

# Triangulation Trimming

## By Bryan Hebert

### Introduction:

This is going to be long winded. I want to preface this discussion by saying I have learned a great deal from Dean Pappas one of my heroes in the sport, Jim Oddino I read these guys all the time, Nat Penton. I learned a great deal about painting from Mike Harrison who is always willing to tell you what he knows <G> and I have looked up to Earl Haury as an all around Teacher and appreciate those guys for their hard work in the sport and their I'll leave that title to Nat Penton as he deserves it, But the two guys that started this flying madness were bicycle mechanics as we all know, so I'm in good company After trimming over 15 of my own designs willingness to share what they know. Now let me say I am no flight engineer or aerodynamic Guru, and trimming and building two or three airplanes a year for about 20 years I have a lot of practical knowledge on this subject matter and have kept notes. to verify my observations. I hope this will help. A better flyer with more experience will be a better trimmer because he demands more from his airplane, tail heavy/nose heavy is relative to the recommended C/G and not always an extreme position; just lane but being a better trimmer will earn you better flying skills.

For the purpose of this discuss a way to example it.

If you are using a 0-0 setup things may- be a little different as to what I say and what you see on your airplanes as you fly them my set up and your set up are not to be equated with each other. and I think that's where some of the confusion comes in you having only experienced your set ups.

However „left rudder tuck is a symptom of the airplane being tail heavy on all pattern models no matter the set up, as long as the stab and elevators are accurately adjusted, Extreme tail heavy will mean both knives will tuck to the belly. it is just a symptom that tells me the cure and allows me to diagnose trim problems. Any wing has to produce lift, to fly and there are two ways to do it, add positive incidence to the wing according to the datum line on the fuse (My Method) or, add positive incidence to the fuse, the 0-0 method. By this I mean, flying the airplane a little tail heavy to achieve positive incidence. There is no way around it, the wing has to have a positive angle of attack to produce lift and fly level and lift 11 pounds of balsa and Glass. Vertical c/g has no factor on this discussion. I don't understand enough about it to discuss it(G). The stab does not induce the lift, it controls the lift of the wing and steers the wing and fuse. (no arguments here please I'm trying to make the bigger picture, I know it does contribute lift and share the lift load,)

**A 0-0 or sub 1/2 positive set up will cause some or all of these problems.** For you guys that set up 0-0, check um off

- A tuck to the belly on left rudder (or both depending on how tail heavy) more tail heavy more tuck
- Pull in both up and down lines. So now we add down thrust to fix one problem, upline pull and it magnifies the others. Now it may give a differential problem. so we address that with the radio. by mixing and this occurs
- Stalls may be hard to do because, "mix don't go away".
- Snaps and spins are hard to perform correctly start-stop consistently, and they wander off line in the uplines and 4/5's so you see flyers using opposite rudder to lead before, and after to keep them on line, and even more apparently and worse in a upline. You can't convince these guys that it's possible to do a snap without displacing or tucking etc, because they have never experienced it. and it supports their lack of trimming skills or a poor design, Sorry Guys!!

BTW contrary to popular belief nose heavy airplanes (weight forward ) snap better, lands the snap cleaner, is perfectly consistently and stays on line way better , Do you have an airplane you have to lead to stop? Its because it does not recover from the stalled condition or its probably tail heavy. A nose heavy set up stops instantly, providing you have the right inputs.

In windy weather the 0-0 or sub 1/2 positive airplane moves all over the place and is not solid at all. It is not directionally stable because of the tail weight needed to induce the positive incidence in the wing. A positive set up will actually weather vein into the wind by itself and you will need opposite rudder to maintain the line sometimes. In other words, it will self correct in the wind. This makes it much easier to fly in windy weather.

To correctly trim a model you need three tools,

1. An incidence meter no matter what kind dig. may be better,,
2. Honesty without it you will deceive yourself into believing it`s trimmed
3. Patience - I know I just lost some of you but there is only one of these three you can do without; it`s the incidence. Meter. The other two will guide you if you stay at it till it`s right.

## **The Hebert Triangulation Method:**

Assuming everything else is perfectly straight and aligned correctly (this is a big assumption) set your c/g according to the design spec on the drawings for your design as a starting point. If you don`t have a C/G spec contact Nat Penton, he will give you a great formula he has worked up.

1. Set motor at 1/2 deg down (neg incidence), wings at 1/2 positive to start (this is not a hard deck) and stabs at 1/4 positive because this is about where you will end up. Line up all your control surfaces and get them even. We are going to let the airplane tell us what to do to fix it later
2. Fly the airplane and trim hands off for level flight,, don`t cheat ,(I know a lot of guys use a little down trim in upright flight to help with upline pulls). It has to be hands off perfect. Then fly inverted to see if you like the inverted elevator and the airplane feels solid and easy to hold on a line.  
Then take notes on what you just did and on the following items as they are flown (it helps to have someone do the notes as you fly).
3. Pull a vertical line see what it does
4. Put it straight down see how long it takes to pull out to the canopy
5. Do a left rudder knife edge ,see if it`s straight - no pull the entire length of the field (don`t cheat).
6. Do a right rudder knife edge see if it`s straight same as above. This is the triangulation method I use to diagnose all trim problems with any airplane; IMAC to pattern.
7. Land and see where the elevator wound up. Never mind the stabs right now, we will adjust them later. Take notes of what the airplane did in all these maneuvers. You will see you can triangulate a common input fix. I find it helpful to have a buddy to help remember what`s happening in the air. Look at the elevator trim and see what it has in. If we are lucky and your airplane is 10 pounds you are almost done although it just may take a little c/g change to give a click or two one way or the other.

## **Fixing Problems:**

1. Pulls to Canopy in up lines and downlines: You need more positive incidence. Do turn at a time on the adjuster. As an aside, if you have rear adjusters, take them out and put pins and donuts to make sure they do not move at all as this will mess with the trim process

2. Goes to the belly in left rudder. Move the c/g forward(you're tail heavy) until it stops pulling to the belly regardless of the incidence. If it goes to the canopy in both knives fix #1 will probably work but refer to the inverted flight part of your notes and see if you think the elevator was mushy (holdable but mushy). If it was mushy you might require tail weight and positive incidence to fix both problems; canopy pull on downlines and knife edge flight.

Now, because we are on the edge of trim perfection in all wing loaded and unloaded positions, we can adjust c/g by using the earlier mentioned points for fine tune feeling Remember most of the time one fix will fix 3 other things and bring it all together. They are all related That's why a well trimmed airplane rolls with ease and 4 points with ease - we are not fighting any adverse trim issues in any axis or wing load

### **Bryan: I'm not sure what you mean hear. What first flight are you talking about?**

Now do the adjustments and leave the trims on the airplane where they were. Make another flight and your adjustments should jive with the reverse of what you trimmed on the first flight and make your trims work. If you have to increase the trim you already had in from the first flight, LAND. You went the wrong way with the adjustments. Correct and fly again.

If you are flying one of my designs, I know where the incidence should be set. A quick method is to do the triangulation method this way.

- Trim the airplane to fly the down lines. Leave this trim in and land.
- Adjust the wings to get the trim out and all three maneuvers are now happy,,

The closer you get to the end, the finer the tuning will need to be, and it can try your patience. Make sure the tank is centered on the c/g or you will have trim changes during the flight as the tank drains

Don't get mad at me if you cannot fix your favorite airplane. Just buy a better design (Mine preferably <G>). I would like to add this. I agree with Nat that add on T wings are smoke and mirrors but who is going to argue with the word Champion? Yes, it does work somewhat. It reduces the required rudder angle needed to hold knife edges which will in fact reduce mix; less rudder less mix. A POSITIVE setup needs none of this. Hope this helped. You may need to read it twice to absorb it all. THANKS for your interest

Bryan Hebert

<http://www.hebertcompetitiondesigns.com>