Gordy's Travels #2

Does Your Tail Hang Down?

Understanding Nose Weight, Lift and Sink

I have been traveling (soaring) the Ontario area of Canada lately and I met another couple of guys who I wish were part of my Club. Scottish Canadians with Austin Powers accents, who happen to be flying Stratos and Extreme molded open class sailplanes. Both these guys are talented modelers and contest winning records with years of experience, so like your local 'top guys' its assumed that they understand air and sailplanes.

I was explaining my method for balancing a sailplane (see "Gordy's Balancing System") and one of the gents mentioned that when he had his plane balanced close to neutral, it would 'hang its tail' and mush….And he thought that was a bad thing. He thought that by adding weight to the nose, it was solved. I knew he had things backwards but I figured it would take some convincing to get him to believe otherwise. So I asked if I could do a few hand tosses of his plane to see how it's trim and balance felt to me.

The first toss was as expected, an immediate 'balloon' from the speed of the initial toss, then a quick drop of the nose, lots of stick corrections needed to get it flying on its own and the usual sharp glide angle to the ground. I tossed it twice to confirm what was causing the action of the sailplane.

It's nose weight caused a need for up elevator in order for the plane to fly level (at cruising speed). That up elevator is what caused the initial ballooning on the toss, the loss of airspeed at the top of that balloon meant a loss of authority of the elevator, which meant no ability to hold the weight in the nose. The weight in the nose causes the deep glide angle (and high landing speeds, ESPECIALLY with the use of flaps).

None of that sounds beneficial to getting our contest times or creating a sailplane that can indicate and take advantage of light lift, or is easy to 'drive' into the 100 point spot…and it isn't.

So what about the 'hanging tail'? Let's take a look at the model again. Consider the 'balance point' of the model to be the 'teeter point'. The nose weight being a 'heavy kid' and the tail being a 'light kid' sitting on a teeter-totter (fuselage) with one side longer than the other. The wing as a sort of 'dampener' that tries to hold the fuselage level …as long as the uneven teeter-board (fuselage) is balanced just right on its back.

If the fuse (with rear parts) is set just right on the wing it's easy to get that wing to move to tip in either direction.

Now be careful here, don't get confused with this analogy, the light kid (elevator end) has the ability to change his weight! The light kid is our elevator and its 'lever' strength (authority) increases with airflow (speed).

So lets go back to the teeter-totter, lets say that in at the 'average' wind speed the kids are balanced parallel to the ground, but as the wind increases the light kid drops, the heavy kid goes up. As the wind decreases the heavy kid drops, and at no wind speed the heavy kid BANGS into the ground for a butt busting jar. (If it's our sailplane the nose breaks off and the tail boom snaps!)
The light kid's (elevator) weight changes with airspeed because he can only keep his heavy friend from dropping to the ground and the 'teeter-totter' level while at a specific airspeed in this analogy. Since he is our elevator, our elevator has some 'up' in it so that at that specific airspeed it can hold/match the weight of the heavy kid (nose weight) on the other end…keeping the board/fuselage level.

Lets not forget that wing and its desire to hold an angle of attack (its relationship to the ground). As we know when we put our hands out the window of the car on the highway, when its edge is held parallel to the airflow it slips through the air fairly easily, but when tipped up there is a violent reaction. It takes an effort to hold it from tipping violently up or down. I didn't say a LOT of effort - I said AN effort. The lengths of the front and back of the fuselage act as the controller for the wings pitching (tipping) movements.

So since the wing needs a mechanism to keep it from uncontrolled attitude changes, the fuselage acts as a movement dampener. The Elevator acts as the attitude controller. If those things are true, then it is the nose and tail moments that most effect the wing's 'tipping' response, or lack thereof. It is not intended to provide 'control'. Proper nose weight is set to determine an optimum degree of average wing angle of attack… and the elevator is there to provide directional control… not dictate average and optimum angle of attack.

Okay so maybe that's not strictly scientifically corrects but in general that's the reality… in our use.

IF we have a full flying stabilizer and a 'balanced' sailplane…one that doesn't use elevator angle of attack to CORRECT for needless nose weight.

Back to the Hanging Tail ☺

We all know that when there is lift (energy blasting upwards) it is indicated by our plane's TAILS popping up (not the noses). Its because energy is actually rushing under our plane's wings and tails. Our planes come alive, become lively, speed up, react…in this condition… especially if they are very energy efficient, as in not carrying the nose with the tails. A nose full of lead means a tail that is pushing down in back.

When the air is dropping on TOP of our plane (Sink) they become sluggish, mushy, resist control inputs and the tails drop…. Because the tails are way back there and the air dropping on the stabs push the tails down….and that is not a 'good' thing….it's a GREAT thing.

With an unbalanced plane (nose heavy, cuz you won't be able to fly a tail-heavy plane at all) instead of the tail rising in lift (remember its got UP elevator forcing it to stay down). And dropping in sink conditions (the heavy nose drops cuz of the lack of elevator authority and the whole plane sinks instead of the tail) you get no indication of sink conditions. In fact the plane speeds up, making you think that you are in good air, when in fact the plane is getting airspeed (instead of rising energy) from its nose over fall.

Trim and balance is a whole other exciting part of our hobby, that goes beyond the color of the plane, the foil, span, servos, materials and the air reading part.

So often we hear of a pretty cool sailplane that flies terrible… I never think twice about comments and reports like that, because I have no idea if that plane was trimmed and balanced to its optimum before an evaluation was conducted.

When I hear the comment, "I like to fly my planes a little nose heavy cuz they are 'more' stable… ", I cringe…. Because I know it will be a matter of time before I see that guy's model sitting in a tree, lost down wind, or with a leading edge dent from the guy's shin.

There is never a good payback to flying a crooked sailplane. Don't get me wrong, a crooked sailplane is not a 'tuned to taste' sailplane… to paraphrase Joe Wurts –*I used to fly my planes almost negative neutral because I like the way they indicated the lightest lift. But now that my eyes are what they used to be, I have moved my balance point so that my plane is not as reactive to lift as they used to be. It lets me relax some when my plane is way up and out.*

Notice he didn't say nose heavy. Balanced to taste AFTER finding the balance point definitely affects the efficiency of the sailplane, but the benefit far exceeds the loss.

Go back and read Gordy's Balancing System, find your planes optimum balance point and then 'tune' from there. It's the journey that's the most satisfying, not the destination ☺!

See you next trip!
Gordy Stahl
Gordysoar@aol.com