Aviation Human Factors Industry News

Volume XII. Issue 22, November 13, 2016

Hello all,

To subscribe send an email to: rhughes@humanfactorsedu.com

In this weeks edition of *Aviation Human Factors Industry News* you will read the following stories:

★Give Yourself The Gift of Human Factors Education

★Dramatic GE engine explosion on Boeing 767 poses puzzle for investigators

★Probe confirms actuator jam in Alitalia gear-up landing

★New material to improve de-icing

★New focus on hospital errors aims to correct problems

★Vectors for Safety

★Pilot who got his helicopter repaired by car mechanics now banned from flying, faces punishment

★And Much More

Give Yourself The Gift of Human Factors Education!

Bob Baron, PH.D and president of *The Aviation Consulting Group* has scheduled a human factors Initial course in Myrtle Brach on Feb.20-21, 2017. https://www.tacgworldwide.com/Scheduled-Courses

Bob would be more than happy to offer the subscribers of *Aviation Human Factors Industry News* a very generous 50% discount off the regular Initial HF course fee. The regular fee is $1,995.00 per person. $997.50 would be your discounted fee. It includes lunch and coffee breaks each day!

Other discounts would not apply. This discount is only for the Initial course, although Bob will be offering a recurrent and a train-the-trainer that week as well.

We would match your course enrollment with my mailing list to validate the 50% discount. If you're not on my free newsletter mailing list, to take advantage of the HF course discount, then subscribe to receive the discounted price.

Just write me at rhughes@humanfactorsedu.com

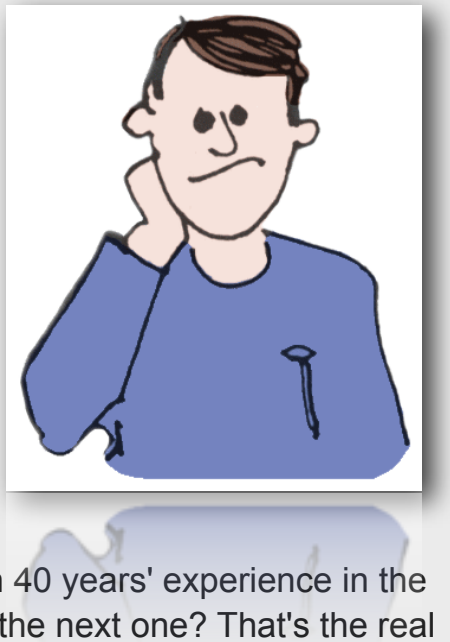
https://www.tacgworldwide.com/Scheduled-Courses

Phone:
1-954-383-7428

Email (best contact method):
tacg@sccoast.net

Dramatic GE engine explosion on Boeing 767 poses puzzle for investigators

Industry experts say the cause of the incident was the first of its kind.



The nearly catastrophic explosion of an engine that caused a fire on an American Airlines Boeing 767 just short of takeoff in Chicago on Oct. 28 occurred when a specific part that had never before failed broke into pieces.

The breakup of a heavy metal disk that rotates in the engine core reveals a new risk to airline passengers that, however rare, has already spurred a scramble by engine-maker General Electric and government safety agencies to find and fix the vulnerability."The risk will be eliminated," said John Goglia, a former National Transportation Safety Board member with more than 40 years' experience in the aviation-safety industry. "Will it be eliminated before the next one? That's the real question. Everything relies upon the timeliness of the system to correct itself."

American Airlines Flight 383 to Miami was speeding down the runway at O'Hare International Airport in Chicago when the second-stage disk of the high-pressure turbine broke apart inside the right engine with a loud explosion that blew metal shrapnel out through the engine casing.

Hot metal ripped through the wing, igniting aviation fuel. In an update this month, the National Safety Board, often called the NTSB, described how the pilot aborted the takeoff just seconds before reaching a speed at which he would have had to leave the ground. Slamming on the brakes as the jet reached a speed of 154 miles per hour, he brought the plane to a halt within 25 seconds and 900 yards further down the runway.

Moving quickly, the cabin staff evacuated all 161 passengers and nine crew using the escape slides on the undamaged left side of the aircraft. Twenty people suffered minor injuries.

Behind them on the runway, the black smoke billowing skyward and the blaze melting the right wing into a drooping mess testified to how close the passengers had come to a large-scale tragedy.

GE spokesman Rick Kennedy stresses the reliability of the CF6 engine involved. The latest models, introduced in the 1980s, currently power about 4,000 widebody jets, including Boeing 767s, 747s and Airbus A330s, and have flown for more than 220 million hours.

"The CF6 is the workhorse engine of jumbo jets on a level never experienced before," Kennedy said.

Yet the danger posed by a so-called "uncontained engine failure" cannot be overstated.

The disk that broke apart in Chicago — one of two disks in what's called the high-pressure turbine that drives the engine's air compressor — is about 2 feet in diameter and weighs more than 100 pounds.

At full power for takeoff, the temperature in the high-pressure turbine reaches more than 2,200 degrees.

The pod around the engine has Kevlar armor around the big fan at the front, designed to contain any blades that fly off. But the pod cannot possibly contain the enormous energy of flying metal ejected from an engine-core breakup.

The NTSB has said one piece of the broken disk went through the right wing, then arced high over the airplane and came crashing through the roof of a UPS warehouse almost 1,000 yards away.

"Any time a turbine disk fails, it's a big deal," Goglia said.

In 2006, a CF6-80 engine — the same model as in the Chicago incident — on another American Airlines 767 that was powered up during maintenance, exploded on the ground in Los Angeles, with no passengers aboard.

A big piece of the high-pressure turbine disk in the left engine pierced the engine casing, sliced through the airplane's lower fuselage and embedded itself like an ax-head in the casing of the right engine on the other side of the airplane.

That jarring incident came after two other CF6-80 high-pressure turbine-disk breakups.

In 2000, as a US Airways 767 was undergoing engine maintenance on the ground in Philadelphia, a disk rupture split the left engine clean in two and ignited a fire under the wing.

In 2002, it happened while a jet was in the air.

The left engine of an Air New Zealand 767 blew up six minutes after takeoff from Brisbane, Australia, damaging the wing flaps and forcing an emergency landing. Luckily, there was no fire that time, and all 200 people on board were safe.

In all three of those CF6-80 incidents, the disk that broke up was the first of two inside the turbine.

Although the two disks look alike, the first stage is next to the hottest part of the engine core and must withstand the highest temperatures and air pressure.

After the 2006 incident, the government safety system kicked into high gear. The Federal Aviation Administration, or FAA, issued an Airworthiness Directive ordering urgent inspections of these disks inside older CF6-80 engines.

Subsequently, GE redesigned the first-stage disk to take more stress, adjusting the shape and the composition of the sophisticated nickel alloy.

All planes flying today have been retrofitted with that redesigned disk, Kennedy said.

"That's behind us," he said.

But the disk that exploded in Chicago was the second-stage disk.

This disk is subject to lower temperatures and air flow, so it undergoes relatively less stress than the first.

"There has never been an Airworthiness Directive associated with a second-stage disk," Kennedy said. "This is new."

That's what's raised alarm bells at the NTSB and the FAA.

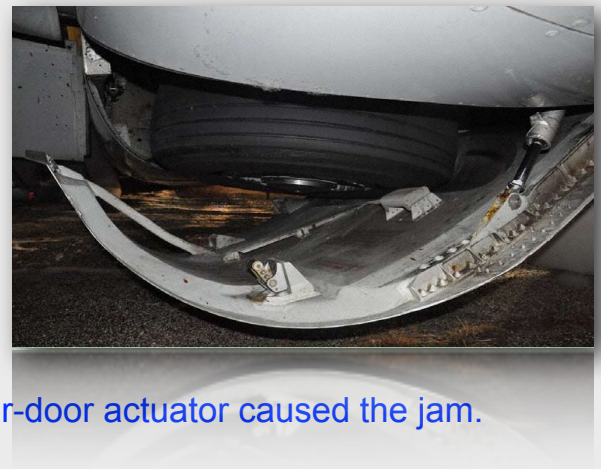
The NTSB said that particular disk had been flying for 18 years and completed almost 11,000 flights, short of the limit of 15,000 cycles after which it must be replaced.

Goglia and other industry experts said the sudden breakup almost certainly stemmed from a microscopic crack, caused by a flaw in the metal invisible to the eye, that grew over years of service.

Using electron microscopes, metallurgists at the NTSB Materials Laboratory in Washington, D.C., are now scanning the pieces of the broken stage-two disk, 95 percent of which was recovered.

"They'll examine the metal down to the tiniest element to determine the cause," said Goglia.

Probe confirms actuator jam in Alitalia gear-up landing



Italian investigators have concluded that an Alitalia Airbus A320's right-hand main landing-gear failed to extend after suffering a jammed actuator.

The aircraft carried out a landing at Rome Fiumicino on 29 September 2013 using nose-gear and left-hand main gear. Italian investigation authority ANSV has detailed the circumstances of the accident, concluding that debris in the gear-door actuator caused the jam.

Analysis identified two components within the actuator as sources of the debris: the spirolox ring and damping ring.

It says the failure appears to have been the result of a design flaw in the spirolox ring which suffered premature deterioration, leading to metal contamination.

Actuator failure had been linked to a Wizz Air A320 landing accident at Fiumicino, in similar circumstances, less than four months earlier.

Airbus introduced a new actuator design in response while Europe's safety regulator ordered checks on the component in other A320s.

New material to improve de-icing

Icy conditions can be deadly, whether you're flying into bad weather or too close to power transmission lines during a storm. Researchers at the University of Houston have reported the discovery of a material that can be applied to any surface to repel ice. The material, known as a magnetic slippery surface (MAGSS) is described in the current issue of Nature Communications.

Hadi Ghasemi, Bill D. Cook Assistant Professor of mechanical engineering at UH and principal investigator for the research, said the material outperforms all others currently in use.

"Anti-icing surfaces have a critical footprint on daily lives of humans ranging from transportation systems and infrastructure to energy systems, but creation of these surfaces for low temperatures remains elusive," the researchers wrote. "Non-wetting surfaces and liquid-infused surfaces have inspired routes for the development of icephobic surfaces. However, high freezing temperature, high ice adhesion strength, and high cost have restricted their practical applications."

Ghasemi describes the material this way: One side of the surface is coated with a magnetic material, while a thin layer of magnetic fluid -- a mixture of fluid and iron oxide nanoparticles -- is deposited on the other side. The magnetic fluid faces outside. When a droplet of water hits the surface, the magnetic fluid acts as a barrier, stopping the droplet from reaching the solid surface.

"There's no adhesion of the ice to the solid surface, so it basically slides off the surface," he said. Four of his students are listed as co-authors: Peyman Irajizad, Nazanin Farokhnia, Seyed Mohammad Sajadi and Munib Hasnain.

Potential applications range from the aircraft industry -- planes can encounter freezing rain or super-cooled water droplets while flying, leading to a buildup of ice and potentially, a crash -- to the power industry, where icing can cause power poles, towers and transmission lines to collapse. Ultimately, Ghasemi hopes to develop the coating as a spray that can be applied to any surface. He has a patent pending on the discovery.

"These surfaces (MAGSS) provide a defect-free surface for ice nucleation and thereby lower the ice formation to close to homogenous nucleation limit," the researchers wrote. "These surfaces promise a new paradigm for development of icephobic surfaces in aviation technologies, ocean-going vessels, power transmission lines and wind turbines in extreme environments."

Among the advantages of the new material, Ghasemi said, is that it has a far lower freezing threshold than the best icephobic technology currently available -- about minus 29 degrees Fahrenheit, compared to minus 13 degrees Fahrenheit for current technology.

"These new surfaces provide the path to tackle the challenge of icing in systems, thereby improving the quality of human life," he said.

New focus on hospital errors aims to correct problems

Every weekday morning, a 20-member team gathers at Carilion Roanoke Memorial Hospital to talk about everything that went wrong the day before. Each patient fall, employee needle stick, central line infection, medication error, unanticipated death is picked apart until a portrait of the culprit emerges.

The team is seeking to determine what — not who — caused the error. It's a shift in a health care culture that traditionally drilled down through mistakes, grilling the people involved until a finger could be pointed and punishment meted.

Instead, Carilion is embracing the concept that even the most highly trained, dedicated humans will err. The goal, then, is to redesign processes and systems to keep mistakes from harming patients.

Safety engineering is not a new concept. Other industries already look at the way people work to find ways to do jobs more efficiently and more safely. But applying the concept to health care has been a slow process.

"The metrics we report today will change over the next five years," said Dr. Ralph Whatley, Carilion's chief quality officer. "What we aspire is, for the most important metrics for health and safety, to be in the top 10 percent, if not 1 percent." To get there, Carilion plans to ramp up efforts to move further away from a culture of denial to one that encourages employees to point out the potential for errors, he said.

“Carilion is within the standards of care set by state and national organizations,” said Steve Arner, Carilion’s chief operating officer. “Countless agencies and organizations measure our quality based on hundreds of thousands, if not millions, of data points. Depending on which ratings, collectively as a system, we fall in the middle or higher upper ratings.”

Arner said Carilion expects to be a leader in quality in patient safety. Part of the plan entails deploying rapid 90-day projects that identify areas of improvement, engage the people involved in the process and then implement changes, which are measured to determine whether they’re working.

Some of the projects cut across departments. “We can look at any work process to look for efficiency and quality,” said Paul O’Quinn, Carilion’s director of process improvement. “We can figure it out with an analytical approach that takes away some of the blame and is seen as objective.”

Focusing on errors

In 2000, the Institute of Medicine published “To Err is Human: Building a Safer Health System.” The report found that at least 44,000 people, and perhaps as many as 98,000, die each year in hospitals as the result of medical errors.
In the report’s wake, Congress passed legislation to reduce medical errors by 50 percent in five years. Money was spent to hire quality and safety officers. The public focused on errors. The Centers for Medicare and Medicaid began to adjust payments based on quality measures, and published star ratings on its website for patients to compare hospitals.

“We’ve all been putting all our efforts into this, and you know what all the studies are telling us about our advancements since this time? We’re not safer,” said Dr. Terry Fairbanks, an associate professor of emergency medicine at Georgetown University and an adjunct associate professor of industrial systems engineering at the University of Buffalo.

Fairbanks practices emergency medicine at MedStar Washington Hospital Center, heads the health system’s National Center for Human Factors and serves on the National Patient Safety Foundation’s board of advisors.

He came to medicine through Virginia Tech’s industrial safety engineering program.

He was enrolled in the graduate program looking forward to a career in aviation safety, earning his pilot's license at the Roanoke-Blacksburg Regional Airport, and working as an EMT for Radford's ambulance service when he discovered emergency department medicine. He enrolled in medical school and has applied lessons learned in aviation to patient safety.

Until the 1970s, pilot error was blamed for numerous crashes, he said. The airline industry was forced to change and look at what caused the pilots to make mistakes, and then to design systems to catch the mistakes before passengers were harmed. Fairbanks said pilots and air traffic controllers still make an average of four mistakes every hour, and yet with 30,000 flights a day, air travel is one of the safest activities a human can do in the United States.

The same could not be said for health care. "Health care is just about the most dangerous thing we can do in this country. You think about risk. Many people are afraid to fly. You should be afraid to go in the hospital," he said.

Studying human factors

The National Patient Safety Foundation revisited the 2000 report last year and found that the issue has become more complex, with care moving from hospitals to ambulatory care clinics, free-standing surgical and diagnostic centers, long-term care facilities and patients' homes.

Carilion, which shifted its business model from a collection of hospitals and primary care offices to a clinic that integrates care across platforms, also shifted its patient safety and quality measures about four or five years ago, and is preparing to accelerate efforts.

Fairbanks spoke this month at Carilion's inaugural quality conference, which also celebrated employee teams that had identified safety concerns and developed plans to prevent problems. Fairbanks said Carilion is among health care leaders as it turns away from the practice of looking for someone to blame.

"Health care is a place where people are really, really highly trained with high standards. There are few professions that have the standardization we have in medicine, nursing, pharmacy," Fairbanks said. "We have smart people, and we have well-intentioned people.

Those people are going to make mistakes."

Fairbanks said the health care industry needs to consider human factors, a type of engineering that crunches data about how people perform tasks and use equipment, then applies the results to designing products and procedures. Ergonomic chairs are an an example of this type of engineering.
Fairbanks showed a picture of a defibrillator that was designed without considering how people would use it. The machine features a big green button that says “On” that’s often mistakenly pushed during an emergency instead of a less-prominent red button that says “Shock.” The “on” button actually turns off the unit — wasting life-saving minutes to recharge.

Yet, Fairbanks said, if he tried to shut down the projector he was using during his presentation — a much simpler machine — he’d get a message asking him if he was sure he wanted to turn it off. He also suggested looking for the gap “between the way leaders think work is getting done on the front line and the ways work is getting done on the front lines.”

One of Carilion’s success stories is a pharmacy project team at Carilion Tazewell, which looked at why the hospital consistently posted the worst rate among Carilion hospitals for scanning medications into patients’ electronic records. The team found a few barriers. Among them: The wireless connectivity didn’t work well in all rooms. Since the improvement project, Tazewell’s scanning compliance has stayed above 98 percent for the last two years.

A team at Carilion Stonewall Jackson Hospital knocked down its high rate of infections from catheters to zero for 19 consecutive months. Other teams evaluated the quality of different surgical masks, instituted a central process for sterilizing equipment and looked for the best way to help patients lose weight.
Patient safety measures are reaching beyond hospitals.

“The National Patient Safety Foundation would like to see much more emphasis and research dollars go into ambulatory and home settings, because we don’t have as good a grasp as to what the problems are in those settings and how to avoid them,” said Dr. Tejal Gandhi, the foundation’s president and CEO.
The shift to look at safety outside of hospitals is also being embraced by the Virginia Hospital and Healthcare Association, which has made quality and patient safety one of its top priorities.

It publishes hospital patient safety scores on its websites and provides ways for its members to share best practices. The goal is to make Virginia tops in the nation for patient safety, and not just in hospitals but at home, said spokesman Julian Walker.

Vectors for Safety

Nov. 1, 2016

Visit GeneBenson.com

View Latest "Vectors for Safety"

The most recent "Vectors" blog reminds us that sometimes little things can present big problems. I relate a personal story of a fuel cap coming off and how I was fortunate that the distraction did not result in a serious problem. The issue also provides examples of accidents that resulted from frost on the airframe, an unlatched cabin door, and a technology distraction.

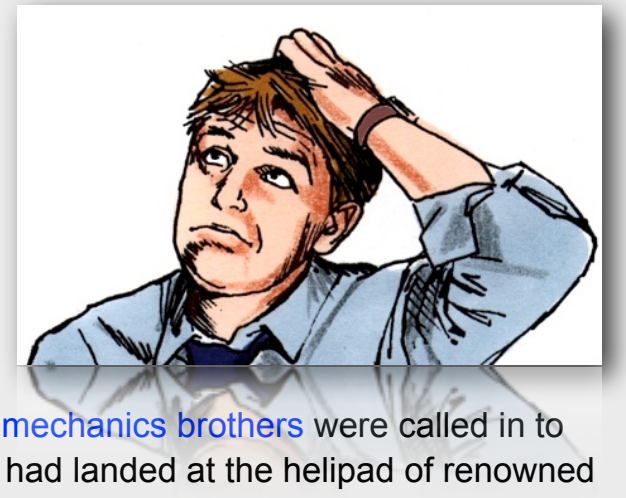
Click here to see the Nov. 1 edition.

Pilot who got his helicopter repaired by car mechanics now banned from flying, faces punishment

DGCA officials said that getting a helicopter repaired from unqualified Aircraft maintenance engineers is a violation of rules and if found at fault, action has be taken against the pilot and the aviation company as well.

The Kolhapur-based brothers who repaired a helicopter last week might have received lot of fame but the pilot of the said helicopter is facing a lot of heat from Directorate General of Civil Aviation (DGCA) for letting unqualified helicopter maintenance engineers repair his vehicle.

INVESTIGATION HAS BEGUN



As the news and pictures of car mechanics repairing helicopter reached DGCA, officers have started investigating the matter and learned that Pune based Avinash Bhosale, the Chairman of Varva Aviation was flying in his Agusta Westland AW 109 (VT-VCA) chopper from Goa to Pune. After the helicopter developed a technical snag, the chopper had to take a brief hault at Kolhapur in Maharashtra. It was here that mechanics brothers were called in to see if they could repair this helicopter that had landed at the helipad of renowned educationist D Y Patil's mansion in Kolhapur.

The DGCA officials said that an enquiry has been initiated to probe the said incident. They added that getting a helicopter repaired from unqualified Aircraft maintenance engineers is a violation of rules and if found at fault, action has be taken against the pilot and the aviation company as well.

Till the probe is over the helicopter pilot of the said helicopter has banned from flying for allowing car mechanics to repair the helicopter and also for not bringing the snag incident to the notice of the DGCA authorities.

Aviation safety experts work to address common thread in plane crashes

The Alaska Aviation Safety Foundation and the National Transportation Safety Board partnered to address loss of control on Saturday.

The NTSB said the loss of control issue has been a problem for years.

NTSB senior investigator Brice Banning said the vast majority of loss of control accidents happen to general aviation pilots and his goal is to teach pilots how to mitigate the risks."We see a lot of accidents that involve a loss of control," Banning said.

Mary O'Connor, a board member of Alaska Aviation Safety Foundation said loss of control can happen during engine failures, often when pilots fly at low altitudes to look at animals like moose.

"If they're not paying attention to their air speed and their angle of bank, that can result in a stall or a loss of air flow over the wings," O'Connor said.

Banning said the key to prevention starts on the ground.

"I firmly believe there's a lesson to be learned in every accident," Banning said.

Larry Todd, a long time pilot said he's flown in Alaska for over 50 years and said there's always an opportunity to learn.

"You can always learn something new and if it isn't new, it's good to review maybe what you knew and forgot," Todd said.

Todd said it's always good to refresh and review issues like overloading the plane.

"Don't overload the airplane, that's the number 1 thing people tend to overload their airplanes," Todd said. "They were talking about having a scale, but if you're not sure about it, leave it behind."

It's a combination of keeping old mistakes in mind, remembering to continue flying the plane and considering new technology Banning said he hopes will keep pilots in control and reach their destinations.

Aging gracefully

Irrespective of the pace of new aircraft deliveries, older aircraft remain a key part of aviation's growth.

Traffic growth and record orders creating production backlogs has made extending fleet life important.There are challenges involved in the endeavor. Following the recent crash of a 34-year-old passenger transport, for example, Indonesia grounded aircraft more than 30 years old and banned importation of any commercial aircraft more than 10 years old.

But an analysis of aircraft accidents for the 53-year span between 1959 and 2012 "does not support simple age-based restrictions as the most effective means to maintain aviation safety," according to Professor R. John Hansman, Jr., Director of MIT's International Center for Air Transportation.

“Many states have rigorous processes to assure the continued airworthiness of older aircraft,” he says.

Major MRO programs

The rigorous assessment of older aircraft stems in part from the 1988 Aloha Airlines Flight 243 incident in which part of the Boeing 737’s fuselage peeled off in flight, as though opened by a can opener.

The accident triggered regulatory and industry reviews that led to several major maintenance programs. Corrosion, fatigue cracking, repair assessment, and widespread fatigue damage (WFD) evaluation are all addressed under new initiatives.

Now, instead of applying the aircraft model’s Design Service Goal (DSG)—which typically correlates to 20-25 years of operation—the WFD rule establishes a Limit of Validity (LoV). The LoV is a value that can be demonstrated by test and analysis to ensure that catastrophic WFD will not occur. In essence, therefore, the LoV represents the end of an airframe’s life. For example, the US Federal Aviation Administration’s (FAA) default LoV for an Airbus A300 B4-2C model is 40,000 flight cycles. For a Boeing 737 Classic, it is 75,000 flight cycles.

Extending life

Whether an aircraft is worth repairing becomes a significant issue close to its LoV. A cracked part, most often due to its geometry, may already be damaged beyond repair and require replacement if the aircraft is to extend its life. This is especially true for large integrally machined parts.

It may be worthwhile for operators to inspect more regularly or use more elaborate inspection techniques, so a crack can be found when it is still repairable.

There are also options for improving the environmental performance of an older aircraft. Such emissions-reducing upgrades as winglets are a common feature of many older aircraft and airlines continue to invest in these and other appropriate developments.

“On a complex system like the engine, it is not simple to install major changes, but there are a few options available,” says Zoran Muratovic, Senior Aircraft System Engineer Powerplant & APU for Lufthansa Technik AG. “A good example is the installation of new acoustic liners on Lufthansa’s Boeing 737s to reduce noise.”

All 737 aircraft stationed at Frankfurt, Germany have been fitted with new sound-absorbing materials, or hush kits, reducing noise emissions from the engines. Muratovic also notes that software modifications can help to reduce thrust on the ground and save up to 10% fuel on the A321 fleet.

Rules of aging

With Airbus and Boeing together having a backlog of more than 12,000 aircraft, the market for used aircraft remains strong, according to Airbus Group Head of Environmental Affairs, Jean-Luc Taupiac. He notes that fewer than 100 of the aircraft parked at the Tarmac Aerosave storage facilities in southwest France and northern Spain have been dismantled in the previous six years.

There is an abundance of spare parts available for older model aircraft, especially the common narrowbodies. Engines and engine components, landing gear, and avionics are the most popular commodities. However, Taupiac cautions: “Managing second-hand parts is really important. It’s a matter of safety. When you have second-hand equipment to replace a part on an aircraft, this has to be traced and you have to be sure this equipment is in good condition.”

The European Aviation Safety Agency (EASA) is considering a new rule on aging aircraft structures. This was published for comment in 2013, though a final version is not expected to formally take effect before 2017. Its content has been harmonized, as much as possible, with FAA recommendations.

In any case, OEMs have already updated their instructions for continued airworthiness. As such, compliancy with EASA's new requirements is already largely in place.

Maintenance status

Finally, one of "the fundamental factors to be considered when valuing an older aircraft is the condition of its maintenance status," according to Shannon Ackert, Senior Vice President, Commercial Operations, at Jackson Square Aviation.

"The sometimes wide disparity between appraisals for similarly aged aircraft can often be explained by differences in their maintenance condition," Ackert explains.

The vast majority of aircraft appraisers and traders quantify the value of an aircraft's maintenance status through analysis of certain, high-cost major maintenance events. These events generally consist of:

1. Airframe heavy check (heavy structural inspection)
2. Engine performance restoration and life limited parts replacement
3. Landing gear overhaul
4. Auxiliary Power Unit performance restoration.

Keeping an aging aircraft going isn't easy but a properly maintained older aircraft could offer a few more years of safe operation and a higher resale value.

Through the Looking Glass

Marketing for the Boeing 787 has focused heavily on its oversized windows, which replace the mechanical blinds found on other commercial aircraft with an electrochromic dimming function.

Glass that darkens at the touch of a button may lend a futuristic feel to the cabin, but the most advanced windows technology is typically found in the cockpit.
Unlike the acrylic passenger windows on modern aircraft, pilots' windshields are still made from glass, albeit chemically-tempered glass produced to unique specifications.

At three plies thick, glass windshields are designed to protect against bird strikes; de-ice from minus 50 degrees; resist fogging and provide exceptional optical qualities.

Bonded between the plies of certain windshields is a conductive plasma coating only a few nanometers thick, which can generate heat for de-icing and de-fogging.

Together, the three plies are around 2cm thick, though only the inner two layers of glass are structural elements; the outer layer acts as a barrier and aircraft can be flown even if it suffers damage, although pilots are understandably loth to do so.

"Even if [the outer layer] fails it's totally safe for the pressure from bird strikes and so on, but pilots are scared and they don't know which ply cracked, so most of the time they abort the mission," explains Sylvain Mourlhon, sales director, aerospace, for Saint-Gobain Sully. Like many other component manufacturers, aircraft transparency suppliers rely on the aftermarket for the bulk of their profits.

It is perhaps surprising, then, that their products are largely designed to be maintenance-free, beyond the odd polishing. However, foreign object damage from events such as bird strikes and hail means that an aircraft will typically go through three to four windshields in its lifetime.

Since windshields cannot be repaired on airframe, this provides a lucrative opportunity for their manufacturers to sell spares and conduct repairs, which usually involve delaminating and rebonding the glass plies.

Millions Fall Asleep Behind the Wheel According to NSF's Sleep Health Index

The National Sleep Foundation's (NSF) recent fielding of the Sleep Health Index (SHI) reports that 3% of Americans, representing more than 7 million drivers, reported falling asleep behind the wheel within the past two weeks.Results of the SHI also indicate that people only felt well-rested about four days per week.

"Three days out of the week the average American is not well-rested, which has implications for productivity, well-being, mood, health, and of course, driving. This suggests that the occurrence of drowsy driving is likely underreported," says NSF research fellow, Kristen Knutson, PhD, in a release.Other results from the SHI found that only 8% of respondents reported having avoided driving in the past two weeks because of feeling tired. Additionally, only 2% of respondents indicated that they avoided taking a ride with a driver who they felt was too tired to drive safely in that same time period.

These numbers highlight the importance of drowsy driving legislation, public education, and awareness programs, states the NSF. To reduce the 6,400 annual deaths attributed to drowsy driving, NSF is declaring November 6-13, 2016 to be Drowsy Driving Prevention Week (DDPW). This annual campaign, which coincides with the end of daylight saving time, provides public education about the risks of driving while drowsy and ways to improve safety.

Additional resources can be accessed via [NSF's DDPW webpage](#).