

CIRCLE TRIM

by Aaron Petersen

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For several years I've been exploring the Circle Trim flight adjustment system for rubber-powered (and now electric) sport and scale models. To begin with, I wanted a scheme that would (a) give a good, solid, predictable procedure, (b) allow me to fly in confined spaces when desired -- gyms, armories, city parks, school yards, etc., and (c) produce good contest results indoors and out. All Objectives have been met. I can trim most new models quickly and efficiently.

I can fly in small spaces (when the wind is down). Using Circle Trim, I have won 10 straight local outdoor Embryo Endurance events and have attained a 97.8-second contest flight under a 30-foot ceiling with an Ord-Hume 7 Walnut model that weighs 20 gm. without rubber. Maximum climb or steady low cruise: it works for both.

The basics of Circle Trim: (1) wing wash (vs. turn) to control bank angle, (2) rudder offset to establish the cruise/glide turn, (3) forward CG and matching (usually generous) decalage, and (4) thrust offset to control power climb and turn as necessary. This system is hardly new. The 1933 Jimmie Allen Bluebird plan shows considerable wing wash to offset torque—the keystone of the whole idea. One can find good references all through modeling literature—Dick Korda, Henry Struck, Butch Hadland, Bill Warner, Wm. McCombs, Tonda Alfery—all these experts (and many others) have laid it out at one time or another. Power fliers use washin to stabilize climb turn. The famous Square Eagle P-30's success is partly based on Circle Trim. Many of you are now using Circle Trim, even if it's a matter of pasting a drag flap onto a wing T.E. So—I have invented nothing, but maybe I can offer a few little slants on the subject that might be of use.

One thing's sure -- I'm sold on it!

Many construction articles (and some kit instructions) admonish you to build everything straight and to steam out any and all warps. On that point they are clear, but when it comes to flight trimming, things muddy up very quickly. Often it seems given that if the precious model is only built "correctly," it will fly with little or no trouble at all. We all know that is not the case! Indeed, a normal sort of model can be trimmed to fly OK in a large circle or in a large "s" pattern just by getting it balanced properly, maybe giving it some downthrust, and tweaking the rudder to the right to offset torque. Maybe some hot breath on the stab. But those aren't the kinds of patterns I want, indoors or out. They take up way too much room, and the model either hits a wall or grows smaller and smaller in the distance as it heads for the trees. I like to see my outdoor planes fly, especially the scale jobs. I want them close at hand, overhead, with the sun shining through the tissue. (Not that an efficient high-powered model like an Embryo can't get really high in a hurry with Circle Trim. It most certainly can.)

Circle Trim starts in the building phase. Several factors ought to be incorporated right in the structure. The first thing to

decide is which way you want the model to turn—left or right. Indoors, I definitely believe that left is better. Right turns get you to the ceiling too fast. Outdoors, I don't think it makes any big difference, at least for high-wing models. I've flown sport models and old-timers that had big climbs, nice glides, and good thermaling behavior in both directions, right and left. Supposedly it's better to fly a freewheeler to the right, though I've seen no proof of that in my own models. Because of torque effects, a righthand pattern will require less sidethrust than a lefthand pattern. Some lefthand models require huge amounts of right thrust. Anyhow, once you decide which way to go, **something has to be done to the wings to oppose that turn direction.** You can wash-in the inside wing. You can wash-out the outside wing. You can make the airfoil of the inside wing 15% thicker than that of the outside wing. All these devices work. But there's another way, a refinement that I prefer above the others: differential washout. We know, of course, that washout is desirable for stability, indoors and out. Washin can shoot you down (via tip-stall) if you hit a ceiling or a gust. (Never wash-in both wings!) Wash-out each wing, but to differing degrees. On a Peanut flying to the left, wash-out the left wing 1/16" and the right wing about 5/32". On a Bostonian, make it 1/16" and 1/4". On a 24-inch model, make it 1/8" and 7/16". My Howard GH-1 (32" span) has a 1/16" and 1/2" setup. A heavy model might require a bit more differential. It's not critical. Just so you have that good solid influence vs. the spiral, yet not so much that your rudder has to be offset unduly to overpower the wingwash in the glide, thus requiring even more sidethrust to offset the rudder in the climb, etc. It all works together, you see, keeping a nice steady circle all the way up and all the way down. A hinged rudder (or tab) is a big help in all this, possibly even essential. Glue it fast when the final set is found.

With a new model, use rudder offset, CG, and decalage to set the desired turn and glide. (Hand-toss or fly under low power.) Then **slowly** build up in power, working thereafter almost solely with thrustline (noseblock) offsets to control the climb and/or cruise. Use downthrust to stop zooms or to stay away from the ceiling. Use sidethrust to maintain the turn radius. Remember: a change in turn always affects climb angle, and vice versa. Take your time, no more than 100+ turns per flight. Work up to maximum power desired, and there you have it. Just don't rush things, and all will be cool.

So how do you build in the wing wash? The best way is to make a wing-size (oversize, actually) 1/8" sheet balsa platform jig that sits atop your regular building board, with the root-rib end and the leading edge border pinned down, and with a wing-length wedge of the proper size glued to the bottom of the trailing edge border. Build your wing on top of this platform, and it will have the correct angle set into it. (Shrink your covering on this jig also.) Another way is to build flat as per usual, then when the glue is dry, wedge up the T.E. as desired, leaving root + LE tightly pinned down. Saturate the structure with water spray, let dry for 24 hours, then re-glue main joints and let dry. The least desirable method is to cover a flat wing structure, spray it, pin it down, wedging the T.E. This way you depend on the tissue alone to hold the wash. Under ordinary conditions this works OK, but let some sag get into that tissue, and you are flirting with a Death Spiral. Always be cautious with Circle Trim models in humid conditions. Those with good structural integrity will be OK;

others may not. Lots of dope will help avoid sag if you do fly in humid conditions a lot.

Some will tell you that those "warped" wings either look funny or downright ugly. It's in the eye of the beholder. All I know is, they sure look good in the air, up there on them "rails" they're flyin' on!