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# AMT AIRCRAFT MAINTENANCE TECHNOLOGY

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# IASS 2016 FEATURED FIRST TIME MAINTENANCE AND ENGINEERING SAFETY TRACK

## One full day of the 2016 International Air Safety Summit contained sessions dedicated to maintenance and engineering safety programs

The Flight Safety Foundation (FSF) held its annual International Air Safety Summit (IASS) last November in Dubai UAE. The event drew airline and aviation safety representatives from around the world and provided attendees several days of aviation safety presentations, discussions, and workshops, all in support of the FSF mission of supporting, developing, promoting safety standards, practices, and solutions on a global scale.

I did not have the pleasure of attending last year's IASS but what caught my attention was for the first time this global aviation safety event contained one full-day of maintenance and engineering safety sessions. Topics covered were Engineering Safety Culture, Fatigue Risk Management, Maintenance LOSA, Maintenance Human Factors, and Measuring Safety in a Maintenance Organization all presented by an impressive group of industry leaders.

The maintenance track was moderated by Joseph Barclay, CEO and president, Inflight Warning Systems, a member of the FSF International Advisory Committee and current chairman of the FSF Maintenance Advisory Committee.

I recently spoke with Greg Marshall, Flight Safety Foundation's Vice President of Global Programs about IASS 2016. Marshall commented that including the day-long maintenance and engineering track was very well received, and the Foundation was pleased with the level of participation and the feedback received from participants.

For some time now FSF has had its Maintenance Advisory Committee but the primary focus of FSF initiatives and programs has always had more of an eye toward flight operations rather than directly on any specific maintenance and engineering safety topics. Perhaps including maintenance and engineering sessions into the IASS signals a change.

This year's International Air Safety Summit is scheduled to be held October 23rd through the 25th in Dublin, Ireland, and plans are to again include a maintenance and engineering track.

Thanks FSF for continuing to include maintenance on your list of global safety initiatives.

*Ron*

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# AEROSPACE AND DEFENSE 2017 PREDICTIONS

## Innovations and obstacles create a race for production, risk-sharing, and aftermarket services

*By Anand Parameswaran*

**2016** WAS ANOTHER VERY GOOD YEAR FOR the aerospace industry. At the Farnborough Airshow alone we saw US$123.9 billion of deals recorded. The global aerospace and defense market continues to enjoy huge revenue momentum, with historically high backlogs for Tier 1 suppliers, and the industry has to try to keep up with this demand.

Airbus and Boeing are now at the point where they are no longer competing in the same way. There are now too many orders for both combined, and the new battleground moving into 2017, will be fought in their factories, as they race to see who can increase production rates to match their commitments. To tackle this, Boeing and Airbus have targeted 25 to 30 percent increases in production. Keeping pace with this will be a significant challenge for both companies and their supply chains, and we are seeing a huge drive for innovations that can support progress here.

But this is far from the only obstacle that the industry faces in 2017 and beyond. In this article, I will also explore developments that are happening in the aftermarket, how technology is transforming this and the manufacturing side of aerospace, as


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well as potential new entrants from the far East that could transform the market in decades to come.

## GETTING THE PRODUCTION LINE UP TO SPEED – BUT FOR HOW LONG?

When it comes to the aerospace manufacturing supply chain, production ramp-up is the No. 1 priority. Capacity is already stretched and suppliers are struggling to keep pace with the surge, resulting in billions of dollars' worth of inventory sitting in the parking bays. This has already played out in dramatic fashion in the interiors market, with serious output delays being reported by a major OEM. But this is indicative of the pressures felt across the wider supply chain.


**AIRBUS A380** at the 2016 Farnborough Airshow. RONALD DONNER

**With lucrative contracts at stake,** suppliers cannot afford to let the slightest defect impact their reputation and bottom line, and the cost of missed deadlines is incredibly high. Pressure is on OEMs to deliver vast amounts of product in very short time spans, to perfection; and efficiencies along the supply chain must be gained if this is to be achieved.

Much of this demand is being driven out of Asia, especially China and India and this is set to continue for at least the next 18 to 24 months, when production rates are likely to stabilize. With this in mind, OEMs and Tier 1 suppliers are focusing on harnessing efficiencies through operational readiness, supplier management/quality, and zero defect production. However, this sprint for increased production, needs to be complemented with a longer-term view, in the knowledge that the abundance of orders is not an indefinite state of affairs. The supply chain is also under pressure to make these efficiencies while finding ways to reduce costs. By focusing on optimizing production processes the supply chain can achieve both in a sustainable manner, particularly when drawing on the benefits of automation as they become more established.

Zero defect manufacturing is certainly one popular answer here. With lucrative contracts at stake, suppliers cannot afford to let the slightest defect impact their reputation and bottom line, and the cost of missed deadlines is incredibly high. At low volumes, defects can be managed, but when demand for aircraft is so high, this becomes unsustainable. On top of this, there are also stringent safety requirements and exacting standards that have to be met for each flight. Pressure is therefore on OEMs to deliver vast amounts of product in very short time spans, to perfection; and efficiencies along the supply chain must be gained if this is to be achieved.

Though there is an initial upfront investment to correct defunct processes and get them to the optimal stage of production, the long-term benefits are significant. Due to the fact that fewer design iterations are needed, significant time savings can be gained, meaning the product lifecycle is reduced and components get to market quicker.

Alongside this, as OEMs look to capture a greater percentage of the profits in the production line, we will also see more risk sharing partnerships, giving the supply chain further incentive to deliver under these difficult conditions.

## PRINTING AT A SPRINT — THE TECHNOLOGY TRANSFORMING AEROSPACE MANUFACTURING

The words on the supply chain's lips are "production rate, production rate, production rate." But increasing the volume without compromising the quality is the biggest challenge and OEMs are turning to the latest technologies in their pursuit of this zero defect nirvana.

One of the most impactful, technological advances is additive manufacturing (AM). The demand for addi-

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**BOEING 737** MAX on display at the 2016 Farnborough International Airshow. RONALD DONNER

tive manufacturing is growing: the global market is expected to increase from $3.07bn in revenue in 2013 to $12.8bn by 2018, exceeding $21bn by 2020. This is no more so apparent than in aerospace and defense (A&D) production and MRO applications.

The precision that it allows, particularly with intricate components, means that OEMs can manufacture, lighter and more accurate products faster than ever before. With greater efficiency and reduction in fuel usage high on the agenda, every gram of weight saved counts. The latter has a greater role to play in MRO as the constant high pressure placed on parts results in some components needing to be regularly replaced. The faster this can be done, the less time aircraft fleets spend grounded — an issue that is costing the industry vast sums of money. Airbus China, for example, recently estimated the cost of a grounded A380 Airbus to be $1,250,000 every day.

Equally, the manufacturing process here is far more streamlined, reducing human error, and allowing rapid prototyping to stress test new innovations or design concepts, before going into mass production.

Despite the advantages of AM in A&D, there are some challenges that need to be addressed before the technology can be adopted more widely across the industry. The nature of the inherent risks associated with aviation makes it a highly regulated sector and this impacts the speed at which 3-D manufacturing processes are being adopted. The technology has drawn heavy scrutiny from regulators, and manufacturers face a challenge in proving the safety of products produced by this new process and gaining accreditation. Some of the areas regulators are keen to focus their attention on over the next few years are how printed products will behave over time and based on the materials used, it will also be interesting to see how the industry adopts means to accelerate its adoption.

Nevertheless, despite the regulatory hurdles to overcome, significant cost and efficiency benefits are being seen across the design and manufacturing lifecycle. AM is set to continue to have a transformational impact on the A&D industry and it will be fascinating to see where the next innovations come from. All the signs are there for this technological innovation to create the biggest impact on this industry over the next five to 10 years.

## AFTERMARKET AND NEW ENTRANTS

The most dynamic area of the aerospace industry, moving into 2017, will be in aftermarket services. With the efficiencies being imposed on manufacturing, Tier 1 suppliers are looking to garner more of their profits from the aftermarket business. They will continue to take more control of this area, either by signing long-term maintenance contracts or by signing pay-by-the-hour agreements with airlines. But this move does not come without resistance from the rest of the market, as they will be jostling for space with traditional MROs that already operate in this space.

The aftermarket is certainly going to be the area to watch for two reasons: first the growing presence of OEMs in the aftermarket and second the disruption caused by new technologies that drive improved aircraft availability. On newer platforms, OEMs are increasing their footprint in the aftermarket and are incentivizing

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buyers to enter into all-inclusive 'aftercare' packages, rather than engage with different MROs on a case-by-case basis. While OEMs see a positive long-term revenue outlook here and are breaking even on new platforms faster, the buyer must accept that, given the level of IP protected technologies on-board, the OEM is better placed to manage this than any third-party MRO.

While for the older programs, OEMs are disrupting the direct component/part supplier chain by trying to become super suppliers. If we try to understand the effect based on the "type of the operator": smaller and newer ones will be more willing to be a part of OEM 'aftercare' packages, so they focus on their operational efficiencies and save their base maintenance CAPEX. Larger ones, who tend to have their own MROs for component and base maintenance and drive their operational costs down through direct component/part supplier sourcing, will now look toward OEMs for part supplies. With the newer platforms still settling in, it will be interesting to see how traditional third-party independent MROs face this disruption.

In 2017 we will continue to see **sizable investments going into big data and analytics**.

## THE TECHNOLOGICAL REVOLUTION IN THE AFTERMARKET

The aftermarket is also where we are going to see digital transformation have the most impact. In 2017 we will continue to see sizable investments going into big data and analytics. This will focus on developments in health monitoring, predictive maintenance, and driving efficiencies throughout the MRO ecosystem, as Tier 1 suppliers look to improve reliability, reduce maintenance costs, and increase business visibility across their network.

Digital solutions are at the center of this, with modern aircraft producing upwards of half a terabyte of data per flight. Sifting through this information to uncover useful, actionable intelligence is crucial. This is because data-driven decision making, when applied to traditional maintenance procedures, drives efficiencies, improving and even preventing costly operations as a result.

A practical example of this is seen in predicting maintenance requirements. Using data transmitted from sensors throughout the aircraft systems and subsystems, in line with preprogrammed safety parameters, maintenance crews can foresee the requirements of an asset before an incident occurs. As this technology develops, we'll soon have the ability to stream this information in real-time, while the plane is in flight, so teams on the ground will have access to immediate maintenance requirements, and can be ready with the appropriate solution before the plane has even landed for inspection.

New players are breaking into the market and the search for real-time health monitoring of the entire aircraft and predicting unforeseen maintenance requirements could dramatically reduce costly aircraft on ground incidents and maintenance costs.

## THE RISING CHALLENGE FROM THE EAST

Though not an immediate concern, the industry is keeping a careful watch on new entrants to the market and the customer receptiveness to newer platforms like the Bombardier C-Series. However, the question on everyone's minds moving beyond 2017 to the next 10 to 20 years, is "What plans does China have for the aerospace market?" While the introduction of Asian platforms like MRJ, ARJ, Comac (C919, C929), and CJ series of high bypass turbofans bring some fresh air, sooner or later we could soon see China raising its head above the parapet with genuine contenders to challenge traditional Tier 1 supplier platforms.

If executed correctly, new entrants from China have the potential to transform the way that planes are sold and disrupt the entire lifestyle of the aircraft — from manufacture through to delivery and maintenance. With aggressive pricing, and by leveraging their large cash surplus to upend current leasing models, Asian aerospace companies could pose a threat in new markets like Africa, using this base to launch into the more established European and American markets.

As technology continues to transform the way the aerospace industry manufactures, sells, and maintains its aircraft, companies throughout the supply chain must evolve, and fast! One thing is for sure, 2017 is set to be an exciting and turbulent year, and it will be fascinating to see how the race for aircraft production unfolds. **AMT**

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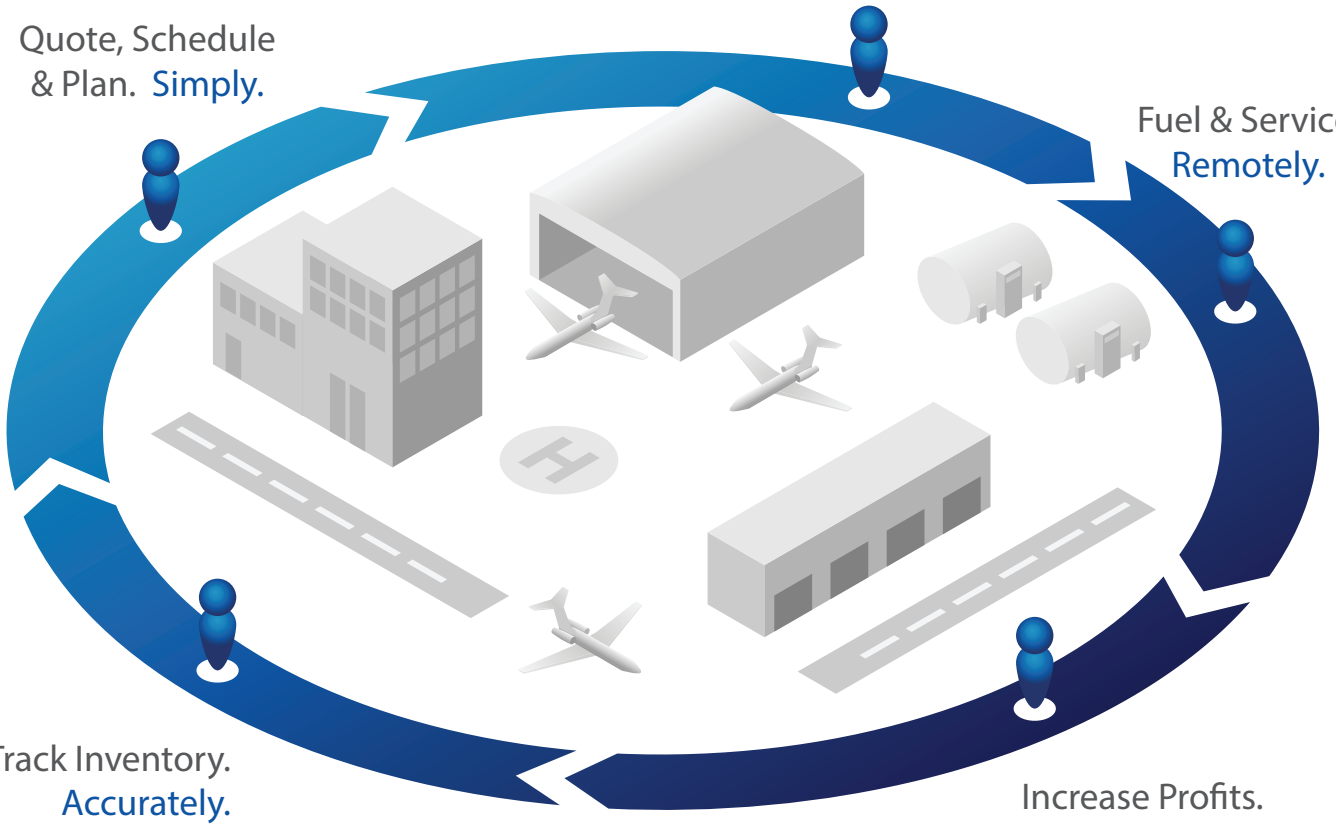

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# CAN PMA PARTS COMPETE WITH OEM AFTERMARKET?

The perception and adoption of PMA parts can vary based on geography, the category of customer (air carrier, leasing company, parts broker, independent MRO), and in some cases, simply the familiarity and confidence of the customer with the quality of these alternatives

*By Jeff Elliott*

WHEN IT COMES TO REPLACEMENT PARTS, THE large OEMs would prefer to have a monopoly on the aftermarket business. But as with any industry, the presence of alternative aftermarket products of comparable, or even better, quality drives down prices. For the aviation industry, this competition comes from smaller independent MROs as well as PMA parts manufacturers.


**IN ADDITION** to providing a high quality part, working with smaller PMA suppliers instead of large OEMs can offer advantages in the areas of cost and delivery.

In response, OEMs attempt to retain as much of the aftermarket as possible by marketing their parts as the highest quality, most reliable parts available, through warranty and contracts with air carriers and leasing companies, and now through new bundling strategies designed to lock out alternative suppliers.

According to Tom Wolfe of FAA-certified MRO component repair facility AeroKool Aviation - a company that specializes in environmental control systems, air cycle machines, valves, and heat exchangers — the OEMs have a vested interest in discouraging the use of third-party repair stations and PMA parts providers.

"The OEMs invest heavily in product development on the front end and hope to recoup some of that investment in aftermarket programs," says Wolfe.

Techniques designed to keep the repair and part replacement business in-house include contractual agreements that specify the use of OEM replacement parts only.

OEMs may also employ repair "bundling" strategies for complete packages of repair for entire systems — and even other parts of the aircraft — under a single, blended rate. This makes it difficult for the air carrier to get information on individual part costs to evaluate if switching to a PMA part might be advantageous.

"The aviation industry benefits from the competition, which drives down prices for the airlines," says Wolfe. "There is no competition when the OEM is the only option in the market."

That being the case, PMA parts are still at a disadvantage when compared to OEM parts — not because of price or quality, but rather a lack of education about alternate options.

Parts Manufacturer Approval (PMA) is an authorization granted by the Federal Aviation Administration (FAA) to a manufacturer of aircraft parts. PMA parts must pass the same rigorous quality and testing requirements as OEM parts, but are often significantly lower in price.

The perception and adoption of PMA parts can vary based on geography, the category of customer (air carrier, leasing company, parts broker,

independent MRO), and in some cases, simply the familiarity and confidence of the customer with the quality of these alternatives.

In North America, the majority of air carriers already accept PMA parts. However, in Europe, Asia, and developing countries there remains a perception that OEM parts are higher quality and more reliable.

"There is a perception in some parts of the world, which I believe is changing, that PMA parts may be inferior in quality and design robustness to OEM parts, but as has been proven many times, PMA parts meet the requirement of being equal to, or better, than the OEM," says John Grimshaw of Triumph Accessory Services, Wellington, a Part 145 repair station in Kansas.

As for other segments of the industry, aircraft leasing companies largely continue to specify in lease agreements that only OEM replacement parts may be used. For parts brokers and distributors,

**PARTS MANUFACTURER** Approval (PMA) is granted by the FAA to a manufacturer of aircraft parts which must pass the same quality and testing requirements as OEM parts.

**INDEPENDENT MROS** recommend PMA parts, like the air cycle machine (ACM), because these parts offer the same quality but are less expensive.

the decision to use OEM or PMA parts is often driven by the customer so they offer both options.

According to Grimshaw, independent MROs tend to specialize in specific components or subsystems within the aircraft. For Triumph Accessory Services that means electrical generators, hydraulic pumps, pneumatic valves, air cycle machines, various types of actuators, and power generation and transmission equipment.

The bulk of the work comes from air carriers that no longer perform in-house repairs, from parts brokers and distributors that need components tested, repaired and overhauled to resell, and from freight carriers converting passenger aircraft.

OEM repair shops, on the other hand, can offer a broader portfolio of parts. In addition, they can offer air carriers parts at below-catalog rates, while the MRO often must pay full price.

Therefore, to compete effectively, third-party repair shops often promote the use of PMA parts.

Rich Simmons, operations manager at Texas Pneumatic Systems (TPS), a third-party MRO that specializes in pneumatic, fuel, and hydraulic components, concurs.

"If a customer is looking for a cost-effective solution, we want to be able to offer them the PMA parts because they are less expensive than the OEM," says Simmons. "For our service, we would be remiss if we didn't offer that."

## TECHNOLOGY, QUALITY, AND PRICE

A prime example of the push-pull between OEM and PMA provider can be found in the maintenance and repair of environmental control systems used in most military and commercial aircraft.

Environmental control systems (ECS) provide air supply, cooling and heating, and cabin pressurization for the crew and passengers. Major OEMs such as Honeywell, United Technologies Corporation Aerospace Systems (UTAS), and Liebherr dominate the market.

A key component in these systems is the air cycle machine (ACM). To produce cool air without the uses of a refrigerant, such as Freon, this high-speed rotating machine utilizes sophisticated foil air bearings that conform to the shape of a mating rotating shaft. Most commercial and military aircraft today utilize ACMs with this type of bearing.

However, at 30,000 to 45,000 rpms even well-manufactured foil bearings can fail or wear out from constant use over time. When this occurs, the ACM may fail to operate in-flight. More serious failures or imbalances of the rotating elements can also cause ancillary damage to other components in the air conditioning pack.

Although common, less-sophisticated PMA parts may be available from many sources, some — like foil-air bearings — may only be available from a few. Finding a qualified PMA provider is not difficult. Sources include the FAA's web site, Inventory Locator Service (ILS), trade shows and even through the company's own advertising and marketing efforts.

Any concerns over the quality of these sophisticated PMA parts quickly vanish when engineering personnel learn more about some of these companies and who runs them. For example R&D Dynamics, a producer and supplier of FAA approved foil air/gas bearings and other PMA parts, founder, Dr. Giri Agrawal, pioneered the design and development of high-speed rotating machines supported on foil air/gas bearings for air cycle machines in the '70s and '80s while working at Honeywell and Hamilton Sundstrand.

"One of the benefits that companies like this have is that their founders were a key driver in the development of foil-air bearing technology," says Wolfe of AeroKool Aviation in Hialeah, FL.

"When you are looking at PMA parts and your looking at options at how you can be more competitive with the OEMs, when you see that type of pedigree and credentials, you understand that this company is different from other PMA companies," adds Wolfe.

However, Texas Pneumatic Systems' Simmons is quick to add that the reputation of the PMA provider only gets the company's foot in the door.

Although he was also impressed with some of the backgrounds for these PMA suppliers, he says that what ultimately keeps the customer engaged over time boils down to quality and price.

"Reputation gets us moving, but reputation won't keep us a customer," explains Simmons. "The proof is still in the pudding; when we use the product, do we get the life out of it that we get out of the OEM part? Do we have more or less warranty returns?"

In addition to providing a high quality part, working with smaller PMA suppliers instead of large OEMs can have other advantages as well. Because of their focused expertise, many of these companies can offer OEM-level technical support and are agile and small enough to respond quickly to any situations that arise. This includes expediting delivery of parts when necessary.

**"Reputation gets us moving, but reputation won't keep us a customer.** The proof is still in the pudding; when we use the product, do we get the life out of it that we get out of the OEM part?"

*— Rich Simmons, Texas Pneumatic Systems*

"With a PMA parts manufacturer, there is a willingness to make adjustments in the supply chain, the delivery schedule or if there is a hiccup of any kind, they are able to jump right on to it and get the fix completed with the main guys making the decisions," says Grimshaw of Triumph Accessory Services, Wellington.

"You don't have huge conglomerate and multi-layered management where things are slow to get done, with an agile PMA manufacturer it can get done overnight," he adds. ***AMT***

*For more information contact R&D Dynamics at www.rddynamics.com; Triumph Accessory Services, Wellington at www.triumphgroup.com/companies/triumph-accessory-services-wellington; Texas Pneumatic Systems at www.txps.com; and AeroKool at aerokool.com.*

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*By Jerome Greer Chandler*

Corporate jet operators outsource to MROs; MROs outsource to subcontractors. And down the food chain it goes — each layer adding to, and benefiting from, the architecture of it all. In an increasing number of cases, there's yet a third tier: Jet Support Services Incorporated.

JSSI is an hourly cost maintenance provider, one whose aim is pretty straightforward: to "eliminate your risk [while] enhancing the residual value of the aircraft," says Raymond Weiser, a helicopter program specialist with the privately owned Chicago-based company.

wrench itself. Instead, "We have a vendor network," says Weiser. "Our vendors are the ones who provide the work for us. We're a financial *tool,*" he asserts. "Our vendor network is extensive. Matter of fact, there's a line of vendors waiting to come on board to become part of the JSSI network."

That network is bizjet and helicopter powerplant heavy. The company says there are some 350 different JSSI powerplant programs just now, programs covering virtually all types of turbine engines. Among the players represented: GE, P&WC, Rolls-Royce, CFM, Honeywell, and Safran/

**"We're basically an extension of [our client's] maintenance department.** We'll inspect their engine … essentially providing a check and balance throughout the MRO process."

*— Raymond Weiser*

While declining to provide specific numbers, JSSI says "2016 was the strongest sales year in JSSI's 28-year history." Specializing in corporate aircraft — both fixed wing and rotary — it spends north of a half billion U.S. dollars each year on maintenance on behalf of some 2,000 clients worldwide — all without ever turning a

Turbomecca. Jet Support Services Incorporated says it manages 250 to 300 overhauls each year.

### CLOSE SCRUTINY

'Manage' is operant word here, close-in, eyes wide open oversight. "We represent [our clients] in times of major events," says Weiser. "We'll travel to

the OEM. We're basically an extension of [our client's] maintenance department. We'll inspect their engine … essentially providing a check and balance throughout the MRO process."

Boots on the hangar floor are provided by experts who know the terrain intimately, product line specialists. "For each engine product line there's a product line specialist. "We're not taking a Rolls-Royce guy and [assigning him to] a Pratt & Whitney-type event," says Weiser. At JSSI, the inspector understands the sometimes-subtle twists and turns of the powerplant whose overhaul he's overseeing and understands them well.

Re-wind time for a moment here and understand how it all fits in the bigger picture. "On any given day," says Weiser, "your director of maintenance is responsible for helicopters, for airplanes, for employees ordering parts.

"He doesn't have *time* to specialize," asserts Weiser," an ex-maintenance director himself. He may have sat in on an overhaul once every five or six years. By contrast, a JSSI product line specialist can expect to see perhaps two dozen per year."

## NEW ON THE HORIZON

Complementing JSSI's philosophy is its new Asset Monitoring Platform 2.0. The company says AMP 2.0 "has a new feature set which enables subscribers to access a variety of tools for managing an aircraft's financial and maintenance status, even if the aircraft is not enrolled in a JSSI program."

Among the more relevant features are:

- A maintenance rating tool;
- A "Request for Tech Inspection" Service;
- A "Request a Tech Oversight" Service;
- JSSI Parts Ordering;
- Intuitive Navigating and Reporting;
- A High-Level Fleet Maintenance Forecast covering major events.

JSSI President and CEO Neil Book calls AMP 2.0 a platform for allowing finance and leasing companies to leverage the technology to provide enhanced visibility into their aviation portfolio on a real-time basis. "Over the coming months" watch for the company to introduce a range of

JSSI is neither an MRO, a parts supermarket nor a middleman. **Its services are best described as "tool[s] to help contain costs …** The more we can drive our client's costs down, the greater the trust."

new services which Book contends will "drive additional value not only to our customers, but the [business aviation] marketplace at large."

## INDEPENDENCE?

The emergence of JSSI as a major player on the MRO stage underscores a growing trend toward independent sourcing on the part of operators, fixed wing and rotary alike. After 35 years in this business, that's certainly Ray Weiser's assessment. "In the past, if you had certain aircraft, the only place

you could go [for maintenance, repair and overhaul] would be the OEM. In the past, they were the only option you could go to."

That was some 28 years ago, an era in which the options for MRO were — compared to today — limited. JSSI "initially started by overseeing the upkeep of Garrett 731s, a popular powerplant for corporate jets. "We then went into other jets: turbofans, propjets."

## HELICOPTERS

Recent years have seen JSSI expand into the world of rotary wing maintenance oversight.

In the world of wings that go round-n'-round maintenance intervals have often been shorter, and tolerances for parts and components lower compared to their fixed-wing brethren. Weiser says this is especially true for "newer model helicopters that may have come out in the last three years. Their tolerances are tighter." The JSSI rotary wing specialist says a couple of reasons underlie this trend. "Clients want to look at their product as soon as possible to see how it's holding up" under the often unrelenting rigors of helicopter operations.

Then there's this: "Helicopters tend to be more labor-intensive, *far* more labor intensive, than fixed-wing aircraft. They are inherently so."

Precisely because of the sometimes-higher costs attached to rotary-wing MRO this is an arena in which JSSI tends to shine.

Take the case of an overseas helicopter operator who asked that *AMT* not use their name. Weiser says, "The OEM wanted to give the client an exchange module, part of the engine really. Essentially, the client had a cracked flame tube … The answer to that was, 'Well, let's have an exchange for US$170,000. We'll take your module in exchange and we'll give you one for $170,000, plus potential bill backs.

"[JSSI] looked at that work scope [and discovered] it was a simple repair that gets done in a specialized [Level 3] facility. *That* repair runs about $US40,000 to $45,000.

Weiser ended up dealing directly with the client. "We talked about it. He said, 'If you can repair my engine for $45,000 vs. $170,000 you've got my business. So we managed the event for the client. We sent it to a Level 3 facility. The repair was done as we said [it would be]. He had it back in his hands within a couple of weeks."

This deal paved the way for a substantial future contract for a specified number of aircraft.

"This is where we shine," says Weiser. Indeed, "there's nothing more critical than when your engine goes into the shop," he says. Overhauls can run a half-million U.S. dollars at a crack.

## AN IMPORTANT TOOL

Again, JSSI is neither an MRO, a parts supermarket nor a middleman. Its services are best described as "tool[s] to help contain costs … The more we can drive our client's costs down, the greater the trust."

Here's the kicker. Weiser says, "When we save a client money, the money goes back to the client. We're very transparent in how we do things." JSSI derives those discounts because of the volume of work it oversees.

Transparency and trust are commodities in short supply these days. The concepts are touchstones at the company. Consider, Weiser contends JSSI "is the only one in the industry to utilize a trust to safeguard the client's money." The protection clicks in in case something happens to the company.

Competitive cost, quality work, knowledgeable oversight transparenc,y and trust: Essential ingredients in an uncertain age. ***AMT***

**JEROME GREER CHANDLER** is a two-time winner in the Aerospace Journalist of the Year competition's Best Maintenance Submission category; he won in 2000 and 2008. His best-seller 'Fire and Rain' chronicles the wind shear crash of Delta Flight 191 at DFW. Chandler's passion for aviation safety is more than professional. It's personal. Two of his relatives have perished on commercial airliners, one of them in the infamous Braniff Electra crash of 1959.

# THE ROLE OF MENTORING IN THE AVIATION INDUSTRY

Take time to reflect on where you want your career to take you instead of allowing your career to "happen"

*By Jennie Santoro*

THE AVIATION INDUSTRY IS HOST TO A wide variety of technically skilled and high paying jobs requiring not only a solid educational foundation, but also experience on the job. In a dynamic industry with a broad range of career paths, a mentor can be an invaluable resource to individuals beginning or building their careers. With a large number of aviation experts expected to retire within the near future, it is beneficial to young professionals to help them navigate their professional growth within the industry, and critical to the aviation community to develop a strong group of future leaders and experts.

I had the opportunity to participate as a panelist at the Airport Consultants Council (ACC) Annual Conference in a session that addressed the important role that mentoring plays in our careers and how mentoring is "making a difference for the next generation."

## MENTORING WITHIN AN ORGANIZATION VS. MENTORING WITHIN THE INDUSTRY

When it comes to seeking out mentors, we need to look both inside our company and externally in the industry. Progressive companies are committed to offering a successful mentoring program within their organizations, as well as providing employees with additional mentoring and networking opportunities in the industry.

**Roddy Boggus**, who was employed with WSP Parsons Brinckerhoff at the time, explained that internal mentoring provides mentees with guidance on what

the organization wants from them and what is expected professionally, so they can be professionally successful in their jobs. In contrast, he says, industry mentoring, or mentoring outside of a company, provides a dual benefit. "If you do well for yourself, you will be doing well for your employer."

From the perspective of a young professional, I believe it is crucial to have mentors both within and outside your organization. Internal mentors have a vision for your corporate growth and they can provide insights on the corporate culture and opportunities for professional development and advancement. External mentors can offer a broader perspective, unbiased opinions, and help establish a positive career path. They are in a better position to help you navigate internal corporate challenges that you're not comfortable bringing up with internal mentors.

Both mentoring relationships are important to career growth and development, resulting is a well-rounded individual who can be successful in a variety of job situations and environments.

## FINDING A MENTOR

Despite the importance of mentoring in skilled fields, it may be challenging to find the right mentor. The process can be organic through natural "on the job" interactions with colleagues, or it can be facilitated within companies and industry organizations. Both ways are valuable for mentor development and often result in a diverse range of opportunities for people new to this field.

Panelist **Chris Spaulding**, who worked for the Airport Consultants Council at the time, reinforced that personality characteristics play a major role in the mentorship relationship. "Overall, it can be a challenging process because everyone has a different personality type and they tend to approach situations and people in different ways. Many mentor relationships happen when you don't expect it."

As someone who has been with the same company — HNTB Corp. — for the duration of my career, I have been fortunate to experience both sides of the mentoring relationship and realize how much it has helped form the foundation of my career success at the company and in the industry. HNTB has a great track record of successful mentoring and the relationships that have been established are mutually rewarding. Even after a formal mentorship program ends, it is essential to maintain contact with former mentors because each person's career continues to develop and future opportunities may arise that can be advantageous.

## THE IMPORTANCE OF NETWORKING

The value of networking cannot be understated. Fortunately, there are many associations and organizations a new professional can be involved with to meet key industry professionals and influencers. According to Boggus, "The easiest way for mentors to help young professionals network in the aviation industry is to work with them, spend time and be willing to make introductions to colleagues at industry conferences, exhibit halls, networking mixers, socials and other key industry events."

Networking can be a great entryway to find industry mentors. It's a way to meet similar professionals, learn about them and their experiences, and share information about yourself. It affords the opportunity to hear about what's going on in the

industry and get a perspective that you might not find in the daily working environment. If you make a great connection with someone, it might lead to a future positive mentor/mentee relationship.

All panelists agreed that involvement in industry associations is a great way to network and potentially find a mentor. "Associations can create 'the perfect storm' for finding a good mentor as an environment that provides you access to other like-minded leaders in the industry," added Spaulding.

## THE PATH TO SUCCESS

Many young professionals are eager to be successful, but don't know where to start. Mentors can help them set reasonable goals and provide them with appropriate responsibilities. Development often requires being challenged to take on tasks or roles that offer growth and is the first step toward career and professional success.

Spaulding says that patience is key, and a good way for mentees to learn is for mentors to share their own experiences and help set realistic goals. Boggus believes in working with the individual to create a path toward measurable goals so success can be seen at every step.

It's essential for mentees to establish long-term career goals that they can share with their mentor, enabling them to work productively together to achieve success. Mentorship starts with getting to know each other — teaching and learning will follow.

## KEY LEARNINGS

As I look back on my professional career, I have learned valuable lessons from my mentoring relationships. I've had great opportunities in my career, but early on I did not take the time to set my long-term goals and outline ways to achieve them. I learned that new professionals should start planning and shaping their career from the beginning to achieve a rewarding career and professional success. It's imperative to take time to reflect on where you want your career to take you and I encourage all professionals to shape their career instead of allowing their career to "happen" to them.

Throughout the spirited discussion, a few key themes emerged. First, mentorships are for everyone. No one is ever too old to be mentored, because there is always more to learn. The least intelligent person in the room is the one who thinks they already know all there is to know. Even successful professionals need guidance, advice and counsel, or a different perspective to help them become better leaders and collaborative team members. A good mentoring connection generally starts with personalities that mesh, and evolves into a mutually beneficial relationship based on trust and investment by both members. Lastly, it is a good strategy to have more than one mentor and the concept of a 'panel' of mentors or advisors, was eye opening. Professor Randy Berg said, "I tell my students to develop their own board of directors … choose three or four people that you really trust and turn to them when making big decisions."

This group of trusted advisors is something that I've been cultivating over the years without necessarily thinking about it. I now plan on making a conscious effort to maintain my 'board of directors' as my mentor relationships evolve and encourage all professionals to do the same.

In conclusion, moderator Kristin Shaw summed it up beautifully for the audience: "Mentoring doesn't always involve just one person but a collection of knowledge passed down from experienced people in the industry." Mentors are an essential part of every successful career. ***AMT***

**JENNIE SANTORO**, NCARB, AIA, serves as project architect for HNTB Corp. She is a licensed architect in California, member of Airport Consultants Council Young Professionals Forum, mentor with ACE Mentor Program for high school students and mentor with AIA Los Angeles. Contact her at jsantoro@HNTB.com.

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**THE STAMPE** SV4

# REVERSE ENGINEERING: HOW TO RECONSTRUCT AIRCRAFT PARTS

*By Marino Boric*

IN THE AEROSPACE WORLD, THE procurement of spare parts is not always easy and is usually expensive, specially for older aircraft. At some point, when it comes to vintage aircraft, spare parts become rare, or in a worst case they simply don't exist anymore. A historically significant airplane disappears from the airfield and becomes in a best case a static exhibit in the museum.

Today, with a help of reverse engineering technology the active life of such an airplane or entire fleet can be extended at a reasonable price. Till just a few years ago the failure of an engine part in a vintage airplane often was its death sentence. Now, there is a way to prevent the aircraft from being wrecked and to get them back in the air, even if there are no spare parts available.

Sheet metal parts are easier to reconstruct, engine parts, specially the big ones like engine blocks, are one much different and complicated story. This is mainly, because after decades casting molds don't exist anymore — usually the original manufacturer went out of business decades ago and a new series production is not feasible for reasons of cost. In this case, reverse engineering technology now helps to reconstruct parts. This process, a kind of reverse development, makes it possible to re-create a product, which exactly equals to the original part, using an existing (broken) part, a piece of it, or a blueprint. In doing so, reverse engineering must go through a certain process, which includes the strategic consideration of how this "restoration" has to happen — where a specific succession of steps is required. This reverse engineering has many similarities with the design of a new part.

On the recovery path, from a damaged or no longer existing part, many problems have to be solved, because such a process is not simply a copy of the original part. Thanks to modern technologies such as 3-D scanning and new designer software, almost everything has become "doable," even with much better properties than the original part. An improvement of the properties is usually not (always) desired in aviation, since the parts have to meet the original certification standards. If reverse engineering is used for the commercial reproduction of parts, extensive industrial property rights and the corresponding licensing laws must also be observed. Parts for experimental aircraft can be reproduced in better quality, can be lighter, and cheaper, since less legal standards have to be met. A certified part has to be restored according to OEM (original equipment manufacturer) specification, as the original part was. It could, however, also be improved by more modern technology/materials, but this has to be coordinated by and with the OEM and the aviation authorities, otherwise the certification may be lost. In a concrete example, which I have discovered at the last AirVenture in Oshkosh, I would like

to explain the reverse engineering process. It does not always have to include all the described steps, some may be obsolete but sometimes some may be added — all taking into consideration the condition of the original part and many other factors.

This text describes a vintage airplane, engine crankcase remanufacturing done with a highly digitized process of two French companies: Ventana and Vintair. It is just an example of new remanufacturing possibilities offered by the use of modern technologies and proven traditional skills. It can be used in many fields like mechanical parts, sheet metal, molded parts, etc.

## THE STAMPE SV4 - BIPLANE

The Stampe SV4 is a French aviation milestone. The Stampe, a little biplane, is part of the French aviation heritage and is famous for having been widely used in army and civilian flying schools in late '40s and early '50s. 850 airplanes were built in 1946-47, as an after WWII war reconstruction effort. The Stampe was built in France under license, and is based on a Belgian design from 1936. Those French-built Stampes were equipped with a 145-hp Renault, four-stroke, four-cylinder, in-line engine. Stampe features nice aerobatic capabilities, delightful handling, and has become a myth in the French aviation community. More than 200 airplanes exist, and are close to, or in a flying condition.

## MATERIAL FATIGUE AS THE LIFE LIMITING FACTOR

One of the most challenging problems to keep Stampes flying is to find spare aluminum crankcases for the Renault engine. In-service crankcases and the (rare) spares available have logged a considerable number of hours. Like all light alloys parts they are subject to cyclic loads, where material fatigue is limiting their life. Many of the inspected crankcases show fatigue cracks.

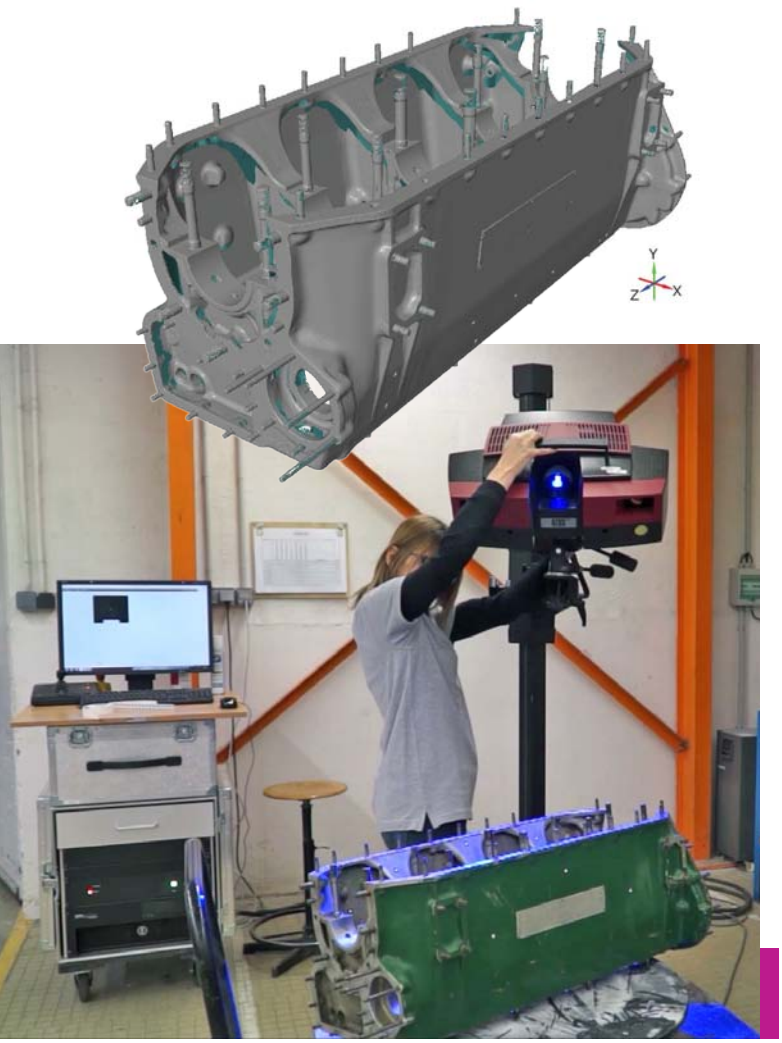
Metallurgic analysis of the crankcases showed poor mechanical resistance, caused by impurities and internal corrosion, making the welding repair highly uncertain.

Because of this, some users started to consider moving to another engine. This is a very costly option, and no other engine allows it to stay close to the appearance and handling of the historic Stampe. For those reasons it was decided to remanufacture the crankcase using Ventana's new techniques and Vintair reverse engineering skills offering a historically correct solution to the part shortage.

This is a typical example of the new technological possibilities when it comes to parts shortage. It can be applied to any other complex part and the whole process follows this path: Digitization of the used part. Using a high-precision optical scanner, the visible surfaces of the existing engine block are scanned creating a cluster of points with an accuracy of 0.02 millimeters creating a very good start point for a complete CAD reconstruction. To capture hidden details, like internal cavities or ducts, tomography technique may be used — the same complex and costly technique used in a medical scanner. Dedicated software allows to interpolate missing surfaces and to re-create the details using original design principles and geometry. When the highest accuracy is needed, a 3-D measuring robot is used for the most sensitive areas.

## 3-D MODEL, MANUFACTURING DRAWINGS SETUP

Most of the time, the data acquired by the optical scanner cannot directly be used, and a thorough functional analysis should be performed, what often requires careful measurement of adjacent parts.




A major step in this process is the CAD model creation — made by using all data acquired in the digitization step. This is a real reverse engineering step where dimensions and tolerances are determined to allow the final assembly, taking into the consideration the bearing alignment, gear axis matching, etc. If drawings/blueprints are available, they are extensively used, adding very useful information in this step.

In a case where no part and/or drawing is available, a new design can be established by using all available clues like pictures, location of adjacent parts, and a functional analysis.

Usually, when the material has been in service for many years, users will know the weakness areas of the part. While staying close to the original design, improvements may be introduced by using better suited alloys or slightly changing the geometry. This improvement process likely requires an approval of local aviation authorities through a minor or major modification request. As Stampe belongs to EASA Annex II aircraft list, this is done under French Civil Aviation Authority (DGAC) and the mod approval is granted to each aircraft owner.

## MATERIAL ANALYSIS

In a case that the original material/alloy is not known a mass spectrometer is used. Yield samples are used to assess the mechanical resistance of the material. This analysis allows the choice of the closest alloy amongst referenced materials. For this Renault crankcase — as no exact material match was found — a high resistance aluminum alloy was chosen. This is a real improvement but only possible for vintage planes under EASA Annex II rules, and under the owner's responsibility.

## CASTING, SOLIDIFICATION SIMULATION

The crankcase is a sand casting made product, so the following step is performed in a foundry.

Once validated, the CAD model is directly used to design the casting mold. In this process a new, powerful simulation software is used, which helps to predict molten metal flow in the mold, temperature gradients, and metal shrinkage. This software simulation allows to avoid real-life testing and dramatically reduces development costs and time.

This phase ends with the sand casting mold design, where extensive foundry know-how is necessary, specially for parts with thin walls or relevant variations in wall thicknesses.

## 3D-PRINTING OF SAND CORES

The cores which constitute the mold are then 3-D printed with a 3-D, S15 sand-printing machine. One layer of sand — to which one component of resin has been added - after another is applied

**WHEN DRAWINGS** aren't available, a new design can be established by using all available clues like pictures, location of adjacent parts, and a functional analysis.

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on the "job box" a vertically moving table. Each layer of sand/resin is then polymerized - sprayed by a "print head" with a catalyst component - what binds the sand to a solid structure in a required form. When the mold is printed, the loose sand is mechanically removed (air blasted, brushed away) and the different cores are assembled to make the final mold.

When using this fully digital, tool-less process, complexity is no more a determining factor. Any part that has been cast can be easily remanufactured. 3-D sand-printing allows a high degree of shape complexity.

Sand printing of the mold sand cores is done by additive layer deposit (ALD) or additive manufacturing (AM).

It works like a big "jet printer" working over a vertically moving (lowering) flat "job box."

A thin layer of sand is spread on the job box. This sand has been previously mixed with one of two components of a special resin. The sand thickness may vary between 0.3 and 1 mm, depending on the accuracy and speed required. The process is very sensitive to the type and amount of resin, and very specific sand is used, which allows a controlled thickness and granulometry of the layer. This is a part of Ventana's know-how, that has been developed through a long set up, to be applied to widely used aeronautical magnesium and aluminum based alloys.

This thin layer of sand is then sprayed through the printer head with the resin's catalyzer to build up the core where the sand has to remain solid. The loose sand that has not been sprayed is kept in place during the process to support the next layers and allows vaults and arch type geometries to be easily built.

This iterative cycle is repeated until the cores are completely built.

Multiple imbricated cores can be printed during the same session, permitting the full box volume use and reducing the (expensive) sand losses.

The mold is usually printed in several parts to allow a perfect cleaning (loose sand removal) and assembled before pouring.

After each layer has been sprayed where it should, the box lowers from the sand layer thickness, and another layer spreading and spraying cycle is started.

Printing can last from several hours to one or more days depending on multiple factors like requested accuracy, cores volume…

## CASTING

Molten metal is poured into the mold on a low-pressure casting station via a complex feeding network that ensures the integral filling of the mold.

Once the mold has cooled down, it is shot blasted to remove the remaining sand from the metal part, and the feeding network is cut away.

## INSPECTION

The part then follows an inspection process that includes geometrical digital scanning, radiography, and other checks. The process is similar to the one used for the aeronautical jet engine parts manufactured by Ventana.

## HEAT TREATMENT

To achieve the desired mechanical properties, light alloys are heat treated.

Through this process, as it is identical to traditional foundry, the mechanical properties and resistance are strictly identical to a casting that would have been obtained through a traditional (not 3-D) pattern casting.

## TESTING

The complete range of NDT (nondestructive testing) is being implemented, from X-ray to automated (PT) fluorescent dye penetrating test - all according to the specifications of the contracting parties. Parts are checked for internal defects and correct metallurgical characteristics, all according to the specifications that are part of the reverse engineering process.

## MECHANICAL MACHINING

The cast, if defect-free, is machined on a fully digital, high-precision CNC machines at the Ventana facility with the help of data obtained in the digitization process.

If needed, high-precision line boring can be performed, in its own traditional engine machining shop. This can include main and rod bearings boring.

## COST AND TIME

The costs and time exposure are difficult to determine in most reverse engineering processes because those figures are influenced by a number of factors. This depends on the nature and complexity of the part to be restored and the quality of delivered/available original part and blueprints. This process uses costly equipment and requires considerable design and engineering effort. While costs are higher than those of original parts that were manufactured in large quantities with a high degree of industrialization, they are much lower than traditional methods for limited quantities as no specific tooling is required, and real-life casting testing is dramatically reduced. Traditional, negative forms aren't necessary, which for large series can cost several hundred thousand dollars.

Cost level is a function of part complex-

## VENTANA AND VINTAIR

A Renault engine housing is being remanufactured for a Stampe SV4 airplane, with French certification. In this example, the French companies Ventana and Vintair cooperate and manufacture a crankcase using a highly digitalized process.

Ventana is a major French aerospace subcontractor. With its four foundry facilities, high precision machining and sheet metal capabilities, Ventana covers many of the required fields and competences when it comes to remanufacturing. Ventana customers are located worldwide, including Airbus, Rolls Royce, and Pratt & Whitney.

Vintair is a small company dedicated to vintage and collection aircraft. It specializes in restoration of vintage engines and has developed reverse engineering skills useful in that field.

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**THE JUNKERS** JU52 original brake drum (left), and the new one using reverse engineering (right).

ity and size, as well as NDT and alloy requirements.

Cost is split between nonrecurrent reverse engineering and mold design costs, and part production cost. Lead time can vary from several weeks for simple parts to three to six months when complex reverse engineering is required. The process is much faster than the standard foundry part development time.

AM of the above described part is somewhat simpler, since no molds are necessary. At a current cost of $500 per cubic inch of a structure, a motor housing would cost about $50,000 per piece - way more than this method.

So far, the absence of spare parts meant in past a sure "death" of an aircraft. With this reverse engineering, the operational life of an historical aircraft can be extended at a manageable cost. Smaller batches are also affordable. The above engine crankcase is only one example, a remanufactured brake drum of the Junkers JU52, which was no longer available, was also built. There are just few similar projects in the USA and Europe that will lead to whole aircraft in the next two to three years with the use of reverse engineering. For example, Replic Air from Toulouse, France is building the Le Dewoitine D551, an aircraft destroyed before its maiden flight in WW2 (www.replicair.fr). In such large-scale projects, the fuselages and wings are "relatively" easy to manufacture because they are made of wood or sheet metal. However, problems arise with non-existing undercarriage and engine components. Here reverse engineering can make a project feasible.

Currently the maximum possible size of a part depends on the dimension of a job box what still limits the production of some parts. Software and testing techniques must also be further developed and adapted. So far, there are only a handful of companies in the world that use this method. With the fast growth of 3-D printing technologies and machines, this will hopefully change soon. For more information visit www.vintair.com or www.ventana-group.eu. **AMT**



**MARINO BORIC** graduated with a university degree as an aeronautic engineer, and acquired degrees in business development/trade and commerce and in journalism. He is a civil and military pilot and has built experimental aircraft. As a journalist, he specializes in aviation and propulsion and travels worldwide, flight-testing UL, LSA, Experimental, and certified aircraft. He is writing for U.S., European, and Chinese media companies.

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FAA accepted course number, C-IND-IM-151030-K-006-003, with an expiration date of October 31, 2017.

# ROTORCRAFT UNDERWRITING

## There are many factors that contribute to the overall underwriting risk equation during the evaluation process

EVER SINCE THE 1940'S THE VERTICAL DEFIANCE of gravity has fascinated the aviation community. The ability to hover above a fixed point and enjoy the view has not lost its thrill. Let's not forget the exceptional utility of these miraculous mechanical marvels. Helicopters are used extensively for heavy lift, patient rescue, law enforcement, news gathering, agricultural spraying, and many other jobs that require the vertical or stability capabilities of these machines. With this utility comes trade-offs. Flying helicopters safely and precisely requires continuous training and practice, as well as frequent and intensive maintenance and high operating expenses can lend to difficulty in obtaining insurance.

### SPECIFIC GENERALITIES

Aviation underwriters face several realities when they consider accepting a helicopter "risk."

**Flight training in helicopters is a relatively high risk activity —**
Helicopter flight training requires that the student pilot perform maneuvers on the edge of their ability. Having experienced flight instructor on board is crucial not only to training the student pilot the skills and judgment necessary to operate the helicopter, but also prevent accidents during training.

**Helicopters operate in unforgiving flight environments —**
Helicopters fly and hover close to the ground, operate from off-airport sites and often near obstacles. The threat of striking an object with a rotor, operating with low ceilings and visibility, and division of pilot's attention to systems inside and outside the cockpit add to risk factor.

**Repairs can be expensive —**
A friend of mine uses a simple budget when calculating the costs of repair on his helicopter. "Small components are $1,000, larger components are $1,000 x 10, then multiply the sum by 10, then multiply …" Well, you get the idea.

With thousands of parts on a helicopter that may be damaged in an accident, repairs can be extremely expensive. In many cases, the manufacturer stipulates that airframe components are not field repairable and must be replaced if damage is even suspected. The cost for parts, and the labor to repair and install, can be shouldered by the insurance company in the event of a claim.

**A partial loss is uncommon —**
The large amount of energy and moving parts which are characteristic of helicopters typically results in severe damage to the helicopter. Physical damage claim payments are often for the total amount the helicopter was insured for.

**Overall pilot experience in rotorwing,** and in the specific make and model helicopter being flown weigh heavy on the underwriter's pen when calculating premiums.

There are many other factors that contribute to the overall underwriting risk equation during the evaluation process. Overall pilot experience in rotorwing, and in the specific make and model helicopter being flown weigh heavy on the underwriter's pen when calculating premiums.

Accident rates impact the helicopter underwriting process more than most. Since there are not as many 'units' to spread the risk, the insurance premises Law of Large Numbers doesn't apply. In fact, there are more automobiles in an average suburban city than helicopters in the entire USA. When a significant accident occurs, the ripple effect can be felt through the entire helicopter underwriting community.

In summary continued emphasis on quality maintenance to reduce the mechanical risk, frequent training to maintain proficiency, and standard operational procedures will all help to minimize the risk of operating these thrilling machines. **AMT**

**STEVE BRUSS** is president of Wings Insurance, an independent aviation insurance broker headquartered in Minneapolis, MN. Steve has 22 years' experience in aviation insurance, and is also a licensed Commercial pilot and flight instructor. He can be reached at sbruss@wingsinsurance.com or by calling (952) 641-3140; www.wingsinsurance.aero.

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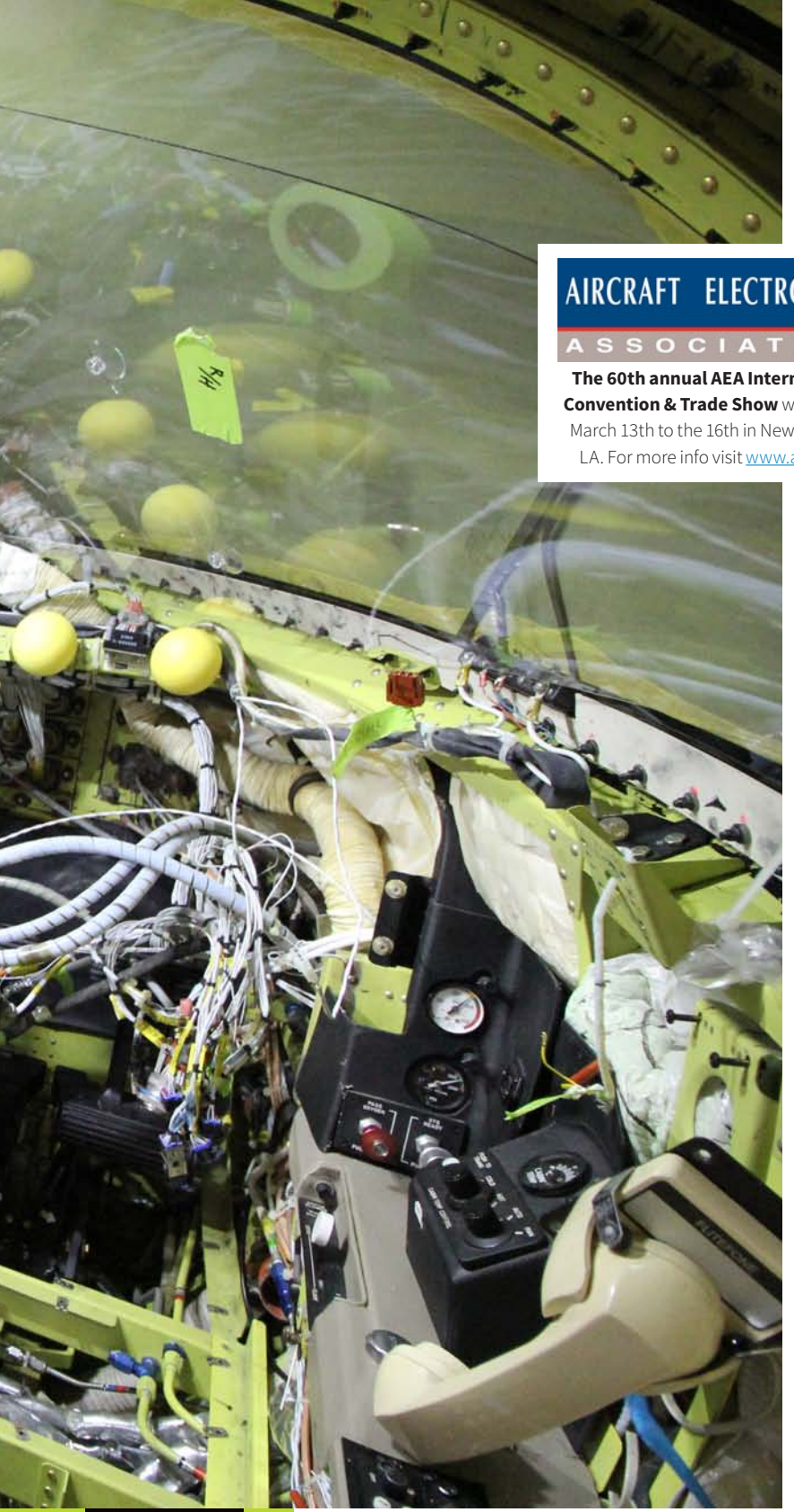
# MAINTAINER'S GUIDE TO ADS-B

Calculating from March 1, 2017, until the final date for completion in order to meet the midnight, Jan. 1, 2020, deadline, there are only 713 working days, excluding weekends and holidays to install ADS-B Out equipment.

*By Ric Peri*



**TYLER LANTZ,** avionics installer for Elliott Aviation, works on a Garmin G5000 installation on a Beechjet 400A. ELLIOTT AVIATION

AIRCRAFT ELECTRONICS ASSOCIATION

**The 60th annual AEA International Convention & Trade Show** will be held March 13th to the 16th in New Orleans, LA. For more info visit www.aea.net.

There have been hundreds if not thousands of articles written about ADS-B Out and the Federal Aviation Administration's 2020 mandate. In addition, there's been a few hundred presentations given stating that close to 150,000 aircraft will need ADS-B Out installations before Jan. 1, 2020, and the available resources to support the procrastinators will be challenged at best. We know people procrastinate; it's human nature, and why spend the money three years before the equipment is actually required?

As a result, we know 2018 and 2019 will be extremely busy years and anyone with a toolbox will be asked to install a "simple" ADS-B Out transmitter. But the system is not simple, and should you do it? And if you do, what are the requirements?

In full disclosure, my employer, the Aircraft Electronics Association (AEA) is a trade organization that represents more than 1,200 aviation businesses worldwide, including the repair stations that specialize in maintenance, repair and installation of avionics and electronic systems in general aviation aircraft. I'm an A&P with more than 40 years of experience. I've also spent the last half of my career on the quality and compliance side of the industry, so I'll focus on the compliance side of meeting the ADS-B Out installations.

## WHAT IS NEXTGEN?

According to the FAA, "NextGen is the transformation of how airplanes traverse the sky. It affects all of us: from the pilots who fly the planes, the passengers who enjoy the flights and the controllers who ensure the safety." NextGen is essentially the modernization of both Air Traffic Management and the systems in the aircraft needed to support and benefit from this modernization of the ground infrastructure. NextGen includes the modernization of each of the three elements of avionics: communications, navigation, and surveillance. ADS-B Out is the modernization of surveillance.

While we are seeing advancements in communication and navigation technologies as well as the improved efficiencies of digital communications and precision navigation, there are no current regulatory mandates. There is, however, an expanded use by the agency to leverage a philosophy known as "best equipped — best served." Internationally, there are transoceanic mandates required by the International Civil Aviation Organization (ICAO) as well as a variety of international mandates implemented by individual countries.

This article focuses on the surveillance piece, the ADS-B Out mandate and the required installations. As we know, 14 CFR 91.225 Automatic Dependent Surveillance-Broadcast Out equipment and use mandates that if we fly in "rule" airspace,

we must have an approved ADS-B Out system installed and we must use it. I won't go into the details of 14 CFR 91.225 and 91.227, but if your customer is flying in airspace that currently requires a transponder, then that airspace will likely require an ADS-B Out system. Remember, this is the modernization of surveillance, so it is logical that if they are required to be under positive surveillance today, they will likely be under positive surveillance tomorrow.

Calculating from March 1, 2017, until the final date for completion in order to meet the midnight, Jan. 1, 2020, deadline, there are only 713 working days, excluding weekends and holidays. That is not a lot of time and certainly doesn't allow the procrastinators to procrastinate very long.

Technician qualifications: Let's look at the age-old question. Can an A&P mechanic install radios? Yes, of course — sort of!

As far as avionics work goes, 14 CFR 65.81 (a) the general privileges and limitations for mechanics, authorizes a certificated mechanic to perform or supervise the alteration of an aircraft for which he is rated but excluding any repair to, or alteration of, instruments. So the installation of a radio is well within the scope and authority of an airframe-rated mechanic.

However, the mechanic may not supervise or approve and return to service the alteration unless he has satisfactorily performed the work concerned at an earlier date. The language of 14 CFR 65.81 (a), which is often overlooked, requires the mechanic to be experienced with the task they are performing in order to have return to service authority. In the case of ADS-B Out systems, this is not a simple installation of a transmitter but rather an installation along with integrations and configuration. So in order to satisfy 14 CFR 65.81 (a), the mechanic would need to show experience with similar integrated, configurable types of installations. The regulations go on to lay out a plan for qualifications if they have performed the work at an earlier date.

## ASSUMING THE TECHNICIAN IS QUALIFIED TO DO ADS-B INSTALLATIONS, WHAT ARE THE QUALIFICATIONS OF THE SYSTEMS?

14 CFR 91.225 requires either ADS-B Out equipment that meets the performance of Technical Standard Order (TSO)-C166b, Extended Squitter Automatic Dependent Surveillance-Broadcast (ADS-B) and Traffic Information Service-Broadcast (TIS-B) Equipment Operating on the Radio Frequency of 1090 Megahertz (MHz), or TSO-C154c, Universal Access Transceiver (UAT) Automatic Dependent Surveillance-Broadcast (ADS-B) Equipment Operating on the Frequency of 978 MHz. While the regulation clearly states "meets the performance requirements," there are other regulatory cites that effectively require "approved equipment" in certified aircraft, so you want to be looking for either TSO-C166b or TSO-C154c.

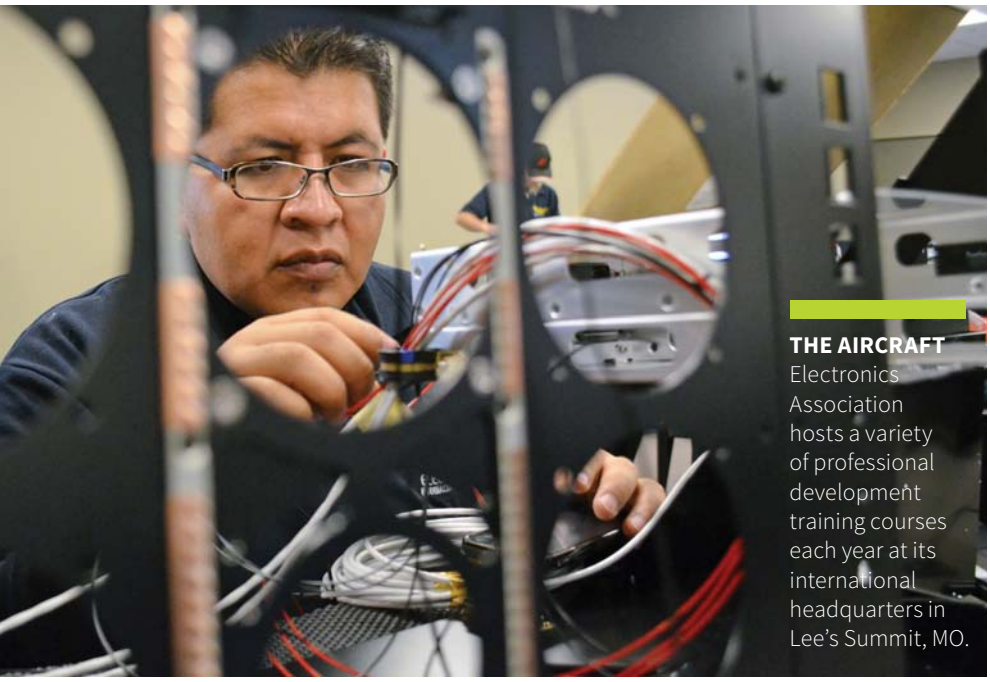
ADS-B Out equipment for EAB/LSA must meet the "performance" requirements of TSO-C166b; or TSO-C154c. The FAA does not "approve" pairings for EAB/LSA, so the manufacturer must attest to the appropriate performance levels for these aircraft.

## IS THE INSTALLATION OF ADS-B OUT A MAJOR OR MINOR ALTERATION?

The FAA March 2, 2016, memorandum titled, "Installation Approval for ADS-B Out Systems," contains three critical elements: (1) blanket (FAA HQ issued) follow-on Field Approval of previously approved STCs; with (2) the approval of the STC holder; but (3) you must treat all follow-on installations as if they were major alterations.

Therefore, based on the administrator's policy, all ADS-B Out installations must be treated as (at a minimum) a major alteration. According to FAA Advisory Circular (AC) 20-165B, the initial airworthiness approval of all ADS-B Out "systems" is done via a type certificate or a supplemental type certificate. However, follow-on installations of the TC/STC are allowed.

The March 2, 2016, memorandum contains specific language and procedures allowing a follow-on installation of a TC/STC approved pairing (system) without an explicit FAA Form 337 block 3 signature. However, there are specific procedures and limitations that MUST be followed. This would be extremely important to every A&P with an Inspection Authorization before they signed the conformity in block 7.



**THE AIRCRAFT** Electronics Association hosts a variety of professional development training courses each year at its international headquarters in Lee's Summit, MO.

AIRCRAFT ELECTRONICS ASSOCIATION

## ADS-B EMITTER CATEGORY TABLE

| EMITTER CATEGORY | DESCRIPTION |
|---|---|
| No Emitter Category | Do not use this emitter category. If no emitter category fits your installation, seek guidance from the FAA as appropriate |
| Light Airplane <15,500 lbs. | Any airplane with a maximum takeoff weight less than 15,500 lbs. This includes very light aircraft (light-sport aircraft) that do not meet the requirements of 14 CFR 103.1. |
| Small Airplane ≥15,500 to <75,000 lbs. | Any airplane with a maximum takeoff weight greater than or equal to 15,000 lbs. but less than 75,000 lbs. |
| Large Airplane ≥75,000 to <300,000 lbs. | Any airplane with a maximum takeoff weight greater than or equal to 75,000 lbs. but less than 300,000 lbs. that does not qualify for the high vortex category. |
| Large Airplane with High Vortex | Any airplane with a maximum takeoff weight greater than or equal to 75,000 lbs. but less than 300,000 lbs. that has been determined to generate a high wake vortex. Currently, the Boeing 757 is the only example. |
| Heavy ≥300,000 lbs. | Any airplane with a maximum takeoff weight equal to or above 300,000 lbs. |
| High Performance >5 G and >400 TAS | Any airplane, regardless of weight, that can maneuver in excess of 5 G's and maintain true airspeed above 400 knots. |
| Rotorcraft | Any rotorcraft, regardless of weight |



Contained within the memorandum is a note about 14 CFR 91.403 (d), which states: "A person must not alter an aircraft based on a supplemental type certificate unless the owner or operator of the aircraft is the holder of the supplemental type certificate, or has written permission from the holder." As a result, in order to take advantage of the FAA headquarters authority for a follow-on field approval for ADS-B Out installations, the installer must be authorized by the STC holder to use the installation data.

### WHAT ARE THE TECHNICIAN'S PERFORMANCE RULES?

The regulation (14 CFR 43.13 (a)) requires that each person performing an alteration to "use the methods, techniques, and practices prescribed in the current manufacturer's maintenance manual or Instructions for Continued Airworthiness prepared by its manufacturer, or other methods, techniques, and practices acceptable to the administrator." Since there is no "acceptable" data available for ADS-B Out installations and since the FAA requires ADS-B Out installations to be treated as if they are major alterations, the installer must use approved data.

The regulations continue with a requirement to "use the tools, equipment, and test apparatus necessary to assure completion of the work in accordance with accepted industry practices. If special equipment or test apparatus is recommended by the manufacturer involved, he must use that equipment or apparatus or its equivalent acceptable to the administrator." Every installation manual requires special test equipment to verify the proper configuration of the ADS-B Out system before return to service.

Currently there are some 20,000 systems installed with a wholly unacceptable error rate of nearly 20 percent. What are the common installation issues?

The seven most common errors are mostly in the configuration of the installations. They include errors in:

- Emitter Category
- Air/Ground Determination Issues
- Baro/Geo Altitude Spikes
- Missing Baro Altitude
- Duplicate or Wrong ICAOs
- Invalid/Missing Mode 3/A Codes
- Flight ID issues

To resolve these installation errors, anyone installing ADS-B Out must familiarize themselves with AC 20-165B Airworthiness Approval of Automatic Dependent Surveillance-Broadcast Out Systems. Many people get confused because the stated purpose of the AC is to "provide guidance for the initial installation and airworthiness approval of Automatic Dependent Surveillance-Broadcast (ADS-B) Out equipment in aircraft." Since most installations are follow-on installation of some type, they dismiss the AC as not applicable.

AC 20-165B Chapter 3 contains ADS-B Out system installation guidance, while paragraph 3.2.3 provides guidance on specific configuration of the associated parameters.

The final issue surrounding ADS-B Out system installations is that TSO-C166b systems are also a Mode S transponder, which will require retesting of the transponder under § 91.413.

§ 91.413 (b) states that "Following any installation or maintenance on an ATC transponder where data correspondence error could be introduced, the integrated system has been tested, inspected, and found to comply with paragraph (c), appendix E, of part 43 of this chapter."

So going back to the leading question: Can an A&P mechanic install radios? Yes, but the other regulations in Part 43, 65, and 91 require attention. ADS-B Out is not simply a radio with a couple of wires, it is an integrated system that requires installation, integration, and configuration. **AMT**

**RIC PERI** is AEA vice president of government and industry affairs. Peri is an A&P with more than 40 years of aircraft maintenance experience. He can be reached at ricp@aea.net or (202) 589-1144.


# THE BUSINESS OF BUSINESS AIRCRAFT AVIONICS AND ELECTRONICS

West Star Aviation's Director of Sales Marty Rhine talks about avionics in the business aviation segment.

*By Ronald Donner*

NEXT GEN, ADS-B, FLIGHT DECK UPGRADES, cabin connectivity, STCs, and approvals are only a few topics regularly heard in the circles of business aircraft owners, operators, and those who maintain these sophisticated aircraft. To get a better view of these issues, *Aircraft Maintenance Technology* (*AMT*) Magazine spoke with West Star Aviation's Director of Sales Marty Rhine. Rhine has been with West Star since 2005.

West Star's three U.S. maintenance facilities and another three satellite locations position them to install, repair, and update many avionics systems used today. West Star Aviation is an FAA-Certified Class I, II, and III avionics repair station.

***AMT:*** **First, for the benefit of me and our readers, I'd like to frame-up the avionics work that your company is currently involved in. Can you describe West Star's avionics business in terms of shop/bench work, new flight deck upgrades, routine avionics and electronics work, line or in-service aircraft work, cabin connectivity projects, etc.**

**WS:** Yes. With the exception of bench work, we are doing all of the above; we are still doing a lot of WAAS/LPV, ADS-B, Wi-Fi, SATCOM upgrades, CMS, retrofits, and LCD upgrades. We have completed several FANS/CPDL-C upgrades too.

***AMT:*** **What would you say are a few of the more significant avionics and electronics related issues the industry as a whole is faced with today?**

**WS:** Wow, that could be answered one of several ways. From a technology standpoint, I would say that we are always chasing the commercial off-the-shelf market as it applies to phones and Wi-Fi connectivity. Whoever it was that coined the phrase "office in the sky" has really put us at a disadvantage in the avionics world today. From an implementation standpoint, ADS-B is without a doubt our biggest hurdle. Jan. 1, 2020 will quickly be upon us. As I stated before, we are doing a lot of installs today. Our quote activity has significantly increased over the last six months. In speaking with some of my colleagues/competitors we are not capturing enough installs at a rate necessary to get all of these airplanes compliant. Lastly, our biggest problem is the experience of our avionics technicians. It takes several years for an avionics technician to come up to speed, in many cases these technicians are getting promoted before

they've really mastered their current role. Due to the fact that there is so much information to learn and retain, we find ourselves continually needing to do more research and more follow-up in trying to meet the expectations of our customers.

***AMT:*** **Looking ahead, which of these would you say will be the most critical facing business aircraft owners, operators, and flight departments in the next few years?**

**WS:** From the answers provided I would say experience among avionics technicians because there is a scarce supply as not many are going into the avionics tech training positions in schools industry wide. West Star hires military or we hire and train ourselves for the uniqueness of the avionics aircraft

***AMT:*** **What would you say are the biggest challenges relating to avionics and electronics work for a business aircraft maintenance provider such as West Star?**

**WS:** Let me caveat my answer by saying that I am currently in an avionics sales position biasing my answer. I want to look at this question not as it applies to mandates but as it applies to typical avionics opportunities. There are many variables that we need to overcome to secure a win. I usually classify aircraft spending into three categories; the first category for expenditures is airframe and engines. The next two buckets are for discretionary spending; in many cases paint and interior take precedence over avionics when it comes to the level 1's decision to spend money. Now, in many cases our customers require between three and five competitive quotes. So, as you can see, all of these variables limit the high probability of securing a win.

***AMT:*** **Can you provide a few examples of how your company addresses these challenges (best practices, etc?)**

**WS:** In general we try to understand our customers' needs in specifics of the opportunity, provide unbiased detailed information, respond in a timely manner, follow-up as often as needed to put ourselves in a position to earn their business and moreover win the opportunity.

***AMT:*** **We haven't talked much about the aircraft cabin and as we all know connectivity, lighting, video conferencing, and all the tools and comforts of the office are now in many business aircraft today. What are the top issues an**

**MRO like yours is faced with regarding the electronic systems in the aircraft cabin?**

**WS:** The first thing would be expectation. It's really important to manage your customers' expectations. We already mentioned the phrase office in the sky and how it is somewhat of a trap. We spend a great deal of time communicating the difference between internet streaming and internet connectivity.

There may not be a guarantee that this information is getting to the end user. My point is, the person in the back writing the checks thinks that they have Internet like they do in the house and that may not be the case. Our next problem is when we get the afterhours call that our customers' Wi-Fi isn't working. This starts a series of questions, including: is the problem Wi-Fi, or the pipe off the airplane? Is the pipe off the airplane satellite based or ground based? Who is your service provider? Is it a performance issue or an expectation issue? Where is the airplane sitting? When is it flying next? Are you comfortable with your chief pilot helping us with troubleshooting this? Once we get a plan together we spend a great deal of time and money chasing broke airplanes all across the country trying to support our customers. I want to interject with a positive note here, you are asking for our struggles for the purpose of the article, but I would like to point out that we are talking about accessing internet at 40,000 feet, travelling 600 miles an hour … which is pretty awesome.

***AMT:*** **In the 2016 *AMT* Magazine Readership Survey, the top two critical issues identified were in this order; training on the complexity of aircraft today and recruitment and retention of employees. I'd like to hear what your view is of this and what best practices your company employs to address these two critical issues.**

**WS:** I agree that training is very complex and challenging for the schools and instructors to stay equal to or ahead of our requirements. As for West Star we send them to schools, seminars, conventions, and online courses as available to us as with the rest of the industry. As for recruitment we work with neighboring colleges and tech schools. At both the shop and enterprise levels we are always reviewing and evaluating how to better West Star Aviation for employee retention. ***AMT***

*AMT* Magazine thanks Marty Rhine and West Star Aviation for sharing some of their insights into the avionics business.

# LET'S TRY A **FATIGUE CHECKLIST**

*By Dr. Bill Johnson*

Research projects, training classes, speeches at every conference, FAA Advisory Circulars, new rules for flight crews, and multiple articles in *AMT* Magazine are examples of efforts to reduce the risk associated with worker fatigue. No one, including Dr. Bill, is ready to step up and say "Mission Accomplished." This article is another attempt to address the fatigue risk challenge. This article minimizes sentences and paragraphs. There are no references! Just use the checklists of actions to help manage your organizational and personal fatigue risk. Want details? (See November/December 2016 *AMT* Magazine.)

## CORPORATE ACTIONS

- ❑ Acknowledge corporate fiduciary responsibility to provide safe air transportation
- ❑ Identify and empower a fatigue risk manager in appropriate departments
- ❑ Send fatigue risk managers to training
- ❑ Establish and promote a fatigue risk management system (FRMS)
- ❑ Ensure organizational buy-in to reduce fatigue-related risk
- ❑ Provide fatigue awareness training to everyone in the organization
- ❑ Ensure that the SMS investigates worker fatigue as a root cause factor in every event
- ❑ Assign values to losses and production inefficiency caused by fatigue
- ❑ Document fatigue issues in all worker injury reports
- ❑ Set reasonable schedules for maximum hours per day for work
- ❑ Set reasonable schedules to accommodate eight hours/day of worker sleep
- ❑ Establish a reasonable plan where a worker can call in "too fatigued to work"
- ❑ Address the risk associated with extended days for road trips or AOG situations
- ❑ Automatically flag time records with frequent extended hours/day and continuous days/week/month
- ❑ Recognize that continuous excessive overtime threatens safe product and worker safety
- ❑ Provide loaner sleep monitor technology to help workers understand their sleep schedules
- ❑ Provide screen for sleep apnea

## WORKER ACTIONS

- ❑ Recognize that fatigue risk management is a shared personal-organizational responsibility
- ❑ Recognize that long work hours and night time schedules have trade-offs with normal life activities
- ❑ Train family/friends to accommodate your commitment to be fit for duty
- ❑ Commit to eight hours of daily sleep
- ❑ Factor commute time into your fitness for duty plans
- ❑ Keep a two-week sleep diary using technology (like Fitbit) or paper
- ❑ Learn from the employer-provided fatigue awareness training
- ❑ Ensure that you have a comfortable, quiet, and dark area for optimal sleep
- ❑ Avoid caffeine or excessive alcohol before sleeping
- ❑ Consider fatigue issues when reporting any hazards
- ❑ Discuss fatigue issues with co-workers
- ❑ Commit to eight hours of daily sleep (repeated on purpose)

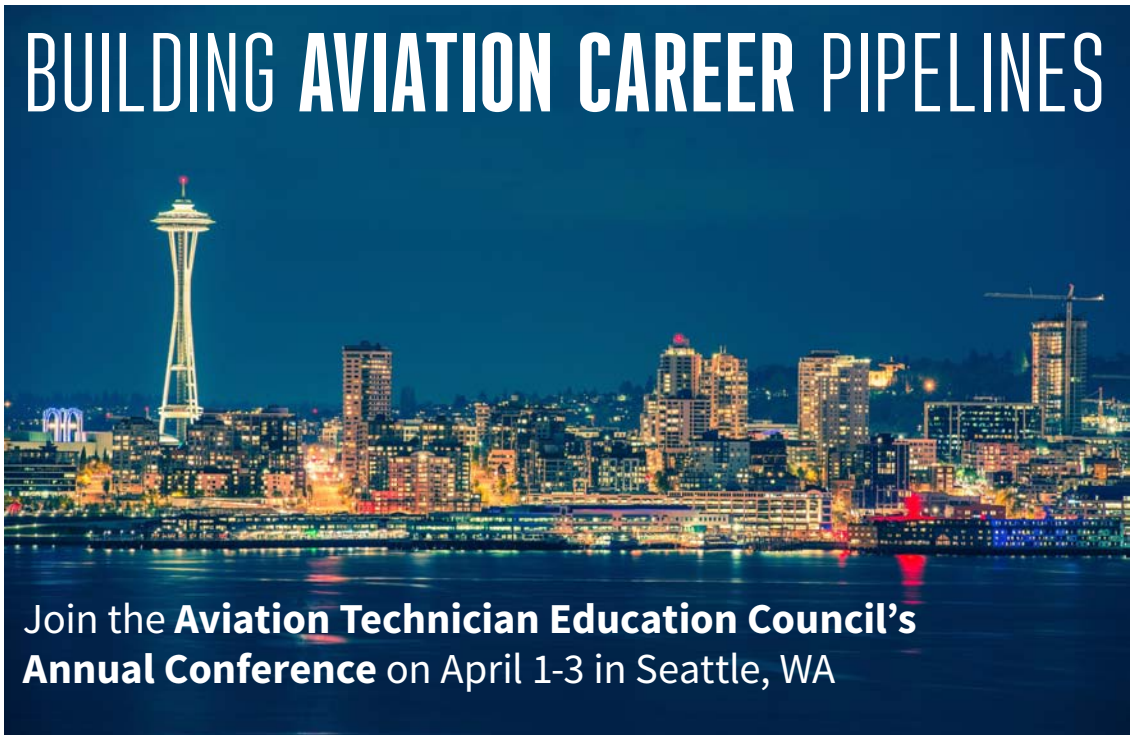
## GOVERNMENT ACTIONS

- ❑ Acknowledge that flight/worker safety and commercial/legal factors should drive fatigue risk management system (FRMS)
- ❑ Ask for fatigue data from SMS
- ❑ Provide hours of duty guidelines for those without FRMS programs
- ❑ Create educational and other FRMS support materials
- ❑ Conduct applied research and development to improve and validate FRMS interventions

**AMT**

**DR. WILLIAM B. JOHNSON** is the FAA Chief Scientific and Technical Advisor for Human Factors in Aircraft Maintenance Systems. His comments are based on nearly 50 years of combined experience as a pilot/mechanic, an airline engineering and MRO consultant, a professor, and an FAA scientific executive.

# BUILDING **AVIATION CAREER** PIPELINES



Join the **Aviation Technician Education Council's Annual Conference** on April 1-3 in Seattle, WA

**RYAN GOERTZEN** is the president of Spartan College of Aeronautics and Technology in Tulsa, OK. He was named president of the Aviation Technician Education Council in April 2014. To learn more about ATEC, visit www.atec-amt.org.

THE AVIATION TECHNICIAN EDUCATION COUNCIL (ATEC) is the voice of aviation maintenance training. The council works tirelessly to promote and support technician education, bringing together part 147 aviation maintenance training schools (AMTS) and the aerospace industry. In furtherance of that work, the theme of this year's ATEC Annual Conference is "building career pipelines." The event agenda illustrates the AMTS community's resolve to address issues facing aviation maintenance training, and to meet the growing demand for technicians.

A full half day of the conference is dedicated to regulatory initiatives. For years, ATEC has pushed for a new part 147, the rule that governs AMTS operations and curriculum, and continues to work with the Federal Aviation Administration (FAA) to ensure that future regulation will allow for a competency-based education module, giving AMTS the ability to cater programs to industry needs. This has been a long time coming, but ATEC believes we are very close to seeing a new rule this summer.

Agency representatives will also discuss the Aviation Maintenance Technician (AMT) Airman Certification Standards (ACS), which will replace outdated Practical Test Standards (PTS). The ACS FAA-industry working group meets regularly to ensure that when the new rules are published there is a seamless transition between the new regulation and testing requirements. Attendees will have the opportunity to hear directly from regulators on how AMTS can best prepare for implementation of a new rule and the AMT ACS.

A recent ATEC survey suggests that a focused effort to provide clear and attractive paths from aviation technician programs to the industry would help fill the demand gap for qualified maintenance employees. To that end, day two of the conference will focus on industry partnerships, and will debut our first-ever Employer Expo, which will provide an opportunity for company recruiters to connect with career development personnel. Thanks to our initial sponsors Endeavor Air, SkyWest Airlines, JetBlue, Columbia Helicopters, and Panasonic Avionics Corporation, the expo will facilitate partnerships and programs to meet the growing global demand for technicians.

The conference will round-out with a Boeing-sponsored day of professional development sessions. ATEC is truly committed to this portion of the conference, focused on the continuing education of our membership's faculty. Thanks to Boeing's generosity, instructors will get a glimpse of how current training is conducted on the 737Max, and how composite training has developed to meet the requirements of the 787.

I invite you to attend ATEC's annual conference to experience all this and more, including an update on ATEC's activities, international opportunities as the need for aviation maintenance technicians continues to grow globally, and a tour of Boeing's Everett plant. We'll see you there! **AMT**

AMT AIRCRAFT MAINTENANCE TECHNOLOGY

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The Industry forecast predicts hundreds of thousands of aircraft technicians will be required to maintain aircraft over the next 20 years.

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The *AMT* Career Development bi-monthly eNewsletter will focus on the latest news, technology, training, and best practices to ensure aviation has the technicians it needs for the future, delivered right to your inbox! To receive the new Career Development eNewsletter, refer to the subscription information below.

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**$138M**

**Cornwell Quality Tools will post sales of about $138 million this year, an increase of more than 100 percent from 2009.**

Japan Air Lines and Finnair will use Apple Inc. iPhones and iPads as part of aircraft maintenance programs. The airline companies signed separate deals with IBM to use custom iOS apps to improve their aircraft maintenance and streamline operations.

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TOOLS

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TOOL STORAGE

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SHOP EQUIPMENT

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This lightweight, rugged, aluminum storage rack from JETechnology is designed specifically for rotary blades. The RBR comes with telescoping rails that allow it to be lengthened to accommodate varying lengths of blades. It comes equipped with UHMW plastic on all contact surfaces of the rack to limit any damage to blades. The RBR is mounted on a set of polyurethane coated, solid iron casters, that enable the rack to be easily used by hand. A towbar is also included for movement of the rack by powered machinery. The RBR is low-maintenance and is a great addition to any hangar that houses rotary wing aircraft.

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AVIONICS

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L3's EFI-650 Electronic Flight Instrument System (EFIS) display upgrade provides a plug-and-play replacement for Cathode Ray Tube (CRT) displays installed on a large number of business and regional aircraft. The EFI-650, which is fully interchangeable with legacy displays, reduces weight by 50 percent and employs the latest display technologies and enhancements for greater reliability and lower life-cycle cost.

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STORAGE SYSTEMS

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TOOLS

## Reversible Drill

**Pan American Tool Corp.**

PART No. 63-044 is light weight at only 2.5 pounds. This drill is reversible for easy back drilling, it accepts 1/4 - 28 threaded angle bits, has a 360º rotatable exhaust, with a 1/4 - 18 NPT air inlet. Features include a feathering trigger which allows operator control of drilling speeds, a reversing button located for superior control, and a smooth quiet operation. It comes with a one year warranty.

PAN AMERICAN TOOL CORPORATION

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SNAP-ON

**Snap-on partners with industry in its annual sponsorship of Aerospace Maintenance Competition**

# TEST SKILLS, RAISE AWARENESS,

*By Steve Staedler*

WHAT DO THE SUPER BOWL, WORLD SERIES, AND THE Stanley Cup all have in common? It pits the best-of-the-best in their respective sport against each other to determine the champion. Of course, if you want to see who the best-of-the-best in aviation maintenance is, then 2017 Aerospace Maintenance Competition Presented by Snap-on is where it's at.

People have been taking to the skies for more than 100 years, and that's due in large part to the skills of talented technicians, mechanics, and engineers who keep aircraft flying safely. Most of the time, these unsung heroes of flight are out of sight. But for three days in Orlando this April, these all-stars become the main attraction.

## KNOWLEDGE, SKILLS, INTEGRITY

"The men and women here are the faces behind safety in aviation. What we're doing is taking a spotlight and shining it on a skilled craft that maintains aircraft around the world," says Ken MacTiernan, chairman of the Aerospace Maintenance Competition Presented by Snap-on. "This event is all about raising the awareness in the public, and to an extent, the industry of the knowledge, skills, and integrity of today's aircraft engineers and technicians."

Held during Aviation Week's MRO Americas conference, the AMC provides a venue for professional AMTs and AMEs, as well as students, to come together in friendly competition, test their


# AND BUILD FOR THE FUTURE

skills against each other, and give a loud shout-out of their presence in the industry.

"The integrity with which these technicians have to do their job is incredible and the responsibilities on them are even more incredible. This gives them some recognition; general awareness for the public about what they do is a big, big thing," says David Leo, a line maintenance supervisor with American Airlines. Last year was the first time American fielded a team in the competition, but Leo says it won't be the last.

American will be joining more than 50 teams from around the world representing major airlines, MROs, military, and technical schools, such as Qantas Airlines, China Southern Airlines, Southwest Airlines, Boeing, U.S. Air Force, Embry-Riddle, and others at this year's AMC, April 25-27, at the Orlando Convention Center in Orlando, FL. These teams compete head-to-head in 24 challenges that test their knowledge, skill, and expertise in avionics, safety wiring, fiber optics, cable rigging, hydraulics, jet engine troubleshooting, workplace SMS, and more. Teams compete to see who's best among their category (Commercial Aviation, General Aviation, Space, School, Military, and MRO/OEM). Each event has a 15-minute time limit, so the action is exciting, fast-paced, and great drama for spectators to watch.

All teams are competing for the privilege of taking home the grand prize — the William F. "Bill" O'Brien Award for Excellence


in Aircraft Maintenance, presented by Snap-on. The team with the overall best score earns this prestigious award, which signifies the highest standard of excellence in aviation maintenance.

The O'Brien Award is a traveling trophy that debuted at the 2013 competition. Alaska Airlines Team Seattle bested 50 other teams last year to capture the 5-foot-tall trophy, and has had the honor of displaying it in their facility in Seattle for the past year. Previous winners include FedEx Indianapolis in 2015, Boeing Seattle in 2014 and FedEx LAX in 2013.

As the official tool sponsor for the AMC, Snap-on donates more than $75,000 in tools and equipment as prizes to the top finishers in the competition.

Additionally, one professional and one student are recognized for their professionalism, enthusiasm, and camaraderie — elements that define the AMC, and are named recipients of the Charles E. Taylor Professional AMT Award. Dallas McLeod of the U.S. Army's Team Apache and Gina Gottfredson-Kelly from Salt Lake Community College were recipients of the Taylor AMT Award last year.

## HONORING THE PAST — AND THE FUTURE

The awards are named in honor of two pioneers of modern aircraft maintenance: William F. "Bill" O'Brien and Charles E. Taylor. Bill O'Brien was a pilot, flight instructor, and certified aircraft mechanic who worked for the FAA for more than two decades, making significant contributions to aviation education throughout his career. Taylor earned his place in aviation as the mechanic and engineer for the Wright Brothers, designing and building the 12-horsepower aluminum engine that powered the first manned flight.

The Aerospace Maintenance Competition presented by Snap-on is held during the MRO Americas conference, April 25-27, in Orlando, FL. For more information on the event, to enter a team, or become a sponsor, contact AMC Chairman Ken MacTiernan at jetdoctor69@gmail.com or visit aerospacemaintenancecompetition.com.

But it's not all about history. The future of the aerospace maintenance industry is in the spotlight at the AMC, and it looks good. In 2009, the first year of the competition, just nine teams competed; in 2016, 51 teams competed, almost half of which were student teams.

"It just shows that in the pipeline we have a new generation of skilled technicians ready to make their mark," MacTiernan says. "And as those who are already established get ready to retire, knowing we have a trained, motivated force coming up is a comforting thought."

## COMPETITION IN NAME ONLY

MacTiernan likes to stress that the AMC is a chance for all AMTs, not just students, to keep learning and improving.

"We don't just learn and stop. What I don't know, someone else will know. And they teach me, and I pass it along. It's how we become stronger," he says.

The importance of teamwork, for both the professionals and students, is a major theme annually for those attending.

"The AMC is a way to learn how to work better as a team … to really grow in the industry," says Maida Ortiz, a team member from Redstone College in Colorado. She says what she took away from last year's AMC is a sense of camaraderie among the aerospace maintenance "family."

Gary Driscoll, one of Salt Lake Community College's team leaders at the 2015 competition, agrees.

"In this industry, you can't do things on your own, you have to function as a team," he says. "We learned how to work under pressure, with distractions, and we got to compete with some of the best in the industry, amazing teams that we got to go head-to-head with."


**THE TEAMS** that competed in 2016.

**JOHN GOGLIA,** Aerospace Maintenance Competition executive director.

SNAP-ON

That's exactly what John Goglia, the Aerospace Maintenance Competition's Executive Director and a 40-year veteran of the industry, likes to hear.

"It's really a competition in name only," he says. "In aircraft maintenance, we're all in this together. The military teams, the corporate teams, the schools, they're all mingling together. There's a lot of mentoring going on here between the professionals in the business and the students. And that's what this

event is all about. I love every minute of it; it's just great."

"One of the best things I've seen among my team and others is the willingness to help some of the students from the schools, help them along, give them some pointers, regardless of the fact that they're competing against each other," adds Leo.

## SPONSORING THE FUTURE

Snap-on has a rich history in aviation, dating back more than 75 years. So, it's a natural fit to be involved in the AMC as its presenting sponsor.

"The Aerospace Maintenance Competition is important to Snap-on because it's important to recognize these technicians and the critical role they play in the industry," says Scott Steward, business development manager, Snap-on. "We know there are job forecasts that predict there may be a shortage of trained mechanics. We want to help tell students who are in school deciding what they want to do that the field of aviation maintenance is a strong career to enter. That's why it's important we see this event continue to expand, not only in terms of the number of teams participating, but also by increasing the general public's awareness of the aviation world and what a great opportunity it holds for employment."

For some students, that career starts at the AMC. Brandon Dubberly, the 2015 Charles E. Taylor Professional AMT Award recipient and recent graduate of Eastern Florida State College, says the event was a great networking opportunity to meet industry professionals.

"The AMC is perfect for students as it can't be any better for someone getting ready to graduate and receiving the exposure to something like this," he says. "The AMC got my name out there, and I had a few people hand me business cards interested in talking with me about future jobs. It's a great venue for students." ***AMT***

**STEVE STAEDLER** is a senior account executive at LePoidevin Marketing, a Brookfield, WI-based business-to-business marketing firm that specializes in the tooling and aerospace industries. Staedler has been covering aeronautical maintenance for nearly 10 years; is a former newspaper reporter; and retired master sergeant from the U.S. Air Force Reserve, where he worked maintenance and public affairs. He can be reached at steve@lepoidevinmarketing.com; (262) 754-9550; or www.lepoidevinmarketing.com.

**An accident report** is supposed to flow from fact to fact to fact, building upon the narrative; the writer is meant to lay out the events

# LOST in TRANSLATION

*By Stephen Carbone*

IN 2003, I ASSISTED THE AVIATION SAFETY Council (ASC) — the Taiwanese version of the NTSB's Aeronautical division — during the China Air 611 accident. Taiwan is an incredible place, very beautiful and full of history. I grew to respect the professionals at the ASC as we shared investigatory techniques. Unfortunately Report ASC-AOR-16-06-001, the TransAsia Airways ATR72, flight GE235, has lost something in the translation from Mandarin (Chinese) to English.

I find the world today relies heavily on written interactions, e.g. texting, emails, etc. Verbal communications are almost nonexistent; we're losing the ability to translate our thoughts into understandable intentions. If I capitalize all letters, I'm yelling; if I write something sarcastically witty, it's viewed as patronizing or insulting. The [digital] pen is more powerful than the sword.

My experience with report writing dictates that there is a 'method' to the flow of information 'madness'. Take the ongoing Malaysian Air MH370 disappearance/spectacle: how much opinion and theory were (and still is) flung against the wall in the hopes of something sticking? It was like watching a confused Durga, unsure of which path to point to. Now, how much fact came to the surface and was followed up on? Not so much. There are two reasons for that: one — way too many experts, and, two — one must follow the facts to analyze, not the other way around.

I'm often critical of the NTSB. However, one thing they do right is the blue cover (aviation) report, the final collection of information for an aviation accident report; the blue cover report lays out the facts before engaging in any type of supposition or analysis; it's like Hercules Poirot explaining the crime to the suspects. It provides that flow of information without the contamination of opinion, allowing the reader to make the connection. Terms like 'may have' or 'probably' have no place here; more definitive verbs and adverbs are used.

This is even true with the Blue Cover's Executive Summary; this is the down-and-dirty about the accident, recapping for the Board Members so they can go right to the probable cause(s) and recommendations; Board Members review accidents taking place in five different modes, so it makes sense. It takes up less than one page and no more than four paragraphs.

Report ASC-AOR-16-06-001, by comparison, commits nine pages to the Executive Summary; this is the equivalent of explaining the entire plot of a book on the jacket. TransAsia Airways, flight 235 lost control, crashing into the Keelung River after striking the Huan-Dong overpass. It lost power shortly after take-off, maneuvered through several downtown buildings before rolling over to port and plunging into the river. It was miraculous anyone onboard survived and multiple building occupants weren't lost on the way to the accident.

In the Executive Summary, report ASC-AOR-16-06-001 contains numerous assumptions on the part of the investigator, e.g. 'Had the crew prioritized their actions to stabilize the aircraft …' or 'the pilots did not respond to stall warnings in a timely manner'. This takes the report out of context. Many allegations are presumptuous unless evidence is provided to lead the reader there, e.g. following the cockpit voice recorder transcript (CVR-T) later in the report I was unsure as to how these conclusions were made — the factual section starts 16 pages after, while the analysis comes in at 140 pages in.

One unsettling assumption in the report states, 'the pilot reduces power and then shuts down the wrong engine.' I read the attached CVR-T several times; unless the conversations were incorrectly

**STEPHEN CARBONE** is an avid writer of aviation fiction; his first novel *Jet Blast* has appealed to mechanics, pilots, air traffic controllers, etc. by giving accurate depictions of the accident investigation process. A former airline mechanic, he has been involved in many aspects of commercial aviation and went on to investigate major aviation accidents for the NTSB. A member of ISASI, Stephen holds a Master's degree in systems safety from ERAU. His weekly blog can be found at: http://jetblast.tateauthor.com

translated from Mandarin, there's no mention of the No. 1 engine being shut down in error. To further the point, the crew 'sound' calm and in control; there is no fighting or lack of situational awareness in the CVR-T transcript.

Now to be fair, the first section of the report is called Findings as a Result of this Investigation; it lays out all the findings in three topics: powerplant, risk, and other findings. What it doesn't do is bring the reader to the end of the report; it's like a mystery's first chapter describing the crime and who did it. Furthermore, it's inaccurate and presumptuous; the investigator 'reads' the pilots' collective minds, knowing their thoughts during the harrowing last minutes of flight.

An accident report is supposed to flow from fact to fact to fact, building upon the narrative; the writer is meant to lay out the events, assuming that the readers don't know the chain of events … because they don't.

In the Probable Cause section of the Executive Summary, the ninth probable cause states, 'An intermittent signal discontinuity between the autofeather unit No. 2 and the torque sensor may have caused … No. 2 autofeathering.' May have? I never worked the ATR so as I understand it there are two probabilities: One — the automatic takeoff power control system (ATCPS) became unarmed during takeoff roll; and, two — the ATCPS being activated during climb. This is an assumption — not based in fact (may have) — and a leap. This statement is found on page three of the Executive Summary; I cannot reconcile how the assumption was drawn.

Again, it may be due to translation, but a confusing aspect of the report fails to establish who's who. The acronym 'PF' means the 'pilot flying', yet never defines which pilot is flying the leg or if the left-seater becomes the PF in the emergency. One pilot is referred to as 'Captain A', instead of Captain or First Officer; this may be a cultural misinterpretation on my part, but it doesn't contribute to understanding the events.

Finally, the report mentions a probable cause that the crew ignored standard operating procedures for engine flameout, while also stating the airline's training and procedures were inadequate. Again, perhaps cultural, but are they holding the crew accountable for what they aren't provided?

I know a lot of hard work went into this report; I also don't know the efforts required to translate the report into English. Unfortunately for me, it raised more questions than answers. **AMT**

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# AN AVIATION **WORLD OF GOOD**

## The strategy for navigating political turbulence will always be about personal relationships

THE AVIATION WORLD ENTERS 2017 FACING uncertainty. Political transitions and global market swings leave certificate holders searching for answers. Regulatory reform? Renegotiation of trade agreements? Territorial isolation? How will the populist revolutions of Brexit (the decision of voters in the United Kingdom to leave the European Union) and the new U.S. president, the apparent opening of previously sanctioned Iran and Cuba, and the continued expansion of South American and Asian interests impact international policy?

**On March 15 ARSA's members take to Capitol Hill** for meetings with elected officials, staff, and committee representatives.

**BRETT LEVANTO** is vice president of operations of Obadal, Filler, MacLeod & Klein, P.L.C. managing firm and client communications in conjunction with regulatory and legislative policy initiatives. He provides strategic and logistical support for the Aeronautical Repair Station Association.

These issues will take time to play out. As they do, engagement will be vital. Working together, connecting with regulatory bodies and government leaders, seeking common ground — the strategy for navigating political turbulence will always be about personal relationships.

Repair stations, parts producers, and manufacturers can build those relationships by filling their calendar and purchasing their tickets. From conventions to expos to government-led meetings, there is simply no substitute for personal involvement.

As the voice of the international aviation maintenance community, ARSA is devoted to the unique needs of a complex, global industry. Through regulatory compliance services, legislative advocacy, training, publications, events, and media engagement, we remind governments, policymakers, and the general public of a simple truth: You can't fly without us.

While there are many places for maintenance providers to congregate, the Annual Repair Symposium is the association's brightest showcase. Every year, participants are brought face-to-face with elected leaders, industry executives, government officials, and international representatives. Put simply, when you get to Washington, D.C., the aviation world is yours — international topics and participants mark every page of the Legislative Day and Symposium agenda.

On March 15, as ARSA's members take to Capitol Hill for meetings with elected officials, staff, and committee representatives, Christian A. Klein will help unveil the association's Annual Global Fleet and MRO Market Assessment, prepared by Oliver Wyman. For years now, the report has hit the same note: The maintenance industry is growing, with new demand for service and support forecast in every part of the world.

On March 16 and 17, participants will tackle the borderless issues that face aviation businesses. From complying with regulatory mandates, to managing business requirements, to finding and retaining qualified technicians, to working with governments, symposium participants will face the industry's most-pressing needs. After more than a year's effort to "smooth" implementation of the changes five and six to the U.S-EU Maintenance Annex Guidance and correct regulatory gaps related to parts documentation, ARSA will update on its efforts towards mutual recognition of regulatory regimes.

These sessions — supported by presenters and participants from around the world — perfectly complement the ARSA's complete coverage of matters essential to the maintenance industry. If you can't be with us from the 15th to the 17th, the association will continue to bring the world to you through its services and communications. From import/export compliance to bilateral relationships and everything in between, ARSA works for you.

Every day of the year, the association helps its members manage the intersection of business and government. For three days in March, we come together to share and learn not only about how that work serves the men and women who keep us all safely in flight, but also how we can do it better. Whether you can be with us or not, find time to get personally involved in this community.

Join us. Together we can do a world of good. **AMT**

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