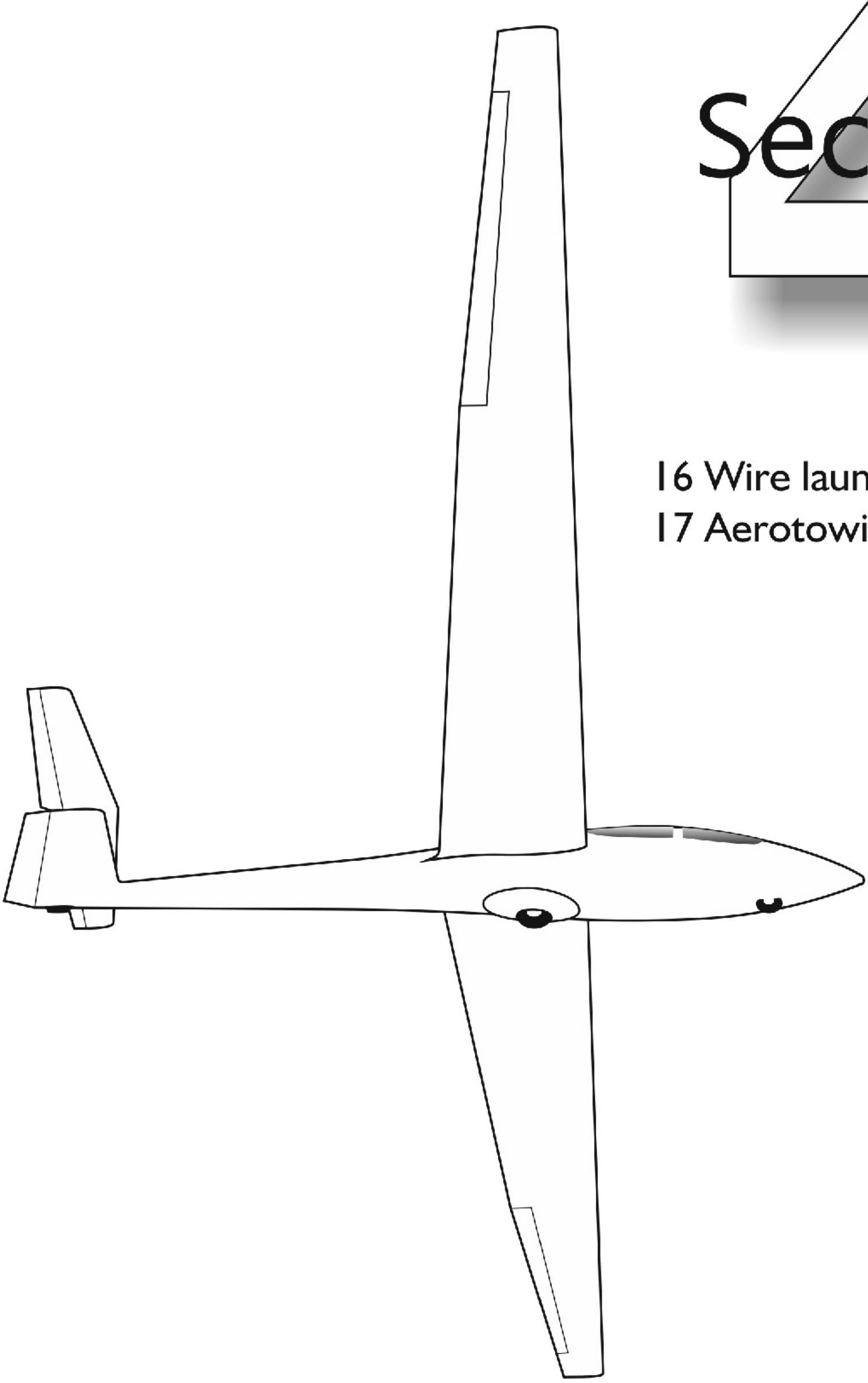
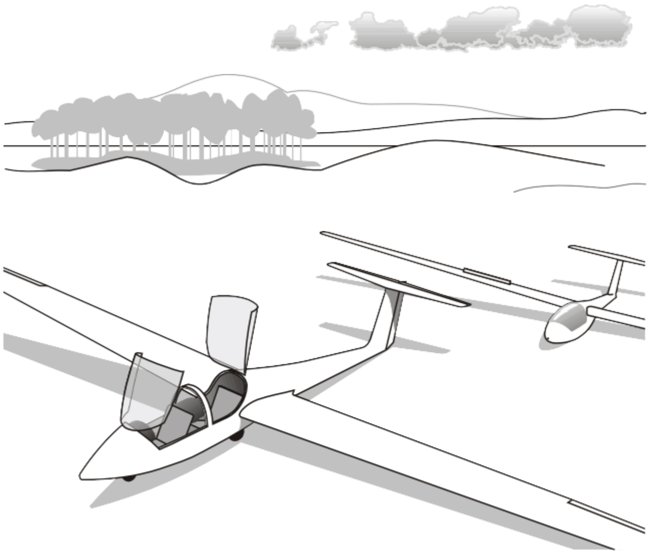
Section 4

16 Wire launching
17 Aerotowing





16 - WIRE LAUNCHING

Before a trainee is taught wire launching he should be able to perceive and control pitch and roll, use the controls smoothly and in a moderately well co-ordinated fashion, and be reasonably confident. Introducing wire launching too early in the training, before the trainee is ready for it, is at best, a waste of time. At worst it can produce a variety of handling and confidence problems which can be hard to pin down, and even harder to put right. In the early stages of training it may therefore be more productive if the instructor does the launches. In unsoarable conditions each extra 200' of height on the launch adds more than a minute to the flight time.

The briefing and flying exercises are divided into three sections, and in order of teaching, these are:

- general briefing, and the full climb and release
- ground run, take-off and initial climb
- launch failures and emergencies.

Formal launch failure training and practice is not appropriate before approach control has been taught. RP techniques and circuit planning have been taught already, and the trainee should be familiar with, though not necessarily competent at stalling and spinning, and be able to distinguish between stalling and reduced G.

The guidance given in this chapter should be used selectively, depending on the equipment, the glider(s), and the site where the training is taking place.

<u>Launch equipment</u>

In still air, modern wire launch systems which use a powerful winch or car, and use strong cable in good condition and with the appropriate weak links, can easily launch any two-seat training glider to between 800' and 900' from an 800yd run; 1100' from 1000yds, and 1300' from 1200yds. Each additional 100yds should add 100' or so to the launch height. Add 50% to these figures for a 15kt headwind component. Attainable launch height does depend on the site, but can be affected also by the use of piano wire rather than stranded cable.

The other variable is the winch's torque control method. Almost all the really powerful (180hp+) winches have automatic gearboxes and hydraulic torque converters, or fixed ratio gearboxes and fluid flywheels. Winches with manual gearboxes, and some that are underpowered, are still in service. Some high powered winches only achieve modest rates of acceleration. It is essential to know the relative performance of the launch system in use at your club and to adapt your teaching methods accordingly. Know your winch!

Compared with the older generation of machines, the heavier GRP gliders add several new factors:

- slower acceleration to safe speed during early parts of the launch
- higher stall speed, giving less margin for error
- higher maximum permissible launch speeds, giving more time to react
- lower drag levels which help, to a small degree, to conserve speed during a cable-break pushover
- by comparison with older gliders, the higher flying speeds lead to larger radius turns.

The physical condition of the equipment has an obvious effect on launching, and the condition of the cable is important. Regular or increasing numbers of inadvertent cable-breaks indicate that the cable/wire should be replaced. When the cable is new a good launch system should have a zero cable failure rate, and less than 1% later on. How long the cable lasts before the failure rate becomes unacceptable may depend on the site; a highly abrasive runway or flinty ground will shorten cable life.

<u>Theoretical aspects of winching</u>

Some of the aerodynamic aspects of flying a wire launch require a good grasp of basic physics, which most of us don't have. The practical result of our ignorance in an area which would seem to be entirely theoretical, is a significant increase in risk - so not that theoretical! In the case of winching, some of the increase in risk is fairly well hidden. These aspects are dealt with below [also chapters 18 & 19], and are best taught in a detailed classroom briefing. An important item relevant to almost every phase of flight, and which usually requires what is, in effect, a physics tutorial, is the relationship between vertical accelerations in relation to the glider, the wing loading, and the AoA, all of which are related to the stalling speed.

LAUNCH SPEEDS

<u>Stalling speed changes and the minimum safe speed</u>

For the glider to climb at all during a wire-launch, the wings must do extra work to oppose the pull of the cable and to provide the initial vertical acceleration during the rotation (<u>figure 3</u>, overleaf) into the climb. In the climb the 'extra work' required - an increase in the wing loading, of which the pilot is largely unaware - can increase the glider's stalling speed by up to 40% of its 'normal' unaccelerated value. To calculate the value of the minimum safe speed which allows for that increase, take the unaccelerated stalling speed (V_S) and add 50%; i.e the 'normal' stalling speed plus half again. For an AS-K13 whose unaccelerated stalling speed is 34kt, say, the minimum safe speed would be 34+17, or 51kt.

It's a slightly different matter for the rotation into the climb. If this is too rapid for the airspeed, i.e. if the vertical acceleration required increases the AoA too much (<u>figure 1(A)</u>, overleaf), the glider can stall. This will be an accelerated stall, as demonstrated by the high speed stall exercise in 18-8, and the glider may then flick and spin. An excessive climb angle can have the same effect, or simply break the cable or the weak link. On low power equipment, climbing too steeply can also slow down or stall the launch vehicle's engine.

The glider's stalling speed also increases progressively - the exact amount is dependent to some extent on the stick position - as it nears the top of the climb. Here, even if the stick is moved fully back, the pitch attitude won't change much, nor will the rate of climb increase (it's already falling), but the AoA will, along with the risk of an accelerated stall. If the stick is well back, the stalling speed can increase by $\sqrt{3} \times V_S$, and not $\sqrt{2}$, as normal. For an AS-K13 this can mean a potential stalling speed of 60kt! The stall would be 'accelerated' even if the pilot only felt 1G, and, as with rotating too quickly into the climb at the beginning of the launch, could result in a 'flick' which would be quite violent if it occurred. This is another case where a shallow attitude, 'adequate speed' and no acceleration obvious to the pilot, can mask a very high AoA [see also chapter 18].

<u>Maximum winch/auto-tow speed</u>

The maximum winch/auto-tow speed is there to protect the glider from structural overload during the launch, as is the weak link. However, the weak link won't break if any additional loads, however high they are, don't act along its length. Bending loads in the wings would be an example. Neither pilots nor 'G' meters are 'aware' of such loads, or the cable tension, because no obvious acceleration is involved.

<u>Too slow or too fast during the launch</u>

Too slow

For safety reasons there is no signal to the winch for 'too slow'. If the launch speed starts to tail-off, <u>reduce the angle of climb</u>. Monitor the airspeed trend, and don't continue in the full climb if the speed is <u>approaching</u> the minimum safe speed. Relaxing the back-pressure on the stick may be enough to cause the winch driver to add more power, or allow a low power or constant tension unit to increase the speed. If so, smoothly raise the nose again. If the speed doesn't pick up, or continues to drop, treat it as a launch failure.

If the speed is dropping, don't hang on in the hope that it will pick up again. The 'land ahead' area will be decreasing. You may also stall. If you're close to the top of the launch, release.

Too fast

The technique for dealing with excessive speed on the launch varies, depending on the launch phase.

In the early part of the launch there is a low risk of an overspeed over-stressing the glider. If the glider isn't climbing steeply at the time the stresses are not much worse than those during an aerotow. However, during the initial stages of the climb, the risk associated with abandoning the launch may be quite high.

<u>Signalling 'too fast'</u>

Yaw the glider with deliberate rudder inputs. Some opposite aileron may be needed to prevent the glider rolling at the same time. The signal needs to look deliberate. The winch driver may interpret slow, or large and untidy yawing movements, as sloppy flying.

In the early part of the launch - 'early' here means up to a height about half that of a normal launch - if the speed approaches the maximum wire launching speed, check first that the climb angle isn't too shallow. If the angle is correct, maintain it and signal too fast. If the speed during this phase is significantly greater than the maximum, maintain the normal climb angle and abandon the launch when high enough to do so safely.

Release with the cable under tension to produce a clean separation between the glider and the cable. Don't immediately lower the nose as you can then fly under the cable and collide with it, or the parachute, or the strop assembly, or all of them. Equally, don't wait too long before you do lower the nose.

Don't try to slow the winch down by climbing excessively steeply. You're much more likely to break the cable, and with some winching systems you'll speed up.

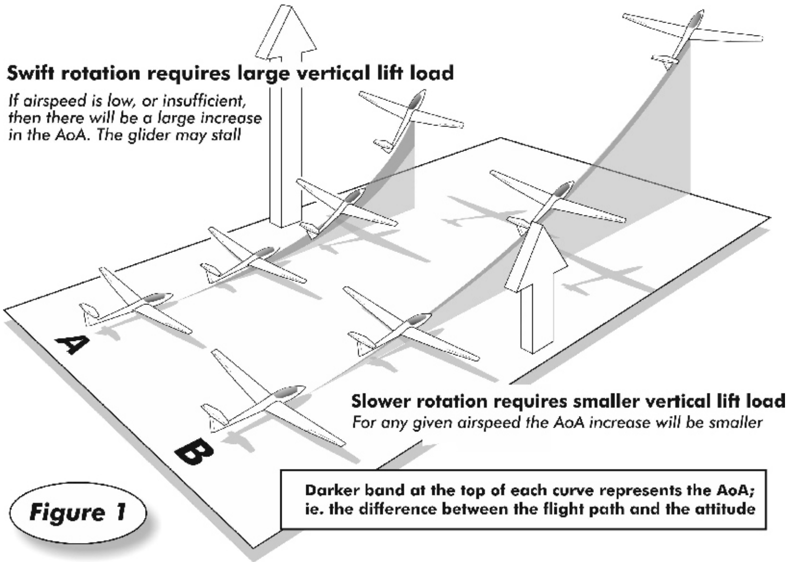


Figure 1

At the top the likelihood of overstressing the glider is increased. If the speed here begins to exceed the placarded maximum winch/auto-tow speed (Vw), it may be better to relax the back pressure on the stick and signal too fast (see box opposite). Relaxing the back pressure reduces:

- the stresses on the glider
- the likelihood of a cable break or back-release
- the possibility of a high speed stall and flick roll.

Continuing to use lots of up-elevator whilst exceeding the placarded limit is not acceptable.

If there is excessive speed during any part of the launch it's important that the trainee doesn't panic, and fail to signal 'too fast' because he believes that he's already too fast to do so! If a serious overspeed occurs in the early stages the best course is to continue in a normal climb to a safe height, and then abandon the launch if things don't improve. The trainee might try to slow down the winch by climbing excessively steeply; don't allow this. The result will depend on the winch system. With some, increasing the climb angle will cause the glider to speed up.

BRIEFING NOTES

<u>General briefing</u>

Wire launching uses a wide variety of equipment, and the piloting technique required can depend on several factors. Amongst them are:

- the power of the launch equipment
- the method of power transfer from engine to wire
- the type of launch equipment eg; winch, auto tow, reverse pulley
- the type of wire being used (stranded or solid), or the properties of any rope being used as a cable
- the type of weak link being used
- the rate at which the glider can be accelerated from rest to a safe launch speed
- the glider's maximum permitted wire launch speed
- the position of the winch tow hook
- the restrictions of the specific site
- minimum safe speeds.

What is taught at one site won't necessarily be appropriate at another.

Pre-flight preparation

Given the rapid acceleration that normally occurs during the first part of the launch, note the following;

- parachutes as back-cushions are fine, but any other packing or padding behind the pilot should be at least as solid [refer to chapter 4's item on straps]
- make sure that:
  - the pilot isn't sitting on soft and/or springy cushions
  - the seat straps are tight enough to prevent him sliding up the seat back
  - he can reach the controls without stretching
- **trim** - set for the selected recovery speed. Choose the recovery speed now, before take-off, in case of a launch failure.

Besides the normal cockpit checks, the following items are also worth considering;

- **weak link** - is it the correct breaking load/colour/type for the glider?
- **hook** - make sure the cable is attached to the correct hook
- **minimum safe speed** - this is the slowest safe speed at which the pilot can allow the glider to be in the full climb
- **launch failures** - the options available from various heights? Also the target minimum speeds
- **cloud base** - estimate this, and don't launch into cloud
- **all clear** - not only above and behind, but also in front
- **swing** - can this be minimised?

Delays after the wire has been attached can be potentially hazardous. Pilots should always be prepared to release the cable if any uncertainty exists. After a long delay the pre-take-off checks should be repeated from the beginning.

Teamwork!

The wire launch involves teamwork between the pilot and winch or car driver. Vague signals or sloppy flying can be misinterpreted. For example, the normal procedure when the launch is a bit slow is for the pilot to lower the nose, to which the winch or car driver responds by adding more power, as he should. However, if the glider is already being launched at the correct speed, but isn't in the appropriate 'correct attitude', the driver may think that it's going too slowly, and put on even more power. The launch then gets too fast.

THE FULL CLIMB AND RELEASE

The trainee will by now be familiar with the pre-flight checks but will need reminding about the trimmer setting, using the correct weak link, attaching the cable to the correct hook, plus the launch failure options and who'll fly the glider if there is one. Demonstrate the full climb and release, followed by trainee practice. Demonstrate the 'too fast' signal before the trainee attempts it. Once the trainee is handling the full climb well, go on to demonstrate the ground run, take-off and initial climb.

The full climb

The optimum attitude for the full climb is a compromise between being sufficiently steep to obtain a high launch, breaking the weak link or having other problems, or ending up low at the wrong end of the airfield.

In free flight the horizon is visible above the nose, but not when the glider is in the full climb. The attitude reference is a choice between the position of the horizon on each side of the canopy, or the angle made by the wings to the horizon. The normal attitude for the full climb is 45° nose up.

Trainees often have difficulty keeping the climb straight down the run, and may wander off to one side or the other. Aiming at a suitable cloud helps maintain the correct track, but if there are no suitable clouds, position has to be judged by the ground visible on each side of the cockpit. This method has the drawback that the 'cone of invisibility' produced by the glider's structure grows as the glider climbs. A long narrow strip can be completely out of sight during the most of the climb. There's no way round this other than practice and familiarity with what the 'right line' looks like in relation to objects which may be well beyond the site boundaries.

The Flying

Once the full climb is established and steady, at a suitable height hand over control to the trainee.

- judge the climb attitude by the angle between the wing and the horizon
- notice the position of the horizon in relation to the sides of the canopy
- keep the wings level using coordinated aileron and rudder, or if there's a crosswind, keep one wing low
- monitor the airspeed trend. If it is falling back towards the minimum safe speed, reduce the angle of climb. If the glider is starting to go too fast, check the climb attitude, and signal. If it is remains too fast, or gets even faster, release
- glance from side to side to check the:
  - angle of the wings in relation to the horizon
  - height above the ground and progress along the site.
- to counteract the downwards pitching moment of the cable - which increases as the glider nears the top of the launch -, more up elevator may be required, but not normally very much. Some older gliders may need plenty of back stick but the majority of modern gliders require little or none. If the glider starts to buck or hunt in pitch - more likely during auto-towing than winching - relax the back pressure.

The release

Assuming no launch failure, try to anticipate the end of the launch from ground references. At the top the nose is being pulled down by the cable. This is one of the clues which tells us that we are approaching the point of release. One of the following will then happen:

- there may be a reduction in the noise transmitted up the cable from the launch equipment, and/or a reduction in airspeed when the driver cuts the power. When this occurs lower the nose into the normal gliding attitude

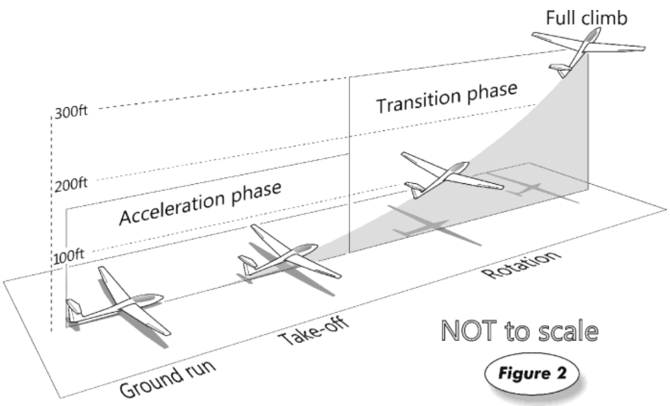


Figure 2

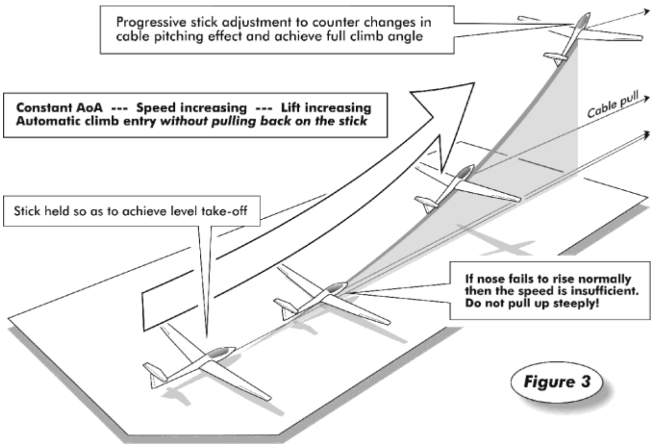


Figure 3

and pull the release twice. This is the preferred method of determining the point of release

• if the winch driver fails to cut the power, and we're at the top of the launch, lower the nose sufficiently to reduce some of the tension in the cable, and pull the release twice

• if the winch driver fails to cut the power and we pass the normal point of release, the rings will back release. In no wind conditions this may not happen until the glider has overflown the launch vehicle, which is then likely to have the cable fall on top of it. This is best avoided. Avoid also hanging on and back-releasing under tension, as it can lead to cable snarl-ups. Piano-wire coils easily and and can be very springy as a result.

Crosswind in the climb

Though maximum height is gained by keeping the wings level and allowing the glider to drift, at many sites the result is the wire dropping onto no-go areas. To avoid this, fly the glider up the launch with the upwind wing held slightly low and the glider yawed somewhat into wind (figure 4). This isn't a sideslip. The glider is flying into the crosswind, in balanced flight, towards the upwind side of the launch run, so that when the cable is released it will fall onto the run and not downwind of it.

On-ground wing drop recognition

During the ground run the trainee may have difficulty recognising when the wings are not level, or indeed when a wing tip is dragging on the ground.

Failure to recognise and react promptly to a significant wing drop can be fatal. Therefore, wing drop recognition should be introduced before the initial winch launch demonstrations.

- Teach the trainee to recognise when the forward picture - and therefore angle of bank - is approaching acceptable limits. Confirm their ability to comply with the mantra: "If I cannot keep the wings level, I will release before the wing tip touches the ground".
- With the glider stationary and held in the attitude attained immediately prior to lift-off, show the trainee various angles of bank with an assistant holding the wing tip.
- Teach the trainee to apply corrective (opposite) aileron as soon as they recognise that the wings are not level; up to full aileron deflection may be required to arrest the wing drop.
- Teach the trainee to recognise the forward picture corresponding to the maximum acceptable angle of bank when the glider is on the ground. Emphasise that the cable must be released at this point if corrective aileron inputs have failed to arrest the wing drop.
- Emphasise that glider design (high or low wing, amount of dihedral) can significantly alter the bank angle at which the wing tip touches the ground. Repeat the sequence for each glider the trainee flies before first solo.
- An undulating airfield surface may reduce wing tip clearance, even with the wings perfectly level. Highlight this phenomenon to the trainee if appropriate.

Prior to first solo, the trainee should attain the following standard:

Looking ahead, the trainee recognises when the wings are not level, and releases the cable with the wing tip still a safe distance off the ground (a spare strop can be used to confirm release).

The trainee must be convinced that the risk from a dragging wing does not diminish with number of launches or experience. Regularly reinforce (as with stall / spin training) that failure to react correctly to a wing drop before the tip touches the ground can prove fatal.

NOTE 1. The associated problems of the wing runner holding a heavy wing, and alignment of the glider and cable to reduce swing on take-off, should be introduced and periodically refreshed concurrently with wing drop recognition.

NOTE 2. Wing drop / drag is one of the 'remaining killers'. It deserves the same emphasis during training that we give to the stall / spin and rapid or over-rotation during the winch launch.

THE GROUND RUN, TAKE-OFF, ROTATION and INITIAL CLIMB

With low power and acceleration equipment the ground run may be protracted, particularly in light winds. With high power and acceleration equipment the ground run can be breathtakingly short.

Stow loose articles before takeoff. Anything loose is particularly likely to fly all over the place during the initial acceleration, or after a cable break.

Decide who will do the flying in the event of a launch failure.

During the ground run the ailerons and rudder need to be used independently of each other. Once the glider has lifted off, independent use of the controls must stop.

Release the cable immediately if a wing goes down or anything else goes wrong during the ground run, eg., an overrun. Keep the left hand on the release knob.

If the stick is kept central the glider will normally lift-off naturally (figure 3, facing page). Not all gliders react this way, and a few require an active forward pressure on the stick to prevent them pitching up too steeply during the initial rotation. At this stage very few require a positive back pressure. If the glider has been correctly trimmed for the recovery speed, then the combination of stick central, recovery speed trim and the pull of the cable will rotate the majority of them smoothly into the climb, with attitude and airspeed safe.

If the glider is already doing exactly what's required, **and safely**, then any extra control inputs from the pilot can only lead to things going less well! We teach trainees not to interfere with the controls if the glider happens to be going where they want and in the way they want. Given the previous provisos, allowing the glider to rotate itself into the climb is no different.

It must be made clear to the trainee that even if the glider does 'auto-rotate' satisfactorily, they are (a) still flying it and can't let go of the controls - what if there's a launch failure? - and that (b) they must actively monitor airspeed, height and attitude; all of which are critical at this stage of the launch.

Satisfactory wire launches include a noticeable sensation of acceleration both before and after take off; particularly so with high power launching equipment. Any lack of or interruption to this acceleration suggests a problem. However, a feeling of acceleration can be produced by the glider pitching up, irrespective of its airspeed. This means that 'acceleration' alone isn't a reliable indication of safe conditions for the full climb. Meeting the safe conditions depends on:

- the **glider type;** its inertia, general 'dragginess', and its normal stalling speed
- **turbulence** - a lull can cause a sudden loss of airspeed
- **wind gradient** - when the glider takes off into-wind and climbs through a wind gradient, its airspeed will increase above that due to the normal acceleration, particularly during the early stages of the climb. If the cable breaks the glider will have to descend back through the same gradient, and so lose the extra airspeed gained when going up. A higher safe speed is required at the top of any wind gradient [chapter 14]. Rotation into the full climb needs also to be slightly slower
- **rain** - raises the stalling speed and reduces visibility. Don't launch.

Throughout, the glider should be flown in such a way that if there is a launch failure, a safe round-out is possible.

The Flying

Ground run, take-off and initial climb

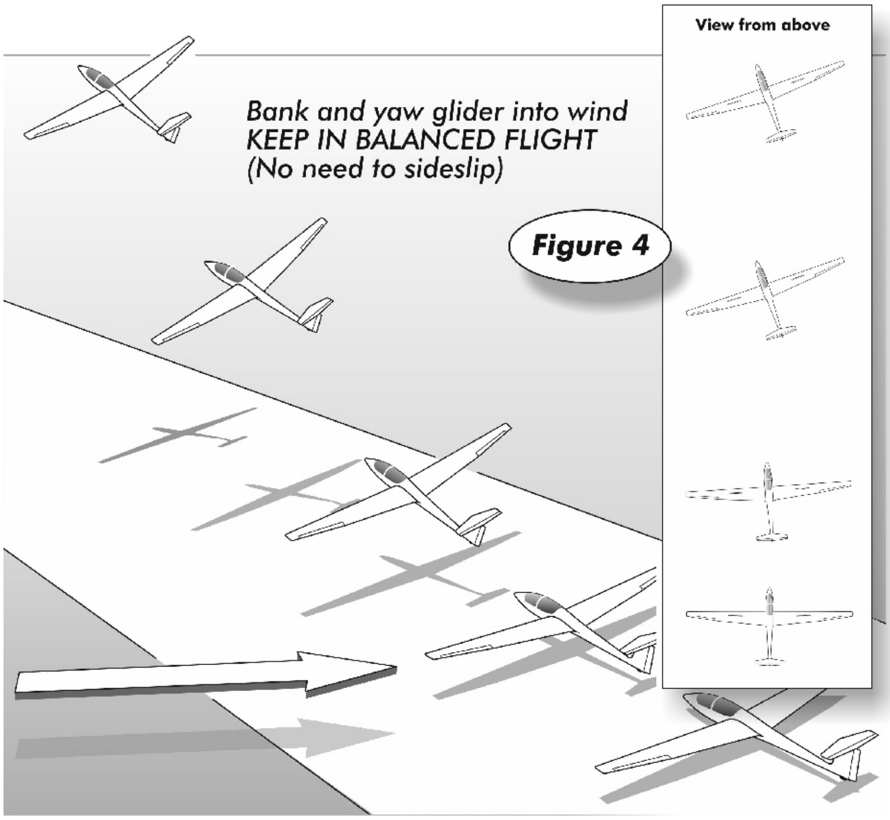
The demonstration might include patter such as the following:

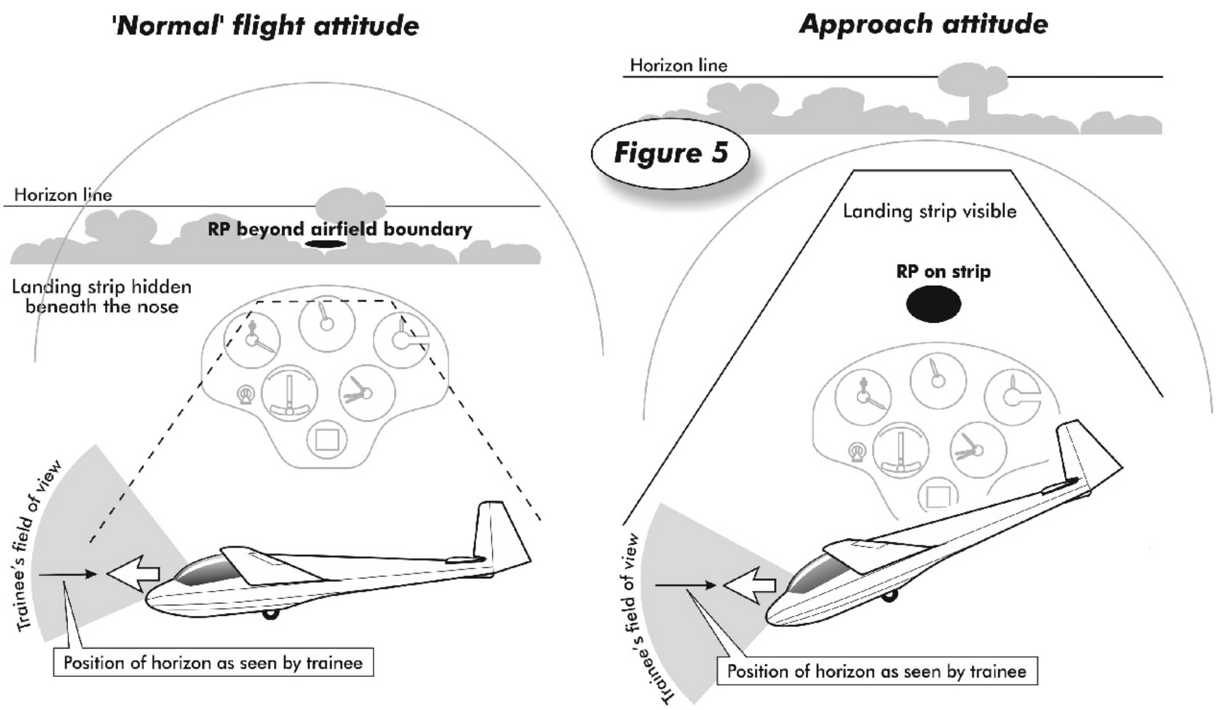
- *as the cable tightens, ensure your left hand is on the release* (see earlier remarks about releasing)
- *as the glider moves forward, keep the wings level using the ailerons . Large deflections may be needed initially*
- *balance the glider on the main wheel using the elevator*
- *keep it straight by using the rudder*
- *if a wing goes down, release*
- *when the glider has flying speed, it will take off by itself*
- *feel the acceleration and notice the airspeed*
- *allow the glider to pitch up. If it seems too rapid, or the glider is climbing too steeply for the speed, use the elevator appropriately to prevent it.* **Note.** Some gliders (e.g. K8) will pitch up very strongly if left to their own devices
- *check the airspeed and attitude regularly*
- *at a safe height and with sufficient airspeed, a small amount of up-elevator may be needed to reach the full climb angle.*

NOTE 1. Since this all happens very quickly, you may have to use much briefer patter, even single words, to avoid what you're saying being left way behind by events.

NOTE 2. The glider is much more likely to pitch up steeply at rotation if the trainee has been trying to get it off the ground before it was ready to fly. Reasons for this include:

- light wind, no wind, tail wind, and/or a low power winch. The ground speed is very high and the glider looks as if it 'ought to have taken-off by now'


View from above
Bank and yaw glider into wind
KEEP IN BALANCED FLIGHT
(No need to sideslip)
Figure 4


'Normal' flight attitude
Horizon line
RP beyond airfield boundary
Landing strip hidden beneath the nose
Trainee's field of view
Position of horizon as seen by trainee
Approach attitude
Horizon line
Figure 5
Landing strip visible
RP on strip
Trainee's field of view
Position of horizon as seen by trainee

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- rough ground. In gliders that don't have sprung main-wheels, rapid pitch up at rotation can result from the trainee's desire to stop being shaken about!

The remedy to the above is to make sure the glider is running on the main wheel, and to monitor the airspeed. If the ASI says 20kt the glider won't take-off however hard the trainee tries to make it do so. One clue to an imminent sudden rotation at take-off, is the tail still on the ground when the glider ought to be in a level attitude, airspeed rising and the stick well back, perhaps against the stop.

Crosswind during takeoff

0 It is unusual for all launches to be directly into wind. The chances of having to abandon a cross wind launch are increased by the possibility of:

- weathercocking, causing a loss of control that may lead to a ground loop
- the into-wind wing lifting before there is sufficient aileron control to prevent it, again causing loss of directional control and the possibility of a ground loop.

0 Most experienced pilots anticipate any swing during the initial acceleration and apply an appropriate amount of rudder **before** the glider starts moving. This may be asking a bit much from ab-initios. With things happening quickly their workload is high and they can forget to take the rudder off - and end up swinging away down-wind, or even digging the downwind wing into the ground. Depending on the strength of the crosswind, it may be best for them to start rudder central and apply it when needed.

0 Four factors can cause a swing. Consider all of them before the launch has begun:

- (1) is there any crosswind (weathercocking)?
- (2) is the winch hook offset, i.e. not on the glider's centre-line? (see 'out of line take-offs', 16-10, for more detail on this and the next item)
- (3) is there a bow in the cable (cable laid out to well to one side of the glider)? The yawing effect of a bow is worse on grass than on tarmac
- (4) which wing tip is being held? In a crosswind holding the downwind wing can help prevent weathercocking.

Trainees often forget to take off rudder during the ground run that they put on before it began. Remind them that once the rudder becomes effective they need to actively steer the glider.

LAUNCH FAILURES

Cable breaks are usually obvious from the lurch and twang which normally accompanies them, but less so if the break occurs close to the winch or car end of the wire. Even less obvious is a gradual failure of the launch vehicle's engine.

After any launch failure the objective is to land safely. To achieve this:

- recover to the appropriate recovery attitude while checking the airspeed
- **wait to regain the approach speed**
- assess the situation
- plan a safe approach and landing
- release the wire
- check the airspeed again
- continue to monitor it
- fly the approach and landing or a circuit variation to it.

The recovery

The extent of the recovery required varies with the height of the launch failure. Very shortly after take-off the glider's attitude will be approximately level, but in the full climb it may be 45° nose up. The amount and rate of control movement required to recover to the 'correct attitude' will vary from relaxing any back pressure on the stick, to a very positive forward movement. The 'correct attitude' will also vary, depending on the height. Reduced G is very likely during recovery from steeper attitudes, and is not always the result of over-controlling.

The indicated airspeed during the recovery provides a guide to how quickly and by how much the nose must be lowered. Regaining the speed may take some time, depending on the circumstances. Use the time to assess your height and position, and plan the approach. Your decisions may be affected by the height lost while gaining speed!

Unless the glider is very close to the ground, the stick must be moved forward to lower the nose to an attitude steeper than would be normal for an approach in the prevailing wind conditions; this is what we call the recovery attitude. The approach speed needs to be gained quickly, particularly if there's a wind gradient to delay the acceleration. Any hesitation in lowering the nose from a break which occurs in a steep climbing attitude will rapidly bring the glider close to, if not actually cause it to stall.

Even if the glider is in a level attitude, a wind gradient can make a low-level failure fraught. In a moderate wind gradient, an AS-K13 which suffers a launch failure at 30' and 45kt may have gained about 5kt of that from the climb up through the gradient, all of which will be lost again during the descent. Any delay in lowering the nose the small amount required will result in a further loss of speed, and the distinct possibility of a heavy landing, or worse.

Planning and judgement

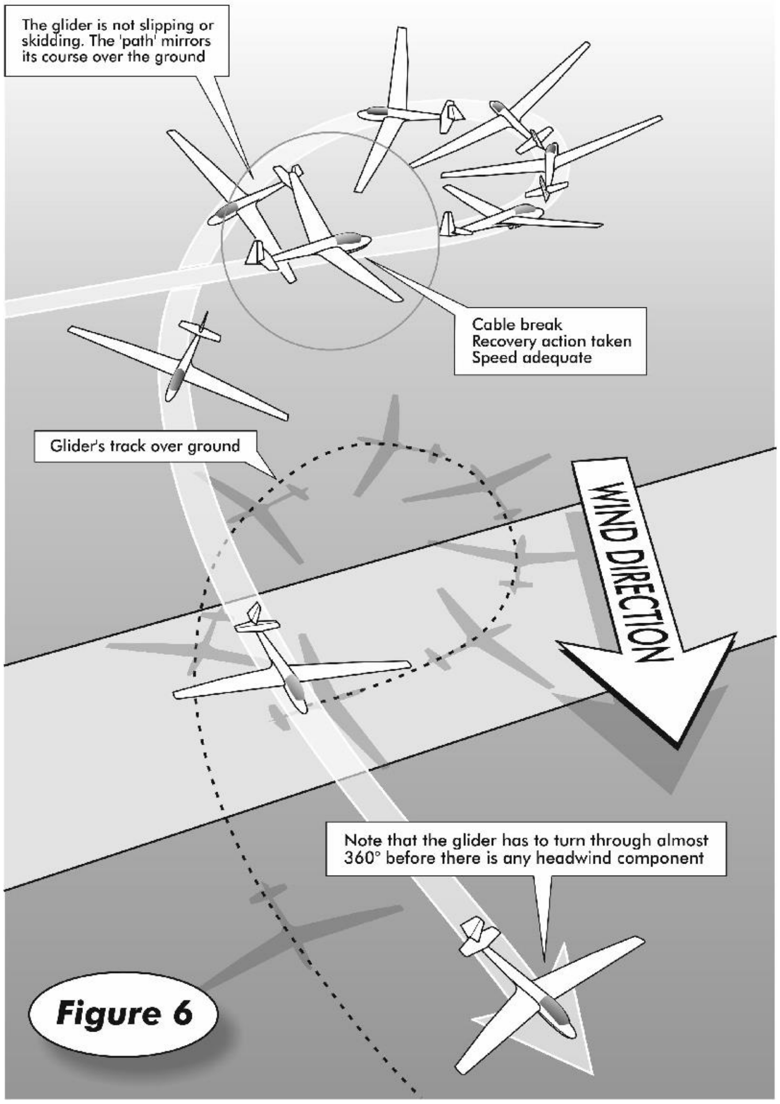
Deal systematically with planning decisions. The only objective is a safe landing. Don't allow the often illusory 'convenience' of a shorter retrieve to influence the decision.

The first question is *Can I land ahead*? If the nose isn't lowered sufficiently after a launch failure at anything more than a few hundred feet, the airfield perspective will look wrong, and there won't appear to be sufficient room to land ahead (figure 5, facing page). The trainee will reply *No* to the question, and almost certainly attempt to turn. Given the initial attitude and speed, a spin is highly likely. The correct answer to the question (even if it is again *No*) is only apparent once the nose has been lowered to the approach attitude, or greater. If the answer to *Can I land ahead?* is then *Yes*, do so!

In the early stages of a marginal straight ahead case the space available may seem insufficient, but usually proves to be more than enough. However, at small or restricted sites, *is there enough space to land ahead?* can be a tricky question.

Assuming that you can land ahead, the next question would be *Do I have to land directly ahead*? Would a small change of direction make more space available, by, say, taking advantage of any crosswind?

- if it is impossible to land ahead, decide which way to turn (a pre-take off decision which is based on any crosswind


The glider is not slipping or skidding. The 'path' mirrors its course over the ground
Cable break
Recovery action taken
Speed adequate
Glider's track over ground
WIND DIRECTION
Note that the glider has to turn through almost 360° before there is any headwind component
Figure 6

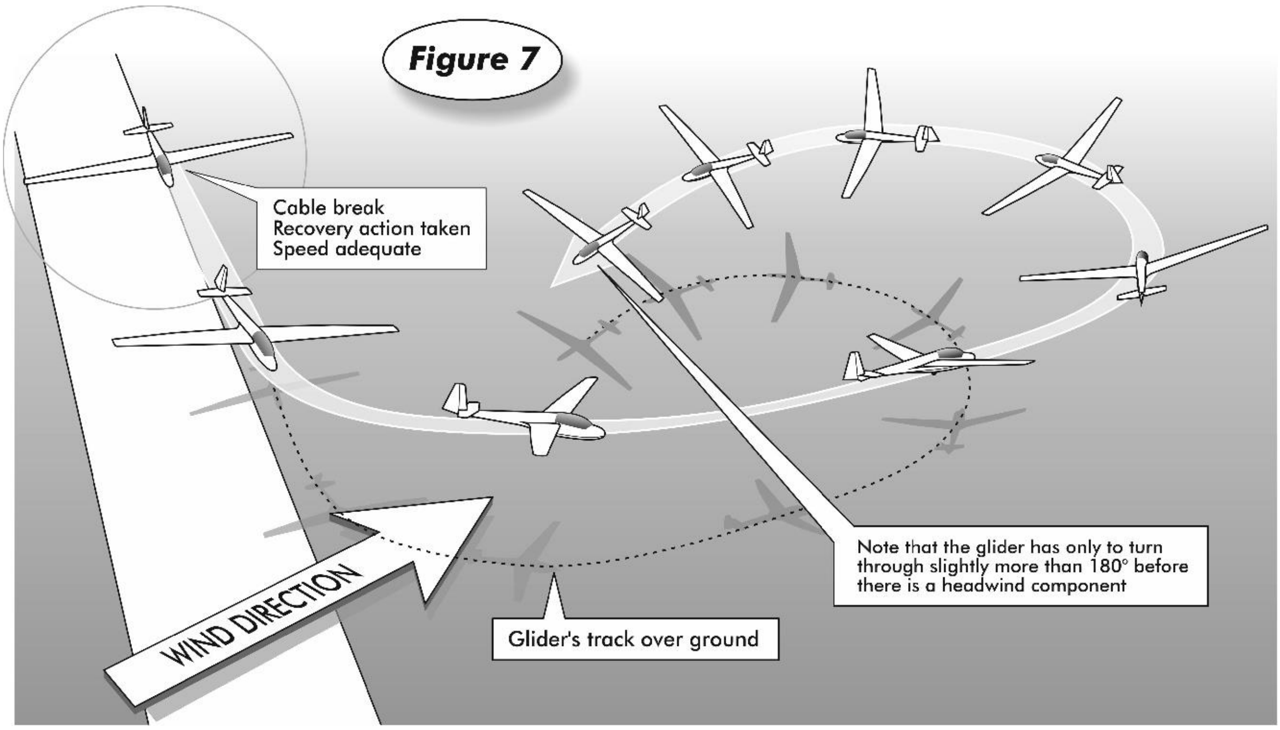


Figure 7
Cable break
Recovery action taken
Speed adequate
Note that the glider has only to turn through slightly more than 180° before there is a headwind component
WIND DIRECTION
Glider's track over ground

component, the airfield layout, and the terrain). In most cases, an upwind turn, as shown in figure 6, is not the best decision. The glider is committed to turning through more than 360˚ to get back onto the run. If the cross wind is strong and the break is at an awkward height, it may be impossible to return to the site. A downwind turn first is best (figure 7), unless it takes the glider over the lee slope at a hill site, say, or is inadvisable for other reasons which are peculiar to the site. Those reasons apart, turning downwind offers more options, and the angle through which the glider has to turn is smaller

- if you decide to turn, be aware that your airspeed may not match your apparent ground speed, and may tempt you to try and slow down. Pay attention to the airspeed. Airspeed counts!!
- before turning too far, (i.e. when you still have the upwind end of the airfield in view) the decision between an into-wind dog-leg or one across the field has to be reviewed. If a dog-leg isn't possible, continue the turn to make a complete circle. You may not have to turn through the full 360°. There may be better choices after 270˚ or so
- as a rule of thumb, if, after turning 270˚, you are below your normal final turn height, level the wings and land if it's safe to do so. Don't continue an already low turn simply for the convenience of landing into wind
- depending on the circumstances, the circle can be extended into a more or less truncated circuit. The decision to turn in is then the same as the one to be made when running out of height in the circuit. The final turn should normally be completed at the same height as any other final turn. At restricted sites a lower than normal final turn may be unavoidable.

There are other possibilities apart from the straight-ahead, dog-leg, circle, and the various circuit options.

- **the Off-field landing.** Don't exclude this possibility at restricted sites, or elsewhere, especially when other choices might involve a very low final turn. An off-field landing might be an option at some hill sites
- **the 'S' turn** involves a fair amount of manoeuvring, often at low altitude, and even on narrow strips is seldom appropriate. It can lose you more height than a straightforward circle, and if badly executed, the glider can arrive higher (in terms of getting into the available space) and nearer the upwind end of the airfield than it would with a straight-ahead approach using airbrakes.

The release

After a launch failure has occurred, the drogue chute and a length of wire sometimes remain attached to the glider. This might cause problems. However, the priority here is to **fly the glider**. Attain the recovery speed and plan the recovery before pulling the release knob.

Be patient and DON'T open the airbrakes or turn until the approach speed has been regained.

Who will teach?

Launch failure training should be the province of the most experienced and in-practice instructors only. At difficult or restricted sites newly-qualified instructors with, say, less than 2 years or 25 hours instructing time, should consider treating every genuine break as a demonstration, and take control rather than let the trainee 'have a go'. Some CFIs don't allow new instructors to simulate launch failures, leaving this exercise to the most experienced instructors.

At many large sites cable break options are plentiful and easy, but in principle you should be teaching trainees to deal with launch failures at **any** site.

The training program may be dictated by the state of the cable. Tatty cables provide plenty of cable break practice, but not necessarily at the right stage. Good cables may mean a concentrated session of training is required just before solo, and regular refresher training later.

The trainee may have managed similar tasks, eg stall recovery, circuit planning etc., but the workload during a launch failure/cable break may be too high for him to cope. If you are not demonstrating then be prepared to help - prompt or demonstrate in part.

The Flying

There are several parts to the launch failure exercise:

- recognition
- recovery
- judgement; planning
- execution of the approach and landing.

Start by demonstrating and practising launch failures as an upper air exercise. On the wire, demonstrate launch failures at different heights before they are practised by the trainee. Begin with the low launch failure and a land ahead first. Then go on to the high launch failure with a mini-circuit, followed by a failure at an awkward height and lastly, the very low failure **which should be done as a demonstration only**.

Teach simulated cable breaks (breaks tend to be sharp and obvious) and winch engine failures (which tend to die away gradually). Before every launch consider the minimum safe speed/height combination for launch and launch failure options and nominate the approach speed before taking off.

- unless close to the ground, lower the nose to the recovery attitude (below the approach attitude)
- check the airspeed
- is it possible to land straight ahead?
- check the airspeed again
- if it isn't possible to land ahead, select alternatives
- don't turn or open the airbrakes until the approach speed is attained
- release the cable (only if time permits).

UPPER AIR-EXERCISES

Launch failure in the full climb

- describe a wire launch failure that occurs during the full climb
- dive the glider to about 70kt, and then pull up smoothly into a 45˚ nose up attitude
- immediately assume that the launch has failed

- lower the nose to the recovery attitude (below the approach attitude)
- wait for the airspeed to increase to the nominated approach speed
- don't turn or open the airbrakes until approach speed is attained
- release the cable.

Stall and Spin from a normal attitude following a launch failure

Refer to chapter 19.

INADVERTENT CLOUD PENETRATION

Avoid launching into cloud and release in good time. If you do enter cloud during the launch (by mischance or misjudgment):

- release under tension to avoid colliding with the flying drogue chute. Do NOT lower the nose before release
- after release:
  - lower the nose to regain approach speed
  - DON'T turn until you are clear of cloud and your speed is adequate
  - if the speed increases excessively, open the airbrakes.

DEBRIEFING

Cover the following items, as appropriate:

Placarded maximum wire launch speed. Minimum safe wire launch speed. Too slow. Too fast. Initial climb considerations. Stall speed on wire launch. Launch failure procedure near the ground. Launch failure procedures at different heights. Allowing time to regain the approach speed before manoeuvring and/or opening airbrakes. Appreciation that different gliders, launch equipment and sites may require different techniques.

ADVICE TO INSTRUCTORS

Hand positions

Be extra alert during the take off, initial climb, and following a genuinely unexpected cable-break. Hover your right hand behind the stick ready to **take over if the trainee tries to climb too steeply**. Have your left hand on the release, but once the glider is airborne behind the airbrake lever to prevent the brakes being inadvertently or deliberately opened at the wrong moment. Be ready to prevent any or too much forward stick if there is a low level launch failure, and be prepared to release immediately during the ground run if a wing touches the ground.

Close to the ground, the effect of a prompt on the trainee's conduct of the launch is both limited and critical. If a potentially hazardous situation looms, take control. Hand control back once the situation is safe again. In the event of an unacceptably rapid pitch-up after take-off, taking over immediately and doing something about it safeguards the situation, and emphasises to the trainee that something wasn't quite right - debrief later! If your hand is hovering just behind the stick (don't actually touch it), then taking control here will come naturally and quickly.

Speed and crosswind factors

Unlike normal free flight the airspeed during the launch is not directly related to the glider's attitude, so the ASI needs monitoring frequently.

The maximum acceptable crosswind component depends on the glider type. Gliders which always sit tail-down and have tail-skids are generally more susceptible to crosswinds. It is usual for the **downwind wing** of most gliders to be held at the start of the ground run, to reduce the risk of weathercocking.

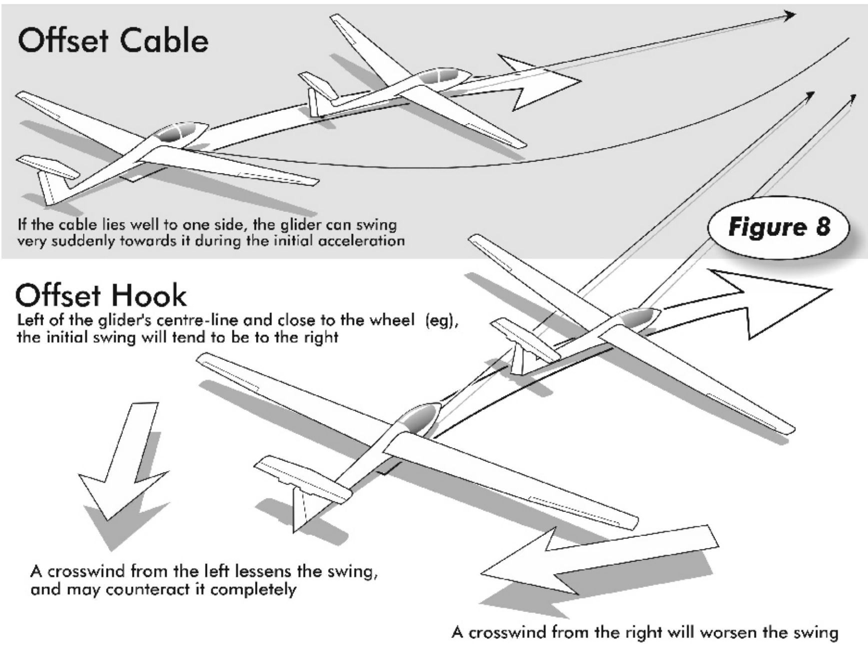
Out-of-line takeoffs

If the cable is offset to any great degree to one side as the glider starts to accelerate for take-off, a strong and completely uncontrollable swing can occur (figure 8, below). With lightning speed the situation can then go seriously wrong. Regardless of advice saying 'don't', pilots often pick up dropped wings and get away with it. That they sometimes do is not down to their piloting skills, but blind and entirely heartless chance.

In the 'out-of-line' scenario the violent yaw induced by the cable pull can 'fly' the glider's forward going wing and stall the other, which will then hit the ground and stay there; guaranteed in rough ground, and long or tussocky grass. The yaw and acceleration will continue and increase. There's no possibility of the winch driver reacting fast enough. Seconds later, sometimes following a spectacular 180° wing-over, the glider will crash.

A crosswind can worsen the situation. During the initial acceleration a glider with an offset winch hook - it doesn't have to be very far off the centre-line either - will be prone to yaw away from the side with the hook. Any crosswind component will add or subtract to the swing, depending on the wind's direction and strength (figure 8).

With a central hook and offset cables the only way to lessen the chance of a ground loop is to be lined up with the cable before you start. With an offset hook a wingtip holder on the appropriate wing can help.



It's easy to get into the habit of being slightly out of line, always just far enough to make miles out of line seem OK, which it is not. Sites which use retrieve winches may seem to be launching with the cable's pull far more out of line that is actually the case. The geometry of these set-ups is such that by the time the glider starts to move the cable pull has become more or less in line with the glider's fuselage. Nevertheless, the accident described is not impossible at such sites.

Out of line take-off or not, always be prepared to release **before** a wing touches the ground. As an instructor, be pedantic about this. The result of a ground loop here can be a serious accident.

Low power winching systems

Slow initial acceleration results in an extended ground run and a longer time before the controls become effective. Airspeed build-up after take-off will be more gradual, and rotation into the full climb must not be too sudden. Height, attitude and airspeed need monitoring more closely. Too vigorous a climb can stall the glider or the winch engine.

Slow acceleration can mean that a power failure at low height will be more difficult to detect. The pilot may be tempted to hang on for a few seconds longer than is safe, in the hope that power will be restored. Any power loss must be countered immediately by lowering the nose and aborting the launch.

After the initial stages the winch launch can be handled like any other, except that in light or zero wind conditions even full throttle may be unable to maintain a satisfactory airspeed and climb rate throughout the launch. The height achieved will be less, as will instruction time, so pre-flight planning and briefing are more important.

Auto-tow and Reverse Pulley Auto-tow

Much the same comments apply as for the low-powered winch. Additionally, some auto-tow vehicles with automatic gearboxes have the annoying habit of changing gear just after the glider has become airborne, which typically results in a brief and, if unanticipated, a disconcerting power loss at 10' to 15'. Normal as that may be, once accepted as such it can mask a genuine failure when other wire launching equipment is being used.

In reverse pulley operations the driver may not be able to see the glider nearing the top of the launch and may fail to slow down. Be aware that the glider's rate of climb has reduced, and release to avoid dropping the wire onto the pulley.

Launch failures

Never let a situation develop that is close to the limits of your capability. Take over well before they're reached. If in doubt about whether you should take control or not, then there is no doubt - take control.

Do NOT simulate a launch failure to test a trainee at a height below which any delay, over-controlling or airbrake deployment, would tax your ability to recover. All launch failures must be pre-briefed and demonstrated before the trainee makes any attempt at the exercise. The exception to this is the ultra- low level (below 50') launch failure which is a **demonstration only**. The pre-brief must contain specific advice about not over-controlling on the elevator. The original 'let the trainee have a go' exercise produced far more accidents than the real thing, certainly far too many to justify trainees attempting the exercise. The exercise must only be done as a winch power failure. A low break initiated from the glider has the potential problem of the glider flying into the parachute, as has happened on a number of occasions.

For very low level failure demos at 5' to 10', don't lower the nose at all. A number of accidents have been caused by lowering the nose into the ground.

With some powerful launch systems, rotating directly into the full climb with ample speed may be possible on almost every occasion. The practice is potentially dangerous because the habit can prevail even when the speed isn't ample, and in any case the glider is very close to the stall.

Low-level manoeuvring, particularly under stress and/or at low speeds, is a MAJOR source of all UK flying accidents. Plans-of-action following a launch failure or an abandoned launch should stress the need to land straight ahead if possible, which might mean an out-landing.

If the trainee decides to land straight ahead - assuming it's safe to do so - allow him to do so even if more 'convenient' options were available. Only by allowing a trainee to carry out his decisions will his confidence increase.

After a launch failure where 'the circle' has been extended into a truncated circuit, the final turn should normally be completed at the same height as any other final turn, but trainees may:

- turn in early and higher than usual because they are being tested, or they're nervous, or both
- continue downwind and turn in lower than usual to reduce the retrieve distance. Discourage this, even though the situation does allow the instructor to see how well the trainee copes with the higher workload.

Converting pilots to wire launching

Beware of conversions from:

- **high acceleration launch systems** to lower acceleration systems. The pilots may rotate into a steep climb immediately after take off
- **auto-tow or weak winch to powerful winch**. Pilots probably won't pull up properly and will get much too fast
- **equipment with a noticeable gear change in the very early part of the launch** - these pilots may not recognise a low level launch failure quickly, and will hang on waiting for the power to pick up
- **aerotow**. Pilots won't pull up at all. They will normally need at least 10 wire launches before becoming competent. Initially, this may dishearten them!

Normally, instructors will be familiar with their club's launching device, and will often have been trained using the same or similar equipment. If you are intending to instruct at a site with different equipment, make sure that you can cope before you attempt to teach others how to do so.

Order of teaching

The correct order for teaching launch failures is as follows:

- the upper air demo and practice of the correct recovery
- a straight ahead launch failure demo immediately followed by a trainee practice
- then moving up the height bands

Always do a demonstration before the trainee has a go. It's important that the first demos and trainee attempts/practice at launch failures involve straight ahead landings, not high level and turn back launch failures [the law of primacy]. A trainee should never be tested on launch failures without warning him first, unless he has already been taught how to deal with them correctly (i.e. has had them demonstrated and been allowed to practice).

COMMON DIFFICULTIES

Too abrupt or gentle a transition into the climb. This may be due to a tendency to look straight ahead rather than scanning from wingtip to wingtip via the ASI. It may also mean that the trainee has never had a decent demonstration of what it should look like in the current wind conditions. Don't be afraid to re- demonstrate if prompts or descriptions don't work. This part of the launch is over too quickly to give you an opportunity of correcting the fault in flight, and each time the trainee climbs too abruptly, he's putting both of you at risk!

Fish-tailing up the launch is usually caused by a failure to apply sufficient (or any) rudder to counteract the adverse yaw which results from small and possibly unnecessary aileron inputs. The trainee may also be bracing himself against the rudder pedals and finding the rudder 'very heavy'.

Incorrect rudder coordination in crosswind drift correction Explain that drift correction is achieved by applying some bank with coordinated controls.

Always turns upwind after release. Explain that not only must the nose be lowered but any bank applied for crosswind correction on the launch must also be removed promptly.

Bucking or hunting at the top of the launch. Some gliders are particularly prone to this, often older ones. The symptoms can be a warning that the glider is near to the stall, or even stalling. The remedy is to lower the nose slightly, enough to stop the oscillation, and then gently raise the nose back into the climb attitude.

Releasing under tension at the top of the launch, can cause time wasting breaks and tangles, particularly if its a winch using piano wire. Releasing under tension does not offer any significant height gain and it increases the wear on the hook as well as unnerving the trainee.

Poor directional control, wing dropping on ground run. The most likely reason is that the trainee hasn't yet learned how large the control movements at low speeds need to be. The problem is aggravated by the fact that on the ground the rudder is steering the glider as well as counteracting aileron drag. If the glider lifts off while recovering from slewing on the ground then the possibility of a spin when the power increases is quite high. Release immediately if a wing goes down on the ground run.

Wing rocking during the climb has two possible causes. Rapid small-scale wing rocking is a symptom of an approaching stall, and the remedy is to lessen the back pressure on the stick until the wing rocking ceases. Slower, large-scale wing rocking is usually caused by the trainee correcting for one wing low but not centralising the ailerons when the wings are level and thus dropping the other wing. This over-controlling may be due to;

- failing to recognise when the wings are level
- not appreciating the very small amounts of aileron required at the launch speed compared with the much higher sustained elevator force
- a tense grip on the controls which may mask the stick forces being applied.

Tries to take-off too soon. This should be discouraged as it can lead to very swift rotation into the climb right at the worst possible moment. Watch out for this if the ground run is longer or faster than usual, and/or the ground is very rough. Get the trainee to run the glider on one wheel, not the main wheels and the tail-skid/wheel.

Veers off to one side during the climb. The trainee needs a reference point to help keep the line of the launch.

