

## F2D News - June 2007

Mark Rudner  
rudner@mit.edu

Possibly the greatest feature of the ready-to-fly models available from Europe is their amazing versatility. There are so many trimming options, that it's almost always possible to make any model fly with any kind of characteristics (very good, or very bad). Although we tend to focus on what we should do with our models once they're in the air, getting them set up correctly on the ground can take you a long way.

This will not be a complete list of all trimming options, as there are undoubtedly many other clever tricks out there. The most important thing is to get your models set up so that they are "pointable," "smooth," "predictable," etc. That is, it is important to set the model's sensitivity properly. The sensitivity you feel when you fly a model depends both on the placement of the center of gravity (CG) and control gain (how much the elevator moves for a given tilt of your wrist). Though it is possible to change the sensitivity of a model by changing either the CG or the elevator throw, these two adjustments actually lead to very different effects.

The best way to sum up the difference between CG and control adjustments is that CG adjustments affect the physics of how the model flies, while changing control throw only changes how you interact with the model. When the CG is too far forward, there is a large stabilizing moment that makes the model resist changes of direction. The wrong solution is to compensate for this fact by increasing control throw; this is just fighting against physics. The right solution is to slide the engine back until the CG is in the right spot. If the CG is too far back, the model will be inherently unstable and will "hunt" in level flight. Reducing control throw will not fix this, as the model suffers from inherent instability to small perturbations.

Sometimes the engine may be at one limit of its range of travel, but the model still doesn't fly right. The answer here is not to simply "live with it." Rather, it's then time to add some small coins to the front or back of the model to shift the CG further forward/back as needed. Yes, I know we spend so much time keeping our models light that it's a shame to add dead weight to them. However, isn't it much more of a waste to fly a beautiful but out-of-whack model and lose because it wouldn't go where you wanted it?

Lateral CG placement is important as well. Due to the weight of the lines, it is necessary to add weight to the outboard side of control line models. Without tip weight, models lack line tension and tend to come slack on the lines, especially upwind or during violent maneuvers. The wrong way to compensate for this lack of line tension is to give the engine "out-thrust," i.e. to point the engine slightly outward. While it's true that engine out-thrust does increase line tension, this wastes engine thrust and may also cause the model to fly with some strange yaw.

Rumor has it that Mike "Whacker" Whillance in Great Britain has an elaborate set of strings hanging down from the ceiling of his workshop to assist in proper CG placement. You can usually recognize his models by the coins taped in seemingly random locations. These coins are very much not randomly placed, however, as each one is carefully placed to ensure that the CG of each model ends up in exactly the same spot. His methods may be curious, but he has used them to considerable success which I assure you is no accident. Or maybe the success is in spite of the methods, we may never know, but either way the intention is right on in my view.

Now suppose you've set your CG and your total control throw and the model is flying pretty good, except for one problem: your outside loops are tighter than your inside loops. What's wrong? Do you have equal amounts of up and down control available in the elevator? Assuming that you do, you should \*not\* try to fix this problem by dialing in more up in the elevator to tighten up the insides. Why? Again, this solution is just fighting against physics. The real problem is that there is a thrust misalignment. If the crankshaft of the engine is pointing at an angle (up or down) relative to the centerline of the wing, then the model will favor turns in one direction relative to the other. To compensate for this, tilt the engine at a slight angle while tightening down the mounting bolts.

That's all I've got for now. Good luck!