Trimming Techniques for Multi Channel Gliders

By: Mike O'Reilly

Many people make the mistake of thinking that because their glider is flying OK that there is nothing more to do with regard to trimming their model. Nothing could be further from the truth. Subtle changes to CG, surface deflection and towhook position can drastically change the way your model launches and flies. Listed below are the ways I approach trimming out a new 4-6 channel glider.

The Model

Before flying the model you should check it out to be sure that there are no warps or mis-aligned surfaces. A model with a twisted wing, or one where the tail is not perpendicular to the wings will be much harder to trim than a 'straight' model. Similarly, check the lateral balance, one heavier wing is not uncommon. At low speed these problems are not so evident, but at high speed they can be very pronounced and require a different trim to correct them. Make every effort to have a 'straight' model.

The whole purpose of the trimming process is to make your glider easy to fly in a 'hands off' situation. The easier it is to fly, the better it will fly.

First launches

Having checked the model for warps etc, put the CG where the manufacturer suggests (or having done your own calculations) checked that the controls all move in the correct direction, you are ready for that first launch. The object of the first few launches is to obtain a neutral trim setting for ailerons, elevator and rudder. Fly the model into wind and adjust the trims to obtain straight and level flight. Adjust the elevator trim to the point where the model feels 'soft' or 'mushy' and then go forward about 2 clicks of down trim.

Centre of Gravity

This subject is probably the object of more debate than any other with regard to model gliders. Why, because changes to CG can drastically affect the way your glider flies. There is no single 'perfect' CG for any model, your flying style is part of the equation. The following technique is widely used and will get the CG close to your ideal position.

Launch the model, level off after the zoom and head into wind. Dive the model at about 300 with wings level for about 2 seconds. Then release the elevator stick and carefully observe the behavior of your model. If the model pitches up (climbs) then the model is nose heavy. Land the model, remove some nose weight (5-7g). Push in 2 clicks of down trim and then launch the model again. Fly straight and level into the wind and adjust the elevator trim to be just forward of that 'mushy' point. Now perform the dive test again and observe the pitching motion of the model. If you remove too much weight the model will continue to dive at ever increasing downwards angles. In this situation the elevator may not respond quickly so don't perform the test close to the ground. (If the model will not pull out with up elevator, don't panic, just feed in some aileron input and the model should come out of the dive. If all else fails push in full down elevator and perform a bunt or ½ outside loop.) The aim is to achieve a model which does not pitch up or down when you release the elevator stick. i.e. is neutrally stable in pitch. (If the surfaces are all straight it should already be neutrally stable in roll and yaw)

Control Surface Deflection

Elevator: Moving the CG rearwards makes the elevator control more efficient or effective. That means that less movement is required to obtain a given amount of pitch movement (the stick becomes more sensitive) The cure for this is not to add lead to the nose of the glider, but to reduce the amount of travel you have on the elevator. Assuming that you are using a computer radio it is a simple matter to reduce the travel (dual rates or travel adjust). How much elevator movement do you need? The 2 situations that require the most elevator movement are the down elevator at the top of the zoom after launch and the amount of up elevator in a tight, slow thermal turn. Reduce your elevator movement so that the stick is almost bottomed out in that tight thermal turn. If you are using equal throws for up and down elevator, test the amount on launch. If you find that you need more throw at the top of the zoom then dial in some more and consider dialing in some exponential as well. A softer elevator input makes the glider much easier to fly, especially at greater distances.

Ailerons: The roll rate of your model is not affected by CG, but increases with the speed of the model. This should be born in mind if you are setting up flight modes in your Tx. So how much aileron control do you need? This is a bit of a 'feel' thing, but for mind the most demanding situation is the downwind turn onto base leg when setting up a landing. If you have done everything correctly you will have plenty of speed on and it is not difficult but we have all made that turn too low and too slow at some stage and felt the sluggish response of the model. Set the aileron rates such that you are happy with the response whilst flying slowly downwind and see what it is like in all other situations. A well trimmed thermal glider should not be able to perform 3 rolls per second, one roll may take up to 2 seconds to complete. Any faster roll rate than this may get you in trouble when you are thermalling a kilometre downwind at low altitude. Minor inputs on the sticks should result in minor outputs at the model. Don't forget that you have exponential control options in your Tx. Aileron differential can have a large bearing on how flat your model will perform thermal turns. All model gliders require some aileron differential. 8 units up and 5 units down is a good starting point for most gliders. Aileron differential is best tested in calm neutral air, strong thermal activity can mask a poor set-up. Launch the model then switch off the aileron-rudder mix. Roll the model to the left and closely watch the angle of the fuselage to the horizon. If it goes nose high (yawing to the right) you have too much differential. If it goes nose down (yawing to the left) you have too little differential. Make the necessary adjustments on your Tx and test again. Aileron – rudder mixing does not cure the nose high or low situation described above, changing the differential is the only cure. Aileron – rudder mixing is used to stop the model skidding in the turns. Imagine looking down on your model (plan view) as it performs the perfect thermal turn. In an ideal world the fuselage would follow the perimeter of that circle. If it is nose in or out there is an increase in drag that will reduce the rate of climb. This is not an easy thing to observe from the ground so using some well proven settings is about as good as you can do. On a 3 metre, 2200g, RG15 equipped model try 10-15% mixing percentage. The faster the model flies use less mixing, the slower it flies use more.

Rudder: The rudder control is not used independently in a thermal glider a lot. As described above it is mixed in automatically in conjunction with the aileron most of the time. Exceptions to this are on launch where corrections to launch direction should be made with rudder not aileron. If you have flight modes then set up a lot of rudder travel in 'Launch' mode. The other consideration is rudder differential in V tail models. This should be tested in calm neutral air. Launch the model and fly into wind with your normal trim settings. Feed in full left rudder and observe the angle of the fuselage to the horizon. Ideally it will remain horizontal as the fuselages yaws to the left. Test with right rudder. If you have the same movement for both left and right rudder then the fuselage should do the same to each direction. If it climbs then you need to reduce the amount of movement on the upgoing side or increase the movement on the downgoing side. This will require some programming input on your part and depending on the brand of radio you use may not be easy. Look in the travel adjust section for rudder to begin with. If the nose drops then the correction is the reverse of that described above.

Flaps: On a modern 6 channel glider the flaps serve 3 purposes. On launch they are used to raise the CL of the wing. In thermal mode the whole of the trailing edge can be raised or lowered to decrease or increase the camber of the wing. This will increase or lower the flying speed of the model. On landing the flaps are lowered to increase the drag and reduce the lift that the wing creates to increase the rate of sink.

Launch. This is a complete and complex subject in itself. Suffice it to say that about 200 positive (down) deflection is a good starting point.

Thermal. The complete trailing edge can be lowered about 3mm (on a 3 metre 250mm root chord wing) to enable the model to fly slower in small weak thermals. This should be set on a switch function rather than a slider if possible so that you always get the same deflection and can easily return the trailing edge to a neutral setting. Similarly the complete trailing edge can be raised 2-3mm to improve penetration in strong winds, between thermals or for speed tasks. The ideal settings vary from model to model and should be tested carefully. Again, calm, neutral air is ideal.

Landing. To really slow the model down and increase the rate of sink, the flaps should be lowered at least 600. At the same time it is normal practice to raise the ailerons about 300. Ideally, this braking action (commonly called crow or butterfly braking) should be operated by the throttle stick. The ideal settings will be determined by a number of things, how much downwards flap movement is mechanically available on your model, what mixing is available on your brand of Tx, and your flying style. There are however, some basic rules to follow.

1. It is better to drop the flaps than raise the ailerons (it effectively washes out the tips lowering the stall speed)

2. Dropping the flaps will cause an upwards pitching movement which should be corrected with down elevator mixing. Have lots of practice landings to fine tune the amount of down elevator mixing. Once properly set up landings become a breeze.

3. Raising the ailerons will reduce the roll rate of the model, making directional changes on final slower than you might expect. If you have flight mode switching on your Tx then dial in as much rudder as you can in landing mode.

4. Remember that the ‘crow’ action is proportional. Half stick movement should result in half the rate of descent etc. Raising the flaps quickly may result in the model losing airspeed and ‘dropping’ out of the sky. Try and move the throttle stick in a smooth and controlled manner.

Towhook position

With few exceptions the towhook should be placed in front of the CG. If your model has an adjustable towhook then start about 6mm in front of the CG with the initial launches. Chances are that you have moved the CG rearwards during the trimming process and once you have completed all the steps above you can move the hook back. The ideal position also depends on flap and elevator presets so there is no definitive position but suffice it to say that if the trailing edge of the towhook is 2mm in front of the CG the model will launch well. Moving the hook rearwards increase the steepness of the climb, but ultimately with a reduction in directional stability. Go too far back, get a poor release of the model and before you know it your pride and joy is buried 300mm deep in the ground. Tread warily as the towhook approaches a position near the CG!