When we look at the elevons when using as elevators, moving up the elevons will result in upwards movement (turn) of the wing glider (the negative lift component increases and overcompensates the CG force -> leading edge of wing will tilt up), while moving down the elevons will result in downwards movement of the glider (the negative lift component doesn't compensate the CG force anymore and leading edge of wing will tilt down). See thoughts at end of this text as well.

When we would introduce rudders on the fins and want to make a right turn, both rudder flaps will have to move to the right. The right rudder will produce a force to the left and drag. Take into account the arm from the CG to the rudder, this will produce a resulting torque that will turn the glider clockwise. The left rudder will also produce the same forces and drag as the right rudder. However, the resulting force will be more in line with the arm seen from the CG, incorporating less torque as a result and may even have the opposite effect when the drag component takes over from the left force component, resulting in a left curve. (This may explain the earlier comments from mhodgson to use differential rudders, outboard moving less than inboard, or not at all. Thanks for that input)

Some further thinking:
If we apply the elevator behaviour to the elevons when in use as ailerons in a right turn (right elevon down, left elevon up ), there must be a sort of twisted force on the wing, equivalent to the forces as described when the elevons are in use as elevators, where the right wing wants to turn (tilt) upwards and the left wing want to turn (tilt) downwards. And this and the possible effect of it, I can't place at the moment.

You asked about dihedral. I've converted several free flight designs to fly RC. As a general rule, with no real science to it, I have cut the dihedral about in half. That has worked well for me. This wing would fly ok with no dihedral with elevator and aileron controls, but would not look as nice and would not be so enjoyable to fly with no dihedral.

Regarding elevon movement, generally you need quite a bit more total throw for the combined control to be predictable and effective. Separate elevator and aileron controls work well with less total movement. If you did separate the functions, the aileron surfaces should definitely be on the tip section. If you wanted to fly without ailerons, I'm sure the model would respond to rudder instead, but it would probably not be nearly as predictable and responsive, and also not so enjoyable to fly.

If you are turning with elevons, adding elevator input moves both surfaces equally away from their aileron input displacement. The aerodynamic forces on the surfaces create moments about the CG.

I think it's getting clear now. Disadvantage of this wing is that you need 2 servo's for every function, so from just 2 for elevons setup only to a total of 6 if you would end up with ailerons, Elevators and Rudders. Sure I will keep the dihedral, as I want to build the model as close as possible to the original design. Adding servo's to the rudders is quite easy to construct, for the elevons a bit more difficult, but I have to admit that it is the first time for me to build a plane with ailerons, so that may play

a factor too. I want to give it a try to keep the elevon controls invisible and may split them in ailerons and elevators. In that case, I am thinking of having a carbon rod through the aileron and elevator surfaces and hinge them on each end of them. Ending up with 3 hinge points total per wing tip

The differential rudders was based on the experience of a fellow flyer (Dave Jones here in UK) many years ago when he built a rudder/elevator plank style wing with tip fins rather than a central rudder. It would only turn properly with the differential was added. It handled as well as having a central fin.
Your hinge idea would work well, though keeping the gap as sealed as possible may help improve control effectiveness. But then I have always used tape hinges for simplicity and gap sealing.

How do you get differential rudders, I mean how do you get the rudder travel differently? Is it a Tx/Rx combination matter? I have a spectrum DX6i.

To stick as much as possible to the original design, the elevons (or whatever I will go for) will have unsheeted (see through) ribs and a trailing edge when hinged just behind the rear spars. So, I need a leading edge (spar) too (or a carbon rod that will act as axle for the elevons), depending on the hinge design. So whenever I want to apply RDS linkage or an alternative hidden linkage, the linkage will cause problems as it has to go through the leading spar or through the carbon rod, weakening the construction. Any solutions for that?

California Condor
I have built several Sailwings going back to the free flight days powered with pylon mounted 1/2A engines. The rudders do almost nothing. Turn both outward to help directional stability.

Thanks for the input Eut,
That makes me thinking I have found the solution for getting differential rudders. If in the neutral position, the rudders are pointing both outwards, when turning right, the right rudder will move further outwards, causing more left force and drag (turning the wing to the right), while the left rudder will point less outwards and also producing less drag and vice versa. It's a matter of trimming and no special Tx/Rx setup or mixing is required.

Now, about your experiences of your elevons setup. Were they effective Eut? And what linkage did you use to control them from your servo's,
thanks, Michael

The elevons worked normally.

Well, there you go, Michael  . Check the 2x sailwing picture in post #11 for the size of the elevons (and the outward pointing rudders? This is not too clear on the picture) . Looks like a perfect starting point to me .

Edit: Did you also notice the diagonal bracing in the middle of the wing (between front and rear spars)? Probably a good thing to do as well.

I was planning to add these diagonal braces as well for strength and the looks.
As the rudders concerned, I will make them at least trimmeable, so that I can adjust them more or less outwards.

I either need to go for hinges fixed out of the centre (top side of the wing) to enable hidden linkage for the elevons, or centered hinges with conventional linkage. I will hinge behind the rear spars, so I will get bigger and more effective elevons. Still not sure whether to split them into elevators and ailerons or not.

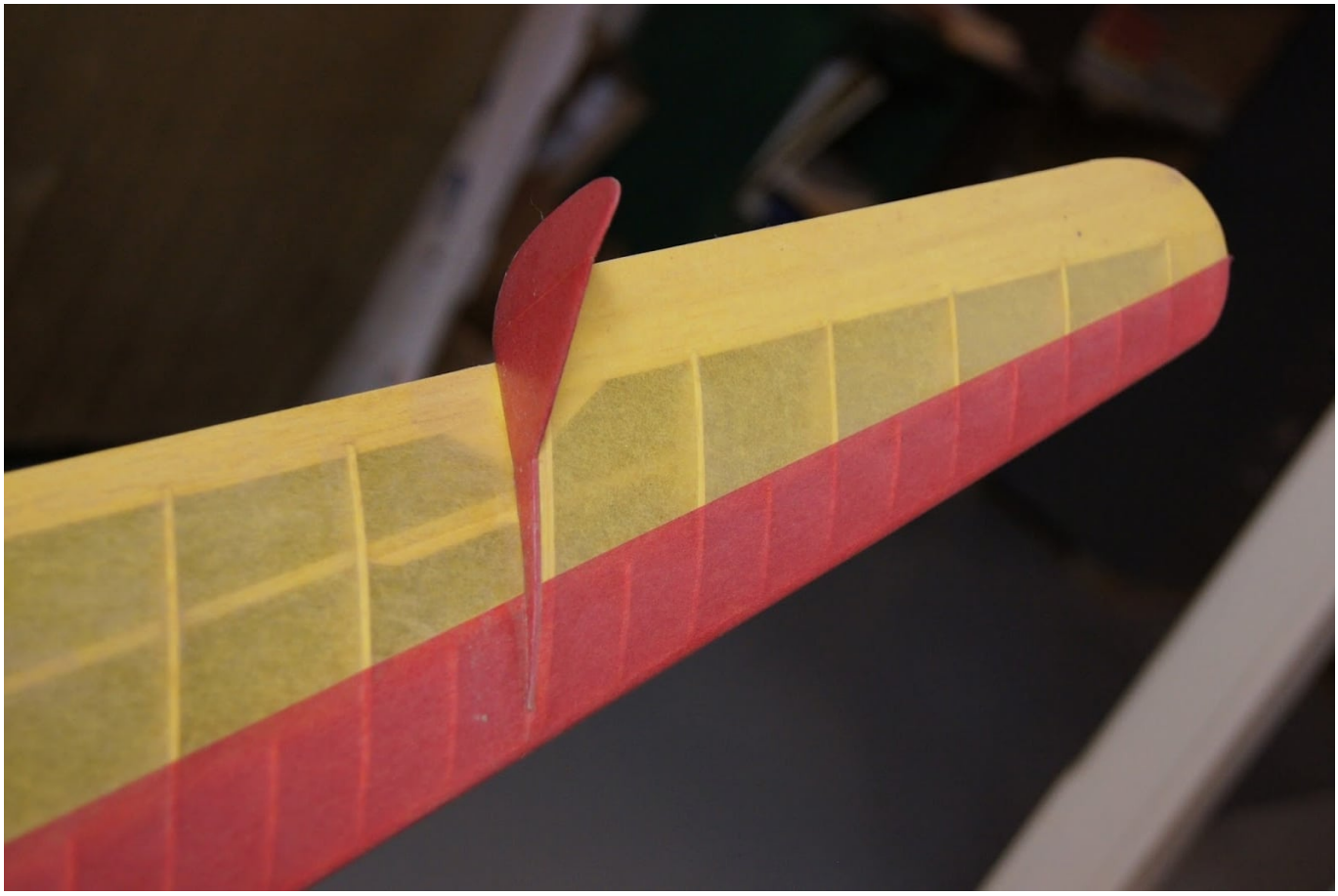
If I would use seperate ailerons and elevators:
when using up/down function only, it has no added value, both elevator surfaces will point down/up. As they are ony half of the surface, they need to travel more to create the same effect as with elevons only. Only disturbing the airfoil more and causing more drag.

when using ailerons only, it has no added value either, one surface down, other up or vice versa. Same story about half of the surface as with elevators, requires them to travel more to create the same effect as with elevons. Disturbing the airfoil more and causing more drag.

when using both functions, elevator and ailerons, one wing side ends up with both flaps pointing down or up, while the other wing side will have the aileron and elevator flap pointing at opposite directions, only working against eachother and just creating drag.

I think I will go for elevons as initially planned, but however, we had an interesting discussion here and the decission motivated clearly.

Currently I am adding the leading edges to the wing structure before I will start with the elevons. I am going to apply the idea of using spruce spars (45 degrees twisted) on the leading edges, covered with balsa to enable easy sanding and rounding of the leading edge. Pictures will follow later.



Here is a picture of someone who built the original 50inch (I suspect a free flight) version, and what you see here is that the (inboard) rudder is pointing outwards. I think just on one side to get the glider flying in a circle. Nicely built though.

I have added the leading edges to the wings of which I will post pictures later. Regarding the elevons, I have decided to go for single elevons for several reasons, which I explained already before. Concerning the linkage to the servo's I think I will go for the following hidden construction, see video link.

The servo will be placed between the front and the rear main spars. A carbon rod will be connected through a ball joint with the servo arm. This rod will lead through the rear main spars into a alluminium bush which is glued into the elevon flaps. If the servo arm moves downwards, the elevon will move upwards and vice versa.
see
https://youtu.be/XXgStUbZRio

I still have a problem to solve. In neutral position, the servo arm is not exactly 90 degrees on the servo itself. I have 4 of these servos and only one servo makes a nice 90 degrees. How to adjust the alignment of the elevons in this construction? With push rods, you can turn in or out the pushrod so that the flaps, rudder or whatever are in neutral position.
The problem is more complicated because I need to align the 2 servos used for the elevons.

Some servo brands only need to have the arm removed and repositioned 90 or 180