13 - LANDING

Teaching landings isn't particularly difficult, but trouble shooting any problems that arise is less easy. In aerotow only training a trainee may be of solo standard after 20-25 launches, given aptitude and continuity of training. In winch based operations, training to solo standard may take 50-60 launches, often unduly prolonged by approach and landing problems. Whatever the method of launch, the landing techniques remain the same, so the difference is almost certainly due to time in the air.

A winch trained pilot attempting a landing after say, 10 launches, will have had very much less hands on time, and so fly less well than an aerotow trained pilot after the same number of aerotows. Broadly speaking, the average amount of hands on time for a trainee on aerotow, in non-soarable conditions, is about three times longer than the equivalent winch flight. On the basis of launches only, it takes a winch trained pilot longer to learn coordination, and the relatively short flights often give little time to relax and settle down.

In winch based operations this can lead to trainees attempting the landing very early on (to give 'good value for money'), often before they are really ready. As a result, 'landing' faults are corrected which are a consequence of the trainee being unable to fly sufficiently well in the first place. Close to the ground, handling problems always look much worse. What looked OK to the trainee at 1,000' can seem unnecessarily dangerous at 200' as the aircraft swoops about all over the place. It will be obvious to him, not entirely inaccurately, that any attempt at landing will result in a crash, or be a complete fluke if it isn't. The fact that there is an instructor in the back makes little or no difference to this perception. Each time the trainee fluffs it - and if he can't fly straight reasonably well, this will be most of the time - landing will become a serious problem, and lessen confidence as a result.

In summary, **to give the best chance of a successful landing - and to build confidence - the trainee must first have reasonable control of the glider**. Anything less wastes everyone's time and may produce problems where there were none before.

BRIEFING POINTS

The exercise can be divided broadly into three stages; the approach (previously dealt with), the round-out and hold-off (or float), and the touchdown and ground run.

No landing is complete until the glider comes to rest. Trainees can be so relieved at having contacted the ground again that they forget to do anything more.

Most early trainees will be unable to manage anything even remotely resembling a spot landing, but they should at least be encouraged to think how they would go about it. It is more important initially that they land the glider well, rather than hit the spot precisely every time. Indeed, in the early stages, regular spot landings can be a sign that the instructor is 'helping' on the controls, or talking too much.

There is nothing to stop you talking down an apt trainee at an early stage in his training. This might be termed a 'confidence landing'. It may be best for you to operate the airbrakes in these cases.

Approach

Encourage trainees to choose approach and landing paths that are well clear of obstructions. Your own landings and demonstrations should not be towards, or close to any. Teach what is acceptable and safe, not what is clever and/or potentially dangerous.

Round-out

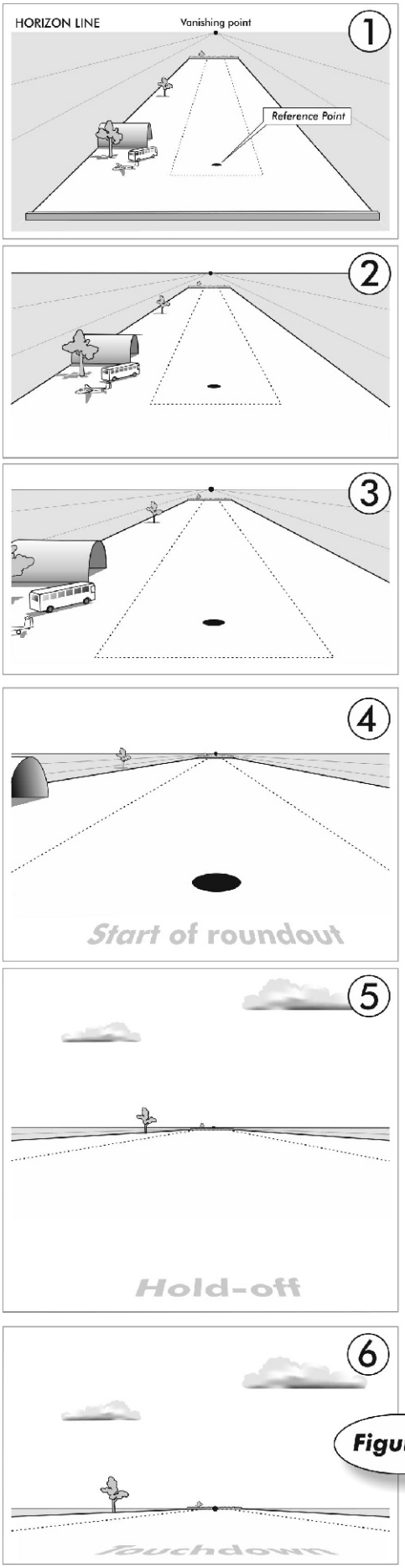
The judgement/perception aspects of a landing, especially the round-out phase, depend on:

- changes in the perspective of the landing area (figure 1, overleaf) are most obvious on a runway or other well-defined, large, and regularly shaped area. Take care on sites which are not flat as there are apparent changes of perspective on sloping or uneven fields. The instructor will be used to these, and regard them as 'normal'. Unusual perspectives in other circumstances can lead to approaches that are either too low or too high, depending on the lie of the slope in relation to the glider. This can cause problems with where to look ahead for the round-out, and consequently, problems with the round-out itself
- peripheral vision providing some textural information - *When the grass looks like grass* - as well as vital clues to the glider's rate of sink
- the changing attitude of the glider and the control movement required
- the rate of change of attitude and/or perspective
- the steepness of the initial approach. Given the same airbrake setting, the round-out will begin higher up for a steep approach in a strong wind than for one in no wind.

The trainee will have already had several demonstration landings, so give prompts for the first few attempts. To communicate as quickly as possible use phrases such as - *I'll want you to round out soon, but not yet ..... not yet .... now!* At any stage during training when the trainee's work load is likely to be high, advice from the instructor should be as brief and to the point as possible, particularly when close to the ground! Choose your words with care though, the single word *Speed!* can mean just about anything, and your trainee may respond in a way you didn't intend.

If the trainee has followed through in previous landings he will already have some idea of the sort of control movements required, and could probably manage to land the glider himself. Early attempts may be less than perfect but, if moderately successful, should give some confidence.

When it is clear from the approach that the glider is going to reach approximately the right area of the airfield, encourage the trainee to freeze the air brake setting. This helps avoid later interactions between his left and right hands - something which will almost inevitably occur at exactly the wrong moment. As the glider reaches the round-out point (figure 2, overleaf), get the trainee to concentrate on looking ahead towards the far end of the airfield, and to move the stick gently but progressively back until the glider is flying just above the ground. It can sometimes help if the trainee can pre-visualise the flight path he wishes the aircraft to follow.



Perspective changes during approach and landing (flat site)

Figure 1

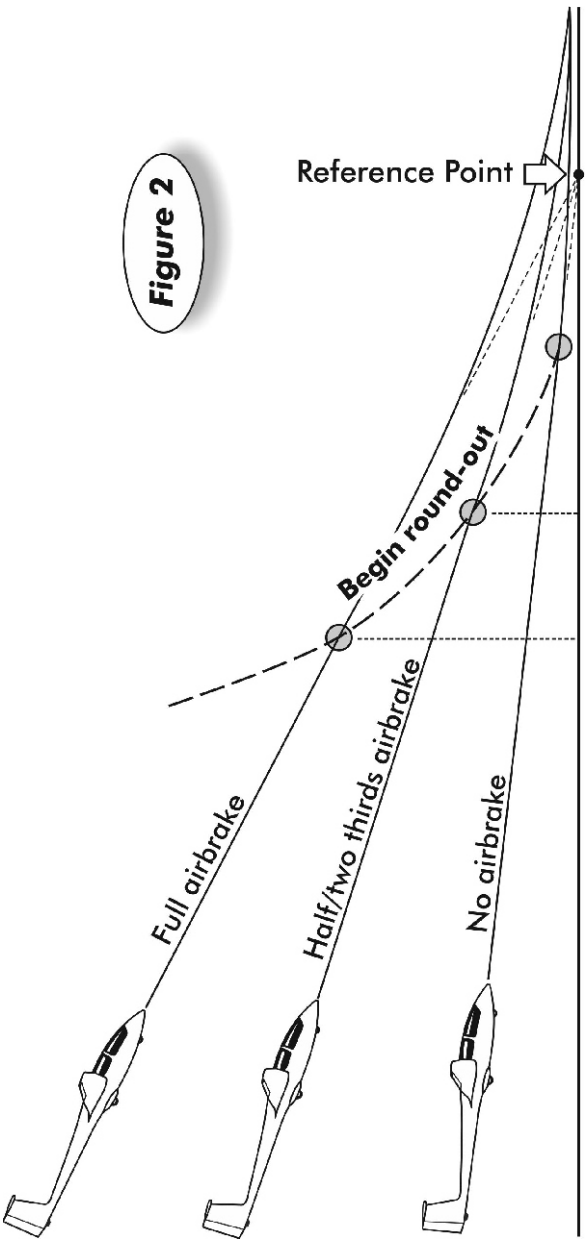


Figure 2

Float or hold-off

In a fully held-off landing the glider's tail wheel touches the ground fractionally before the main wheel. The stick will be fully back and the glider is effectively stalled. A fully held-off landing gives the slowest possible touch down speed. If the glider hits a bump, it won't take-off again, and any impact with embedded stones, holes in the ground etc, will be lessened.

The trainee should have been briefed beforehand that the object of the 'float' phase is to keep the glider flying just above the ground for as long as possible [see figure 1, chapter *12-2*]. As the speed decays the glider will inevitably sink and the stick will need to be brought further and further back to prevent this. Eventually the glider will 'land itself'. There is no need to actively 'land' the glider, but don't extend the float by reducing the airbrake setting.

After touch-down

Once the glider has touched down, open the airbrakes fully (watch out for the wheel-brake coming on!) and bring the stick progressively back to the stop if it is not there already. This will:

- prevent the glider from taking-off again
- prevent damage to the nose skid, if the glider has one
- initially, slow the glider more quickly
- help a glider with a tailwheel to keep running straight
- for some gliders (largely the Ka and AS-K series where both ailerons go up if the stick is held fully back) the aileron response at low speed may be enhanced.

Use of the wheel-brake

If the glider has a wheel brake, and the club doesn't discourage its use (to avoid excessive wear, or over-reliance on it, amongst other things), apply it to bring the glider to rest. If the glider doesn't have a nose wheel or skid, warn the trainee about how easy it is to use too much wheel brake and tip the glider on its nose. If the wheel-brake is activated at the end of the airbrake lever's travel, warn about touching down with the lever back against the stop, i.e. with the wheel brake applied. If there's any drift this can lead to a ground-loop. If the landing surface is wet grass, be exceedingly wary of using too much, or even any wheel-brake. Firstly, it probably won't slow the glider at all; second, it will cut a long and possibly deep furrow, depending on the state of the ground; thirdly, if a ground loop starts, heavy application of the wheel brake will help it along.

Throughout the ground run the wings must be kept level with the ailerons, and the glider kept straight using the rudder. As the speed decays, larger and larger control movements will be required to keep the wings level and/or steer the glider. Like the take-off run, this is another occasion where independent use of the ailerons and rudder may be necessary.

At a later stage the emphasis will go from doing a good, properly held-off landing just about anywhere (within reason) to the greater accuracy required for spot landings.

Remind the trainee that the landing isn't over until the glider has come to a complete stop.

ADVICE TO INSTRUCTORS

A good landing is preceded by a good approach, and a good approach by a good circuit.

A trainee will gain an impression of how to land a glider from the first few flights where the instructor does the landing. If the instructor's landings have been consistent in approach speed and angle, brake setting, round-out height and float, then the trainee will have a much better idea of how to land.

During all phases of the landing the instructor should be ready for any eventuality:

- right hand just in front of but not actually touching the stick. This guards against the trainee suddenly deciding that he MUST land and pushing the stick forward
- feet close to the rudder pedals, or, if you have no choice, on them
- in the 'float' phase the instructor's left hand should be behind (or even on) the airbrake lever to prevent the trainee holding-off with both hands. This also allows the instructor to take charge of and close the airbrakes if the speed is getting a bit slow, giving the trainee more time to concentrate on the landing. Don't forget to say that you've taken charge of the airbrakes - tussles for control at low altitude, almost regardless of the airspeed, aren't good
- be cautious throughout the landing phase.

If you have to take control during the approach it is probably best not to hand it back to the trainee for the round-out, hold-off or landing. The trainee may have simply 'switched off' by then and be unprepared for any form of concentration and fine judgement.

Rounding out too high

Rounding out too high is usually because the trainee is unaware of the glider's height, and any change in it. How this is dealt with depends on the height, attitude, airspeed and airbrake setting at the time:

- with safe speed, a level attitude and moderate brake setting, prompt - *Hold everything still, let the glider sink*
- with safe speed, a level attitude and large brake setting, either prompt *with ease the brakes in*, or do it yourself
- less than safe speed and/or nose-up attitude and with the brakes open then take control, say *I have control*, and close the air-brakes and gently lower the nose.

Rounding out too late

Rounding out too late is usually due to not looking far enough ahead, or 'target fixating' on the RP. Since the time from commencing the round-out height to impact with the ground will be short, to say the least, immediate action is required. In this case, override the trainee and do the round out yourself. Possible problems are:

- the trainee may be unwilling to relinquish control, effectively freezing on the controls
- if you want the trainee to continue flying the glider, then say so - *You still have control* - otherwise he may feel your interference and immediately let go off the controls
- if you don't want the trainee to fly the glider, then say so - *I have control* - if you have time.

If for any reason the brakes have been closed and the trainee has made a reasonable round out and hold off, then beware the possibility of the brakes being opened suddenly!

If there is any drift due to a crosswind component or for any other reason, either:

- ignore it if the amount is small, or
- kick off the drift yourself. Don't forget to tell the trainee what you've done, and why.

Gliders vary in their degrees of tolerance to the pilot 'getting it wrong', from the forgiving T21 to the unforgiving Ka7 or Astir. You will learn the limits with experience.

The most common factor in instructing accidents is 'instructor failed to take-over in time'. These accidents usually involve the trainee responding in an unforeseen way (stick back, say, after a cable brake), or not responding at all (not rounding out). Given that the idea is to let the trainee do as much as possible within their level of skill (crashing isn't part of the syllabus), the instructor should NEVER wait until the very last moment - it can rapidly become the 'wish I'd done something earlier' moment - before responding to a situation that is going awry. This is especially so with manoeuvres close to the ground.

Ballooned landings

The opportunity to teach a trainee how to cope with a ballooned or bounced landing may arise naturally during their early attempts at the approach and landing. If not, the trainee must show that he is able to recover from them before he is sent solo. Initially he should be taught to maintain the airbrake setting, and concentrate on prompt and smooth selection of the level attitude. Adjusting the airbrakes while selecting the correct attitude is a skill that comes only with experience. It is assumed that instructors who are teaching or demonstrating 'balloons' will have these skills.

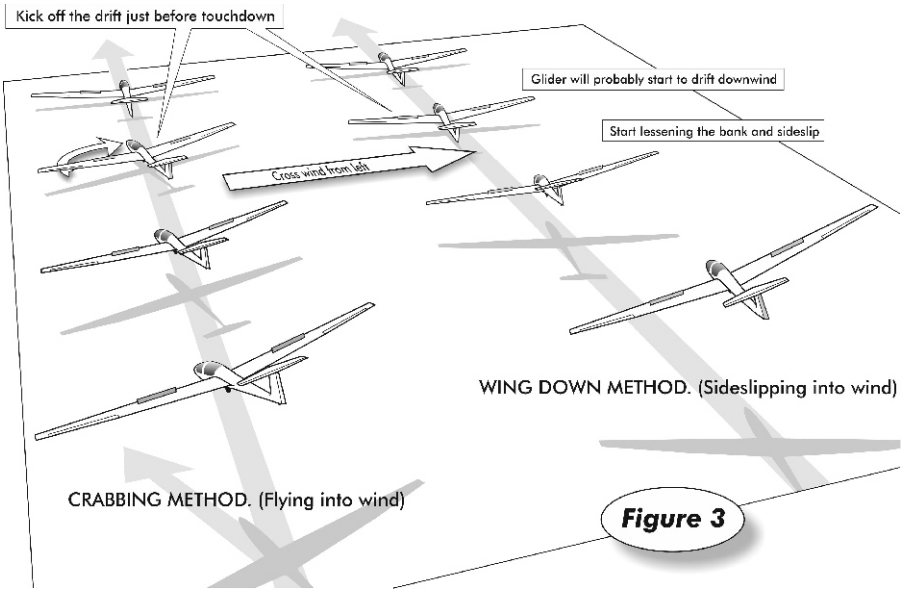


Figure 3

During exercises which involve balloons or bounces, putting the glider into excessively nose-high attitudes is both unrealistic and unsafe, and should be avoided. To set up a 'balloon', do a normal round-out - use a small airbrake setting - but with the airspeed about 10kt higher than usual. This will produce an adequate balloon without bringing the nose up too high.

It is important that recovery isn't taught in terms of 'control movements', but by reference to the glider's attitude and its position in relation to the ground. In other words, teach the student to detect the balloon by seeing the ground 'falling away', and to recover from it by selecting an attitude which prevents any further climb. Throughout the exercise the instructor must remain alert, in case the student either fails to correct the situation, or overreacts in some way.

CROSSWIND LANDINGS

The trainee must be capable of a distinct and controlled hold-off phase in normal into-wind landings before you can consider teaching them cross-wind landings.

There are two methods for crosswind landings; crabbing and wing-down. Each has its particular merits for certain situations. A combination of the two may often be used by the more experienced pilot.

Crabbing method

The glider is turned onto the final approach so that it heads sufficiently into wind to track along the required approach line. Make the approach with the wings level, without skid or slip and with the glider's drift directly along the desired track. When the glider is just about to touch down at the end of the hold-off or 'float', use the rudder to swing the nose into line with the direction from which the ground appears to be coming. This avoids sideways load on the wheel or skid at touchdown.

After touch-down keep the glider straight for as long as possible, 'into wind' wing kept low. Once stopped, use the ailerons to put this wing on the ground so that there's no chance of the glider blowing over before the retrieve crew arrive.

This method has the advantage that it can be used successfully in very strong crosswinds. Care and practice are required to yaw the glider with the rudder at exactly the right moment. The rudder's effectiveness varies between glider types, but whatever the response time, if the rudder is applied too early, the glider will still be airborne and will begin to drift off downwind again. A further application of rudder will then be required to avoid landing with drift.

If the glider accidentally takes off again it will immediately start to drift sideways.

The crabbing angle may need to be reduced if the approach is through a wind gradient.

Wing down method

In this method the glider is turned directly into line with the landing path and sideslipped by applying bank and opposite rudder in such a way that the track is made good. A normal landing is made except that the angle of bank is reduced at the last moment to prevent the wing tip touching the ground. The landing is then made with the 'into wind' wing slightly low. It should be kept in this position after landing, while the glider is held straight with rudder.

The method is well suited to landing across sloping ground when the wind is blowing up the slope. In this case the bank gives greater wing tip clearance; a considerable advantage in a glider with a large span, low set wing. On flat ground the wing down method has the limitation that only a small amount of bank can be safely used, particularly if the sideslipping characteristics of the glider are poor. There are a few gliders (e.g. Janus) which should not be sideslipped.

If the crosswind is very slight, the wing down method is the easiest as it is only a matter of making a normal landing with a little bank applied.

CONSIDERATIONS

Sooner or later you are bound to misjudge a crosswind landing and land with drift. If the landing also happens to be a heavy one, the skid, skid fixings or rubber shock-absorbers may be damaged. The chances of such damage can be greatly reduced by ensuring that the initial touch-down is made on the main wheel. Unlike the skid, this will stand all but the heaviest sideways load without being damaged. If the landing is made with drift, a violent swing into wind can follow touchdown, and must be prevented by immediate and firm use of the rudder.

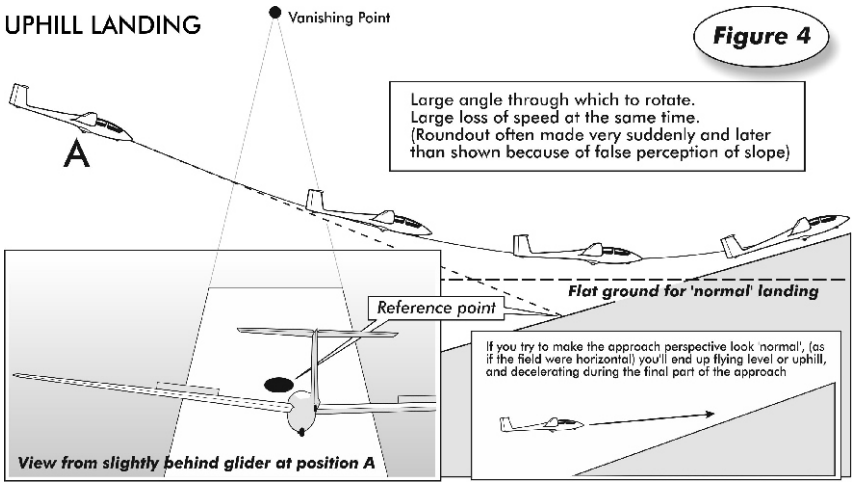
When landing out of wind, avoid approaching near to obstructions or other gliders so that even if the drift is not fully corrected, there is no danger of drifting too close or swinging towards them after landing. There is also the question of turbulence across the intended approach/landing area from buildings/trees and the like.

When the rudder is applied to yaw the glider straight there is a natural tendency for it to bank as well. Prevent this by using the ailerons to keep the wings level. If the glider banks out of wind it will begin to turn and start to drift badly. A firm correction on the rudder will be needed to yaw the nose farther out of wind to eliminate the drift.

Gliders with their CG well behind the wheel have a much stronger tendency to weather-cock into wind. If a swing does develop it will worsen, sometimes very quickly, and the rudder may be incapable of stopping it. Take special care with these machines. Unless full opposite rudder is applied immediately, the glider starts to swing and will almost certainly ground loop, perhaps with serious consequences.

Landing uphill

Landing uphill is potentially awkward because the perspective effects which help us land on level ground can lead us to make approaches which are far too shallow, or to leave the round-out far too late because we haven't allowed for the greater angle through which the glider needs to rotate. During the last stages of an uphill round out the glider tends to decelerate fairly rapidly, because by then it's going uphill (figure 4).



These problems are not likely to be obvious at sites where landing significantly uphill isn't unusual, but pilots from flat sites may only find out when they do their first field landing. This sometimes gets mentioned during early cross-country briefings, but the assumption tends to be that when you're going to land out you'll always choose somewhere flat! An excellent idea, but not always possible! At a suitable stage it's worth the instructor mentioning this to the trainee, and giving him an appropriate briefing.

Downhill landings are inadvisable even though in certain wind directions at some sites, landing down relatively shallow slopes is unavoidable.

COMMON DIFFICULTIES

Faults may arise for a variety of reasons:

- trying the exercise at too early a stage and getting 'up tight', plus nervousness due to the close proximity of the ground
- poor round-out judgement
- Hurried, over-controlled backward movement of the stick with little appreciation of the response rate of the elevator
- nervousness
- not looking far enough ahead
- not looking in the right place ('well ahead')
- RP fixation. This often results in either a very late round-out or none at all
- inappropriate interaction between the trainee's left and right hands
- relaxing (sheer relief!) when the glider has touched down, resulting in a failure to keep the wings level and to keep the ground run straight with the rudder
- looks at obstructions to one side of the intended landing run rather than along the intended line of landing. This almost always results in a gradual swing towards the obstructions.

Failure to spot land. Either no RP was used, or was inappropriately chosen for the prevailing conditions and the glider being flown. On the other hand, if this happens early in the trainee's progress, it may be that his workload is too high for you to reasonably expect a 'spot'.