Basic tuning your sailplane

First we'll take a look at servo linkage mechanical setup.

Next we'll tune the pitch axis.

Then we'll tune the roll axis.

Basic tuning your sailplane

- Setting up your sailplane for best performance considering your flying skills
- We'll look at setting up a RES plane for best combination of stability and performance.
- These basics apply to all sailplanes even the top of the line full house planes.

- But first some comments about older planes you may already have:
- Design has dramatically improved with time. Much research has been done about airfoils, physical structure, and aerodynamic setup of the sailplane. Many (most??) newer planes are well designed, but there are exceptions. Be very careful about RTF setups. You may not have much latitude in adjusting the plane to suit your needs.
- SO generalizing – newer may be better. Not always but ….

- Listen to what others have to say. "AVA, X-RES, Slite, Yellow Jacket are good planes".
- "The Radian is a good ARF". "The Radian Pro is touchy to fly".
- "Samba is fragile". "NG 2M is touchy to fly and the boom is fragile".

- OK let's get into setup – tuning a RES sailplane.
- We'll look at servo linkage, wing alignment, setting the mean aerodynamic chord, and the
- angle of attack (decalage) of the wing/stab.

I encourage a very precise mechanical setup of your servo and control surfaces. Radio trims should be neutral. Servos should be set up to move a full 90 degrees.
Push rods must fit tightly into the control horn and servo arm holes.
Push rod guide tubes inside diameter must be only slightly bigger than the push rod diameter. The tubes must be securely fastened at both ends.

Control horn push rod holes should be over the hinge line -
except flap horn holes should be well behind the hinge line.

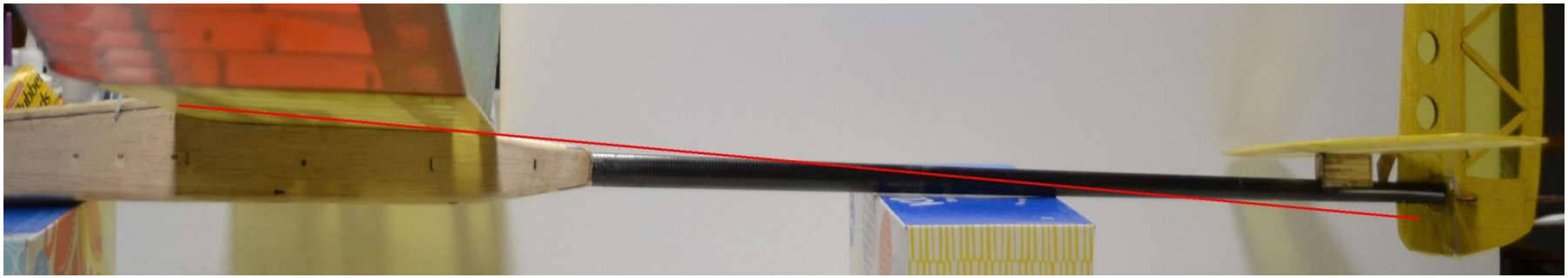
Servo arms neutral position should be at right angles to the push rod.
Mount rudder and elevator servos out of the way under the wing if possible.
This will leave more room up front for receiver, ESC, and battery placement and balancing flexibility.

I recommend that the spoiler servo NOT be directly connected to the spoiler.
It should just simply push it open. When flying, the moving air will push it closed.
I use a small magnet against a screw to hold it closed.

Angle of incidence -- “decalage”

Measured from leading edge of the wing’
Not the bottom of the wing

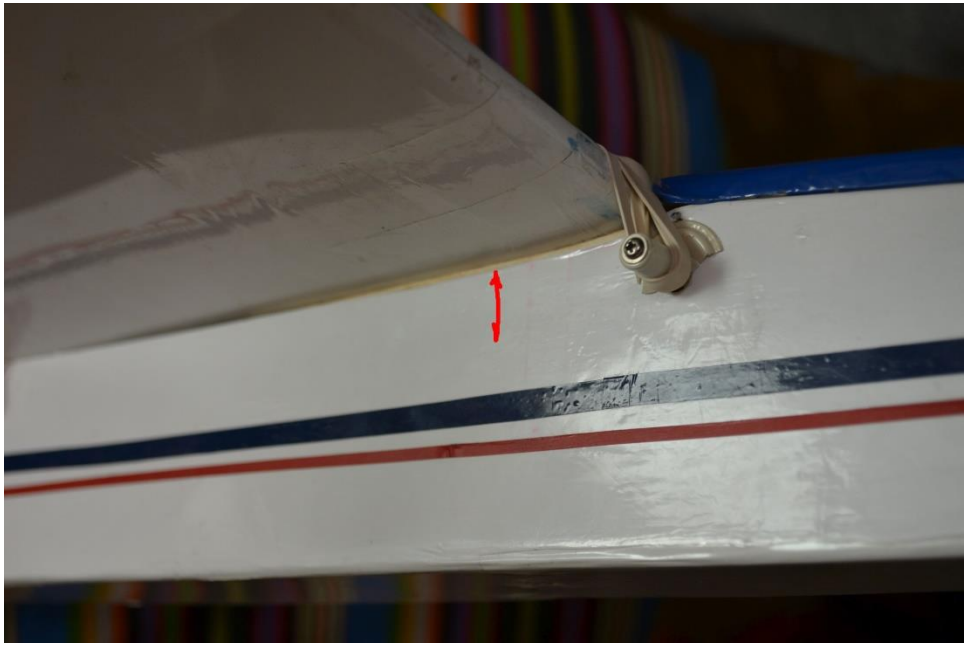
Note elevator in line with stab



All other things being equal – less angle means flies faster

Important: When building the plane take great care to get the stab parallel with the center line of the boom to minimize drag and achieve the designed decalage.

This is my trainer plane.
I wanted it to fly slower to make it easier for those leaning to fly. So I increased the decalage by shimming up the front of the wing.



Adjusting the center of gravity to achieve desired stability and speed.

(try the manufacturers recommendation first.)

Important: this is tested with the elevator at neutral position.

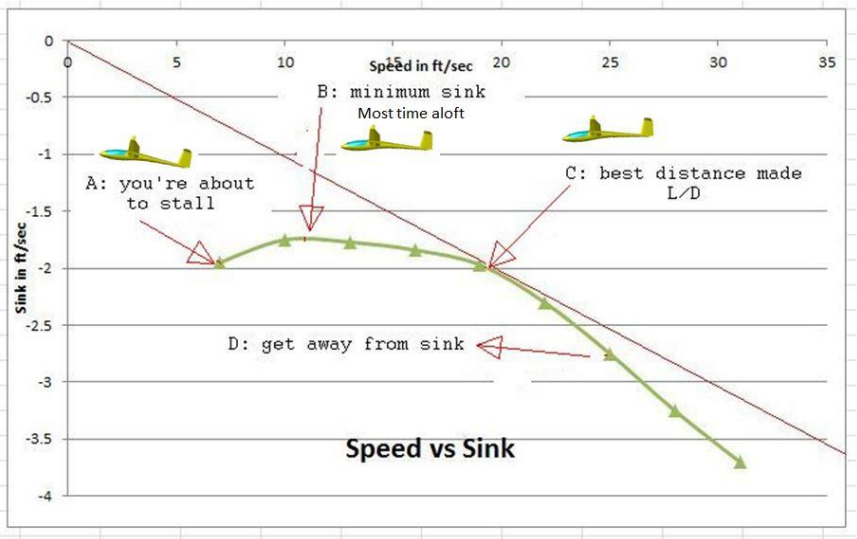
I use a dive test. Dive the plane to about a 45 degree down angle.

Let go of the stick.

If the plane continues to dive towards the ground the CG is too far back.

If the plane pulls up quickly the CG is too far forward.

If the plane very slowly pulls up perhaps this is right for you.

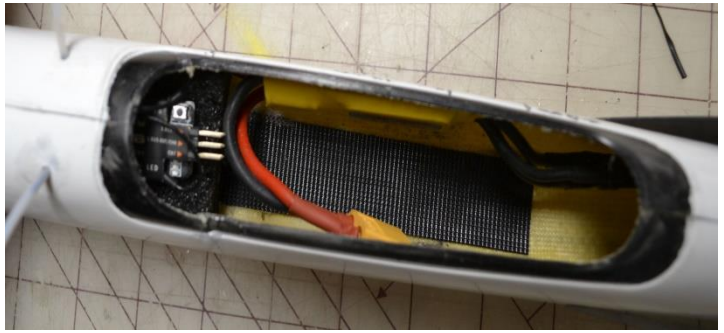


B: sink = -1.75 ft/sec so from a 500' launch height you would be on the ground in 4.76 minutes and traveled 3135 feet

C: sink = -2 ft/sec so from a 500' launch height you would be on the ground in 4.2 minutes and traveled 4500 feet

Hopefully the decalage angle along with setting the CG as above will result in a good cruise speed – see C: in the graph.

?? Why do you want to fly at that speed?? Let's discuss it.



Adjusting your CG :

Move your battery position.

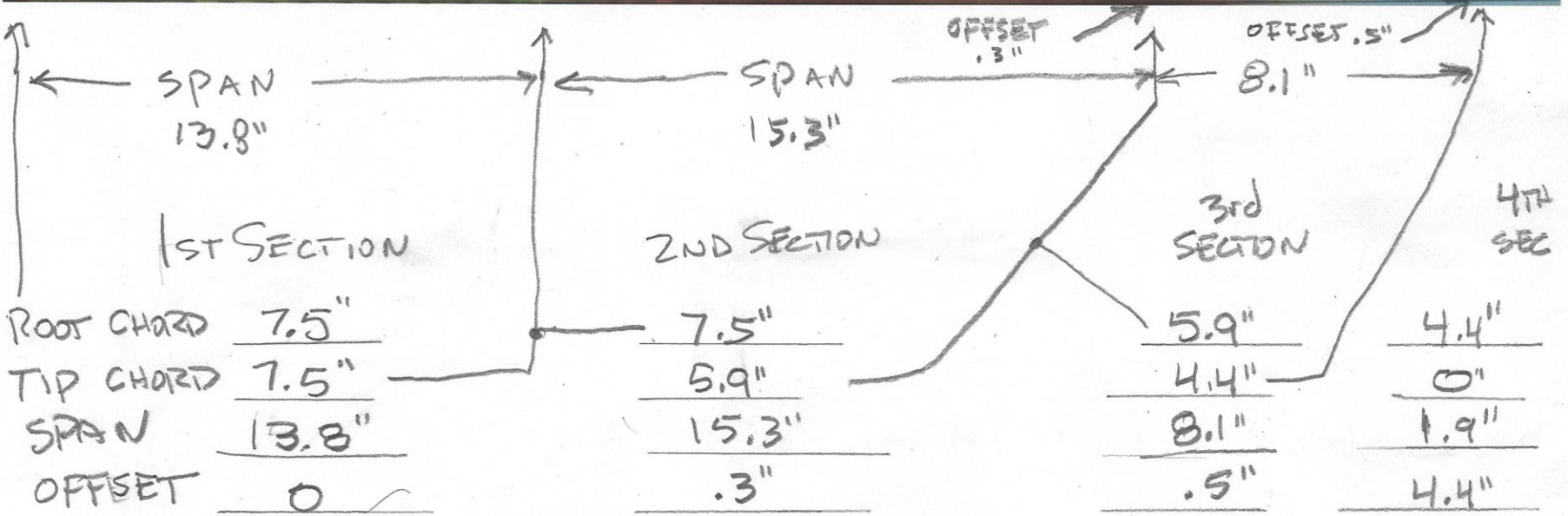
Rearrange your fuse pod setup to accommodate battery further back or forward.

Use a heavier or lighter battery.

Add nose or tail lead weight.

I recommend that with a sailplane you start testing with the CG at 38%
Of the MAC (mean aerodynamic chord).
(flying wings start at 15% - power planes start at 25%)

Balance box makes measuring balance simple.



Determining MAC – I have a program on an Excel spreadsheet. Just need these measurements.

AVERAGE CHORD (MAC) 6.7" OFFSET .18" FROM FRONT OF WING AT FUSE

START HERE WITH CG → 38% = 2.7" DISTANCE FRONT OF WING AT FUSE

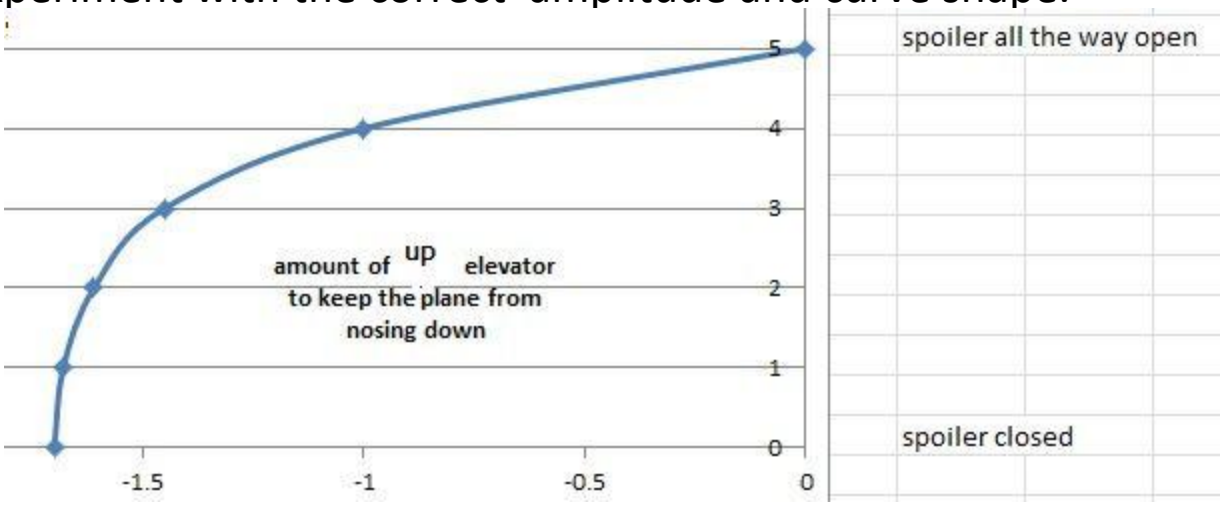
40% = 2.9"

Spoiler or flap elevator compensation tuning.

The goal is that when the spoiler is opened to any degree
That the sailplane continues on the *trajectory* it was headed
and simply slows down.

When the spoiler is first opened it will require up elevator compensation.
As it is opened further it requires a lessor increase in the compensation.
i.e. The difference between 80 and 90 degrees of open does not require
A significant increase of up elevator.

So if you can program the elevator compensation with a curve you can
Experiment with the correct amplitude and curve shape.



How about the other flight axis of our sailplane?

Here's a test: with the rudder aligned with the vertical fin
And the elevator aligned with the stab – hands off the sticks.
Does the plane do even a mild left or right turn?

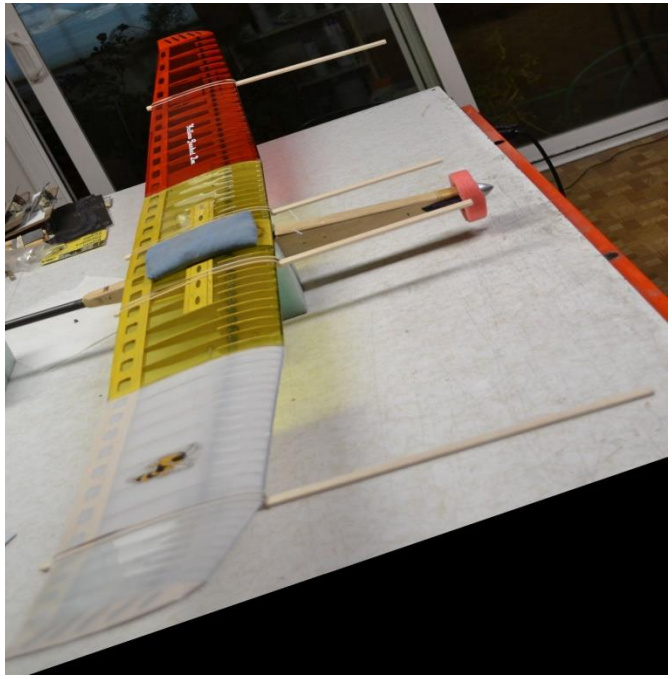
If the answer is NO then all that you need to check is the wing tip washout. The back of the outer wing sections should be mildly raised compared with the main wing. This keeps the outer wing flying longer if the main wing stalls so the plane continues straight ahead during a stall.

If the answer is YES then there at least 4 things to check for problems:

1. Is one wing heavier than the other.
   Check by balancing along the fuse/boom centerline
   Add lead to the opposite wing tip to correct.
2. Is the wing at exactly at right angles to the boom? If not fix it!
3. Is the vertical fin exactly lined up with the boom centerline?
4. Is the wing warped??

CHECKING WING ALIGNMENT

	wing front		wing back
r-outer	183	▲ 7	190
r-fuse	125	▲ 4	121
l-outer	183	▲ 12	195
l-fuse	124	▲ 2	122



So left outer is probably too much washout.

Compare with right outer which is about right.

This will cause a mild left turn which is compensated by right rudder trim.

The plane would perform better and be more stable if the tip washout was the same.

(Delta number are in mm and are just the difference from the front of the stick to the back of the stick.)