers and maintenance providers. I recall not too many years ago when suppliers were called vendors and often times not viewed as partners. These relationships were at times tenuous and all about the business

with little mutual respect or benefit. But in the ever-changing landscape of business today, brought on in part by the economic conditions, globalization, mergers, and acquisitions, partnerships and partnering with key suppliers has become more important. The "go it alone" approach is not always viewed as the best or safest strategy.

### Asset management

Recently I sat down with Steve Hendrickson of Newcastle Aviation Partners, LLC. There's that word partners; right in the name of his company. Newcastle provides a service of asset management particularly for those expensive spare parts such as turbine engines, propeller assemblies, and landing gear or related complex components. As described in the article, partnering with a company to provide timely spare parts through exchange or lease arrangements, instead of outright ownership while maintaining your aircraft or fleet's busy schedule, can be a beneficial partnership worth pursuing.

Other articles in this month's issue of *AMT* include tire care and maintenance by Charles Chandler. Charles spoke with both Goodyear and Gulfstream and provides several of their current tips relating to tire care. Moving up to larger size tires and larger size operations, in this month's MRO Operations feature Tim Kern describes the American Airlines Wheel & Brake Center and how it produces 25,000 wheels and 5,300 brakes each year in order to keep the airline operating. There has to be some successful partnerships here.

As I write this column I am in Duluth, MN, preparing to attend the Cirrus Aircraft Partner Symposium. There's that word again.

*Enjoy the issue, Ron*

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# Challenge

For the mechanics, a new tool from Embry-Riddle



By Nick Sergi

**A**s I write, it's a clear, blue-sky summer day here in Florida. It is also a clear, blue-sky summer day in New York, as Americans, throughout our fine land remember the inhumane, horrible attack on our innocent citizens 10 years ago that killed 2,976. Perhaps, when we see other days like this, it will serve to remind us, lest we forget. We must never fail to remember the challenges we face from enemies that hide within innocent populations who wish to destroy us and our way of life.

Please excuse me for digressing from my original subject which is, in only the most general respect, similar ... challenge. Technicians today face a plethora of demands, including

severe working conditions, pay not commensurate with responsibility, physical risk, undue stress, and the need to stay current in this dynamic industry where technological advance is the order of the day.

Maintaining currency and updating knowledge and skills is an especially difficult task for most.

As a close friend of mine, Jim Sparks, a peer of yours, has stated ... "our career field is in need of a renaissance, as well the well-deserved recognition long overdue our ranks for being the true sentinels of airworthiness." Here! Here!

In this light, I bring to your attention a glimmer of hope that there may be change in the future. True, this relates to the grass roots of our avocation, but isn't that a good place to start?

Two days ago, I was invited to attend the blue ribbon-cutting ceremony for Embry-Riddle Aeronautical University's new Hagedorn complex. It was also, by chance, a beautiful, clear blue-sky day. In his opening remarks the president of the



*President John Johnson's opening remarks at the grand opening of the ERAU Hagedorn complex, "ERAU is the finest aviation university on the planet."*

school, Dr. John Johnson stated, "ERAU is the finest aviation university on the planet." That's a bold statement with which I agree. I think many will concur.

The complex consists of three buildings ... a 15,000-square-foot flight maintenance hangar where ERAU maintains its fleet, a 38,800-square-foot operations building that includes a tower for ramp control and, last, but certainly not least, a new 48,680-square-foot aviation maintenance sciences building, the most modern nexus for primary maintenance education I have seen.

The school is chaired by Chuck Horning, a former Delta avionics program manager and an ERAU instructor for many years. There are six classrooms, (one dedicated to avionics) and seven labs. Currently the 147 program has an enrollment of 180 students. Adding those also entered into the BS degree program, the enrollment exceeds 270. The school is currently maxed out but has plans to increase enrollment in the near future. It's good to see this investment in our industry and future aircraft technicians.

Finally, as I think about 9/11, I am reminded that U.S. aircraft technicians are typical of American stock ... hard workers, generally loyal, willing to go the extra step, and ready to accept the gauntlet of responsibility as it is thrown their way. Here! Here!



*The complex consists of three buildings ... a 15,000-square-foot flight maintenance hangar where ERAU maintains its fleet, a 38,800-square-foot operations building that includes a tower for ramp control, and a new 48,680-square-foot aviation maintenance sciences building.*

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# Asset Management

A review of lease/exchange support for your engines and landing gear



By Ronald Donner

**M**aintenance departments no longer are viewed only as the group that maintains aircraft. Today they play a pivotal role in the financial aspects of any operation. Major spare components such as engines, landing gears, and propeller assemblies are expensive capital intensive assets that present a major investment decision.

What was once a less challenged decision just 10 years ago, the decision to buy, lease, and exchange high value assets today deserves thorough technical and business case review.

With continued pressure to preserve cash and contain costs, operators and service centers look for resourceful ways to invest less on spare parts while improving service recovery response time. The opportunity exists for asset management

companies to play a vital role; one which provides timely, cost-effective spare parts support through exchanges, leases and sale/leasebacks. To learn more about spare part

*Propeller assemblies and engines such as on this King Air can be leased from asset management companies rather than an operator purchasing them outright. Photo courtesy of Hawker Beechcraft.*

asset management, I sat down with Steve Hendrickson and Newcastle Aviation.

*AMT: How can a company like yours manage expensive spares more economically than the operator or service center?*

**SH:** Well, our core business is asset management and we do it very well. For example, an operator's removal forecast may call for needing one spare engine, landing gear, or prop assembly over a two-year period. Depending on the asset, the value could be millions of U.S. dollars.

Many operators view spares as necessary to support their operations. However, if an asset is sitting idle on the shelf, there's an opportunity cost associated with it. If the asset is financed, it is most likely accruing interest expense. Or if the asset is free and clear, it could be sold to free up capital needed to run the company's core business. Through spares pooling we combine the demand forecasts of multiple operators, and provision our spares pool to cover those needs accordingly. We custom tailor a spares support program that meets the needs of our customers.

*AMT: How do you manage your spares level?*

**SH:** It's a dynamic process that requires constant monitoring. We use statistical Poisson distribution modeling to determine the number of spares required to meet specified service levels and the needs of the pool. When properly managed, the pool concept is economically more advantageous to its members because fewer per-capita spares are required to achieve the same service level than if they were not in the pool, and the pool spares are being utilized more steadily. As we add customers to the pool, the same modeling is used to determine when we buy additional assets.

*AMT: How else does the pool concept benefit the operator or service center customer?*

**SH:** We also offer repair management services. We utilize the economies of scale



leverage of our spares pool to negotiate favorable repair/overhaul terms with the repair agencies we use — not with just one, but a minimum of two shops. Quality being equal (uncompromising), we're able to keep our shop visit costs and turn-around times competitive, which translate to lower operating costs for our pool customers.

*AMT: Explain the difference between short-term leasing and exchanges?*

**SH:** They both provide one common objective; immediate access to expensive spare components on demand. Short-term leases are used by operators and service centers that have a short-term operational (versus financial) need for the spare. Reasons for leasing vary, but

most often it provides operational coverage while the operator's component is in repair or overhaul. Following repair, the leased component is removed from wing and returned. This option is more desirable for operators or service centers that need to have their original component back after the shop visit. The primary difference with exchanges is title to the asset is swapped at the point of exchange and the operator or service center will not get their original core back.

*AMT: Are there different kinds of leases?*

**SH:** I prefer to classify component leases into two categories — short-term operating leases and long-term finance leases. Short-term operating leases have a term of one to 12

months and provide flexible, cost-effective spares support during the repair/overhaul of the operator's component, or the lease may be required to supplement existing spares during fleet expansion. The lease rate is typically made up of daily rent and a maintenance reserve. The daily rent portion is a fixed dollar amount paid per day and the maintenance reserve is most often a fixed amount per hour and/or cycle of operation.

Long-term leases of one to 10+ years are otherwise known as finance or capital leases. The long-term lease is an alternative to outright ownership and is a way to finance or lease an asset over the long term. In most leases, the asset is returned to the lessor at the end of the lease term. Some leases allow the operator to buy the asset at a predetermined price

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at the end of the lease term. The lease rate is made up of monthly rent. Most long-term leases do not collect maintenance reserves but instead include specific return conditions for part condition, configuration, and remaining life requirements. Often times there is a buy-out provision which allows the end user to pay for any return conditions not met.

*AMT: What are the different kinds of exchanges?*

**SH:** Flat rate exchanges are offered to operators and service centers for a flat fee, with limitations. Included in the exchange fee is access to the 'ready-to-install' spare and it pays for the 'standard overhaul cost' of the operator's removed core, excluding charges for work considered 'over and above' a normal overhaul workscope. A flat rate exchange is relatively simple for the operator or service center to manage logistically because they're not required to deal directly with the shop. They provide predictable exchange/overhaul cost structure for budgeting and forecasting purposes and are favored by customers that prefer a simple repair management process.

Cost plus exchanges charge an exchange fee plus the actual cost of the overhaul of the customer's asset. This method provides



*Newcastle Aviation's Jim Beckmann, manager Quality & Logistics, is inspecting/verifying documentation on a landing gear drag strut following overhaul at Av-Reps Component R&O in Toronto, Canada.*

the customer a less predictable exchange/overhaul cost structure for budgeting and forecasting purposes — but the customer reserves the right to dispute any charges that do not seem fair and reasonable. Cost plus exchanges are the actual cost of the overhaul and are preferred by customers

with a hands-on approach to reviewing overhaul invoices.

*AMT: What are the major parts of a lease and exchange agreement?*

**SH:** Although these agreements are written for many different types of transactions, the three major parts are: business/operations, legal, and risk management. The business/operations portion of a contract covers items such as: contract term (start/end dates): exchange/lease fees, payment terms, delivery and redelivery terms, shipping



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*AMT: What are the key aspects maintenance personnel need to be aware of regarding lease and exchange parts?*

**SH:** Whether you are purchasing, leasing, or exchanging a component, your plans for use of that part remain the same — to install it on wing and return the aircraft to service.

First, ensure that the component part number and description you are leasing or exchanging is the component you actually need. Careful review of the part and its airworthiness records are essential to ensuring that it is airworthy and in the correct configuration for your operation. Such records include the current return to service

EASA Form One, TCCA Form 1, or FAA 8130-3, SB/AD status, configuration or modification status, PMA parts status, LLP or CLP status, requested trace to birth documents, and test cell/MPA

**“Careful review of the part and its airworthiness records are essential to ensuring that it is airworthy and in the correct configuration for your operation.”**

— Steve Hendrickson,  
Newcastle Aviation

run data, etc. Reliance is put on the top level airworthiness tag — and rightly so. But that shouldn't substitute a careful review of the records beyond that certificate. Another point is the facility that approved the return to service paperwork. Are they required to be added to your organization's approved vendor list? If you don't recognize the shop take the time to verify the status of the repair station certification and capabilities.

*AMT: What is the trend for asset leasing and exchanges going forward?*

**SH:** Operators and service centers will continue to manage operating expenses, improve operational flexibility, and lower the overall cost of ownership. The benefits of participation in lease and exchange pools can produce significant results. But the first and perhaps most difficult questions for the operator or service center to ask are: Are we fully utilizing that expensive capital intensive asset sitting there or is there some unanswered conviction to let it remain there? And what is that really costing us? **AMT**

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*An AMT changing the Goodyear tires on this Lear aircraft. Photo courtesy of Goodyear.*

# Kick the Tires and Light the Fires

Maintenance practices include proper installation, inflation, and removal



By Charles Chandler

**K**ick the tires and light the fires — colorful jargon but poor advice concerning safety and the service life of aircraft tires.

Modern aircraft tires are dependable and capable of dealing with weather extremes, less than stellar landings, high-speed turnoffs, long taxi routes, and significant vibrations on rollout and takeoff.

Aircraft tires are expensive, complex components that are vital to safe aircraft operations. They are dependable and reliable but not indestructible. They require a significant amount of care and maintenance from owners, operators, and maintainers. Servicing tires should be as important as the check and replenishment of engine oils and hydraulic fluids. The recommendations and requirements for tire care and preventive maintenance

are straightforward and clearly stated in both OEM and FAA documentation. They provide advice and direction that should be the foundation of tire maintenance programs.

## Tire care and preventative maintenance

FAA Advisory Circular AC 65-15A (Chapter 9) and AC 20-97B dated 4/18/05, initiated by AFS-306, titled “Aircraft Tire Maintenance and Operational Practices” provides recommended tire care and maintenance practices needed to assure the safety of support personnel and the continued airworthiness of aircraft. Specifically, this AC provides guidance on the installation, inflation, maintenance, and removal of aircraft tires. In addition, it provides guidance on the operational practices necessary to maintain safe aircraft operations.



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*A tire cage is highly recommended for safely inflating aircraft tires. Photos provided by Peter Zeeb, Caesars Entertainment Inc.*

The AC recommends that “operators should comply with tire inspection recommendations specified in the tire manufacturer’s CMM, and consult the tire inspection advice set forth in this document.”

Both the FAA AC and the Goodyear Tire Care and Maintenance Manual stress tire preventative maintenance. Chapter Four: Preventative Maintenance in

the Goodyear manual states, “Tires cannot be taken for granted on any aircraft. Tire maintenance costs will be at their lowest and tire life will be at its longest if proper maintenance practices are observed. Safe tire operation also depends on proper maintenance. Thus, preventive tire maintenance leads to safer, more economical operations.”

They specifically address daily inspections and inflation checks. The AC states that “accurately maintaining the correct inflation pressure is the single-most effective task in the preventive maintenance regimen for safe tire operations.” Both recommend that tire pressure should be checked daily or before

the first flight with a calibrated gauge that is rated to read the pressure of the tires being checked.

### OEM inflation procedures

Larry Rapsard, Goodyear’s North American aviation product support manager for GA Tires, agrees that the most important factor of any aircraft tire maintenance program is maintaining proper inflation pressure. His experience is considerable and as a Goodyear rep and Inspection Authorization (IA) renewal trainer, he’s seen and heard



*Main landing gear on a Gulfstream G-V aircraft.*

firsthand the detrimental effects of inadequate tire maintenance. Rapsard also recommends that aircraft tire inflation pressure should be checked daily because aircraft tires can lose up to 5 percent of their pressure each day.

Compensating for differences in temperature is one area where maintainers have room for improvement. For example, if pressure is checked in a warm hangar and then the aircraft is taken outside into a much colder condition and it sits for an hour or so before takeoff, tire pressure will drop.

### Which is worse: over- or underinflation?

Rapsard replies that “both over and under tire inflation have consequences. Under pressure can damage the tire and over pressure can stress the wheels and landing gears. Underinflation creates faster tread wear on the shoulders and increases the stress and flex result-




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ing in excessive heating in the tire that can lead to tire failure.”

When asked which factors have the greatest influence on the service life of aircraft tire, he says, “Tire maintenance first and weather and taxi speeds next. High taxi speeds and especially high speed turns can really stress and wear the tires.”

Asked if he had any training tips, he recommended that they always follow the Goodyear Tire Care and Maintenance Manual and call with any questions and concerns about Goodyear Aviation Tires. He also shared his list of tire tips that he includes in his IA renewal training (see “Ten Tips”).

### Tire maintenance in business aviation

It is always interesting to learn how the aircraft OEMs support their customers and staff. I asked

### Ten tips for better tire service life

1. Check tire pressure daily.
2. Remove tires that are more than 10 percent underinflated.
3. Avoid over inflation as it leads to uneven tread wear.
4. Wait 12 hours before putting new tires in service after initial inflation.
5. Re-check inflation 24 hours after 12-hour stretch period.
6. Minimize vibration with proper tire and wheel assembly.
7. Avoid the No. 1 cause of early tire removal – foreign object damage.
8. Remove damaged tires if fabric ply cords are visible.
9. Examine tires for uneven wear and correct the cause.
10. Remove tires when tread is worn to the base of any groove.

Gulfstream Aerospace Corp. if it would give its perspective on tire care and maintenance. A team of professionals that included Mark Fulkerson, technical specialist II; and Fred Karst, director, services engineering, provided a quick response.

According to the Gulfstream team, “Tire service life in general is trending up. Increased attention to maintenance, and the manufacturers’ dedication to improve tire tread compounds and manufacturing processes, have resulted in an increase in the number of landings

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per tire. A vast majority of “early removals” are due to FOD, not tire wear. The increased awareness to proper care and maintenance seems to really be paying dividends for everyone.”

When asked about tire care and maintenance training for its customers and staff, it partners with FlightSafety International for both customer and staff training. FlightSafety’s Total Technical Training is an aircraft systems training program for all Gulfstream aircraft delivered at its joint Maintenance Training Center in Savannah, GA.

### New maintenance issues

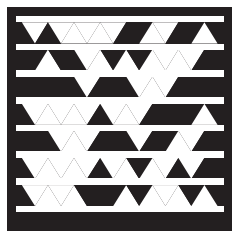
Asked if Gulfstream is seeing any new problems in tire care and maintenance, they stated a concern about some of the current tire cleaning practices. “Everyone likes to see shiny new looking tires on their Gulfstream. The problem is with some of the chemicals used to make them shine. The harsher cleaners actually remove waxes and oils from the outer surface of the tire, which help protect the rubber from ozone attack. In addition, these products are usually applied heavily and by spraying. The overspray can lead to corrosion on the landing gear, wheels and brakes, even affecting braking performance.”

Their final recommendation was to remember that underinflation is the No. 1 tire maintenance issue and it’s 100 percent avoidable. They presented a seven-step job-aid to help with this issue:

### 7 Easy Steps to Proper Inflation

1. Check pressure daily when tires are cool.
2. Use dry nitrogen.
3. Allow for a 12-hour stretch after mounting.
4. Never reduce pressure on a hot tire.
5. Equal pressure on each gear.
6. Use a quality, accurate, properly calibrated gauge.
7. Consult aircraft maintenance manuals for proper levels.

The message is clear, don’t just kick the tires, service them. If you want a safe tire and a long service life for your aircraft tires, check pressure frequently and keep tires inflated to the appropriate pressure. **AMT**



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If you access the Goodyear Aviation Tire home page you will find two excellent training videos: “Aircraft Tire & Maintenance Training — Tire Types, Reading a Sidewall & Proper Mounting & Inflation” and “Aircraft Tire & Maintenance Training — Operating Conditions and In-Service Inspections.” Field Editor Charles Chandler is based in Michigan.



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# Inside the American Airlines Wheel & Brake Center

How AA does it better, faster, and with regard for the environment



By Tim Kern

**W**hen you are responsible for 25,000 wheels and 5,300 brakes each year, you learn a few things about how to do it better, faster, and with regard for the environment.

In a former Builder's Square facility covering some 106,000 square feet in Tulsa, OK, is where American Airlines overhauls and repairs 100 percent of the worn wheels and brakes removed from its mixed fleet of Boeing 737, 757, 767, 777, and MD-80 aircraft.

It's a stand-alone facility, with the engineering, machining, welding, and flame spray capabilities as required to repair any discrepancy indentified during the throughput inspection that starts with two to three stage cleaning process.

All the functions of shipping and receiving the tons of wheels, tires, and brakes take

*Brake assembly castings are routinely inspected for cracks.*

up a lot of time and space; and the assembly and post-assembly balancing and inspections keep the rest of the cross-trained work force busy. ("Wheel" employees stay with wheels; "brake" employees stay with brakes, but each group is flexible in its assignments, so that throughput can be maintained in the face of sicknesses, vacations, etc.)



## Movement and cleaning

The large work floor is arranged with the two lines wrapped in two concentric "horse-shoes" around the circumference, the wheel line outside the brake line, reflecting the relative sizes and populations of the components. Scott Feldman, manager, Composite Repair Center, Wheel & Brake Center and Outside Services, says that one of the toughest parts of the system is one of the first operations: getting the wheels cleaned for inspection in minimum time, while making minimum impact on the environment. Complicating this job is the fact that 777 wheel halves, for example, weigh 140 pounds each — and these wheel assemblies come in and leave the facility complete with tires.

*Heavy parts being inspected such as wheel halves are moved using this robotic device.*



## MRO OPERATIONS

A powered roller conveyor system does a lot of the transport duty through the process, and specialized machines lift and turn heavy assemblies, but there is plenty of manual labor available, and skill and attention are required at each workstation. Though many employees stay for decades (20- and 25-year anniversaries are relatively common), there is higher turnover among newer hires.

Solvents that would make short work of the wheels' grease and brake dust can also make short work of tires, and cleaning must be done before disassembly. So, a hot water spray pre-wash line does the majority of the cleaning; then dedicated washers do the rest. The two-stage system saves "tons" of water, and results in less volume of wash-off per unit of waste, making water recovery more efficient, as well. In fact, virtually all cleaning at the Wheel & Brake Center (WBC) is water-based. Even bearings are washed in 180 F high-pressure water rather than solvents.

The components are broken down and sent to their inspections; or sometimes to rework, or to recycling — wheel halves, tires, hardware, bearings, brake components — each gets cleaned and goes through a visual inspection, before being sent to final cleaning and beyond.

American's efficient high-volume cleaning operations make everything else go faster and make work more accurate. Inspection is tailored to the components: both ultrasonic and eddy current inspections are used on nonferrous parts; magnetic particle inspections are also performed on steel parts, including fasteners.



Tires are not automatically discarded; they are replaced on an as-needed basis. When the wheels come in (typically after three months in service), they are returned to the OEM for recapping and reuse after the inspection at that facility has verified them safe and reliable for the re-treading operation. Many are recycled up to six times before being discarded.

*Tire assemblies going into the precleaning step.*

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Any specific wheel or brake is usually out the door within a week, though some require repairs and take a couple days longer. Components are not kept together in sets: brake parts or wheel halves will probably not leave the shop mated to the same other parts. Not having to keep sets together means that parts can

be used as-available; nothing has to wait for original mates.

American's vertical integration means that 100 percent of the work is done in-shop: engineering, repair, alodine finishing, mounting, and brake relining. Doing everything in-house reduces cycle time, saves shipping costs, and reduces inventory.

No longer is every wheel stripped of paint. "We don't just paint wheels for the heck of it," says Carl Black, Wheel & Brake Center supervisor. Stripping takes time, and so does painting, which also adds weight. Inspection cycles are so short (even "total rebuilds" take place each 18 months) that corrosion rarely takes hold — the alodine coating does a sufficient job of



*New brake pads are always used.*

adequate protection. "We don't remove intact paint unless absolutely necessary for inspection," he says, "and putting on new paint every time would serve no practical purpose."

### Brakes and critical steps

However, every overhauled brake does get relined. In fact each steel brake contains approximately 140 of pads on five stators in assembly with four rotors, a pressure plate, and torque tube at an estimated overhaul cost of around \$10,000 per brake. In comparison, a carbon brake (where each stator and rotor is individually machined from a carbon disc)

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**Tires are not automatically discarded; they are replaced on an as-needed basis. When the wheels come in (typically after three months in service), they are returned to the OEM for recapping and reuse after the inspection at that facility has verified them safe and reliable for the retreading operation. Many are recycled up to six times before being discarded.**

can carry a full-stack cost of up to \$50,000; they're used in certain applications where the significant weight reduction and increased service life produce cost-justifiable long-range efficiencies.

Some critical steps of assembly are automated, and the precision of the automation prolongs the service life of components. For instance,



*Tire assembly ready to go out the door and into service. The American Airlines Wheel & Brake Center handles 25,000 wheels and 5,300 brakes each year.*

the auto-torque that reunites wheel halves holds +/-2 percent torque tolerance, better than the 4 percent a worker achieves manually with a torque wrench. There is plenty of manual labor in the tire inflation cages (nitrogen only), and in the soap-check for leaks. The visual soap-check is extremely effec-

tive when performed by the right people; Black estimates that this improved method alone saves a day of turnaround, and commensurate inventory and floor space.

In most cases, the common hardware, things like the bolts and nuts that hold the wheels together, are re-used. Because all



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*Wheel halves waiting for processing.*

the assembly and disassembly is performed using dedicated tools that fit the parts and automatically and precisely achieve the proper torques, hardware lasts a long time, though

visual inspection is performed at several stages: disassembly, cleaning, and reassembly.

Tires, as mentioned earlier, often go through more than one trip to the Tulsa facility. The old adage of the squawk, "Right inside main tire almost needs

replacement" followed by the log entry, "Almost replaced right inside main tire" reflects business sense and a lot of common sense, and American's people in Tulsa like common sense.

With this much volume, the Wheel & Brake facility sends a full truck to Dallas (DFW) and Chicago (ORD) each day; other locations are served by FedEx, except for some urgent AOG situations, when wheels and brakes are sometimes shipped as cargo in American's fleet.

The overall impression one gets when walking in the huge doors is one of organized, 19th century factory labor. However, as one gets close to each station, the care for both employees' backs and the environment is crystal clear. The pre-wash, the all-water cleanings, the re-use of water — all these

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*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.*

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believe an undercurrent of care for those who are downstream, both literally and figuratively. The attention is there for the regulations, of course; but the impression is that the Wheel & Brake facility does these things because they're the sensible things to do. The ultimate result is greater cleanliness and greater resource savings, plus occasionally having a jump on new regulations.

Management is on the floor much of the time, keeping an eye on workflow and looking for — and listening for — improvements, which are frequently offered, examined, discussed ... and implemented.

Beyond this, each stage is optimized for efficiency, minimum movement of parts, trackability, and balance with the rest of the system. A shop of this size is a giant machine itself, and each component both depends on and supports other components. Cross-training goes a long way toward continuing efficiency, as one operation can get help from another to keep work steadily moving. Another advantage is that each worker has an appreciation for every other worker, and thus can work to make everyone's jobs easier, smoother, and safer — and when these giant parts are moving

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# Diagnostic Tools for the Next Generation

What are the best troubleshooting tools?



By Jim Sparks

**D**uring my early and more formative years in aviation maintenance I had the opportunity to work with an old electrician (probably about 50 then). Vince had been a career enlisted man in the Air Force and had his hands all over many of the most sophisticated aircraft of the day.

At that time we both were working production flight test for the manufacturer of business jets. The job was hectic trying to get the bugs and gremlins exterminated prior to the aircraft being turned over to the new owner. When an electrical or avionics glitch was reported, some of the aircraft crew chiefs would request several of the younger (and perceived to be sharper) electricians.

Vince was known to take more time to get the aircraft back in the air. I did take notice of this tendency and even queried one of the more senior crew chiefs. He suggested I start to look at the trends of reoccurring problems.

## Get as much info as possible

On the whole, our department had a very good record of fixing broken aircraft but Vince was batting 1,000. He attempted to get as much information as he could about the nature of the discrepancy as well as understand as much as possible about the proper operation of the system. Once he could fully comprehend what should happen and what the flight crew observed he would lay out a detailed plan of attack using schematics and wiring diagrams. Prior to heading to the aircraft, a trip to the equipment locker would yield necessary breakout boxes or specific system testers. He once told me the only tool really needed for electrical testing is a basic multimeter and an assortment of test leads.

Over the years it has been my privilege to work with many brilliant technicians and as a result many little known tricks of the trade have been properly archived. My realization, we can troubleshoot many electrical systems

with nothing more than a magnetic stud finder and a lamp of appropriate voltage with test leads attached. Although not normally associated by many with the digital aircraft of today; these tools and techniques will most likely still be employed well after I retire and in the proper hands can reveal many anomalies.

## Toolbox of the future

So what will the toolbox of a next generation aircraft technician consist of? It would be easy to spend thousands of dollars on various types of analyzers and bus readers but will the investment be justified and will the specialized equipment be regularly used? Hand tools such as wire strippers will still need to be suitable for the type of wire along with terminal end crimpers and wire tie pullers. Strange as it may sound, overtightening a wire tie can compress insulation and alter impedance of a digital bus or coax. Calibration again is an important factor.

Aircraft salespeople state that with the sophisticated nature of their product; the onboard computer diagnostics will virtually eliminate the need for troubleshooting. I guess that is why they are salespeople. The majority of built-in diagnostics will only detect signal out of tolerance (SOT) conditions and do not have the ability to reason. Aircraft manufactured in recent years probably have at least some digital technology onboard. This is greatly expanded in machines such as the single engine Cirrus up through the Airbus 380 and most fly-by-wire systems unlike cable operated flight controls have limited need of a cable tensiometer.

One of the leading causes of electronic component failure is electro static discharge (ESD). With that in mind, ESD wrist straps along with a static friendly work surface are paramount for working on a digital aircraft.

Oscilloscopes might be considered the VOM of the future. While they do enable the user to accomplish the traditional meter func-



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tions, they will graphically display problems you can't detect otherwise. With information sampling rates that can keep up with even the highest speed data transfer and the potential for memory storage to hold sample readings for further evaluation, a portable Scopemeter captures and displays waveforms, noise, and other disturbances in great detail.

Newer versions will allow simultaneous monitoring of up to four data lines while smaller units almost rival the traditional volt/ohm meter (VOM) when it comes to the amount of space occupied in the toolbox. Transitioning from a multimeter to an oscilloscope will require some patience and it may be prudent to seek guidance from someone who has used them as proper setup is essential to obtaining usable information in the circuit testing process.

## Calibration and cost

Like with any piece of equipment used to verify airworthiness, periodic calibration is needed. In some cases buying a new unit direct from the manufacturer does not ensure proper calibration. Often the certificate has to be requested at the time of sale and may be a negotiable part of the final price.

Cost of Scopemeters has been a factor prohibiting many technicians from having a personal device. In recent years the price has dropped with very basic units priced in the same general area as a good multimeter. It is not uncommon however to plan on a quote of anywhere from \$1,100 to \$4,000 depending on features and accessories.

Virtually all of the options compatible with a VOM will work with a Scopemeter. Some of the most common include an amp clamp for sensing current

flow and a thermal sensor which can turn a testing device into a digital thermometer. A broad selection of test leads is a must for an aircraft technician along with a spare probe to be used with the scope features.

A signal tracer is another good value and consists of an audio signal generator and a portable signal sensing probe. The audio generator can be attached to the circuit in question and the probe can then sense where the signal can go. This is very effective when it comes to locating nonshielded wires or remotely located components. In many cases the sensitivity of the probe will enable the user to detect the presence of electrical noise at potential points of entry into sensitive circuits.

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be a more appropriate tool than a portable computer?

Many aircraft, engine and avionics manufacturers have stopped producing paper documentation and depend on some form of electronic media. In addition, software is a frequent tool to allow a PC to interface with various airframe systems to facilitate data downloads and/or troubleshooting. Even Smartphones have found a place in the aircraft technician's toolbox. Arguably the primary purpose is to stay connected by either voice or data transmission but newer applications can turn one of these devices into a WiFi signal analyzer, sound meter, flashlight, vibration analyzer, and even a pocket reference guide.

Troubleshooting digital systems does involve a certain finesse along with a strong

constitution as reported problems are frequently related to software glitches and don't have anything to do with system bussing. Although, when an actual bus problem does occur, it is important to consider all the possible factors. High resistance connections, improper insulation, or even capacitance value of the conductors will impact data flow.

## Knowledge

Probably the most important tool to achieve success in the future is knowledge. Understanding principals of operation along with specific system capabilities will undoubtedly provide a solid foundation for building the most effective toolbox necessary for the challenges of the future. Proper education coupled with suitable training can create an awareness

of just what can be accomplished with the equipment at hand.

It is always preferable to be well versed in using the tried and true tools rather than having all the latest and greatest whizbang devices but not a clue in their use.

Some still look as a data bus for what it really is: nothing more than pairs of wires twisted together. What could possibly be difficult in troubleshooting something as simple as that? Maybe my old buddy Vince had something when he said he could fix about anything with a VOM. **AMT**

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

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# Arbitrary, Capricious, and Contrary to Law

National Mediation Board and National Labor Relations Board new rules



By Stephen P. Prentice

**S**ome observers of the recent rules published by the current NMB and NLRB have described them as the above title indicates....and they may be correct.

## Labor Boards 101

The National Mediation Board is a part of the Department of Labor and works to mediate disputes raised by those employees covered under the Railway Labor Act (RLA), which includes those in the airline business. This board has now decided that unions can organize airline and railroad workers if a simple majority of voting workers support unionization, rather than a majority of workers in the proposed bargaining unit, as has been the rule for 75 years. The result is that the vote can be decided by only a small handful of employees.

Delta Airlines is the best current example of how the new rule will probably unionize Delta. Delta is the only major non-union carrier that existed before de-regulation in 1978. It has remained so because it treated all its employees generously with benefits and

effect and likely result in the unions finally being successful at Delta.

One of the significant aspects of the Railway Labor Act is that it provides that once employees are unionized, they cannot be forced to disband their union or be de-certified. So that even if an airline was released from a union contract, as in a bankruptcy proceeding, it still must negotiate with the union in reaching another agreement, if they are still in business. In other words, unionization under the RLA continues indefinitely.

On the other hand, the National Labor Relations Board (NLRB) is an arm of the National Labor Relations Act (NLRA) which is a much broader law that sets rules for collective bargaining efforts on all employees, except airline and agricultural workers, who each have their own labor law. This board has just published a new rule that requires all private business to publish and display notices that explain the right to bargain collectively, to pass out union literature, and to work to improve wages and conditions free of retaliation. Forcing all employers to actively support the unionization of their business is seen by many employers as simply overreaching by government union supporters and indeed is arbitrary, capricious, and may be contrary to law.

Needless to say, these boards are now controlled by the Administration in Washington, although nominally they are supposed to be independent of political pressure.

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wages. There have been many continuous attempts to unionize Delta, the most current resulting in four failed efforts. Obviously, Delta employees, for the most part, do not want union representation. Now, later this year, the new counting method devised by the current administration's NMB will take

## Opposition in new FAA Reauthorization Act

Opposition efforts to set aside the airline (RLA) union voting effort have been inserted into the proposed FAA Reauthorization Act, which is currently in debate (and has been for several years

without results) and presents a huge obstacle to its passage. As we all have noted, some FAA employees have recently been put back to work pending further developments which should be decided by the time you read this. (September 16). The Act probably will be passed or extended with or without the change mentioned. Many fear that unless FAA reauthorization is passed all airline operations may be effectively slowed down. It has not happened so far. Legislators have vowed that this will not happen, we'll see.

No matter what one's feelings are about collective bargaining efforts and unionization, the power now being exerted by the unelected board members on labor issues is seen as getting out of hand by many observers.

**Some history**

Union activity in the airline and aviation business in general has been at a low ebb for many years now. The most significant action was the ultimate demise of Eastern Airlines some years back due to a strike by mechanics and the failure of settlement efforts. The airline folded up as a result and everyone was left without a job. There have been other strike actions since then but for the most part they did not result in any corporate failures.

**Non-union vs. union**

During this time of economic distress in our country unionized employees, including mechanics in the airline business, are protected from dismissal by their collective bargaining agreements, which often require "just cause"

before the termination of any employee. This is valuable protection. Non-union workers traditionally are not guaranteed the protection given to union employees.

Unless non-union employees have individually negotiated employment contracts, they risk being terminated by the use of the common law employment-at-will rule that allows an employer to dismiss an employee at any time for any reason.

The union employee must be afforded several opportunities for reinstatement under most agreements before he can be let go. The process can be long and detailed and is designed to explore all opportunities to retain the employee. If an employer wants to avoid a union all they have to do is provide the same

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benefits and wages that are sought by the union.

### At-will discharge

Fortunately, for the non-union employee, the dismissal *at-will* concept has been slowly eroded, so that many states have all but done away with it, thus making it almost as difficult to dismiss a non-union employee as it is for a union protected person. Where there is no union to deal with employers must still deal with the ever-present threat of a wrongful discharge lawsuit by an employee. The possibility of large jury awards must be considered for the wrongful termination of an at-will employee. The employer may be

faced with both compensatory and punitive damages for mental anguish and or pain and suffering or actual physical injuries.

The real danger of such a tort case is that a jury could become overly sympathetic with

paths to avoid litigation with discharged employees. The continued erosion of the at-will employment concept however, now provides job security not unlike that available to the union employee.

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**The continued erosion of the at-will employment concept however, now provides job security not unlike that available to the union employee.**

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and identify with an aggrieved employee and impose punitive damages as well. The erosion of the at-will employment doctrine provides a judicial solution for those employees. All employers should carefully seek alternate

So the question remains ... if all other things are equal the status can be considered almost equal ... why bother with complex arrangements? **AMT**

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

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## State of AMTSociety Address

We have been extremely busy of late with representing you, the membership, at various meetings some of which will be discussed this month.

On Sunday, Sept. 9, 2011, I attended a meeting with Melvin O. "Mel" Cintron, Division Manager of the General Aviation and Commercial Division, AFS-800. The main point discussed was the FAA AMT Awards Program. There are indications across the United States that the infrastructure for training, safety, and self-improvement is being used by the number of individuals who have or are registered on FAASafety.gov and completed courses, or have made entries for courses they have completed elsewhere. I would encourage each and every one of you to register, complete a "core program," enter your completed data, and receive an award. If you have further questions, review AC 65-26E or contact me with your concerns.

## Aviation Technician Education Council

The semi-annual ATEC board



*Melvin Cintron, FAA Division Manager, General Aviation and Commercial Division, AFS-800 with Tom Hendershot.*

of directors meeting was conducted on Saturday and Sunday, Sept. 10-11, in addition to the afternoon session on Friday with FAA/AFS-300 at Enfont Plaza Headquarters.

The schools for A&P training that participate in the organization are also involved in the FAA's FAR 147 ARAC. Although more than two years was committed to this very important project, it is still under review and we are not certain of a definite date for the industry.

## Emily Griffith Technical College

The United States Air Force Academy (USFA) donated a jet engine to the airplane hangar of West High School where young



*The FAA/ATEC meeting which was held in September. Dan Bachelder, FAA Deputy Assistant - Division Manager AFS-300; Domenic Proscia, Vaughn College of Aeronautics and Technology; Tom Hendershot, AMTSociety; Clint Grant, Pittsburgh Institute of Aeronautics; Amy Kienast Linderman, Michigan Institute of Aviation and Technology; Ryan Goertzen, Spartan College of Aeronautics and Technology; David Jones, Aviation Institute of Maintenance; Paul Herrick, University of Alaska Anchorage; Tom Hagovsky, Purdue University; Fred Dyen, Blue Ridge Community College; Murray Huling, FAA Manager, AFS-300; Ed Hall, FAA ASI, Airworthiness; Raymond Thompson, Western Michigan University; and Andrew Smith, Kansas State University.*

students explore the science of aviation. On Monday, Sept. 12, 2011, this prototype Continental J69 engine was presented as part of an Education Partnership Agreement (EPA) between the U.S. Air Force Academy's Department of Aeronautics, Emily Griffith Technical



College, and Denver West High School.

In close partnership with Emily Griffith Technical College (EGTC), West High School is one of only a few such programs in the country, promoting aviation maintenance technology to high school students interested in a career in aviation.

As Colonel Neal Barlow, chair of the Academy's Engineering Division expressed, "We are excited to share this engine with West High School as an excellent teaching tool and to motivate another generation of students to pursue careers in both aviation as well as science, technology, engineering, and math."

## Added member benefits

For all new members after September you will receive a one-year subscription to Trade-A-Plane. A copy will be delivered to your address every month for one year. This is for new members only.

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— Stay safe, Tom Hendershot

## 2011-2012 AMTSociety IA Renewal Consortium Program

The first IA Renewal program was held Sept. 17 at Crimson Technical College in Los Angeles. Speakers included Bob Hobbi from Service Elements, Dan Prairie from Textron-Bell Helicopter, Mark Collins from FedEx, Paul M. Foster from the FAA, and Ross Gregory from the FAASTeam. Be sure to check the web site,

*AMTSociety.org*, to register and for any last-minute location or time changes that may occur.

Wednesday, Oct. 19, 2011, Holiday Inn and Suites Sunrise, 3003 N. University Dr., Sunrise, FL 33322 (FLL)

Wednesday, Oct. 26, 2011, Doubletree Hotel, 180 Rt. 17 S., Mahwah, NJ 07430, Mahwah, NJ

Wednesday, Nov. 9, 2011, Holiday Inn Seattle International Airport, 17338 Intl. Blvd., Seattle, WA 98188 (SEA)

Wednesday, Nov. 16, 2011, Four Points By Sheraton Pittsburgh Airport, One Industry Lane, Pittsburgh, PA 15275 (PIT)

Wednesday, Dec. 7, 2011, Four Points by Sheraton, Sacramento Intl. Airport, 4900 Duckhorn Dr., Sacramento, CA (SMF)

Wednesday, Jan. 11, 2012, Express Jet Airlines Training Center, Houston, TX (IAH)

Wednesday, Jan. 18, 2012, Salt Lake Community College, Salt Lake City, UT (SLC)

Wednesday, Jan. 25, 2012, Atlanta

Wednesday, Feb. 1, 2012, Spartan College/Tulsa Tech, Tulsa, OK (TUL)

# Tires: Where the Rubber Meets the Runway

Give those tires the respect safety demands



By John Goglia

**T**ires may be the Rodney Dangerfields of airplane components. They often don't get the respect — or attention — they deserve for the outsize job they perform. After all, except for seaplanes operating on water, tires are literally where the rubber meets the tarmac of every flight.

Of course, there's nothing glamorous or sexy about tires; but critical they are to every safe take off and landing on an airport runway. Improperly maintained tires can and have resulted in aircraft accidents. One accident I am familiar with that occurred before I was on the National

Transportation Safety Board involved a DC-8 cargo airplane which blew three of its four tires on the left landing gear while landing at Boston's Logan Airport. When we checked the pressure on the other tires, we found every one significantly underinflated. The fact that no fire resulted and that the aircraft was able to stay on the runway is more attributable to Logan's 12,000-foot runway than the hazard that resulted from the blown tires. I have seen many fires that resulted from a pilot braking hard to stop on a short runway.

And a tire blowing apart can cause catastrophic damage to an aircraft. Many of

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you will remember the last flight of the Concorde in the summer of 2000. On take off from Charles DeGaulle Airport outside Paris, a tire blew after running over a piece of metal on the runway. Centrifugal force threw a piece of the tire into the underside of the wing, resulting in the rupturing of a fuel tank. Hot fuel on a hot brake caused a fire that consumed the aircraft, killing all 100 aboard and four on the ground. While tire maintenance was not a factor, this accident illustrates the danger to the aircraft from a blown tire.

NTSB records are replete with accidents and incidents caused or exacerbated by poorly maintained tires. (And NTSB records may not accurately reflect the number of tire incidents that occur since many are not reported if no aircraft damage or injuries

occur.) Frequently, tire condition contributes to runway excursions, especially on slippery runways.

Too often I have found that mechanics skimp on their inspections of tires: a quick glance and a hand across the tire doesn't count as a proper tire inspection. Far too often I have seen mechanics judge

### NTSB records are replete with accidents and incidents caused or exacerbated by poorly maintained tires.

the condition of a tire by the tread alone. But tread wear is far from the sole determiner of a tire's airworthiness. Just as critical are signs of cracking on the sidewalls caused by the stresses of landing — especially landing on underinflated tires.

Which brings me to the importance of proper tire pressure. There is no way to determine proper tire pressure without actual measurement — whether with a pressure gauge or, if you are lucky enough to be working on an aircraft with an electronic pressure monitor, an actual pressure reading. No matter how many decades you have looked at aircraft tires, there's no substitute for actual measurement.

So next time you do an aircraft inspection, give those tires the respect safety demands. **AMT**

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

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# New Magazine Technologies



Jon Jezo, Publisher

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If you're not familiar with them, they're the square barcodes with the black pattern on a white background that you'll see on this page and elsewhere in our magazine. You may even see some color QR codes in the near future.

Unlike standard barcodes, QR codes can store more data, including URL links, geo-coordinates, videos, coupons or text. These codes can be scanned with a smartphone to link people to additional information.

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