

## WINCHING

Since I took over the job of Accident Investigator for the BGA I have become increasingly concerned over the number of accidents we have been experiencing in the early stages of winch launches. Some of these have been accidents involving aircraft with an instructor on board – usually then attributable to slowness to take control – some of early solo students, but far too many are of pilots with some experience of gliding, but who make mistakes they should have had trained or tested out of them.

I read so many times of:-

- a. “I rotated into the climb and when the power failed, I found I had insufficient speed to prevent a heavy landing.”
- b. “The launch appeared slow and I decided to release. I was too low to regain a safe airspeed and could not prevent a heavy landing.”

Who is checking these pilots at regular intervals on their winching technique? Very often the remedial action recommended is for “additional training in launch failure technique”. How wrong can you be? They need to be re-trained in the technique of winching correctly before anything else.

### What is a safe airspeed?

As we rotate into the climbing attitude on a winch launch, despite no sensation of any increased load through our bodies, the wing load increases.

The pull of the cable can be resolved in two directions relative to the attitude of the glider. During the ground roll, the horizontal pull of the cable is virtually in line with the fore and aft axis of the glider and therefore is almost purely an accelerative force. As long as this aircraft attitude is maintained (within a few degrees) then the accelerating force remains after lift-off. There is only a very small component of this force operating at right angles to the fore and aft axis.

However, when after lift-off, the aircraft is rotated nose up, then the accelerative component of the pull force is reduced, and the component at 90 degrees and downwards to the fore and aft axis of the glider increases. This downwards component can again be resolved into (true) horizontal and vertical components. The vertical component then adds to the weight of the glider and this is what causes the increase in wing loading and hence stalling speed ( $V_{stall}$ ).

Regardless of height above the ground, the higher the nose position, the greater becomes this component. The rate at which  $V_{stall}$  increases depends on the rate at which the wing load increases. (Passing 30 degrees nose up - relative to the cable - it can increase to 150% of the normal ‘1g’  $V_{stall}$ . i.e., the stalling speed of a Ka13, a Std. Cirrus, a Pegasus etc. increases from 34 kts to as high as 51 kts.) If we therefore rotate at a speed only marginally above the ‘1g’  $V_{stall}$ , thereby restricting the acceleration of the machine, the increasing stalling speed will overtake our actual flying speed and when that happens, the aircraft will stall.

A rotation before a safe flying speed has been achieved can very easily precipitate this event. The reason I emphasise this point is that pilots are quite used to approaching stalling speed by reducing airspeed, but the concept of a steady or slowly increasing airspeed being overtaken by a more rapidly increasing stalling speed may be unfamiliar.

**A 'safe' airspeed for rotation into the climbing attitude after a wire launch is one that will not allow the increasing  $V_{stall}$  to overtake our actual speed. The general consensus of opinion is that 'safe' is 150% of the 1g  $V_{stall}$**

The effect of a crosswind.

However, this is not the whole story. The pilots who crash from low level straight ahead in a stalled condition usually walk away from the sad looking glider. What of those who stall and flick? They are all too often carried away.

A recent accident prompted me to exercise the little grey cells. The cable was laid straight ahead of the glider, the belly hook was laterally in the middle of the glider, but the wind was 50 degrees off to the right of the winch direction at about 12 kts. The pilot definitely over-rotated too early, but did the wind have an influence on the flick and the direction of the flick?

The Instructors Manual has a short paragraph or two on 'Crosswind During Take-off', and good advice it is too, but does it go far enough?

Let us look at the situation in the accident. We know, and the pilot knew, that the aircraft was going to weathercock into the wind as soon as the wing walker lets go. The rudder will not become effective until some air is flowing across its' surface, therefore it is prudent to apply anticipatory rudder well before we say 'All Out'. So we have a bootfull of left rudder applied as we initiate the launch. The aircraft swings into wind anyway, because the rudder is initially ineffective. So as it accelerates, we hold onto the rudder to straighten the glider up again, this induces a roll to the left (after effect of rudder) exacerbated by the wind from the right which because of the dihedral, increases the angle of attack on the into wind wing. No problem - right aileron to level the thing up. We are potentially beautifully cross-controlled as we lift-off.

This is not going to be a problem if we a. re-balance the aircraft as soon as possible after lift-off and b. wait to get safe airspeed before we rotate. However, supposing we don't action rebalance, and do not wait for a safe airspeed. Certainly the second failing is all too frequent.

Now it may be some time since the pilots we were talking about early on have been shown this, and they have probably forgotten, but before being shown spins, there is a little exercise called 'changing effect of rudder'. At normal flying speed, application of rudder gives a large amount of yaw, but not much roll, when the same amount of rudder is applied just above the stall, the yaw is minimal, but the roll is considerable. Why? Because the difference in the speed of the air over each wing is sufficient to put the rearward moving wing close to, at or even below stalling speed.

Back to our winch launch. We rotate before we have got a good safe airspeed. The rotation increases the stalling speed – so we are very close to the stall even if we are indicating above '1g' stalling speed, and we still have a bootfull of rudder on. Is it any wonder the glider flicks away from the wind with disastrous results?

Now look at the ailerons. Suppose you do get the rudder off as you lift off. Because of the crosswind there is still a tendency for the aircraft to roll away from the wind (the dihedral causes an increase in the angle of attack on the into wind wing and a decrease on the downwind wing). If you hold on to the aileron displacement as you rotate, the downwind wing has a drooped aileron and the into wind, a raised aileron. The angle of attack is greater on the downwind wing and is therefore closer to the stall than the into wind wing. Increase the wing loading too far and that wing will stall for a second reason - because of the aileron applied. Further, and perhaps more importantly, the drooped aileron causes an increase in drag on that wing (Adverse aileron drag) and a strong tendency to yaw away from the into wind wing.

### Conclusion

Be wise, be thoughtful – avoid becoming an accident statistic. On all wire launches make sure you are well above '1g' stalling speed (150%  $V_{stall}$  is a good figure to make a note of during the 'E' part of your pre-takeoff checks) before rotating into a full climbing attitude.

Remember, after the ground roll and provided the ground roll elevator position is maintained, when the glider has flying speed, it will lift off by itself. Any winch failure during this phase of the launch is no problem – you are still low and in a nice attitude to fly back onto the ground under full control.

Once off the ground and without further up elevator being applied, the aircraft will automatically, under the laws of physics, rotate into a climbing attitude. Further gentle elevator movements should now only be required to control the rate of pitch up. Allow the glider to accelerate through this attitude change with gently increasing height until a safe airspeed is attained.

If you had a cross-wind, use this period to re-balance the aircraft. Get rid of the rudder deflection, put the string in the middle and do a nicely BALANCED turn to allow for the cross wind during the remainder of the launch. Then, and then only gently rotate into the full climb – the rest is another story.

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