Best Practices Guide for Maintaining Aging General Aviation Airplanes

Endorsed by:

Aircraft Owners and Pilots Association (AOPA)

Antique Airplane Association (AAA)

Experimental Aircraft Association (EAA)

Federal Aviation Administration (FAA)

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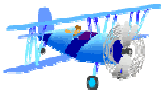


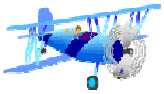
Introduction

This document provides owners of aging single-engine airplanes guidance about maintaining the airworthiness of their airplanes. The general aviation (GA) fleet is aging. In 2000, the average age of the nation's 150,000 single-engine fleet was more than 30 years. By 2020, the average age could approach 50 years. This guide for maintaining older airplanes consists of "best practices" that go beyond normal inspection requirements.

A team made up of airplane manufacturers, owners, their representative organizations, and engineers and inspectors from the Federal Aviation Administration (FAA) developed these best practices. The Aircraft Owners and Pilots Association (AOPA), the Antique Airplane Association (AAA), the Experimental Aircraft Association (EAA), and the FAA endorse this guide.

The intended primary users of this guide are owners of older, small single-engine airplanes. In this guide, owners will find useful tips for assessing the effects of aging on their airplane. They will also find that this guide provides excellent guidance for user groups or type clubs to use for developing a checklist and gathering reference information specific to a model type.

Although targeted specifically for small single-engine airplanes, much of the information in this guide applies to the entire GA fleet. Actions owners take based on these best practices will help protect their investment and, more importantly, help maintain the safety of their airplanes.



Background

The GA fleet is being used well beyond the flight hours and years envisioned when the airplanes were designed. There is concern that continued airworthiness safety matters will become more common as the fleet ages. Several factors are key in keeping the existing fleet in service. Safety studies show that the biggest safety concern for GA safety is pilot situational awareness. To address this concern, modifications to the cockpit are now popular because of the rapid advances in avionics and associated affordability. A 40-year-old, four-place airplane with new avionics can remain productive for many years with periodic avionics upgrades as this technology advances. These improvements will increase safety and allow much of the existing fleet to remain in service well into the 21st century. At the same time, few cost-competitive new models are available.

These airplanes could develop serious age-related problems as they continue to be used well beyond their envisioned design life. The bulk of the fleet is designed to Civil Aviation Regulations (CAR) 3 standards that were established in the 1950s or earlier. These standards lack fatigue and continued airworthiness requirements as part of their certification. Thanks to the robust designs, these airplanes show few signs of aging. However, little is known about the condition of these old airplanes and the general effects of aging on them.

Industry and government have worked together to learn more about the effects of aging on aircraft. The focus of their efforts has been on research and regulation that specifically applies to large transports and commercial operations. However, the physics of aging ignore regulatory boundaries. Through this effort, industry has learned much about corrosion, metal fatigue, inspection techniques, and wiring deterioration. Much of this knowledge can benefit GA.

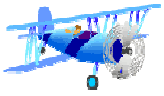
Methods for mitigating the effects of airplane aging parallel those used in medicine. Advances in medical science continue to result in new methods of detecting precursors to serious health problems. Health professionals recommend increasingly more intrusive "inspections" as people age. People accept these recommendations and generally request more thorough physicals as they get older. Conversely, most small airplanes, regardless of age, are rarely (if ever) inspected beyond a non-intrusive annual or 100-hour inspections as required by 14 CFR 43.15, Appendix D.

Purpose

The recommended best practices contained in this guide are similar to suggested physical exams that doctors recommend. Each airplane ages differently depending on how it is maintained and used over its life. However, airplane design concepts are similar from model to model and from manufacturer to manufacturer. Therefore, these best practices generically apply to all GA models regardless of manufacturer.

This guide explains the importance of reviewing the airplane's maintenance records. It gives some ideas for doing it and contains references that provide additional detailed information. It also provides sources of information specific to particular airplane types. The owners of older airplanes routinely form organizations, especially when the manufacturer no longer exists or provides little customer support. These organizations (referred to as "type clubs") share information and are often considered the best source of continued airworthiness concerns that could be or develop into safety problems.

This guide provides a baseline airplane-wide checklist of potential aging concerns for critical areas of an airplane. Included in this guide is an example of such a maintenance and inspection checklist with reference information for a specific airplane model. This example shows how these best practices can be used.



Best Practices

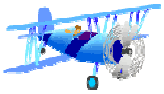
Many aging aircraft designs that are still capable of safe and useful operation in today's environment have manufacturers that have gone out of business or (for other reasons) no longer exist. Other manufacturers that may still exist do not have the capability of providing field support for the aging models. Engineering drawings, maintenance procedures, and other technical data are just not available from these nonexistent or nonsupportive manufacturers.

Acquiring, organizing, preserving, and making available for easy access all data that can be found greatly increases the likelihood for improvements in the maintenance and safe operation of a particular airplane. Extended to a model type or several model types, these actions can have an enormous impact on the future safe operation of the aging small airplane fleet.

Two specific best practices can have a fundamental impact on the way maintenance and inspection is approached for aging airplanes. These are:

- Airplane records research
- Special attention inspections

Doing either of these helps assess the condition of an airplane. Doing both is needed to thoroughly assess the effects of aging on an airplane and provide a method of monitoring its condition as it continues to age.



Best Practice: Airplane Records Research

Records research is the first step in determining the condition of an aging airplane. The degree of inspection necessary, as well as the determination of what items may have already been inspected, will come from a thorough records research. This research will not only identify certain maintenance and usage characteristics of a particular airplane, it will also expose potential areas of attention pertinent to a model type or usage class.

Typically, inspection and overhaul recommendations contained in older GA airplane maintenance instructions do not provide adequate guidance regarding aging maintenance issues. Therefore, assessing the quality of maintenance during an airplane's life is important to determine what parts were replaced, if corrosion was ever a problem, and other maintenance factors that could lead to an aging concern.

In order to establish the maintenance history of a particular airplane, the airplane owner and his or her mechanic must gather all available information. This helps establish a baseline to determine what maintenance, repairs, and alterations have been done and how well the airplane has been cared for.

Research from more general model type issues can be compared with individual airplane information to identify similarities and differences. In effect, this helps answer the question: "Does what I am seeing on this particular airplane match the history of the airplane and type per available records?"

Following is a list of those sources that you should use to determine both individual airplane and model type histories.

A. **Logbook Entries:** This is traditionally where most owners/mechanics begin their investigation. Having logbooks that are complete back to when the airplane came off the production line is a plus, but for various reasons (loss, theft, destroyed, etc.) this is not always possible. This is why the acquisition of the records for the airplane from the FAA (see below) is important. The logbooks should show a clear trend of what maintenance has been preformed throughout the life of the airplane as well as the usage history of the airplane. There should also be clear indications of airworthiness directive (AD) compliance as well as what modifications or major repairs have been done.

The logbook entries should be compared to the physical condition of the airplane. Always ask the question: "Does the logbook reflect what has actually been done to the airplane?" If so, then the owner should have confidence that the logbooks are reasonably accurate. If the logbook contains maintenance or alteration actions that are currently not part of the airplane, then further investigation may be in order to determine the importance of the missing action. Likewise, if the airplane is altered without any logbook entries, then you should investigate the alterations to determine the effect on the performance of the airplane.

B. Aircraft Records: The FAA provides records for specific aircraft, propellers, and engines. By sending a request to the FAA with the aircraft N number, an owner can receive a copy of all the records on that particular aircraft. Because airplane N numbers can change, you should also make a similar request for aircraft make, model, and serial number. If these two do not match, then you may need to further investigate as to why.

Records available include registrations, bills-of-sale, repair and alteration form 337s, supplemental type certificates (STC), and other information. You should also compare this paperwork to the physical airplane to determine if any unrecorded modifications have been made.

These records are sent either on microfiche, on CD, or on paper for some older aircraft. There is a nominal charge to open the aircraft file and copy the material. Information regarding records requests is available from the FAA at Flight Standards Service (AFS-750), Box 25504, Oklahoma City, OK 73125 or at the following website: *http://diy.dot.gov*.

C. Type Certificate Data Sheets (TCDS): The TCDS contains relevant data specific to a model type. The FAA awards a type certificate (TC) only after the applicant shows compliance with the safety regulations as specified by the certification basis listed on the TCDS. The TCDS is a summary of the baseline technical description of the model type, which includes information such as performance, weights, center of gravity limits, and engine and propeller specifications. You can access the TCDS database at the following FAA website: *http://www.airweb.faa.gov/rgl* or by clicking the following hotlink: *type certificate data sheet*.

D. Airworthiness Directives (AD): The FAA issues ADs to owners of affected airplane model types, engines, propellers, or appliances such as instruments. An AD is a mandatory action to correct an unsafe condition. The required actions are usually modifications, one-time inspections, repetitive inspections, or a combination. Owners should compare ADs for their airplane model type with their logbook entries to ensure that the ADs have been done. You can access the AD database at the following FAA website: *http://www.faa.gov/* or by clicking the following hotlink: *Airworthiness Directives*.

E. Special Airworthiness Information Bulletins (SAIB): The FAA issues SAIBs to owners of affected airplane model types, engines, propellers, or appliances such as instruments. An SAIB is not mandatory but provides information regarding an airworthiness concern that is less serious than an unsafe condition addressed with an AD. SAIBs often reference manufacturer service bulletins and service letters. You can access the SAIB database at the following FAA website: *http://av-info.faa.gov/* or by clicking the following hotlink: *Special Airworthiness Information Bulletins (SAIB)*.

F. Service Bulletins/Letters: Aircraft manufacturers issue service bulletins and service letters to address in-service issues or as a method of product improvement. These are often instructions for accomplishing the mandatory actions of an AD. You can obtain service bulletins and service letters from the manufacturer and often from a model's type club.

G. Service Difficulty Reports (SDR): The FAA's database of SDRs contains reported maintenance and/or service problems for any aircraft, engine, or component. An airplane owner can search this database for model specific or individual airplane reports. This can be helpful for identifying areas that may be candidates for special attention (especially if the logbooks are incomplete). This can be useful for determining any past difficulties for specific airplanes. SDRs are available from the FAA Aviation Systems Data Branch (AFS-620), Box 25082, Oklahoma City, OK 73169. You can access the SDR database at the following FAA website: *http://afs600.faa.gov* or by clicking the following hotlink: *SDR Info*.

In order to make the database as useful as possible, owners or mechanics are encouraged to submit SDRs with complete confidence that they will not lead to enforcement actions. Submitting an SDR can help alert other owners, mechanics, or inspectors of problems that may arise in aircraft no longer supported by an active manufacturer.

H. National Transportation Safety Board (NTSB) Records: The NTSB keeps descriptions of more than 140,000 aviation accidents in a searchable database. Searching this database helps the owners/operators or mechanics determine whether their particular aircraft has ever been involved in an accident. This could help the owner/operator or mechanic match up repairs on an aircraft to the reasons for those repairs. It can also help determine trends of accidents regarding a particular model of aircraft. You can access the NTSB database at the following website: *www.ntsb.gov/aviation/aviation.htm* or by clicking the following hotlink: *Accident Database & Synopses*.

I. General Aviation Airworthiness Alerts: Also known as AC 43-16A, aviation maintenance alerts are compilations of recent maintenance problems that are showing up on aircraft (including factory- and amateur-built aircraft, helicopters, powerplants, and propellers), but have not been fully evaluated to the point of becoming a service bulletin, AD, or SAIB. The FAA publishes these alerts monthly from SDRs submitted by those who operate and maintain the civilian aircraft fleet. For aging aircraft, they

can be an early indication of a developing trend of problems. You can access the General Aviation Airworthiness Alerts database at the following FAA website: *http://av-info.faa.gov/* or by clicking the following hotlink: *General Aviation Airworthiness Alerts*.

J. Supplemental Type Certificates (STC): STCs have been developed for many different types of aircraft. These are incorporated to upgrade or improve avionics, systems, engines, gross weight, etc. Design upgrades often have a positive effect with regard to aging issues. A review of the FAA STC database for a specific make and model may reveal design improvements to address an aging issue discovered during routine inspection and maintenance. You can access the STC database at the following FAA website: *http://www.airweb.faa.gov/rgl* or by clicking the following hotlink: *Supplemental Type Certificates (STC)*.

During the research described in **A. Logbook Entries** and **B. Aircraft Records**, owners may discover that STCs are installed on their airplane. In some cases, an STC can affect the continued airworthiness of the airplane. If it does, you should see this reflected with changes to the airplane's Instructions for Continued Airworthiness (ICA). Unfortunately, this does not always happen. Therefore, it is always in the owner's best interest to consider additional maintenance or inspection requirements for incorporated STCs that do not provide specific instructions for continued airworthiness.

During the records research, the owner should be aware of certain factors that may have significant impact on the condition of an aging airplane. You should adjust the way an individual airplane is inspected according to what the research reveals about the airplane's history. The research should answer several questions.

An airplane spends far more time on the ground than it does in the air. Therefore, the environment it is exposed to while on the ground plays a significant role in how it ages.

Has the airplane been hangared? How much of its time has been outside? If the airplane has spent much of its time outside, then there may be additional wear on seals, hoses, and moving parts exposed to the extremes of temperature and moisture. The likelihood of corrosion would be higher for an airplane not hangared.

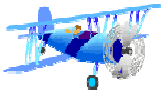
Where has the airplane been geographically? If it has been located in coastal areas, even for a few years, corrosion is probably a concern. (The Florida coast seems to be especially severe.) Corrosion degradation is not limited to structure; it can also cause problems with electrical connectors, etc. Corrosion is more of a concern if the airplane has not been hangared. If it has spent most of its time outside in areas where it gets very cold or very hot, this will take an additional toll. Deterioration of electrical components, hoses, seals, and lubrication is faster when subjected to temperature extremes.

Has the airplane been inactive or in storage for a long period of time? Airplane inactivity has a more severe impact than regular use. The same issues of material deterioration, lubrication, and part wear due to lack of movement can lead to accelerated aging.

Has the airplane been used in a special usage role? A significant amount of time flying at low levels (for example, pipeline patrol or aerial survey) exposes the airframe to more frequent and higher gust loads. This in turn causes additional metal fatigue damage to the wings, empennage, and associated structure. Mountain flying is also a harsher gust environment and therefore more damaging. Operating the airplane with consistently heavy loads or for very short flights also induces additional fatigue damage. Any operation in aerobatic or high-g maneuvers is damaging.

Unfortunately, metal fatigue damage is not "healing." Severe usage early in an airplane's life is just as damaging as similar usage to an old airplane. Just because the airplane was new when it flew in severe operations, unseen and undetected damage to the metal still occurred and will remain. This can manifest itself in a higher likelihood of cracking later in the airplane's life. (Wood and composite structures don't sustain fatigue damage the same as metal, but repeated loads still have long-term damaging effects.)

Good records research enables an assessment of individual airplane history including particular and pertinent environmental and usage factors. When coupled with research results for the model type history, an individual airplane assessment becomes more meaningful.



Best Practice: Special Attention Inspections

An assessment of an airplane's paperwork is only the prelude to a thorough aging evaluation. For aging airplanes, the normal annual inspection minimum requirements specified in 14 CFR 43.15, Appendix D, or those recommended by the manufacturer are probably not enough. A detailed inspection or series of inspections, modifications, parts replacements, or a combination of these may be necessary to keep an aging airplane operating safely.

As an airplane ages, the inspection methods and techniques may change from what was previously required. Special inspections may be required because of high aircraft time, severe operation, inactivity, outside storage, modifications, or poor maintenance. The records research will provide information needed for owners and mechanics to determine what may be needed for a particular airplane or airplane type.

Special inspection criteria can be written to pertain to a specific airplane or airplane type. Appendix 1, Aging Airplane Inspection & Maintenance Baseline Checklist, is a baseline form that you can use as a starting point for developing a model or airplane specific inspection and maintenance checklist.

The design concepts of both systems (mechanical, electrical, and flight controls) and structures (layout and materials) are similar from model to model and from manufacturer to manufacturer for most aging GA airplanes. Areas common to these airplanes areas that are typically susceptible to aging have been identified and are listed in Appendix 1.

The checklist form in Appendix 1 lists areas that are critical to the airworthiness of the airplane. It is broken into several categories or airplane areas:

- General
- Avionics
- Controls
- Electrical
- Empennage
- Engine
- Fuel System
- Fuselage
- Instruments
- Landing Gear
- Modifications
- Propeller
- Repairs
- Systems
- Wing

Some of the listed airplane areas are sensitive to calendar age. Corrosion, wiring, electrical connectors, seals, fuel and hydraulics plumbing, and control cables are some examples. Other areas are sensitive to flight hours or corrosion. Major attach fittings such as wing, empennage, and engine attachments are some examples. For instance, the attach bolts are typically never removed and inspected.

In addition to pointing out specific areas to inspect, the checklist form provides space in columns to document why the inspection may be necessary, when the area or part was last inspected or replaced, and any findings or notes. This last column may aid in documenting special inspections, part replacements, or other noteworthy actions.

Airplane owners or mechanics should expand the checklist form to include items of special concern that result from the records research. When available, manufacturer service bulletins and service letters usually provide directions about how to perform specific inspections (visual, magnifying lens, dye penetrant, eddy current, etc.) or modifications along with special precautions. If special inspections or modifications are developed independently, then you should include or attach this information to the form. Ideally, this information would be tied back to the airplane records research. You should also document special inspections required by the ICA of a field approval here as well.

When working through this process, owners or mechanics may determine that normal visual inspection techniques are not practical. In that case, you may need more intrusive inspections. Inspection methods continuously improve or become more affordable. Borescopes provide high-quality methods for visual inspections to some inaccessible areas. Other techniques, like eddy current, are becoming more popular for assessing a wide range of concerns. Standbys like dye penetrant and magnetic particle remain effective for detecting cracks.

When access to a critical area is a problem, you may need panels installed. This should not deter an owner from having it done. Type clubs may have knowledge of modifications that enable easier inspection or alternative inspection techniques.

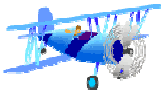
When developing a special inspection program for an airplane, an owner or mechanic should keep in mind how often any inspection should be done. Some areas may be easy to inspect and can be added to the annual inspection list. More difficult inspections may need to be done once every 5 or 10 years. Of course, this would depend on the usage and environmental variables

discussed earlier. You should give consideration to any harm that could be done in order to inspect an area versus the frequency such an inspection is needed. (For instance, repeated removal of fasteners can damage the holes, causing a higher likelihood of cracking. Removal of control surfaces requires re-rigging, which, if not done properly, creates a safety concern.)

Tailoring the checklist form to an individual airplane or model helps the owner keep good records of the special inspection items or other actions that pertain to their airplane. Coupled with the findings of the records research, this becomes an important part of an airplane's maintenance history. It is wise to keep these completed checklists with the airplane maintenance logs and other records.

Documents listed in the references section of this guide are excellent resources that will provide more ideas for a comprehensive checklist. Advisory Circular AC 20-106, Aircraft Inspection for the General Aviation Aircraft Owner, contains an enormous amount of detailed information that directly applies to special inspections. AC 20-64, Maintenance Inspection Notes for Lockheed L-188 is basically an inspection checklist for that model. Although it's for a large airplane, its content and document layout serve as a good example.

Appendix 2 is an example of the checklist applied to a small airplane. It is tailored to the wing structure and its unique design features for certain American Champion airplanes. Appendix 2 also includes information found through records research, such as industry and FAA points of contact and a listing of references materials.



Role of Type Clubs

It is in the airplane owner's best interest to perform the records research and special inspections for his or her airplane. The appendices are provided to aid the owner in that effort. However, much of the model-specific information may already reside with the type clubs. Owners or mechanics may find the job of developing a special inspection checklist easier if they use the information type clubs have.

Type clubs typically have much expertise regarding the maintenance of a particular model and keep up-to-date on service difficulties. They usually have data pertaining to the best inspection and maintenance techniques. They also have data regarding field approvals for modifications and alterations. This may be especially helpful if the airplane needs to be modified to gain access for a difficult inspection. Some type clubs maintain databases of service difficulties and use that to determine trends specific to demographics such as airplane location, flight hours, etc. This collective knowledge within a type club could easily be used to develop special inspection guidelines for a model type. When shared with its members, this knowledge is enhanced with feedback from individual airplane inspections.

When type clubs provide easy access to all available data on a particular model to its members, the probability that an owner or their mechanic will use it increases. Compiling and making all data available to mechanics and owners should result in the improvement (over time) in maintenance efficiency, operating safety, and cost of operation. Mechanics will have more time

to spend doing maintenance on the airplane rather than spending time trying to figure out the best way to inspect, maintain, or repair the airplane. This will result in an overall improvement in the airworthiness of the airplane. This increase in maintenance efficiency would also benefit the owner of the airplane by lowering the total cost of aircraft ownership.

Ideally, this information would be accessible at a type club's Internet website. A checklist form, such as Appendix 1, tailored to the model would be a useful resource to airplane owners and mechanics. A method for receiving feedback from inspection results would provide for needed adjustments to the checklist form. The checklist would be a "living" document where information would be added or revised as necessary based on feedback.

Information about specific type clubs can be obtained from the websites listed below. AOPA, AAA, and EAA maintain current contact information for more than 100 type clubs. Many type clubs maintain their own websites that contain much information that would be useful when performing an age-related special inspection.

- AOPA website: *http://data.aopa2.org/associations*
- AAA website: *http://www.aaa-apm.org/aaa*
- EAA website: *http://vintageaircraft.org/type*

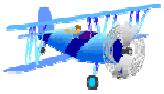
Type club members are encouraged to discuss this concept with their membership. The type clubs already serve an important role in maintaining the safety of the GA fleet. Developing a special inspection checklist would increase their positive impact on safety. In addition to providing detailed maintenance and inspection data, the checklist enhances the educational aspects of maintaining older airplanes and also promotes consistency in the industry.

Summary

Reading and understanding this guide is just the starting point for any owner of an aging small airplane. You need to use the practices described in this document. Records research, development of a special inspection checklist, and inspecting airplanes per the checklist provides the safety benefit. Owners should find that keeping any records research and documentation of special inspections makes future inspections easier and increases the value of their airplane.

These benefits can be enhanced when information is shared with other owners, either through type clubs or other methods. This guide is meant to be a "living" document. Additional best practices will be added as they are developed.

Remember, in many ways airplanes age much like humans. Realize that age does take its toll. However, if owners take care of their airplanes properly, deal with concerns quickly, and keep up-to-date on the latest information, their airplanes will remain "healthy" and safe for a long time.

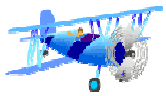


References

This guide was written to provide a wide range of information helpful to the aging airplane owner. The following list of documents provides references for further study and references for more detailed and technical information. Some of the documents contain photos and illustrations of typical age-related concerns (such as corrosion, wear, and cracking), inspection techniques, and good maintenance practices.

Many of these documents are available at the following FAA website: *http://www.faa.gov/* or by clicking the following hotlink: *Regulation & Certification Advisory Circulars*.

- AC 20-64, Maintenance Inspection Notes for Lockheed L-188
- AC 20-106, Aircraft Inspection for the General Aviation Aircraft Owner
- AC 43-4A, Corrosion Control for Aircraft
- AC 43-12A, Preventative Maintenance
- AC 43.13-1B, Acceptable Methods, Techniques, and Practices - Aircraft Inspection and Repair
- ANC Bulletin-18, Design of Wood Aircraft Structures
- Cessna Aircraft Company Model 100 Series Continued Airworthiness Program, D5133-13
- Cessna Aircraft Company Model 200 Series Continued Airworthiness Program, D5121-1-13
- Forest Products Laboratory Wood Handbook
- 14 CFR 43.15, Appendix D, Scope and Detail of Items (as Applicable to the Particular Aircraft) To Be Included in Annual and 100-Hour Inspections



Acknowledgements

A team made up of manufacturers, owners, their representative organizations, and FAA engineers and inspectors wrote this guide. The team members are experienced in small airplane maintenance or engineering or both and provided a broad perspective. They all understand the importance that special maintenance and inspections have in keeping older airplanes safe. They contributed because they believe that this extra attention to aging airplanes is needed to keep them safe.

The three participating GA organizations, along with the FAA, are glad to endorse this guide.

The team members and their affiliations are shown below.

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Brent Taylor		Antique Airplane Association (AAA)
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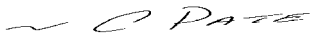
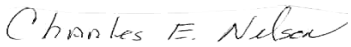
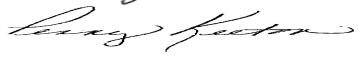
Charles Pate		Cessna Aircraft Company
Earl Lawrence		Experimental Aircraft Association (EAA)
Daryl Lenz		Experimental Aircraft Association (EAA)
Johnny Smith		Raytheon Aircraft Company
Charles Nelson		Swift Museum Foundation
Pierre Debruge		Twin Commander Company
Marv Nuss		Small Airplane Directorate, FAA
Barry Ballenger		Small Airplane Directorate, FAA
Vy Nguyen		Wichita Aircraft Certification Office, FAA
Bill Rohder		Chicago Aircraft Certification Office, FAA
Mike Alquist		Kansas City Aircraft Evaluation Group, FAA
Kim Barnette		Flight Standards Aircraft Maintenance Division, FAA
Randy Carter		Production and Airworthiness Division, FAA
Penny Keeton		Small Airplane Directorate, FAA

The guide is intended to be a fluid document and updated to remain current. If you have ideas for improvement or change, submit your suggestion in writing to an area aviation safety counselor, your local FSDO, or your type club representative.

Appendix 1

Aging Airplane Inspection & Maintenance Baseline Checklist Sample Guide/Form

The list contained in this appendix is not all-inclusive or mandatory. It is intended to be used to guide an owner or type club through the process of developing an inspection and maintenance checklist for their specific model.

This checklist is not intended to replace a manufacturer's recommended annual inspection program or other suitable annual inspection program. However, this checklist can be very useful for assessing additional inspection and maintenance that should be performed on older airplanes. Once developed for a specific model or airplane, it can become a convenient means of recording past inspections and maintenance, which will help determine the need and frequency for follow-on inspections or maintenance.

Aging Airplane Inspection & Maintenance Baseline Checklist
for Airplanes Without a Type Specific Checklist
(this list is not all inclusive or mandatory, to be used as a guide only)

COMPONENT	*SERVICE LETTERS AND/OR ADVISORY MATERIAL*	*DATE LAST INSPECTED/ REPLACED*	*FINDINGS/NOTES*
GENERAL			
Weigh aircraft for actual weight and balance report			
Special attention for corrosion of magnesium parts (i.e., control surfaces, castings, etc.)			
AVIONICS			
Antenna (requires removal) - corrosion - electrical characteristics			
Coax cable condition in inaccessible areas			
Connectors			
Static dischargers - resistance check			
Bonding - resistance check			
ELT - bench check for power output and proper frequency			

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COMPONENT	*SERVICE LETTERS AND/OR ADVISORY MATERIAL*	*DATE LAST INSPECTED/ REPLACED*	*FINDINGS/NOTES*
CONTROLS			
Control surface - balance and rigging			
Inaccessible areas of control surfaces - corrosion - cracking			
Attach points - corrosion - cracking			
Inaccessible control cable runs - condition - corrosion of terminal ends			
Control surface balance weights - corrosion - security of fasteners - condition of attach points			
ELECTRICAL			
Wires (especially inaccessible wiring bundles and wiring behind the control panel)			
Circuit breakers (check for proper operation at rating)			
Capacity check of aircraft battery			

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EMPENNAGE			
Condition of stabilizer attachment structures			
Inaccessible areas of stabilizers - corrosion - cracking			
ENGINE			
Accuracy of engine indicating gauges - tachometer - oil pressure - fuel flow - manifold pressure - exhaust gas temp (EGT) - cylinder head temp (CHT) - oil temperature - fuel pressure			
Engine mounts - fatigue - cracking - condition of vibration isolators			
Internal condition of exhaust piping			
Condition of exhaust clamps and hardware			
Turbocharge wastegate controller bench - check for proper operation			

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COMPONENT	*SERVICE LETTERS AND/OR ADVISORY MATERIAL*	*DATE LAST INSPECTED/ REPLACED*	*FINDINGS/NOTES*
ENGINE (CONTINUED)			
Accuracy of turbocharger system indicators			
FUEL SYSTEM			
Plumbing - rubber hoses			
Fuel quantity - gauging accuracy			
Fuel tank installation - corrosion - leakage - plumbing - attachment			
FUSELAGE			
Seat tracks - wear - cracking - positive locking of seats			
Fuselage attach points - wing - stabilizer - landing gear			
Inaccessible areas (remove all interior items, including headliner, side upholstery panels, carpeting, etc.) - corrosion - cracks			

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INSTRUMENTS			
Plumbing - condition of rubber hoses			
Instrument panel shock mounts			
Pitot/static system - leak check per 91.411			
Airspeed/vertical airspeed calibration			
Altimeter calibration			
Stall warning system calibration			
Magnetic compass calibration			
LANDING GEAR			
Attach bolts NDT			
Axle/attach NDT			
Inaccessible areas of wheel well - corrosion - cracking			

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COMPONENT	*SERVICE LETTERS AND/OR ADVISORY MATERIAL*	*DATE LAST INSPECTED/ REPLACED*	*FINDINGS/NOTES*
MODIFICATIONS			
Records review for proper approval of all modifications including weight and balance revisions			
Additional continued airworthiness inspection/maintenance requirements for modifications that do not include instructions for continued airworthiness			
PROPELLER			
REPAIRS			
Records review for proper approval of all repairs including weight and balance revisions			

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COMPONENT	*SERVICE LETTERS AND/OR ADVISORY MATERIAL*	*DATE LAST INSPECTED/ REPLACED*	*FINDINGS/NOTES*
SYSTEMS			
Cabin pressure control accuracy			
Heater muff type heating system - pressure test of exhaust system for leaks			
Seat belts (certify or replace)			
Cargo restraints (certify or replace)			
Fire extinguisher (certify)			
Hydraulic system plumbing in inaccessible areas			
Hydraulic system gauging accuracy			
Proper operation of oxygen regulator			
Hydrostatic check of oxygen bottle			
Calibration check of oxygen auto dispensing system			
Pneumatic plumbing - rubber hoses			
Pneumatic gauging accuracy			

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COMPONENT	*SERVICE LETTERS AND/OR ADVISORY MATERIAL*	*DATE LAST INSPECTED/ REPLACED*	*FINDINGS/NOTES*
SYSTEMS (Continued)			
Calibration check of pneumatic de-ice system pressure indication (switches or gauges)			
Vacuum plumbing - rubber hoses			
Vacuum regulation - accuracy check - proper operation			
Vacuum gauging accuracy			
WING			
Wing attach bolts			
Strut attach fittings (wood spar)			
Strut attach fittings (metal spar)			
Front strut			
Rear strut			
Strut attach bolts			
Spar (metal)			

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COMPONENT	*SERVICE LETTERS AND/OR ADVISORY MATERIAL*	*DATE LAST INSPECTED/ REPLACED*	*FINDINGS/NOTES*
WING (Continued)			
Spar (wood)			
Nails (wood spar)			
Compression struts			
Drag wire assembly			
Ribs/wingtip			
Fabric			
Inspection holes			
Drains			
Wing general			

Appendix 2 - Example Maintenance & Inspection Checklist

This is an example of how the best practices described in this guide can be used. The checklist format of Appendix 1 was used to develop a special inspection checklist for the wing structure on certain American Champion airplanes. Results of the records research are shown. Manufacturer service letters, applicable ADs, SAIBs, SDRs, and GA alerts (AC 43-16) are listed. It also lists manufacturer, type club, and FAA contact points along with other related technical references.

Wing Inspection (Fabric Covered)
American Champion Aircraft Corporation 7, 8, and 11 Series Aircraft

Component	Service Letters/ Advisory Material	Date Last Inspected/ Replaced	Findings/Notes
Wing attach bolts			
Strut attach fittings (wood spar)	S/L65		
Strut attach fittings (metal spar)	S/L 405 (8GCBC), S/L 408-415		
Front strut			
Rear strut			
Strut attach bolts			
Spar (metal)			
Spar (wood)	S/L 406 A		
Nails (wood spar)	S/L C-139		
Compression struts			
Drag wire assembly			
Ribs/wingtip	S/L #3, S/L #35, S/L #113 (8KCAB)		
Fabric	S/L #75, S/L #85		
Inspection holes	S/L 417C		
Drains			
Wing general	S/L #116, S/L #C130 (8KCAB)		

Airworthiness Directives:

- ✓ 74-23-04 - Fatigue Cracks and/or Distortion of Rib Flanges (8KCAB)
- ✓ 90-15-15 R1 - Upper Wing Front Spar Strut Fittings (8KCAB)
- ✓ 96-03-11 - Metal Spar Wing Front Strut Fittings (8KCAB, 8GCBC, 7GCBC, 7ECA)
- ✓ 96-18-02 - Metal Spar Wing Front Strut Fittings (8KCAB, 8GCBC, 7GCBC, 7ECA)
- ✓ 2000-25-02 R1 - Wood Spar Inspection (7, 8, and 11 Series Aircraft)

Special Airworthiness Information Bulletins (SAIB):

- ✓ ACE-98-32

Service Difficulty Reports Summary (1995 - May 19, 2003):

- ✓ 89 wing-related reports

    - 67 reports related to AD 200-25-02 R1, Wood Spar Damage - compression failures, longitudinal cracks, and loose and missing nails
    - 2 reports of corroded struts filled with water
    - 1 report of cracked ribs
    - 2 reports of corroded strut attach bolts
    - 3 reports of skin attach rivets pulling through the rib flange
    - 1 report of worn fuselage attach bolts and corroded bushings
    - 6 reports of cracked strut attach fittings
    - 8 reports of cracked metal wing skins located over the fuel cell

General Aviation Airworthiness Alerts Summary, AC 43-16A - (May 1997 - May 2003):

- ✓ 6 wing-related alerts pertaining to damaged wood spars.

Wing Related Accident/Incident (January 1998 - May 2003):

- ✓ None

Manufacturer Information:

American Champion Aircraft Company
P.O. Box 37
32032 Washington Ave – Hwy D
Rochester, WI 53167
Phone: (262) 534-2395
website: *www.amerchampionaircraft.com*

Federal Aviation Administration Office:

Chicago Aircraft Certification Office
Program Manager: Bill Rohder
2300 East Devon Ave
Des Plaines, IL 60018

Type Clubs:

National Aeronca Association (NAA)
806 Lockport Rd
P.O. Box 2219
Terre Haute, IN 47802
Phone: (812) 232-1491

Bellanca-Champion Club
P.O. Box 100
Coxsackie, NY 12051-0100
Phone: (518) 731-6800

Additional Manufacturer's Comments:

(Specific information to be entered by aircraft manufacturer)

Type Club Comments and Concerns:

(Specific information to be entered by type clubs)

Note: See appropriate FAA, NTSB, manufacturer, and type club websites for complete and current service related information.

Reference Material:

- Manufacturer's Maintenance Manual (contact manufacturer)
- Parts Manual (contact manufacturer)
- Service Letters (contact manufacturer)
- Advisory Circular (AC) 43.13-1B, Acceptable Methods, Techniques, and Practices - Aircraft Inspection and Repair:
  - Chapter 1. Wood Structure
  - Chapter 2. Fabric Covering
  - Chapter 5. Nondestructive Testing
  - Chapter 6. Corrosion, Inspection, & Repair
- AC 20-106, Aircraft Inspection for the General Aviation Aircraft Owner
  - Part II, Inspection Techniques, Section 5. Wing-Center Section
- ANC Bulletin-18, Design of Wood Aircraft Structures
- Forest Products Laboratory Wood Handbook
- Current Type Specific Information (Contact type clubs and FAA Aircraft Certification Office)