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Too Old to Fly?

Relieving the Aches and Pains of Aging GA Aircraft

Airplanes are a lot like the human body. Take good care of them and they usually return the favor by running at peak performance for longer than you might expect. Neglect them, and they will age before your eyes, becoming much more prone to sickness and fatigue. One glaring difference between the two however, is that humans can generally detect when something is going wrong with the body. Nagging chest pain or shortness of breath usually prompt a visit to the doctor.

An ailing airplane is generally much less forthcoming with critical precursors of imminent danger. Blinking warning lights, leaking fluids, and creaky latches are all helpful indicators of an airplane problem. Often, though, discovering an unsafe condition, particularly with an aircraft over the 40-year mark, requires a much closer look. Much like caring for an infant or pet, we have to rely on a combination of what we can see and observe, what we know from experience and data, and what we sense from old-fashioned intuition. Being adept at these measures won't make you the aviation-version of Ponce De Leon, but it can still help you give your airplane a longer and safer life.

The Gen-Xers of the GA Fleet

Whoever said 40 is the new 20 obviously wasn't referring to airplanes. In the harsh and unforgiving world of aviation, 40 years might actually be closer to 50, 60, or higher. There's no denying the aging process for aircraft, regardless of how meticulously you maintain them. And, given that 40 is now the average age for more than two-thirds of aircraft in the GA fleet, staying ahead of this aging curve has never been more important.

Photo by Ken Pepard

So, what exactly causes an aircraft to age? After all, a machine made of sturdy metals and flexible composites should easily stand the test of time, right? "Not necessarily," says Keith Noles, an airframe engineer at FAA's Aircraft Certification Office in Atlanta, Ga. "Theoretically, a GA aircraft could last indefinitely," says Noles, "provided just about everything on it is replaced. From both an economic and practical standpoint, that would not make sense." Despite this inevitable mortality, the vast majority of GA aircraft are in fact designed under Civil Aviation Regulations (CAR) part 3, which does not mandate service life limit requirements. That all changed in 1969 when fatigue life limits became required for new unpressurized aircraft designs under FAR part 23. (Life limits for CAR 3 pressurized structure were mandated in 1957.) But should we be concerned about an airplane designed prior to life limit requirements somehow exceeding its useful life expectancy? Or, even with newer aircraft, should we still be concerned with how aging can affect more modern construction materials and methods?

Should the owner of an aging GA aircraft be worried? No. But should they continue to look at things they can do to stay proactive with safety? Absolutely.

Both are valid questions and understandable areas of concern for aircraft owners. To address the issue, the FAA, along with industry, has invested considerable time and resources studying various aging factors that can impact aircraft over time. As a result, much has been discovered about corrosion, fatigue, and inspection techniques. All are key factors for mitigating the effects of aging in general aviation aircraft.

***Firewall corrosion damage discovered on a 1978 Piper* Lance.**

So How Old is Too Old?

True, there might be a few more of the figurative gray hairs and wrinkles on the average aircraft these days. But according to FAA Small Airplane Directorate Continued Operational Safety Program Manager Marv Nuss, the GA fleet is aging quite well. "Should the owner of an aging GA aircraft be worried? No. But should they continue to look at things they can do to stay proactive with safety? Absolutely."

Nuss points out that with the more than 20,000 Cessna 172s, many of which are now 40 to 50 years old and still flying, there has been no evidence of any systemic safety issues due to aging. Solid design and construction characteristics are a major factor in the longevity of these aircraft, yet that can also be the cause for complacency.

"There's no requirement for an annual inspection to be any different for an aircraft that's 40-years old," states Nuss. "But that doesn't mean a 40-year-old plane should get the same type of inspection. Certain areas that aren't required to be checked should be."

A prime example of an inspection that overlooked a potentially catastrophic condition happened with the 1978 Piper *Lance* pictured *(below)*. In the photo we see extensive corrosion damage to both the engine mount and galvanized metal firewall. The culprit in this case was a leaking turbocharger and exhaust system. Their proximity to the firewall also helped conceal corrosion during the annual. The lesson from this example is simple: ensure that inspections include all areas of the aircraft, not just the ones that are easy to reach and labeled on a checklist. In the case of the *Lance*, a proper inspection means removing the insulation blanket and upholstery that covers the firewall.

Also keep in mind that as an airplane ages, the inspection methods and techniques may change and require "special attention" inspections. These special inspections, focused on areas prone to aging problems, become even more critical when an aircraft is subjected to conditions like outdoor storage, inactivity, or modifications. If applicable, be sure to expand your normal inspection checklists to include these special attention items. For assistance, recruit help from the manufacturer, a mechanic, or a type club, and be sure to reference Advisory

Circular AC20-106, *Aircraft Inspection for General Aviation Aircraft Owner*. There's also a good baseline checklist at the back of the *Best Practices Guide for Maintaining Aging General Aviation Airplanes* (see link at the end).

Just thinking back to your last physical exam, you can probably sympathize with the need for these intrusive inspections. While thoughts of being poked and prodded are enough to make us shiver, they are a necessary part of caring for an aging body. And as physically and financially painful as these extra-thorough inspections may seem, they can help you (and your aircraft) reap life-saving dividends.

Extensive corrosion of a wing strut attachment fitting found on a float-equipped Taylorcraft BF-12.

Photo courtesy of NTSB

A Corrosive Mix

Imagine waking up one morning and finding your arms covered with red, itchy blotches. Not a pleasant thought, and you'd be ill-advised to ignore it and just hope it goes away. After all, the remedy could be as simple as using an over-the-counter lotion. The key is treating the rash before it becomes worse and perhaps heeding it as a possible sign of a bigger issue. In many ways, finding corrosion on an aircraft can be similar. Knowing what causes it and what corrosion looks like on different parts of your aircraft will help you identify, treat, and prevent it from doing further damage.

Corrosion is essentially the wearing away of metals from a chemical reaction. It is probably the most visible effect aging can have on an aircraft. Many airframe structures use high-strength aluminum alloy coated with a corrosion resistant pure aluminum coating (alclad). However, when you introduce airborne salts and pollutants along with moisture, the alclad can break down, resulting in the deterioration of the aluminum alloy below it. Protective primer is another method used to mitigate corrosion, however, it too is not an infinite protection. Corrosion on aluminum parts will generally appear like a crusty white or gray powder and can be removed by mechanical polishing or brushing with materials softer than the metal.

Another common material in aircraft construction is steel, which exhibits the familiar reddish brown rust when corrosion is present. Corrosion on steel can be controlled by removing it mechanically and by maintaining its protective coating (usually a cadmium or zinc plating).

Your chances of having corrosion are also highly dependent on where an aircraft is flown and stored. For example, owners who operate or store their aircraft in the warm, humid conditions found in coastal states like Florida or Louisiana need to keep a more watchful eye for corrosion. Just take a look at the extensive corrosion found in the photo (*above*) which shows a wing strut attachment fitting from a 1941 float-equipped Taylorcraft BF-12 operated in Oregon.

This corrosion, a byproduct of improper maintenance, inadequate inspections and exposure to water, was cited by the NTSB as being a probable cause for a fatal accident involving this aircraft. During a water landing attempt in July 2007, the weakened left wing strut separated and caused the wing to fold up against the fuselage seconds before the aircraft impacted the water. It was later discovered that the Taylorcraft owner had performed an annual inspection only two months before the accident, but did not catch the deadly corrosion even though it was included in a service bulletin issued earlier that year.

For more detailed photos on corrosion types and control methods, have a look at AC 43-4A, *Corrosion Control for Aircraft*.

Cracks Kill

Another leading factor in aging aircraft issues—fatigue—can be a lot harder to detect. The topic made media headlines last April when a Southwest Airlines 737 experienced a four-foot tear in the fuselage midflight. NTSB preliminary findings indicated fatigue cracks were found emanating from at least 42 of the 58 rivet holes connected by the fracture. While many GA aircraft owners are not overly worried about the punishing stress of pressurization common to air carrier operations, there are many other causes of fatigue germane to GA. These include wind gusts, unpaved runways, and yes, the occasional student pilot. If left unchecked, these damaging forces can have deadly consequences.

"Some aspects of aircraft aging and fatigue are 'genetic,' says Nuss. "Just like a human's genetic code predisposes them for a particular ailment or condition, so can an aircraft's design or construction materials." Certain parts and components, like engine supports, or wing spar attachment fittings can become fatigue hot spots. The key here is to know the hot spots specific to your aircraft and to keep these areas thoroughly inspected. A good way of doing this is to stay on top of pertinent FAA and manufacturer-based notices, like ADs, SAIBs, and service bulletins. Type clubs can also help keep you in the loop.

Learn as much as you can about your aircraft. Know where it's been, keep it maintained well, and never stop assessing the need for additional inspections.

The effects of fatigue are also cumulative, meaning airplanes can't heal from being stressed. And since fatigue is not necessarily related to age, even owners of newer aircraft need to be vigilant and proactive in their inspections.

It's also a good idea to have detailed information about your aircraft's history. According to Noles, aging issues aren't limited to the number of years or flight hours an aircraft has accumulated. "Additional considerations," says Noles, "are understanding how and where an individual aircraft is used, and how those factors influence its design characteristics and the likelihood of aging-related damage." Among the many questions you should ask during your research are: Where has the aircraft been geographically? Has it been hangared? Was it flown in any special or severe usage capacity? If that information proves hard to come by, try looking at some of the aircraft's maintenance records. You might find that it once had floats, or belonged to a flight school. The address of the owner or the repair facility should also provide clues to its whereabouts and the climates it has been exposed to.

Wing spar fatigue crack found on an Ayres Thrush S-2.

Test Your Knowledge

What is the most corrosion-prone metal used on aircraft?

a. Aluminum alloys
b. Magnesium alloys
c. Copper-based alloys

Answer: b

Use It or Lose It

Another factor worthy of researching is how *much* an aircraft has been used. "While it is true that special uses like moving heavy loads, low altitude flying, or flight instruction can exacerbate the effects of aging, certain areas of an aircraft can develop problems from being underutilized" says Noles.

It's helpful to think about it from a human perspective as well. How many times have you heard just 30 minutes a day of physical activity is the key to good health? Activity keeps the blood flowing, the joints limber and the muscles strong, just as regular flying keeps the engine parts lubricated and aircraft system components working as intended. In contrast, an aircraft sitting idle on a ramp may have components that deteriorate and age faster than those on a similar aircraft that sees a fair amount of routine flying. Sounds like a good excuse to take your airplane flying (and take yourself to the gym)!

Tools You Can Use

As you can see, there are a great many details to become familiar with when it comes to aircraft aging. Thankfully there are tons of resources and tools you can use to help you become better educated on how to properly care for older aircraft. But if you prefer one-stop shopping, the FAA-

sponsored website (www.aginggeneralaviation.org) provides a single access point to type-specific aging aircraft maintenance information. In addition to providing an extensive list of aging-related documents, training curricula, type club information, and database links, the site also features a "War Stories" section where viewers can read, or even add a personal account of an aging-related aircraft incident.

"There's no silver bullet when it comes aircraft aging problems," notes Nuss. "The best you can do is to learn as much as you can about your aircraft. Know where it's been, keep it maintained well, and never stop assessing the need for additional inspections."

Good advice, for both the body and the airplane.

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For More Information

Best Practices Guide to Aging GA Aircraft
www.faa.gov/aircraft/air_cert/design_approvals/small_airplanes/cos/aging_aircraft/media/aging_aircraft_best_practices.pdf

FAA's Service Difficulty Reporting Site
http://av-info.faa.gov/sdrx/

FAA Advisory Circular (AC) 43.13-1B, Acceptable Methods, Techniques, and Practices - Aircraft Inspection and Repair
www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/99861

AOPA/Air Safety Institute Online Course for Aging GA Aircraft
http://flash.aopa.org/asf/agingaircraft/swf/flash.cfm?