

Trimming with Bryan Hebert

By Don Ramsey

I recently finished airplane and thought it would be nice to get some help from the one of the most experienced guys I know on setting up the model. I contacted Bryan and he agreed to help. The newly finished model is the Mystic, designed by Todd Schmidt, and is all paint with a Hacker Q14XS, PT 22x12E prop. With Hobby People 4500 mah 30 C batteries, its maiden flight will be at 10 pounds ½ ounce. My instruction from Bryan was to set the stab to 0 as a reference for the wings and motor, the wings ½ degree positive, and the motor ½ degree negative. Again, the wing and motor setting are both relative to the stab setting. He also wanted the fuse marked to indicate a CG of 27% to 33%. To check your CG here is a link to a CG calculator <http://www.coastalplanes.com/tools/cgcalc/centerofgravitycalculator.htm>. When using the calculator you should make measurements from the center of the fuselage. For example, the span is from the fuse center to the tip. That is not clear on the web page for the calculator.

When trimming a plane the goal is to get the model to fly with as little input from you as possible. That goal is achieved by balancing CG, incidence, and thrust. The plane may fly with several setups but one will fly much better than the others. If the model is trimmed for level flight:

- Increasing the incidence of the wing requires down elevator or down thrust to counter.
- Adding down thrust to the motor will require up elevator or more incidence.
- Moving the CG forward will require more up elevator or more incidence to counter and, of course, the reverse for moving the CG back.
- To counter a pull to canopy in up and down lines, increase the incidence (add more positive).

Tuck to the belly with left rudder in knife edge indicates aft CG (move it forward).

The optimal setup will have a combined incidence of the wing and the absolute value of down thrust on the engine near 1 degree.

For instance, the wing set to ½ positive and the engine set at ½ negative gives $\frac{1}{2} + \frac{1}{2} = 1$ degree.

Hebert makes available a complete trimming guide (found on his website, <http://www.hebertcompetitiondesigns.com/>) and I'm going to try to relate all the adjustments we make to that guide. Usually the quickest way to arrive at a very good setup is to fly the model, note the problems, then make one change and fly again to see the effect. This takes patience but the end result will be worth the effort. Note for using the trim chart: If the chart has multiple fixes start with the first and work through them from left to right.

Bryan says, "To correctly trim a model you need three tools,

An incidence meter.

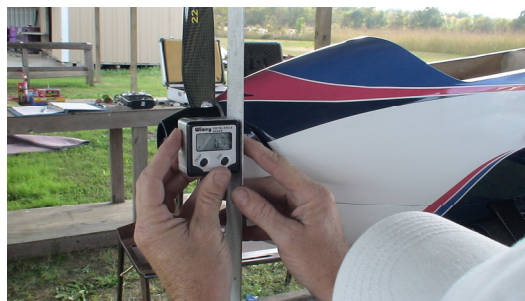
Honesty - without it you will deceive yourself into believing it's trimmed.

Patience - I know I just lost some of you there.

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 closer you get to the end, the finer the tuning will need to be and that can try your patience."

Over a period of 2 days we did 10 flights. In about 5 of those flights Bryan had an airplane that flying competitively and the other flights were fine tuning. Here's a summary of those flights.

These photos show verification of the parameters I was asked to set prior to the trimming session. In the first photo you can see four rods that allow you to easily verify the same setting on both elevator halves as well as any warp in the surfaces. Second photo is verification of thrust line and final photo is flying by moonlight.



UL=Up Line, DL=Down Line, KE LR= Knife Edge Left Rudder, KE RR= Knife Edge Right Rudder

	UL	DL	KE LR	KE RR
Flight 1	Pull to Canopy	Canopy	Canopy, roll right	Belly, roll right
	Right aileron trim required – more than average			
	Up elevator trim needed – excessive			
Adjustment	Add positive incidence on the left wing. This should require some down elevator on the next flight which will help with the UL, DL, KE LR pull to canopy, take the roll out of both KE, and take some up elevator trim out. Note: it also allowed the model to fly more stable in the wind.			
Flight 2	Canopy	OK	Belly – slight	Belly
Adjustment	There was a slight roll to left on KE. Increase incidence on left wing and check surfaces with instruments			
Flight 3	Canopy	Canopy	Canopy – slight	Canopy – slight
Adjustment	Looking at Bryan’s Trimming Chart, this would require 2 different adjustments, one for the UL and DL and one for the KE. The best plan is make one adjustment and see what happens. The chart says to move the CG back to correct KE pull to canopy, so, we moved the CG back from 27% to 33%. This change in CG should require a little down elevator on the next flight and correct the KE.			
Flight 4	Canopy	Canopy	Belly – slight	Belly – slight and roll right
Adjustment	The pull to the canopy in the UL was the biggest problem here and to correct that the Trim Chart says to increase incidence, so, we added 1-1/2 turns positive incidence. Positive incidence will require a little down elevator and correct the pull to canopy on the up line.			
Flight 5	Canopy	Canopy	Canopy	Belly, roll right
Adjustment	Add 1-3/4 ounces tail weight (since my flight batteries were at their rear limit on their mount) and decrease the incidence of the wing. I’ll change the mounting system for the batteries later if the tail weight is still needed. This is fine tuning to arrive at a balance.			
Flight 6	OK	OK	Belly	Belly
Adjustment	Decrease the incidence of the wing because of KE. This should require a little more up elevator on the next flight. Aircraft flies very well at this point and this is fine tuning to see if adjustment can improve overall performance.			
Flight 7	OK	OK	Belly	Belly
Adjustment	Add down thrust (the model came from the maker with 1 degree down thrust and I had shimmed mine to ½ degree) and remove 1 ounce weight from tail.			
Flight 8	Canopy – slight	OK	OK	Belly – slight
Adjustment	Remove remaining ¾ ounce weight from tail.			
Flight 9	OK	OK	OK	Near perfect
Adjustment	Add down thrust to arrive at factory setting. Spinner backplate matches nose of model. The thrust line was only about a ¼ degree or less off the nose so shims were removed.			
Flight 10	OK	OK	OK	OK
Adjustment	Now start adjusting for snaps and spins			

As a review, if your airplane pulls to the belly on both knife edges you have either too much pos incidence in the wing or the plane is tail heavy. Let’s use the snaps and spins to figure this out. Snaps should be set up to only need about 12 deg up 14 deg down elevator, 15-18 deg aileron and low rate rudder (approximately 60% of full rate). The airplane should snap, stay on line and instantly recover with no winding up or guessing the exit. If you can’t control snap/spin exit with low rudder rate, you’re tail heavy. If you

can't fly a dead solid inverted line you're tail heavy. If the airplane has any directional problems out of a down line to a radius - tail heavy

Nose heavy takes a lot of down elevator inverted. It's hard to get a "nose high" clean stall for spins. After a 1.5 snap to inverted if the airplane deviates off line falling from the 45 line forcing you to catch it with elevator - Nose Heavy. These are good indicators for detecting tail or nose heavy.