Mechanical Setup of Control Linkages by Sherman Knight

Quote:

Originally Posted by **freechip**
All my trims are always at zero, I set mechanically. Any trim changes is clearly visible when I power on my tx. I recommend you always trim mechanically.

Freechip is spot on. Features like subtrim and FM trims allow you to make an incredible amount changes in the radio without paying attention to the mechanicals. Unfortunately, not paying attention to the mechanicals winds up with opposite controls like ailerons, acting differently. Each mechanical involves converting a rotary movement to a linear movement. Differences in starting angles relative to the output, changes in the radius of the arc, different length linkages and a bunch of others results in a motion that you may not be able to remove with the radio. An example is aileron differential.

The mechanicals in the aircraft, if setup for it, can create differential. There are several methods for accomplishing this. The mechanical method uses an offset rotational not a linear motion, or an angle offset relative to the hinge line to create the differential. The radio on the other hand, uses a linear method to create differential. One cannot perfectly counter or supplement one with the other. If the mechanicals are different, you can still get the ailerons to get close to mirroring each other, but you will never get them to be perfect mirror images.

If you are only concerned with making sure the max "up" and "down" position of both ailerons are the same, you might be missing my point. Max up and max down are just one point of the aileron control surface travel. Seldom do we fly banging the aileron stick from stop to stop. We spend a LOT of time on the stick somewhere in between center and the stop. It is just as important to make sure the no matter where you stop the stick, both ailerons behave the same.

The only way to accomplish this is to start with matched mechanicals.

A very common place to see the conflicts that can occur is when someone buys a used aircraft that was setup with a different brand radio. Rather than take the time to realign the mechanicals, they use excessive amounts of sub-trim or travel adjustments to get the control surfaces to line up. An example would be the plane that required nearly all the sub-trim to correctly position the full flying stabilizer. As a result the elevator now fails to move as far as it needs in one direction or when applying flaps, the elevator compensation mix runs our of available travel.

Never underestimate the benefits of good mechanicals (centering the control surfaces with sub-trim as close to zero as possible) and starting there first. Programming is always easier and there are fewer chances for conflicts if all the mechanicals are mirror images (ailerons or flaps) or control surfaces are properly centered before you start messing with the programming. We are always in a hurry to get out newest project in the air and because mechanicals are often the last thing we do on a new project, it is easy to be in a hurry or just lazy.

Sherman Knight
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I spend a lot of time helping others trim their aircraft. It's fun.

There is a part of my check list that I always run through twice. First thing I do when check out someone else's aircraft is that stick movement matches control surface movement. Not just does it move, but does it move appropriately.

With control surfaces at neutral or centered, I actually say out loud, Left is left and right is right (rudder stick, may take several back and forth movements to check for appropriate throw), than left is left and right is right (ailerons, may take several back and forth movements to compare for appropriate throw and aileron to rudder mix is correct) and finally up is up and down is down (again, may take several back and forth movements to compare for appropriate throw).

Then after messing around with modifying linkages, adjusting CG, locking down batteries, battery charged and so on, I do it all over again before I step up to the winch. Nothing is worse that crunching someone else's plane. So going through the steps is rather automatic with someone else's plane.

It is amazing to me, how easy it is to skip this step when we fly our own aircraft.

Most of my contest sailplanes cost upwards of $3500 (including electronics) so I don't ever skip this step. Well let me take that back, there were two times and both wound up with totally destroyed aircraft. Both times I was distracted by someone asking for help on something right before launch. I shut down and helped them out. Then to show them an example of what they were questioning me about, I grabbed my plane and stepped up and launched. I was in a hurry, did not go through my check list, and forgot to turn the power on in the aircraft.

Those days really hurt.

I step up to the winch with my own aircraft that I have flown hundreds of times, I now do the left is left, right is right and up is up and down is down. Saved my you know what the other day. I was experimenting with some programming ideas using one of my contest ships the other day on the bench. I was called away for dinner and never got back to finishing my testing. AND never rebound to my template I use for flying.

The quick check may have saved me a load of money.

When something could have been avoided with a simple pilot initiated ground check, the reason for the crash is always "pilot error."

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