Model Setup and Trimming

I thought I'd knock up a little article on how to setup and trim and aeroplane correctly as there's a lot more to trimming than fiddling with the trim levers on your TX until the plane flies straight and level! A well trimmed plane will reduce your flying workload and hopefully improve your flying. There's no such thing as a perfectly trimmed plane but we can certainly reduce the bad habits as much as possible. In this article I'm assuming most of you have computerised TX's with mixing by now. If not go and get one as you're missing out!!!

Servo setup
Firstly we need to setup the servos to provide the maximum precision (via use of the full range of the servo) and power (via mechanical advantage) to the control surfaces. This involves deciding the maximum throw we want from the control surface and setting the control rod up between the servo and control surface to produce the required throw at the servos full movement. For a 3d model this may be 45 degrees of surface movement and for a precision or scale model this may be only 12 – 15 degrees. However, there is no point setting up a precision model with 45 degrees of movement and only using 12 degrees on a low rate switch as we will loose precision and power on the servos, so we really do need to think about the maximum movement we need to fly with.

Adjusting the amount of movement is easily achieved by moving the control rod to different holes on the servo arm or control arm. One bad habit that a computer radio allows is setting the end points (ATV) to get the required throws, but there is no point setting this to use only 50% of the servos total movement as we loose the precision of the servo against the 1024 (and 2048 these days) resolution of the radio. i.e. 100% movement gives us 1024 steps on the servo and using 50% only gives us 512 step so less precision. Ideally we want to set the servo up on the tx with 140% (max) throw and the end points adjusted physically by moving the control rods. The end point adjustment on the TX should really only be used for fine tuning.

As for the throttle, most people have their throttle trimmed correctly to produce a nice idle and to hit the max rpm at the top end. But it's worth noting that it is also important to use as much travel on the throttle servo as well to give the maximum resolution and control of the throttle. We want a nice smooth change in rpm throughout the throttle stick movement, not big steps. Also most carbs don't produce a linear power band from the engine and we notice that the first half of the stick controls most of the power and the second half doesn't make much difference. We can get round this and make the throttle more linear by applying exponential to the throttle channel on the TX. I normally find around 30% does the trick. This will then mean that at ¼ power I have ¼ power, half stick I have half power, ¾ stick has ¾ power etc. A nice smooth and linear throttle is the key to getting many manoeuvres right and makes all the difference.

A good overall setup will provide a smoother and crisper more responsive feel to the model. Of course we need to make sure the servos are man enough for the job or all that effort will be wasted.

Trimming
Next we need to trim the plane which should ideally be done in sequence to make sure each adjustment does not affect the previous one. The following is in order.

Balance
A good starting point for the c of g is the model's instruction manual, but this normally needs adjusting to achieve the best result. Too far forward and the plane will feel mushy and too far back it will feel unstable. A good way to get the best c of g is to fly inverted and check how much down elevator is needed to stay level. Only a small amount should be required. Too much then the plane is nose heavy and if it climbs hands off inverted then it is tail heavy. A good way to double check is to climb upright at 45 degrees and let go of the sticks. The plane should stay on the 45. If it drops it is nose heavy and climbs then tail heavy. Correct by moving batteries and radio around or adding lead as a last resort.

Lateral (dynamic) balance
The best way to check this without the effect of engine side thrust is with the engine at idle. So climb high, throttle back, put the plane into a vertical dive and pull out quite sharply. Not only does this ensure no thrust effect but that the wings also start off level at the pull out point. One wing will normally drop, in which case add weight to the opposite wing until this no longer happens and the plane will be laterally balanced.

Thrust Angles
Getting the thrust angle correction right makes the plane fly nice and straight and makes prop hanging much easier. The easiest method to check this is to pull vertical on full power and see if any right rudder is needed to maintain the vertical. If it drifts off to the left then right thrust is need and vice versa. Another nice way is to add rudder trim until it climbs vertically, then when back on the ground measure the amount of rudder added in degrees and divide this by 2 to get the degrees of engine offset required. Alternatively and what I do sometimes is to keep the thrust angle neutral and instead add a mix of throttle to rudder on the tx so that the rudder is applied as the throttle progresses until a straight upline is achieved. This also produces straight downlines with the throttle off. This is quite useful where the cowling exit dictates the angle of the engine exit for prop and spinner alignment etc.

Differential
Aileron differential is required where the drag on the down-going aileron does not match the up-going aileron. Usually because the pressure on the underside of the wing is greater than the top causing greater drag on the down-going aileron and the roll to be barrelled rather than nice and axial. Getting this right will make your rolls and point rolls look much nicer. Planes with fully symmetrical wings such as your aerobatic and 3d types are not affected as much as the wing profile does not generate lift in the same way.

Most modern computer radios allow differential to be added easily using a dedicated differential setting or adjusting the end point (ATV) on the downward aileron. This does

assume you have one servo per aileron however. If not then you have to play with the control horn positioning on the servo until the geometry gives you more up aileron than down. To check if differential is needed fly away from yourself and pull a 45 degree upline into wind. Roll to the right using full aileron deflection. If the plane drifts to the right then you have too much down travel on your ailerons and if it drifts to the left then too much up travel. Adjust the differential on the ground and try again until the model tracks straight in the roll.

Mixing
Next we can apply various mixes to trim out the affects on the rudder on pitch and roll of the plane so that the rudder only causes the plane to yaw when applied.

Rudder to Aileron Mixing
Check if this is required by carrying out a flat turn with rudder only to the left. The model should just yaw with no roll. If it rolls to the left which is quite likely then create a mix on the tx of rudder to aileron of around 5% to start with. Most computer TX's have these mixes as defaults so are easy to setup. What you should see on the surfaces is a small amount of right aileron being applied when left rudder is applied. Fly again and keep adjusting until the roll stops. Repeat this process with the right rudder, it probably won't be the same amount of mixing as the left due to the engine torque affect.

Fine tuning the amount of mixing of rudder to aileron can be achieved by flying the plane on a knife edge and checking whether the plane rolls out and in which direction. Do this on both sides using left and right rudder until the plane is neutral in roll.

Rudder to Elevator Mixing
Most planes will need this. Again start with a flat turn using rudder only to the left and see if the plane descends or climbs. If it does then add a mix on the TX of rudder to elevator so a small amount of correcting elevator is applied with the rudder. Again around 5% to start with and try again until a flat turn is achieved without a change in height. Repeat with right rudder.

Fine tuning the amount of mixing of rudder to elevator can be achieved by flying the plane on a knife edge and checking whether the plane pitches to the belly or canopy. Again do this on both sides using left and right rudder until the plane is neutral.

You should now be able to fly a flat turn without rolling or changing height! This has major advantages in manoeuvres that use a lot of rudder including knife edge flight and rolling circles but also the more basic ones such as a stall turn where the plane will now turn back to the downwards vertical without rolling or pitching out. Hesitation rolls will also now be much more axial.

Conclusion
Correctly setting a plane can take sometime, normally around 15-20 flights, which can seem quite laborious but once correctly done is well worth it. Not only will your flying

look much nicer but learning new manoeuvres will be easier to achieve without having to fight the plane. Those slow rolls and the bunt on the B test become easy all of a sudden!

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