Analyzing Martin Weberschock's Launch setup.

A theory by Marcus Stent

This is basically my opinion on how Martin Weberschocks sets up the Launch Mode of his F3B glider. This was deduced by listening to his lecture in 2000 and applying my learning's from the XFoil program (Profili 2). Please feel free to make comment on my observations

Step 1.
The towhook for Launch Mode is not dependent on where the C.G. is, but rather where the Aerodynamic Centre of the model is located. This is because during launch we add an external force to the model (the winch) which adds probably 50Kg of force to the Model. This force needs to balance with the Lift force of the Wing, so we get a smooth launch, and this Lift force is generated at the Aerodynamic Centre of the model. The fact that there is a 2Kg model stuck in between these two huge forces is just about irrelevant, and weather the 2Kg mass is 5mm forward or back is going to have even les effect.. The mass of the model is just along for the ride. As you can see the relationship between the line tension (set by the towhook) and the lift of the model (located at the Aerodynamic Centre) are the most important factors.

Step 2.
What the C.G. does do to the launch is to change the elevator trim position that you fly with. E.g. Lets assume that you are flying in Thermal Mode and you have two identical models with a fixed towhook and flap settings. Then you set up Model 1 in Thermal Mode to have a forward CG of 30% and therefore some up trim (e.g. +2%) is required in the elevator to compensate for the forward CG. Model 2 is set up with a rearward CG of 40% and therefore you have some down trim (e.g. -2%) to compensate for the rearward CG. Both models fly around in Thermal Mode very nicely `balanced'. So then what happens during Launch mode is this: Model 1 with its up trim (+2% from the Thermal Mode) during launch (because we use the same elevator settings for our Thermal Mode as we do for the Launch Mode, don't we!) so the plane pulls hard and wants to tip stall and every one yells "move the towhook forward!!". Model 2 is exactly the opposite and the down trim in the elevator (-2% from Thermal mode) causes the plane to launch very flat and every one shouts "move the towhook back!" What this shows is that two identical planes can end up with two different towhook positions depending on where you set the CG, but what we learnt from the Step 1 is that the Towhook should be set relative to the Aerodynamic Centre of the model and not the CG. So how do we fix this? I am glad you asked.....

Step 3.
What we need is an independent elevator setting that gives us the best balance for Launch irrespective of where your elevator trim is during Thermal mode. We start by looking at the theoretical polar of an airfoil with a high flap deflection (15 degrees) and you will see there is only one optimal Lift position and this corresponds to a specific angle of attack.
Too much angle of attack or too little angle of attack and the Airfoil generates lots and lots of drag. So if we can find the optimal angle of attack (elevator pre set) for this flap setting, then we will have the optimal launch. To do this, fly around on the slope with your

model in Launch Mode (Launch flap set at say 15 degrees) and adjust your Launch Mode elevator preset (or angle of attack) until the model fly's around without stalling or diving. By doing this you have found the best angle of attack for the airfoil with 15 degrees of Flap. This new elevator setting you have discovered is making the wing work at its optimal angle of attack. What you are doing is matching the practical behavior of the model to the theoretical polar. Eg because you have found the best angle of attack (elevator preset) by flying around, you must have found the best angle of attack on the theoretical polar. Too much angle of attack and the plane gets draggy and stalls, too low an angle of attack and the plane dives and loses height, just like the theoretical polar. You can then play with different flap settings and find the optimal elevator preset for each one. Then you will have a table of Flap settings with their corresponding optimum elevator presets.

Step 4.
Now you can take a model that you know has the best setup for that particular flap setting (Flap and elevator setting from Step 3) and apply the 50 Kg of Launch loads to the system. Now, it is a matter of matching the towhook position to the Aerodynamic centre of the model (remember Step 1) by moving the towhook back. As you move the towhook back you will eventually find the spot that lies under the Aerodynamic Centre and the model will be balanced and you will get a smooth launch. What you also know is that this combination of the Flap and the elevator preset that you discovered in Step
3 is giving you the most efficient Lift and this should result in the best launch.

In Conclusion:
We are using the same principle here as we do when we change into camber mode when we are thermal flying. E.g. you are flying around with a nicely trimmed model and then you 'flick' into Camber mode which gives you 2mm of thermal flap. What happens? The model pitches up, stalls and comes down quicker, until we add a little down elevator pre-set and find the new 'optimum point' between the flaps and the elevator.
In a nutshell: "Finding the optimal Launch setup is like finding the optimal thermal setting, the only difference is there is 50Kg of concrete hanging off the bottom of the plane in Launch mode"
In both cases you want the best combination of flap and elevator setting to keep you up the longest.

All the best with your launch setup.

Marcus