



# EAA<sup>®</sup> Technical Counselor News

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## Jerry Walker's Falco



Don Leone reports on Jerry Walker's Falco. He reports that his wood scarfing jig works great.



The aircraft won't be flying for a few years because he works only two to three months a year on it, the rest of the time he is out of town. This shot shows the canopy bow.



This shows the cockpit interior and some of the nice woodwork that Jerry is doing. Note the wax paper covered strip to the left stapling down the cockpit interior wall to the fuselage station frame.



As seen in the picture, Jerry does a great job of woodwork, nice inspection door!

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# Questions And Answers

The Questions and Answers column has appeared in SPORT AVIATION magazine since January of 1987 up to approximately 6 months ago. It is currently used primarily as a filler. During the 3 years it was a feature in SPORT AVIATION, Information Services provided 175 out of approximately 200 of the questions and answers that appeared in the article. Some of the questions below, may be of interest to technical counselors who frequently have to answer questions of all sorts.

**QUESTION:** What are the various categories of "experimental"?

**ANSWER:** Within the experimental category there are "Research and Development" aircraft which are generally pure test aircraft. There is also a category "Showing Compliance With Regulations" and is used for obtaining supplemental type certificates, etc. There's another category for "Crew Training" to train crews on new models of aircraft. There's a category "Exhibition" for those aircraft primarily used in air show work. There's a category for "Air Racing". There is also a category for "Market Surveys" where they take the aircraft out and show it to sell it, etc. The final category is Experimental — "Operating Amateur Built Aircraft". The principal reason for this category is to build aircraft "solely for aviation education or recreation". There is no provision in the experimental amateur built category for you to hire another person to build the aircraft for you. The major portion of the aircraft must be built by the owner. As they are not "Type Certificated", operating limitations apply to this entire general category of experimental aircraft. Certain operating limitations may be added or removed as the administrator (or your local FAA man representing the administrator) sees fit. It is also quite possible for an aircraft to be in two categories at once, not an unusual situation in exhibition and market surveys.

**QUESTION:** I am currently a rated private pilot close to 400 hours flight time. If I added my simulator time I would have over 400 hours. Can I do this and take a biannual flight review every two years?

**ANSWER:** I contacted Mr. Jim Byers at the FAA Washington Office. Mr. Byers said that flight simulator time will apply toward the 400 hours. The reason is that taking Flight Simulator training under a CFI is a pretty clear indication that a person is going to upgrade themselves to the instrument pilot rating.

**QUESTION:** Why was the requirement for an annual flight review included in the recreational pilots license final rule?

**ANSWER:** EAA & AOPA jointly submitted a petition for a recreational pilots license in 1985. The FAA then requested we withdraw this as they had a committee formed by the National Association of Flight Instructors (NAFI) to address the recreational license. One of the provisions of the NAFI committee was "the committee decided that the unusually high number of accidents involving low time pilots be reduced by requiring a flight review every twelve months for this pilot population". This was included in Notice 85-13. This notice of proposed rule making was withdrawn due to many objections by pilots due to the added costs for all pilots.

2

As frequently happens, this was resubmitted and the NAFI's suggestion was included in the final rule.

**QUESTION:** I would like to know if there is a data book available to pick an amateur built aircraft to build.

**ANSWER:** EAA has two (2) reference books for this. The first is Sport Aircraft You Can Build, written in 1982. It was updated as of 4/90 including most modern aircraft and is available at \$1.99 postpaid. The Light Plane World Buyers Guide was published in the September 1989 Experimenter and is available at \$2.50 postpaid.

**QUESTION:** I would like a listing of Antique Classic Type Clubs.

**ANSWER:** The November 1989 Vintage Airplane had a listing of Type Clubs. Back issues are available at \$1.50 postpaid.

**QUESTION:** Is it legal to use a hand held transceiver connected to an external antenna as the sole radio in an airplane? A local A & P told me that since this is not a permanent installation an FCC aircraft radio station license is not required. Is this correct?

**ANSWER:** This is not correct. It is only legal to use a hand held transceiver in the aircraft with an FCC aircraft radio station license in the airplane.

**QUESTION:** What are the FCC forms and where are they available?

**ANSWER:** The FCC Form 404 is a radio station license for the aircraft required when a radio is operating. The FCC form 753 is a restricted radio telephone license for the pilot usually only required when flying outside of the Continental United States. The forms are available from the FCC Office, 1919 M Street N.W., Washington DC 20554, telephone 202/632-7175 or through the Chicago Office, FCC, 230 S. Dearborn Street, Chicago, IL 60604, telephone 312/353-0195.

**QUESTION:** Is it harmful to an aircraft radio to have it switched "on" while starting the engine?

**ANSWER:** Yes, a major radio shop reports that it is harmful to have the aircraft radio switched on while starting the engine. The main reason is that it is possible for high voltage spikes to be driven through the radio. Once the engine has started and the voltage has stabilized then you can switch the radio on.

**QUESTION:** I noticed on the FAA medical form that they ask if we have ever had a conviction of any kind.

**ANSWER:** Forever, YES, if you had a conviction, not just the first time you filled out the form. You are then to mark "no changes" if there have been no changes in your records since the previous FAA medical examination. If a conviction occurred since the last medical, you are to tell all about it. Unintentional mistakes concerning the sometimes confusing form, however, are not considered fraud. This statement from the NTSB Reporter, Volume 8, No. 1, January of 1990.

# Projects

## PAUL KAUFFMAN'S BD-4

Donald C. Leone, technical counselor from Traverse City, Michigan reports on Paul Kauffman's BD-4 rebuild.



This is a nice shot of the O-320-D1B Lycoming of 160 horsepower with a constant speed prop.



This shows the engine running tests and the makeshift fuel tank.

## JIM CONES ZENAIR



How to hide the muffler on the a Rotec installation. Gear reduction is also visible.

This photo shows Jim Cone's Zenair 701 of Petroskey, Michigan



Cabin area shown fairly clearly here and also the leading edge slats.



The cockpit area, nice upholstery!



# Engines

## Light Plane Engines Break-In Period By Jack Hakes, Technical Counselor for Chapter 49

Back in the 40's, Cubs and Airknockers tied down with their freshly overhauled engines pointed into the wind, churning out the required 4 hours of run in at ever increasing rpm to achieve break-in. Some gave good performance for 600 to 800 hours, and some burned excessive oil whenever flown. Today, 40 years later, some engines are still being broken in essentially the same way, ignoring the knowledge science has gained for us in the meantime.

High power microscopes and other measuring devices have shown that our freshly refinished steel or chrome cylinders with their mating rings and pistons are not what we think. These smooth, honed, cross hatched surfaces are, when looked at with these instruments, in reality, as rough as the Rocky Mountains and look the same !!!

Our desired break-in really consists of wearing off the peaks of these surfaces. Actually these parts literally weld together and tear apart on each stroke! Needless to say, this generates a vast amount of **heat**. Too much heat and pistons get scuffed, cylinders score and rings lose their tension. The engine consumes oil and generally performs poorly. I know of more than one engine which had to be topped because of this situation.

Since we know that excessive heat is the problem, a simple procedure will virtually assure a good break-in. I've used this with excellent results on a variety of air cooled engines. What I do is prevent overheating by limiting the running times.

The initial run is preceded by removing one spark plug from each cylinder, then turn the engine over with the starter and watch for oil pressure to build up to approximately 20 PSI. Use straight mineral oil and in cold weather preheat the oil and the engine to 80 degrees F. Install the spark plugs, place the aircraft pointed into the wind, have an assistant stand by outside the aircraft to watch for oil leaks, keep people from walking into the propeller, and check the cylinder temperatures by feel. Start and run the engine under 1000 RPM until the cylinder barrel fins (not heads) get too hot to keep your hand on. Be sure to monitor the oil pressure and cylinder head temperature on each run. Then shut down, and let the engine cool down to ambient temperature. This usually takes between 20 and 30 **seconds** of run time.

The subsequent runs usually are about double the preceding time before the fins get too hot and you must shut down, i.e., the second run will be 40 to 60 seconds, the third run will be close to two minutes, 3rd run etc. I record these times and temperature readings at the start, during, and at the end of the runs. Maximum Cylinder Head Temp. of 500 degrees F. for most engines. Check the engine operating manual for your particular engine. Gradually increase the RPM and the run times until the total run time is 1/2 hours. Then try a brief, not over 15 seconds at full power RPM run. **DO NOT CYCLE A CONTROLLABLE PROP.** If you were to cycle the prop at this time from low to high pitch, scuffing of the pistons and scoring of the cylinder walls could easily occur. You would

be "lugging" the engine, increasing the side load on the pistons while a high friction coefficient is present. If your engine is equipped with counterweights, cycling the prop may cause the crankshaft to detune, and on some engines the pins may break. Make any ground adjustments during cool down periods and check on the next run time. When your RPM has reached 1600 to 1800, make a quick mag check on one of the last run times prior to flight.

Now it's ready to fly. Keep the aircraft light (minimum fuel, no baggage, passengers, etc.) Push or tow the plane to the takeoff point since the taxiing can easily overheat and ruin the engine !!! Use minimum power to get some airspeed (and cooling airflow) before applying enough power to achieve a flat and clean climb out to a minimum cruise altitude. Use minimum RPM to achieve level flight for good cooling. Do not move the propeller pitch from low to high pitch setting.

Fly with the propeller in low pitch for the first 5-10 minutes after takeoff with the engine running relatively free of lugging loads. The high RPM also supplies the cylinders and pistons with the maximum amount of oil. After 5-10 minutes, set the propeller to the desired setting. Fly for 30 minutes at maximum cruise power settings for your aircraft. **(Note any engine malfunctions and monitor and record all temperature readings.)** It is good to have a CHT temp. probe and readout on each cylinder if possible. In about 1/2 hour, the CHT should decrease approximately 50 to 75 degrees, showing that initial break-in has been achieved. Keep the engine working at all times, but do not lug and avoid abrupt fluctuations. After you have landed, check the oil and determine the consumption. Repeat the flight as outlined above for another 30 minutes, again measure the oil consumption. If the consumption is excessive, fly the airplane for 45 minutes at full rated allowable power. Note: all flight procedures are subject to proper pilotage, terrain and obstructions. If high oil consumption continues, check the compression for proper ring seating, it is possible to have to remove and deglaze the cylinders again, and start over with the break-in procedures. However, if the above directions are followed this is very unlikely.

For the next 10 hours, operate the aircraft with light loads and power settings. Avoid sudden power reductions which can cause cooling cracks. During descent, plan ahead and start descending further out and keep the RPM and cylinder head temp. up and maintain manifold pressure at all times to show that the engine is working, but do not lug.

Check the oil screens or filter at the end of the first hour or two for metal particles. It is normal for some small metal particles to show up in either the screens or filter. Check these particles with a magnet to see if any particles are steel. The oil filter should be opened up and the filter element spread out to thoroughly check the interior of the pleats for metal particles. This procedure should be accomplished again at about 10 to 15 hours of run time on the engine. If oil consumption has stopped a detergent type aircraft oil can now be put in the engine after 10 to 15 hours operating time.

Steel cylinders do not glaze as easily as chrome cylinders therefore, it is very important not to allow chrome cylinders to glaze over by running at low RPM's. If glazing occurs, high oil consumption can be expected during the life of the engine unless the cylinders are removed and deglazed.

After five or six hours, the pistons will have been sufficiently burnished to prevent their scuffing and cylinder walls scoring. Cycling the prop should no longer be of concern, but when you do cycle the prop on a ground run, run up to 1700 RPM in low pitch, then check the prop operation by moving the pitch to high just long enough for the RPM to drop to about 1500. This will eliminate unnecessary lugging of the engine.

Maximum oil consumptions are listed for the following engines during run in: For O-235's it is .9 pounds per hour or .56 quarts per hour. For O-290's, it is 1 pound per hour or .56 quarts per hour. For O-320's it is 1.2 pounds per hour or .67 quarts per hour. For O-360's, it is 1.4 pounds per hour or .78 quarts per hour. These are the maximum oil consumption stats for a new or overhauled engine. If it is over this, you should check very carefully and possibly consider engine teardown.

I recommend that a newly built aircraft should not use a new or freshly overhauled engine for ground taxi tests as this can be very detrimental to proper break-in procedures due to lack of cooling.

#### **Letter from John Giordano As Reprinted in the "Soneral Newsletter, April-May-June 1990**

Item for the Newsletter: I may have solved the mystery of the valve train/wavy washers breaking problem, at least, for myself, I've had the problem four times now, each time accompanied by loss of power. In fact, during the last 15 minutes of my cross country back from Oshkosh this summer, I couldn't even maintain altitude. Fortunately, I was close enough to my airport to make it no problem.

I took a valve train off an old Bug engine and compared it side-by-side to mine. Guess what? Several flat washers were missing on the aircraft valve trains; consequently, the wavy washers were contacting the rocker arms directly. It doesn't take an engineer to see that the rotating rocker arm will sooner or later put considerable stress on the bulge in the wavy washer. The old Bug engines — this one, at least, had flat washers between the wavy washers and the rocker arms to act as buffers. You also need one next to the retainer cups. I've had two of these break. I bought a bunch of flat washers and haven't had any problems since.

I should point out that I bought an Engine Kit from HAPI, and I remember the two valve train assemblies already put together, complete with nice white grease. They looked good to me, so I just bolted them on.

Editor's Note: We have done pretty extensive research on causes of accidents in amateur built aircraft and over the seventeen years or so that I have been with EAA, I have found that approximately 25 percent of all accidents are listed as being caused by engine failure. Not all accidents are investigated very thoroughly and there may be some of these that don't actually belong in "engine" failure areas (but it is a pretty good estimate). In going over accident reports for all general aviation accidents, we have found that this percentage holds approximately true. The percentages of causes for amateur built aircraft is very similar to factory built aircraft except we appear to have fewer weather related mishaps.

#### **V-6 Gearbox Status By Technical Counselor Richard Finch of Goleta, California**

On February 26, Richard Finch drove to Los Angeles and spent the entire day overseeing the final machining processes on the prop reduction gearbox. Every part of the gearbox, except the bearings and the nuts and bolts, is all-new design. He calls the aircraft the Finchbird and he plans for it to totally meet the design requirements for transmitting Buick V-6 engine power to a fixed-pitched, metal airplane propeller. He is shooting for a completed gear box weight of 40 pounds.

This month's picture shows a completed paint job on the fuselage of my Grumman test bed. It will get a 1/4 inch thick windshield for extra bird-strike protection, and improved noise quietening. The Volvo V-6 will be flight tested after the Buick V-6 files for 200 hours. We are looking forward to Dick's engine on display near the homebuilders headquarters.



#### **PROPELLERS AND ENGINES**

##### **Propellers**

The question has arisen of whether it is legal to polish props to a mirrored finish. For this week's answer, we contacted Jim at Whirlwind Propellers in Illinois. He says that polish is legal BUT, you need to take the surface down until all scratches are out so you go deeper by several thousandths than you normally would for a prop clean up. Due to this, the prop that might go four overhauls, usually goes only two due to the size reduction. Also, you must polish the surfaces every two weeks or so as it will go all white quickly. If you paint it, then you don't have to take the scratches off and don't take so much blade off and the propeller will last a lot longer.

##### **Sizing The Phillips Head Screwdriver**

**By Douglas Murray, Newsletter Editor  
of EAA Chapter 923**

"When working under the dash of a car or cockpit of an airplane and you can't see what size screwdriver you will need, place your finger against the head to get an imprint in your skin to help select the proper size screwdriver."

# Safety

## SAFETY

The following comes from Ballistic Recovery Systems, Inc., Fleming Field, 1845 Henry Avenue, South Saint Paul, Minnesota 55075.

The following is excerpted from a letter by Dave Faneuf, EAA Chapter 42 entitled "JERRY JACOBS — NO. 38TH SAVE". This documents the 38th save of a ballistic recovery system parachute of ultralight and other aircraft.

Five ultralights took off together and Jerry Jacobs' Eipper MXL started a fairly tight and steep descending turn and he quickly and calmly informed us he had rudder problems and was unable to maintain control. Dave Faneuf followed him down as he was directly behind him. Jerry's control seemed to be limited to keep the airplane in about a 30 degree right bank, descending rapidly. Below was a small muddy lake in the middle of dense woods, a pipeline and an active high-tension powerline. The stress level was about to shatter the world record when Jerry deployed his chute. Jerry's steep descent now became a slow, pretty scene with the MXL drifting out of danger of the powerline and lake. The wind carried him into a dense section of pines near the pipeline and he came to rest unharmed with the chute canopy at the top of a tall pine and MXL hanging vertically 8 or 10 feet off the ground. Jerry quickly let us know he was all right.

We managed to get the airplane out of the area and it turned out that a bolt had broken in the rudder mount and control system which led to the inability to control the airplane. It's a grade 8 bolt and all of us Quicksilver owners should take this as a warning and carefully check our airplanes. It's worth mentioning that Jerry's MXL suffered amazingly little damage from the tree engagement. This is a strong case for carrying a ballistic chute.

### Bonanza Nearly "Torched"!

From the "World Beechcraft Society News, Mar/Apr 1990

Ken Ellison of Albuquerque, New Mexico reports on a near disaster from improper grounding while refueling his Bonanza. He taxied it to the fuel pumps and made arrangements to top off the tanks. He left the aircraft and went inside for breakfast and then he heard "The Bonanza's on fire"!! By the time he reached the outside, the fire was out and the left side of the aircraft was covered with fire retardant and the fuel opening equally covered and the wing area ranged from light soot to black scorch.

With all the commotion, we attracted a lot of "would be experts" as to the cause. When the attendant finished topping the tank and was pulling the hose nozzle away with some residual fuel still flowing, a spark jumped between the nozzle and the open fuel ring. Flames immediately shot up, the attendant dropped the hose which now lead to flames underneath the aircraft, yelled fire, and ran. Much to this person's credit, he immediately secured a fire extinguisher and put the fire out. The pilot's wife was observing from the upper deck and felt the attendant was down to seconds to react.

After careful investigation, the owner found the cause was grounding the airplane to the exhaust stacks. The pump ground was correct, the ground gear on the aircraft measured okay, the wing tie down and the nose wheel clean points all checked okay, but measuring from the stacks to common ground checked 2-3 ohms. The ground jumper strap across the engine mounts were in place. The cause therefore, was an insufficient ground at the stacks. This was reaffirmed by a 15 year old local boy who works part time at the FBO. After joining the crowd and finding out the Bonanza had been grounded at the stacks, he states: "Those Bonanzas snap, crackle and pop all the time if you ground them at the stacks."

Needless to say, we were all in deep pro-active thought after this statement. I have observed our aircraft and others being grounded at the stacks for a very long time and always thinking this was a wise choice. However, no longer.

### Accident Report From Don Leone of Traverse City, Michigan

Don reports on the fatal accident to one of the local EAA members flying a Volkswagen powered airplane. This is certainly not a condemnation of VW power but shows what can happen when engines aren't assembled properly. The accident was caused by engine loss of power from poor maintenance. The builder never set the valves until he had about 90 hours on the engine and it was running so poorly that he already had 2 or 3 emergency landings. He had a valve job performed and when he installed the heads, broke a stud and stripped out a spark plug hole, but finally got it all together (he did all the work himself).

He flew it with very little ground running time and we believe it to be a case of fly in itis (he wanted to fly his plane very badly to a fly in).



Photos number 1 and 2 show a hole in the head. Very hard to see in photos 1 and 2 is a groove hammered in the head running 90 degrees in each direction from the hole. Looking at it from the side, it is a very sharp edge and the head was on crooked and worked loose. The hole looked like it was cut with a cutting torch.



In photo number 5, you can see the external view of the hole that was burned in the head from the hot gases. (All this from not tightening up the head bolts running in the engine and checking it again.)



In photo number 3 and 4, you can see the areas where the hot gases bypassed the head, burning a hole in the head and marking the cylinder lip themselves.



Photo 6, the push rod tube housing also shows evidence of hot gases on its exterior.



Photo 7 is the last picture taken after the fire rescue team cut the aircraft apart to get the pilot out. It looks like he tried to fly back to the airport and stalled the airplane trying to turn too slow and came straight into large trees.

# Tool Tips

Letter by Arthur J. Medwedoff

Arthur resides at 15555 Fairlane Drive, Livonia, Michigan 48154.

I finally got around to reading Tony Bizgellis' excellent book, "The Sportplane Builder", after buying it at Oshkosh '89. On page 84 appears the statement that "After prolonged use, some of the drill shanks are apt to get so marred that you cannot read the drill size." This does not have to happen. It indicates that the drill chuck was not tightened correctly.

I sell drill bits, and a large percentage of auto and truck mechanics do not know that ALL 3 HOLES of a drill chuck must be tightened to correctly tighten a drill chuck. The first time you tighten all three holes, you will be surprised to find that the 2nd hole will tighten about 1/4 turn of the chuck key. After tightening all 3 holes, drill chuck is centered, tightened correctly, and drill bit is less likely to slip. The drill shanks will not be marred or gouged, and the good drill bits are less likely to be broken from the shock of a slipping drill bit grabbing. Your drill bits will perform better and last longer.

From Ralph Ballard, Secretary of Chapter 865,  
Niles, Michigan

Subject: Hand rivet squeezer.

For those builders who would like to construct a metal airframe, but do not want to invest in expensive riveting equipment, I suggest the hand rivet squeezer. This tool can be purchased from most aircraft tool supply catalogs, price ranges from about \$110 to \$200 for the "deep throat" 6 inch model. A six piece rivet set sells for about \$16 and will fit most sizes and types of rivet head. The new designs have a 360 degree swivel head that can exert 3,500 pounds of pressure. Some types can also be used with dimple dies. The advantage of the hand squeezer is a uniform rivet set, one man operation and low cost. Be sure to check on the construction method for the airframe that you choose, most riveting must be within 6 inches of the edge of the work piece. It is possible that pop rivets could be used in a few inaccessible places, (check with the designer!). Thanks to fellow chapter member Larry Miller for cluing me in on the hand squeezer. Larry is building an RV4 and plans to use the tool in every area that is possible because of the uniform results.

## EAA® TECHNICAL COUNSELOR NEWS

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