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## Ercoupe Water in Fuel, Tail Height and Correct Nose Gear Geometry

### The Great Landing Gear Discussion

From Coupe Capers September 1991 Issue

Intro – Ed Burkhead

At the 1991 National Convention in Lock Haven, Pennsylvania, there was a lot of talk about how various problems were related to the design of the landing gear.

There wasn't a soul in attendance that thought Fred's overall design was faulty – rather, the consensus was that the original design was wizardly well done! Unfortunately, some problems that have come up have been attributed to the aging of the parts that makes our forty year old landing gears deviate from the designed shape.

Oh Thursday night, somewhere around 11:00 pm, I passed by a group of hangar fliers in the picnic shelter on the way to my tent. They were intensely analyzing the aerodynamics of the Ercoupe, the aspects of aging of parts, the legality of some existing update...lots of things – I couldn't pass up that kind of talk. Somewhere near 2:00am I finally got to bed.

The guru of the discussion was Harry Lapham. I don't think that Harry has any kind of degree in aerodynamics or aeronautical engineering. I do think that he pretty well knows what he is talking about.

There are a couple of places where I want to qualify what he says in the following article and later I'll discuss them. But then, I don't have a degree in aeronautical engineering either.

At our request, Harry wrote up his ideas and sent them into Skip. If there's anything you disagree with, please send an article or a note to the editor. Collectively, among all of you, individual writers, and maybe even a comment from Fred Weick, I'd bet we can solve and analyze anything!

### **YOUR LANDING GEAR MAY BE DANGEROUS TO YOU**

**By Harry Lapham**

*Dear Skip, (I) attended the National Fly-in at Lock Haven Thursday and Friday. Enjoyed it. Nicely organized. Thank you for your super effort to make it a success.*

*Thursday evening, an in-promptu discussion was held in the picnic shelter from 10:30 to 1:30 am.*

*Enclosed, you'll find a summary of it for all those absent. Several men asked me to write it out for all to read so here it is:*

### **OH, WHERE IS THE WATER HIDING? (-and other mysteries solved)**

**WATER in the fuel system** has brought low more 'Coupes than possibly any other mechanical defect. Isn't it odd that the same C-75/85/90 is found in Aeroncas, Luscombes & Cessnas, and gives them no such grief? What is peculiar in the Ercoupe design that hides the water? Nothing was wrong with the original design, but today none of the Coupes are "original."

The answer to this intractable mystery has nothing to do with the fuel system directly, and this is why the water is so illusive. The ANSWER is get this, **incorrect geometry of the landing gear!**

Open the ERCOUCPE SERVICE MANUAL to page 8. See the fins are to be 6'-3" above the tarmac! The change to the larger diameter nose wheel and the aging of the main landing gear donuts has dropped the fin height to, often  $5 \frac{1}{2} \pm$  feet.

**So, what does the fin height** have to do with hiding water in the fuel system? Experiments done by the writer prove conclusively water is hiding at the back of the wing tanks when the plane sits in a tail-low attitude! Once airborne, the water drifts forward into the engine and the fire goes out in the pots.

#### HOW TO CORRECT WRONG MAIN GEAR GEOMETRY

1. See STC 467112034 by William Coons. Add two 7/16" bushings to the main shocks.
2. Replace the old rubber "donuts" with new.

The tail fins will now rise to 6'3" and – the WATER will have no place to hide!

#### ANOTHER MYSTERY – WHY DOES THE PLANCE BEHAVE SQUIRRELY ON TAKE-OFF AND LANDINGS – ESPECIALLY ON LANDINGS?

ANSWER: The nose strut is hobbled by a too short "safety cable." The cable will not allow the strut to fully extend as it was designed to do. This prohibits the Ercoupe from making a **three-point TOUCHDOWN**. See *Coupe Capers*, Feb. 1990 entitled: "Nose strut fairing" by Skip Cardin.

Also, see the SERVICE MANUAL, page 11, fig. 2A, and page 44, fig. 30. Notice the nose strut is **fully extended in flight**, thus allowing the nose and main wheels to contact the runway at the **same moment!** The Coupe must always make a 3-point landing to assure positive steering & cross wind control. The nose wheel must not "float" when the mains are rolling, or poor cross wind control will result and all landings will be squirrely and too fast.

**THE SAFETY CABLE was not designed on the "original" '46 aircraft. No AD was ever issued for its use!** Most in use today are far too short to allow the strut to fully extend, as intended by its designers. Its use is **illegal!** (You may unofficially use it, provided it is sized long enough not to hobble the strut's full extensions.)

CAUTION! The "nutcracker" inside angle must be less than  $180^\circ$ , i.e.  $160^\circ - 170^\circ \pm$ . **The STOP must be fresh rubber and attached to the inside top-half of the nutcracker assembly.** Its purpose is to stop, prevent, the nutcracker from going to, or over, dead-center and locking the strut in the fully extended (down) position. If this should occur, the strut cannot compress the internal spring when the nose wheel hit the pavement and damage may occur to the nose gear. Be sure to recharge lost hydraulic fluid in the dash-pot chambers within the nose strut. See MEMORANDUM BOOK for this methodology. **When the "illegal" cable is off, the nose strut will no longer leak – another mystery solved!**

#### HOW TO CONFIRM LANDING GEAR GEOMETRY IS CORRECT

1. See aircraft specifications no A-787 paragraph entitled "specification pertinent to all models," pg. 3 of document. (Copy found in appendix of book TOUCH OF CLASS. **Quote:** "Hatch sill on either side of the fuselage must be level." Use a sprit level to confirm that on your plane the sills are your "horizontal datum." [The window sills should be level front to rear as the plane sits on the ground when your landing gear is correct. Ed]
2. Fins are now 6'3" or close to it.
3. Main gear tailing –beams inside angles are oblique  $130^\circ \pm$ . Note acute [less than  $90^\circ$ ], as they are when the tail sits low.

4. Strut on nose assembly will fully extend, fall free, when you depress tail to pavement.

**WHY SHOULD I CORRECT THESE DEFICIENCIES?** (When the old way is OK?)

ADVANTAGES:

- Better short field performance. Faster acceleration to flying speed because wing has no induced drag. Positive ground braking.
- Shorter landings. At touchdown, on all three wheels, wing goes into a negative angle of attack killing lift and putting full weight of aircraft on wheels for good short field braking. No "floating" or "hunting" of nose wheel. Positive control.
- Positive steering. Roll-out is true. Nice to have on narrow runways.
- Excellent cross wind control. It can only happen when all three wheels are holding onto the runway.

**- AND NO MORE WATER HIDING IN FUEL SYSTEM!**

**TO SUMMARIZE:**

1. ADD "bushing" to main landing gear shocks;
2. SUBTRACT "safety cable" on nose gear strut.

**Now, your plane can perform as originally intended by its designers. FIX IT RIGHT TODAY!**

Harry Lapham  
Lakemont Rd.  
Addison, PA 15411