



Give Me a Brake!

Wheel vibration, as a result of brake application, has been an on going problem with EZ's since the start. Most of us have just gotten used to the idea of getting off the brakes momentarily if the vibration appears. Some people report horrible vibration while others report little or none. What is the cause and what is the fix?

Fiberglass landing gear struts are very strong but also quite flexible. During brake application, the slowing wheel tends to pull the strut back and applies a little twist since the wheel is not located on the centerline of the strut. If the braking force is constant the strut simply deforms and slows the airplane down smoothly.

If the brake action is irregular or pulsating the strut is rapidly pulled back and twisted (toe out) then released to "unwind" throwing the axle forward and toed in. This sequence can happen at a rapid rate shaking the entire airframe to the point where one feels the landing gear may come off.

This vibration usually occurs at a relatively low speed (under 40 mph) and stops when the airplane is: slowed to a speed that produces a vibration no longer in sympathy with the natural frequency of the flexible fiberglass strut, or when no pulsating brake action occurs to "wind up" and "unwind" the gear leg.

One may wonder how to prevent all this from occurring in the first place. To get the strut vibration started one must have the proper frequency of pulsating brake and have a strut flexible enough to allow the vibration to develop. If the brake action is perfectly even or if the strut is completely rigid the vibration will never develop.

When I built my Long-EZ I tried to increase the stiffness of the landing gear strut by adding two plies to the torsion wrap that is called for. Stiff-

ness increased a very small amount and the speed at which the vibration occurred was slightly higher than it was with the original torsional layup schedule. I figured I'd need a landing gear strut about the size of my thigh (I have fat thighs) to stop the vibration in the normal brake application speed range. That idea was given a swift death.

The other alternative was to stop the pulsating brake action. That action is caused by a changing coefficient of friction between the brake disc and the brake pads. The change occurs as a result of several factors. My first brake discs were used and had some pitting. The pits were not evenly spaced so the brake action was pulsating thus causing vibration. I then installed chrome discs only to have the underlying copper plating get hot on hard braking and melt. That event allowed the disc surface to be covered with patches of chrome plate, copper plate, and bare steel which has since gotten pitted. The predictable result is pulsating brake action again.

The Cleveland discs seem to vary in thickness which also causes a pulsating brake action. In addition, I've found the discs to not run true. One disc I installed had over .010" runout.

In a bull session at Oshkosh I heard at least one person tell of how the Appalachian discs accumulate brake dust and debris in the holes on the disc face which then chips the brake pads.

Just as the bull session group was about to decide to just live with vibrating brakes, Mike Melvill suggested we look at Maatco brakes, from Salt Lake City, at one of the booths. He said they have 3/8" disc thickness and run double pads. I didn't get to the vendor for a look but you might talk to them if brake vibration is driving you berserk.

If any of you have these brakes installed I would appreciate a report of your experience with them.



Lighter Than Air Core Material

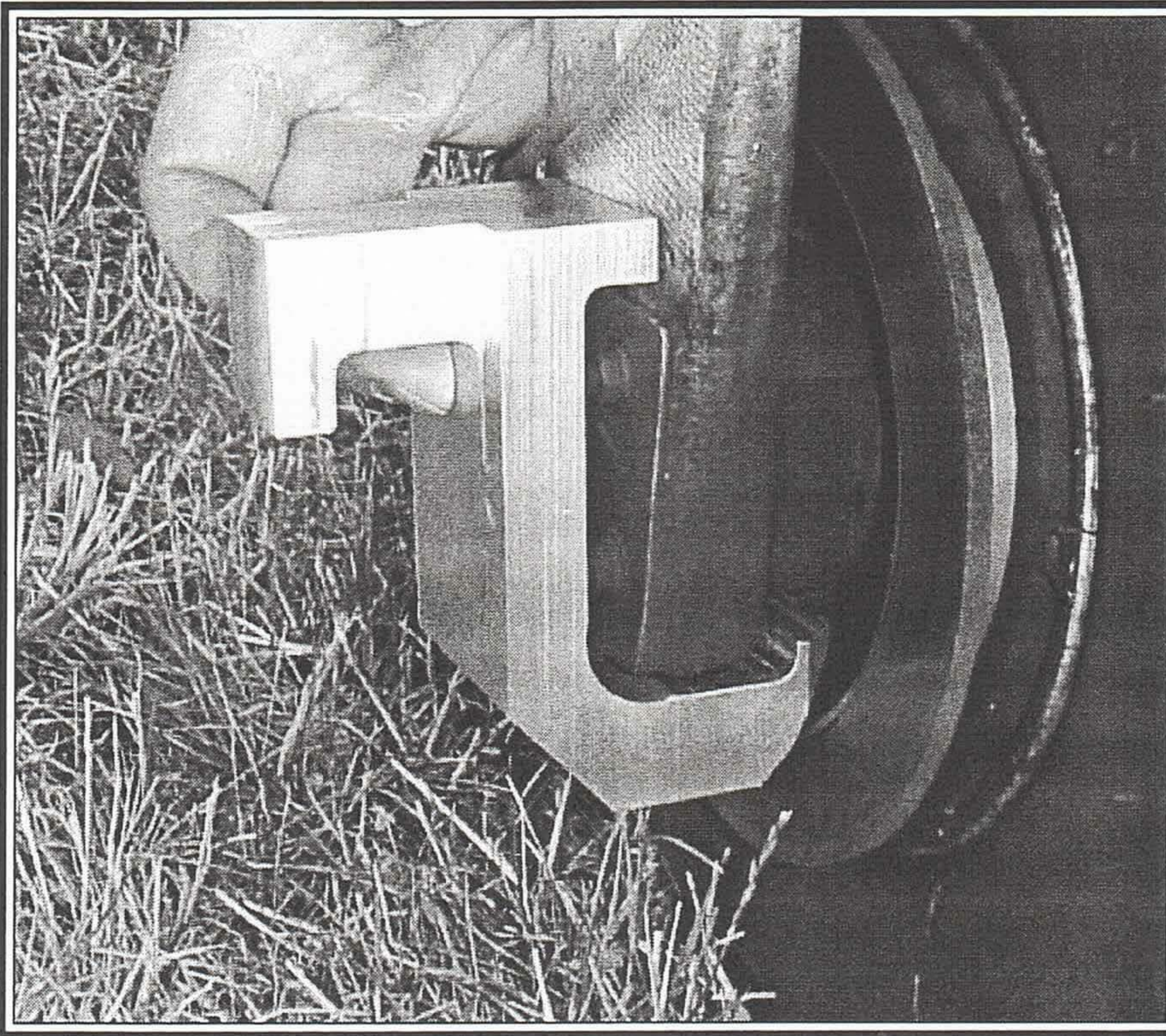
We are always looking for ways to make our airplanes lighter yet retain strength. Future builders and environmentally aware people have been concerned about the future availability of foam since the condemnation of CFC's. The whole foam manufacturing issue appeared to be filled with question. One of my students, Nick Szabo, brought an interesting new product to light which may offer a solution to the problem. The article was published in Popular Science, October 1992.

A possible replacement material might be SEAgel? It's an acronym for **Safe Emulsion Agar Gel**. This biodegradable lighter than air substance is being studied as a possible replacement for balsa wood. Balsa is used as a core material in the Berkut as well as other composite construction products. Researchers at Lawrence Livermore National Laboratory in California have developed this product. Check it out!!

OOPSI

It appears I neglected to mention the name of a member who joined Central States over a year ago. He is Allen J. R. Dunlap, 14213 14th Ct. S. E., Mill Creek, WA 98012. Allen has an O-320 powered Long-EZ, N539AD with a Ted Henderson prop. Home phone number is 206-742-0612 and work phone is 206-296-4509.

If I have overlooked anyone else please inform me. It seems my system is flawed.



This is an interesting approach to a strut jack pad. A rolling floor jack would probably be best used to allow for the gear spread
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Cleveland Brake O-rings

Stet Elliott (NM) - I have the heavy-duty brake calipers on my EZ (caliper assembly 30-133). After two phone calls to Spruce, and one to Cleveland tech support, I've finally got the part number I need. So no one else has to go through the same thing, here are the o-ring part numbers. All three part numbers identify the same o-ring.

Cleveland part number 101-05200
(not listed in Spruce catalog)

MS number MS28775-224 (also not listed in Spruce catalog)

AN number AN6230B-2 (this one IS listed in the catalog)

Hertzler Propeller E-mail Change

Please notice Gary Hertzler's e-mail address has changed to:

hertzler@yahoo.com

Vibration on Landing

Dean Byers (CA) - Thanks for all the answers and advice I got regarding a low speed vibration on landing roll-out. I wish to share the answers I received as the cause or what to go check out (number of responses for the subject are in parentheses):

Warped Discs (6), Nose Wheel Shimmy (2), Main Wheel Balance (3), Wheel Pant Balance (3), Lower Main Tire Pressure (2), Wrap the Gear (1), Nose Wheel Tire Balance (1), Loose Main Axles (2)

By far the most response favored a warped disc. Well I thought it was the nose wheel shimmy and as I deemed it the easiest to check out, proceeded in that direction. I tightened the castellated nut one hole at a time and then test flew (landed) after each adjustment. After the first adjustment, vibration appeared to lessen, so I thought I might be onto something. But each of the other two adjustments brought less if no return, vibration was still there.

Upon making the logbook entries, I realized the annual condition inspection was due. As part of the annual condition inspection, there are items on my checklist to inspect the brakes and pack the bearings. While that was all apart, I decided to check the main axles for tightness (as two respondents suggested) and guess what, they were loose. In particular the left side.

Man was I surprised and it is now on my checklist. After finishing up the annual condition inspection, I test flew the airplane and no vibration on landing Thanks again to the list for all your support, in particular the two gentlemen who suggested the loose axles, one of whom (if I recall correctly and sorry that I don't remember the other) was Dave Timms.

Mike is presently reported to be testing a Woofter/Saber prop extension to determine resonant frequency. It is believed to be much higher because of a stiffer design. **No Woofter extension failure** is known and many are running on the O-360 which has severe power impulses.

The most recent contact with RAF, 10-4-94, found no final answer to the O-360 vibration problem. **The O-235 with 6" extension and the O-320 with 6" extension have no vibration problem.** Presently, it may not be true of the O-360. A finite element analysis is planned but the facts are not presently known. If you are intending to purchase an O-360 for your pusher RAF will recommend you buy one with a 5th order damped crank. Counter weighted crankshafts have their own problems too, so be sure to check all the AD notes before flying over shark infested waters.

More on this discussion will be found in the Cozy Newsletter and the Canard Pusher as it all develops. The O-360 is recommended for the Cozy Mark IV and the Defiant so both these publications will have something to say, I'm sure.

The latest Cozy Newsletter (10-4-94) indicates you should do all things possible to not over speed your engine and possibly get into the resonant RPM range: Check prop flange run-out. Keep it under .002". Check and balance the prop. Check the prop to see if the blade profile is symmetrical from blade to blade. I have seen prop airfoil sections that varied considerably from one blade to the other. That causes uneven thrust from blade to blade and hence creates vibration. Mike Melvill limits his cruise RPM to 2600, well under the resonant frequency

Oil Cooler Outlet Location

Bill Freeman (KS) - Builders looking for an oil cooler air outlet will find the top of the cowl outlet to be more efficient than the bottom exit.

Nylaflow Brake Line Upgrade

Bill Freeman (KS) - It is good to replace old Nylaflow lines that may be getting brittle from age and heat. Replace them with 1/8" OD X .028" wall 3003-O aluminum tube. The neat thing about that size is it slides up inside the old Nylaflow that you glued to the aft edge of the strut. No cutting and repainting of the strut is needed.

You should leave about a foot or so of Nylaflow outside the strut at the top (in the "hell hole" under the passenger seat) to protect the tube and keep it from kinking or chafing. You will need a piece of flexible hose (I am using Nylaflow, since it is away from heat and UV) to accommodate the large movement of the front mounted master cylinders. I have a parking brake valve mounted to a plywood hard point on each side of the fuselage about 6" ahead of the panel and 6" above the floor. The aluminum tube goes into the valve and the Nylaflow comes out.

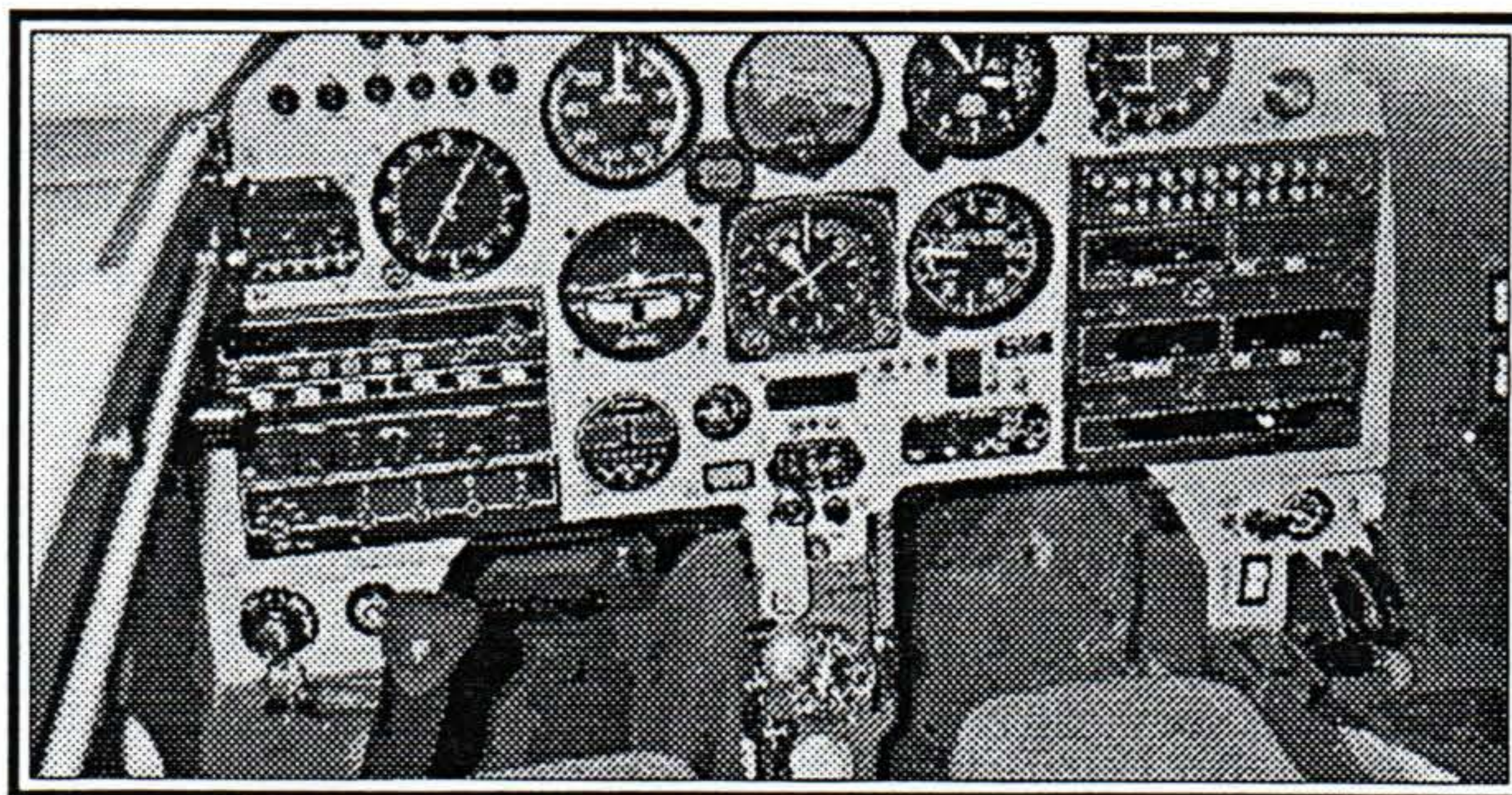
You may have a little trouble flaring 1/8", but with a little practice on scrap tube it is not too bad. You will need a pair each of AN822-2D flared tube elbows, AN819-2D coupling sleeves and AN818-2D coupling nuts for the caliper end and probably a pair of

AN816-2D flared tube nipples with sleeves and nuts for the other end. I have used mine for 5 years and 500+ hours without a problem.

I always wondered why everyone complained about standard brakes on the Long-EZ, since mine were fine. Terry Yake recently replaced his Nylaflow with the aluminum and reports much firmer and better brake action after about 7 years of Nylaflow. Apparently the Nylaflow was ballooning and using up much of the pedal stroke, decreasing the brake efficiency quite a bit.

I see no need for a flex line at the caliper end since my two Cessna 150's have no flex line or strain relief loop in their aluminum brake lines. They are much larger 1/4" OD and, therefore, much stiffer. Some flex is required to let the caliper float on the caliper pins, however. Tuck the line away from the disc and protect it from direct heat with Fiberfrax and aluminum tape to ensure the fluid doesn't boil. I use DOT 5 spec (very high temp rating) which is compatible with all types of rubber and does not break down with age as does normal automotive brake fluid.

**This is your last issue.
It's time to renew.**



Check out the extra wide instrument panel on Sam Kriedel's O-360 powered "Limo-EZ". This outstanding airplane will be featured in the January issue