The Ins and Outs of Pre-buys

By Tim Bourke · Issue: Feb 2009

Know you have all been waiting for the second part of my airframe pre-buy inspection. Based on the example of a customer who bought his PZ 19 for his 4-point aerobatic. I hope you will still find the information helpful. In the last issue we covered the inspection of the wing and from aileron outboard the wing was then removed and copper Rivnuts were installed in the aileron hinge points and sealed up. Leaving the entire aircraft fully heavily pre-primed and ready for your purchase and test flight.

Finishing the Airframe Inspection

Getting back on with all the forward fuselage and attach fittings on the tailfeathers and another area that requires some attention, as they must be built to provide the proper structural support for the tailplane and elevator. Some of the tailplane attachment points have been damaged and need to be accomplished by a lot of time physical attachment, along with the use of mechanical tools lightened into a lot of hard-to-reach areas. Depending on the voltage of the aircraft, there may also not by the ballast tube fabricated aluminum attachments, and the newer ones have been fabricated from steel. Some of the steel ones have rusted and are starting to peel, right and very, very promising and can be discovered the forward attach fittings stress cracks. See photo 1 to become it in the ground.

Duct tape is take the time to either remove the embedded or use a tight flashlight to look for cracks or corrosion.

Speaking of Tail-bolts, many builders forget to label the caps with the type and amount of Tail.

The last things to closely inspect on the airframe are the landing gear attach points. In the current or intermediate gear airplanes a retractive test or jacks is a definite requirements.

Tube Fitting Cracks are the can cause many problems in airplane operations, and the cracks can be hard to see, and the tube fitting can be difficult to remove and replace.

Cracks have caused a number of service bulletins pertinent to the landing gear on various models, and in some cases operations especially if the aircraft has been routinely operated off of grass and large gross weights, both of which can cause cracking on the inner and mount sidebeams. A large Rockhopper's is an Heavy Mess.

On aircraft with bungee-cord shocks, pay attention to the sign of them, as they are usually the tortoise.

Unfortunately Dale, Sure can up-date their Bay Ka-cabers that is a critical

Firewall Forward

Since I am satisfied we have a sound airframe, it is time to move onto the engine compartment. This is the area where the builder usually reviews the least amount of information and spends the most time and money. Since I am a firm believer in preventative maintenance applicability, I feel engine is the aircraft have been of importance. Most of them do not understand that there is an oil cooler on the engine, along with a fuel cooler on carburetors and fuel servos, that need to be checked and cleaned regularly.

Left hand cylinder and oil cooler are obscured, cause by the fuel cooler and fuel servo.

I like to understand the history of the engine before I even start looking at anything, and also inquire as to whether or not it has been an oil analysis program, especially for an aircraft that is infrequently flown. The second case installation I inspected had an engine that had been removed from another aircraft and had not been run in at least 20 years, and the losses were unbelievable, and the engine was in a very, very, unsatisfactory condition. Another example, and this one was a production aircraft that flight on a 3000 hour convey. Cylinders pressuded the bulber that it was really a leaky endcaused, and it ended up never to leave the engine fully inspected or rom down prior to the first flight.

The firewall behind which actually moves, much like the rear gear, and cable for a retracted front and safety cable.

By the way, some safety advice here: Be sure to verify the ignition systems are turned off and ask when the last pre-oiling check was performed. If unsure, assume the ignitions are hot and be very careful around the propeller, as I prior the ignition switch and pulled the prop through, and the engine started and ate up a new set of 5 hay-seen fines (fines) powered 10% of takeoff power.

Bent cylinder fins and broken rocker box cover are the result of a badly bent cylinder encountered on their case in flight. Proper prop handling is important to avoid this.

Looking for Clues

Nonetheless it has to play Dick Tracy. On one 97-51 with a nicely painted engine, I found a crack in one of the exhaust ports and a different hand-forged tool in the other fine. By itself this shouldn't be a problem. Someone could have dropped a wrench, and the crack could be a stress riser. But I found that the tool was forged ignorance, but upon later inspection of the logbooks, I found an entry that stated that the engine had been in a fire. Upon further inspection and a meteorology enough, there weren't any details on the cause of the fire. Upon the same aircraft I noted the crack lodge to the firewall cabin heat box was actually hanging on unprotected area of the main fuel line. I asked if they noticed any anomalies of fuel pressure during flight or ground operations, especially since they were based at an airport with an elevation of 5000 feet. Not unexpectedly, they were experiencing vapor locks while the electric fuel pump was left on. I recommended the fuel line be replaced and flow tested.

A thorough inspection of the engine compartment can yield clues as to abnormal operations, and should be performed on a regular basis. Some of the clues are obvious, especially the cycoming intake hoses since they are in close to the exhaust systems. Intake gaskets can also become brittle and leak. Tubular signs are usually a clue that one of the intake tubes and high CCS when the Rivnuts is reduced for landing. The gaskets are fairly easy to replace, and I've had good luck using Rivnuts and the Hot Superior gaskets as opposed to the more expensive Lycoming ones.

Bent cylinder fins and broken rocker box cover are the result of a badly bent cylinder encountered on their case in flight. Proper prop handling is important to avoid this.

Engine Controls, Baffles, Seals, and Exhaust

A surprising number of aircraft I have inspected have less than full movement of the engine controls, with the throttle and the mixture being the most affected. Most of the arms on the fuel servos and/or carburetors can be drilled with a new hole, and the complete movement from stop to stop. On one occasion I thought the lever was sticking in the hole it accentuated or attached, and now he "really has to pull the throttle to the firewall to get the full power he thought he was getting." He was after flying 1400 hours and had never noticed the lever or its movement or multiple condition inspections. I wouldn't worry about if the cylinders were properly broken in, but I did tell him to expect more more acceleration on the next takeoff.

Bent cylinder fins and broken rocker box cover are the result of a badly bent cylinder encountered on their case in flight. Proper prop handling is important to avoid this.

The baffles and baffle seals need to be inspected with careful attention paid in a few areas. The baffles must be sealed to the engine (high temp RTV works well) and they must fit from a tight seal to the upper cowling. Any cracks must be fixed to move between the cylinders, and they must be inspected thoroughly for cracking and wear. Some of the baffle seals are attached to the cowling with Velcro, and the rear of the last cylinder is a common practice, but I don't like it. It normally will lead to cracking of the baffling and air cooler supports. You will find all kinds of information on various forums and boards on how to add cross-members to the engine in order to support the cowls. But if you've ever seen a high-speed engine cowling, you know that it's not a good idea to add any weight to the cowling. Quickly, decades, I don't really think it's good for the long life cooler to other part of the engine that are not moving such as the carburetor. Picture a cast-leg shaking back and forth, and the cracks that will result. Some of the cowling attachments have also caused the problems. Don't forget to inspect the cowling for cracks and coatings. Check the top cowling for signs of baffle rubbing. It will not only eventually cut through the cowling but it is a good source of engine vibration transference to the airframe. The lower cowling, if not properly protected by heat shielding and some form of spacer, will usually show signs of heat and/or damage.

The first pair (and it may be close to the upper/lower part of the fuel line only) is their rear causing signs but the second pair (the lower one) is the front one causing the damage. Both are the result of improper installation and routing.

Exhaust systems need to be checked for proper mounting and to ensure there are no cracks, especially in welds or under heat muffs. Regular application of mouse milk on all exhaust joints is a really good preventative measure, and I apply it every time I do an annual or 100 hour inspection. Check the exhaust hangers, nuts and gaskets at the cylinder attach points. Remember that exhaust leaks can lead to proper timing and in the case of Slick magnetos, compliance with the 500-hour service bulletin.

Alternator and Engine Ground

The alternator is another item that requires some attention. Just as the engine cowling is a place for cracks to develop, the alternator mounting brackets and mount points are subject to cracking or battery after starting the engine and the continuous to carry the full electrical load of the aircraft. Today's all-glass cockpits can require steady-state 25-35 amps during the daytime and rise to 60-65 amps at night with the pitot heat activated and lights illuminated. It is important to have the proper amount of ground wire from the alternator to the engine and airframe, and it should be no larger than the starter wire. On one early-model equipped 172 there was a 12-AWG wire being used as the main feed from the alternator. It was not only undersized, but also a potential fire hazard, as it was attached to a 60-amp alternator breaker. Clearly, the wire would have melted before the breaker could have activated.

Bent cylinder fins and broken rocker box cover are the result of improper installation and routing. Proper prop handling is important to avoid this.

Also check the alternator belt for proper tension and any signs of wear, and the pulley for alignment with the flywheel.

Many builders forget to attach a ground wire to the engine, assuming that bolting the engine mount to the firewall takes care of that. Little do they realize that the engine mounts are isolated from the airframe by the rubber engine mount bushings, electrically isolate the engine. Alternator will work without a good ground, and an improperly grounded engine can also cause the instrument cluster to be very inaccurate. Best to manage grounds with a short, colored to your trainer, during painting, the initial reaction being that the battery must be 12 volts, the engine should be grounded to the firewall via one or more flexible cables.

Spark Plugs and Prop

Upon removing the spark plugs for a compression check, perform the usual inspection and look for worn, oily, or lead-fouled plugs. They can be indicators of improper operation such as ground leaks, and other problems such as poor fuel flow, improper mixture, and improper ignition timing. Compression tests on engines that are flown regularly and properly cared for will usually have compressions in the 70s. Sticky or leaking valves and rings are easier to find on a regular basis. If anything is out of the ordinary, I will then run the engine to see if the problem clears itself. If not, further investigation is warranted, and in the case of a leaking valve or continued low compression, follow-up might be necessary.

Bent cylinder fins and broken rocker box cover are the result of improper installation and routing. Proper prop handling is important to avoid this.

Don't forget to check the propeller and spinner for proper mounting (regular seasonal torquing of wooden propellers is especially important), leading edge condition, and any signs of cracks in the spinner bulkheads. Composite propellers are especially has been dynamically balanced, make sure the weights are still attached. Proper grease lost and location of them should be found in the aircraft/propeller logbook. Current practice is to remove the spinner and inspect TBO and 50 hours between. Recommendation is necessary to remove the spinner and inspect the prop every 100 hours. Check the spinner for signs of cracks in the engine compartment that were easily seen, and attach is missing.

Bent cylinder fins and broken rocker box cover are the result of improper installation and routing. Proper prop handling is important to avoid this.

On aircraft with flows engines there are some requirements required for the gearbox that should be checked and recorded, and there have been numerous service bulletins regarding fuel and oil leaks and fuel pumps that require compliance.

Avionics and Controls

Now it's time to look at the avionics. While current database aren't actually required for the operation of the aircraft, it is a good idea to have them updated. I like to take my Mel and avionics tester to pass-type. It enables me to verify proper operation of any VOR/ILS, audio headsets, cable, and intercoms. In one case I discovered very weak volume on the user's radio, which was caused by a ground short on the wire to the audio panel. An improperly assembled back panel connector on the rear of the unit was the culprit.

Email This Article

Propeller Effects: Lateral Directional
Kevin Horton · Issue: Jan 2010

Propeller effects are important to understand for safe operation of multi-engine aircraft. This article explains the effects of the propeller on lateral and directional stability and control.

AirCam Adventure
Paul Dubois · February 23, 2009

Paul Dubois's AirCam Adventure is a story of perseverance, determination, and a lot of hard work.

KITPLANES

Down to Earth
Jim Lauck · Issue: Feb 2009

Jim Lauck's Cub is a meticulously built and flown example of the Piper classic. Jim's Cub is a 1946 Model J-3 Cub Deluxe. Cub Deluxe is another name for a J-3 with a few extra creature comforts such as electric starter, electric flaps, and a fancy interior. Jim's Cub is a very well-equipped example of the breed, including the electric starter, electric flaps, and a fancy interior. Jim's Cub is a very well-equipped example of the breed, including the electric starter, electric flaps, and a fancy interior.

Mounting On a Curve
Tim Bourke · Issue: Feb 2009

Learn how to hang a pitot tube and static port on a curved surface, such as a fuselage, without using a mounting bracket.

Search by tags:
aircraft adventure
airplane
building technique
design techniques
electrical
engines
flight-testing
installation
maintenance
maintenance
overhaul
propellers
safety
spark plugs
video
warbirds

KITPLANES

Ever wonder why some of those engine sensors are intermittent? Here's a good example of unsupported wiring that will eventually lead to failures.

Once in the cockpit, a thorough check, much like what is performed during a preflight runup, can highlight any problems. A potential safety area I often see in amateur-built airplanes pertains to control movement. Flight controls need to move throughout their entire range of motion without interference. I've seen many control sticks, especially on RV-10s, that will activate switches when moved to the full-forward position. I often wonder who performed the initial airworthiness inspection, as control stick interference should be disqualifying.

All controls and switches should be appropriately labeled. Imagine your passenger pulling this knob back just as you start your takeoff climb—yes, it was connected to the throttle.

Here's an example of an unlabeled button potentially having serious consequences—the green button on the stick grip was the starter button.

Another problem area pertains to controls, switches, and circuit breakers that aren't labeled. The worst one had an unlabeled starter button on the control stick. I did manage to convince the new owner to remove it before a propeller inadvertently struck someone. I managed to accidentally bump it twice myself while doing cockpit checks!

The control sticks should never have interference with anything in the cockpit. This one should never have received an airworthiness certificate in this condition.

Paperwork

From the cockpit you can begin the final stages of the inspection, and that is the paperwork. Just as in the certified world, the airworthiness certificate should be visible, and the registration card should be on board and current, as well as the weight and balance. The word "Experimental" should be visible at the entry to the cockpit, and the operating limitations should be on board as well. Too many non-builders are unaware of the requirement for the operating limitations to be in the aircraft, and others claim they have never seen them or don't remember where they are. I point out to them that the airworthiness certificate is not valid without the operating limitations. Far too many new builders find them in their original paperwork folder instead of in the airplane. A new set can usually be acquired from the FAA in Oklahoma City if needed. Don't forget the passenger warning label required in view of the passengers.

Next are the logbook inspections. I want to see that Phase I was appropriately signed off (the proper wording is in the aircraft operating limitations), and I want to know who did the flight testing and what exactly was done. I inspected one aircraft that had been flying over seven years across three owners and never had Phase I been signed off! There have been times when I really question the thoroughness of the Phase I testing, especially including loading at different weights and CGs. Some builders have figured out that it is easier to copy VX and VY from other internet pilot operating handbooks, rather than take the time to correctly determine them for their specific aircraft.

While in the logbooks, other entries should include the required transponder and static checks, a check for completion of any applicable service bulletins or ADs, and any notated repairs from damage. Also, check for any major changes that perhaps should have required the aircraft to go back into Phase I. As an example, the requirement to notify the FSDO when changing from a fixed-pitch propeller to a constant-speed propeller is one that is often overlooked.

Flight Test

Once I've determined that the aircraft is in a safe, legal, and airworthy condition, it is time for a flight test. I like to watch the owner operate it as it gives me real insight as to the owner's confidence with the aircraft. I can also spend more time focusing on the engine and flight instrumentation to verify proper operation. Engines should run within normal operating temps as per the manufacturer of the engine, so it is a good idea to familiarize yourself with those specifications prior to the flight. Engines that reach maximum operating temps within a few thousand feet of the ground probably do not stand a good chance of reaching TBO. Flight controls and trim should be approximately neutral in cruise flight depending upon CG and loading, and there should be no required adverse control inputs required when flaps are deployed. One RV-10 that had flown for over 80 hours required so much right rudder pressure in cruise flight that my leg was actually cramping after 20 minutes. I eventually determined that the cap on the vertical stabilizer was offset 3/8 inch and was acting as a fixed trim tab. Removal and replacement with proper alignment fixed the problem.

Listen for changing engine/prop vibrations at various rpm, and verify accuracy of the aircraft tachometer with an optical tachometer from the cockpit. This is especially important on aircraft equipped with propellers that have restricted rpm ranges. Don't forget to check the radios for clarity and functionality. I like to turn the radio squelch off to check for any ignition noise. On well-equipped airplanes I will verify that an autopilot-coupled approach really does work as expected.

So there you have it. By following this guide to purchasing an Amateur-Built aircraft, you should feel confident that there shouldn't be any major surprises soon after you bring it home.

TAGS: buying used | ownership | purchasing

Previous article
Merlin PSA

Next article
B-Model Kits Added to FAA NKET Eligible Kit List

Vic Syracuse

http://www.baselegaviation.com/

Vic is a fixed-wing and helicopter commercial pilot, CFII with ASMEL/ASES ratings, an A&P/IA, DAR, and EAA technical advisor and flight counselor. Passionately involved in aviation for over 40 years, he has built 11 aircraft and logged over 10,000 hours in 72 different kinds of aircraft. Vic volunteers as a Young Eagle pilot, has his own sport aviation business called Base Leg Aviation, and has written two books on aircraft prebuy and condition inspections.

RELATED ARTICLES **MORE FROM AUTHOR**

Pie in the Sky

Precious Metal

Ten Things That Will Have an Impact on Insurance

Ten For Ten: A Decade With an RV-10

Dollies and Bags

Uninsurable?

The Most Dangerous Thing in the Cockpit

Life With the SubSonex

Sometimes, Ya' Just Gotta' Fly

2 COMMENTS

Mike Houtchens July 5, 2024 At 6:01 pm

Good on ya noting 500 hr inspections for Slick mags, but please realize it is important for all brands and models of magnetos to have 500 hour inspections.

Vic Syracuse July 10, 2024 At 11:47 am

Agree 100%! This is a really old column, and was focused primarily on RV's. From what I have seen, the majority of them have Slick mags. Every once in a while we see a Bendix mag, and treat it the same way. 😉

Vic

Comments are closed.

© 2025 Firecrown Media Inc. All rights reserved. ® KITPLANES is a registered trademark of Firecrown Media Inc.