Peter Goldsmith
Trimming Procedure

For Precision flying Peter would expect our model to be running between 12 to 15 degrees of elevator throw. If you need more than this, check your exponential because it may be too high. Peter believes a 35% expo is a linear feel.

Sequencing: Peter's concept of sequencing the trimming process is simple. He can't emphasize enough that it is crucial to trim your model in the correct sequence to make sure each adjustment has no effect on the previous adjustment.

1. **CG is first**. You can't move ahead until you have a CG that you're happy with. If you change the CG later, you will need to start over and check your entire trim setup. Differential, knife-edge flight, and down-line tracking will be affected by the CG. Same if you change your propeller.

   Balance: How do you know the correct CG for your model? If in doubt, read the model's instruction; that's usually a good place to start. For precision flying, forward is better but to far forward can be a problem.

   Forward CG: When entering a spin, your model mushes and kind of slides into the spin no real stall visible, your CG may be too far forward. Anther sign of forward CG is excessive down-elevator needed for inverted flight.

   Rear CG: Some obvious clues are that the model is sensitive in pitch, unpredictable around the stall, or climbs when on an inverted 45 degree line.

   NOTE: Peter recommends at least 10-15 flights before making the commitment to where the CG needs to be if you're trimming a new model.

2. **Dynamic Balance:** Okay, you're happy with the CG. The next trim setup is dynamic balance.

   Procedure: Put the model into a vertical dive with the throttle back minimum of three to four seconds and pull a hard corner at the bottom. No matter where the wings are in roll, when you pull to level the wings must be level. It really doesn't matter where our model's wings are. As you pull to horizontal flight, the wings must be level. If you go from Vertical to horizontal, not only will the engine thrust have no effect, but your wings can be anywhere as you're on vertical down-line. If you notice that one wing consistently drops then add some weight to the opposite wingtip.

   Note: Make sure you only use elevator through the corner. Perhaps just for the trimming process you can increase the aileron stick tension to ensure that you don't accidentally input a bit of aileron with the elevator and that the elevator track correctly when you pull the stick back.

3. **Thrust Angles:** It's time to put ascetics aside and get the thrust correct.

   Procedure: Make sure your wings are level before pulling vertical. Fly directly overhead, into the wind, where you can clearly see the wings, and then pull to a vertical up-line. We are only trimming for the first 1000 feet.

   Trim the rudder left or right until the airplane tracks straight for 1000 feet. Land the plane and us a protractor o see how man degrees of rudder where required for a straight vertical. Whatever it is, divide it by two and that will be what you need to add to the right or left thrust.

4. **Differential:** Aileron differential is required when the drag of the down-going aileron does not mach the up-going aileron.

   WARNING: Make absolutely sure that you are not getting surface blowback. You will never get your differential correct if you are. How do you check for blowback? Push to a vertical down-line and roll to the right, stop rolling for a second and then roll again. The roll rate should be the same. If it is slowing, your model's surfaces are not reaching their intended throws. Another way to check is if the up-line roll rate is faster than the down.
   Either increase the servo power or improve the geometry by reducing the servo-arm radius and or by increasing the distance the control-horn pickup is from the hinge line. You could need more servos.

   Procedure: Checking differential is simple. Fly directly overhead and away from you. This time pull to 45 degrees up-line, making sure you are flying either directly into the wind or directly downwind. Using full aileron deflection, roll to the right. If the aircraft "Walks to the right," you have too much down travel on the ailerons. If the model "walks to the left," then you roll it to the right, you have too much up travel in your ailerons. Repeat the process to the left as well until you are satisfied that your model is tracking true in the roll axis. Don't expect your model to continue to roll for 5000 feet on a sting. If just can't be done.

5. **Throttle-to-Aileron Mixing:**

   Procedure: The first way is to climb your model to a high altitude, simulating a typical top-of-the-box altitude, and fly it directly over your head and into the wind. Roughly 50-100 feet out from yourself, push down. Watch carefully to see if the model is rolling on the down-line. Most models will roll slightly to the right as the aileron trim set for full throttle will be too much at low throttle as the torque effects will be greatly reduced.
   The second way to check is to fly along at level flight, medium height, and reduce the throttle. Watch carefully and see if your model is rolling: chances are that it is. Add Aileron mix to throttle to correct the problem.

6. **Throttle-to-Rudder Mixing:**

   Procedure: To check for this, use the same technique as the throttle to aileron setup. Fly the model above yourself, directly into the wind, and push down in front of yourself and watch carefully. You will be amazed, especially at the start of the down-line. If you haven't gotten any throttle offset to rudder, you are most likely flying around the problem. And where I find it most challenging is in figure 9s and vertical and horizontal 8s.

   Something you may want to experiment with in both of these scenarios is where the mix is activated. For a low-throttle left-rudder mix, I like to have the stick offset start at least above half and let it progress from there as I reduce the throttle. It seems to be the best balance, and I am not getting a sudden mix input; it progresses more or less with the model's speed. This will vary from model to model, but try to keep the mix activation well above an idle setting. Add Rudder mix to throttle to correct the problem.

7. **Rudder-Aileron Mixing:**

   Procedure: In most cases, for rudder-aileron mix, a linear P-mix is all that is required. What I mean by linear P-mix is that you don't need a progressive value to the mix; i.e., less at the start and more at the end. The mix will be linear.

   What causes adverse roll or perverse roll coupled to the rudder is the incorrect dihedral. Most modern designs, with the exception of biplanes, are really close and only require a small amount of rudder-aileron mix. Some like to put their models on knife-edge, but I like to just do a flat turn, simulating rolling turn inputs.

   Rolling turns require more precise mixing than sustained knife-edge flight. In a contest your model doesn't do much flying on its side, but it sure does a lot of rolling turns. So I like to do the flat-turn thing. Doing a simple inside rudder turn to the left, using left rudder, the model should just yaw, with no roll effect. It the roll rolls to the left, you need to mix 2%-5% right aileron to left rudder. Repeat the process with right rudder.

   Note: Now vary the speed at which your aircraft does flat turns. If you find that the mix becomes to much as you increase your model's speed, you could be getting surface blowback.

   With insufficient rudder power, when you apply a P-mix for roll, or pitch for the matter, the mix value will become too much as the rudder throw reduces because of aerodynamic pressure. This could be why you have your mix perfect for knife edge, but you chase your aircraft everywhere doing rolling circles

8. **Rudder-Elevator Mixing:**

Procedure: As with the previous rudder aileron, start by doing a flat turn to the left and see what happens. If your model pitches down when rudder is applied, mix a small about of up-elevator: if it pitches up, apply a small amount of down-elevator. In some cases, even without blowback, the mix value will not be exactly correct for all throttle settings.

Don’t panic because, as with most modern radios that are suitable for aerobatics, you can use what is called a curve mix. It allows you to have multiple points along your mix curve to increase or decrease your mix value at different rudder inputs.