OUTLANDING

In soaring the thrill and frequently the frustration results from making decisions both good and bad in rapid succession, whilst maintaining a range of options. Chance may also plays a role as lift can suddenly die or be difficult to locate. Whatever may happen the final result will be either the joy of a successful final glide or the adventure of an out-landing.

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Given the high performance of modern FRP (fibre reinforced plastic) sailplanes, an informative pre-flight briefing, and supportive coaching techniques, the likelihood of out-landing can be reduced. Indeed, many soaring pilots fly a whole season without out-landing, and a current and well-practised pilot flying in Australian conditions may land out on only one in twenty flights. All pilots will get low on occasions, and should have several suitable paddocks selected, followed by a specific paddock in case of an imminent out-landing. Your aim when low must be never to run out of height, speed and ideas all at the same time. The essence is to plan and think ahead so that you are always in a position to make a safe landing. This requires good flight management.

FLIGHT MANAGEMENT

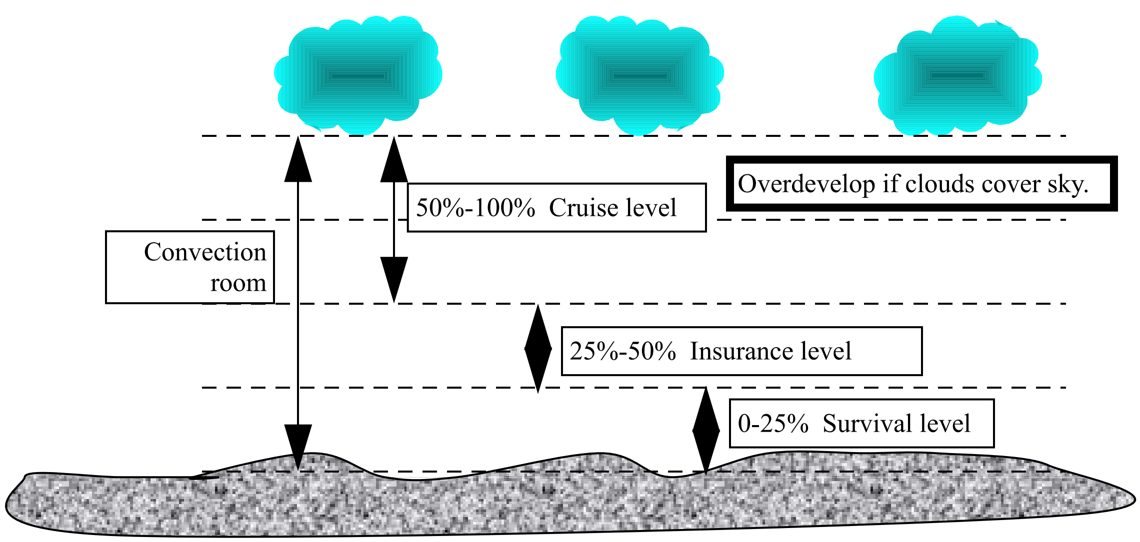
Good flight management demands a strategy, sound judgement , the need to prioritise and at the same time keep sufficient energy within the sailplane in order to maintain a safe, efficient, and accurate flight profile. The model offered below is not rigid. In this case the pilot aims to cruise at McCready or a modified McCready speed in the upper 50% of the convection room[1], if the thermals are going to 6000 feet above the ground then the lower level would be 3000 feet above the ground. The lower 50% is then split into two, an "Insurance Level" which in the above example would be between 3000 feet and 1500 feet levels and a "Survival Level" between ground and 1500 feet. In the insurance level speed and direction may be adjusted to maximise the search area for lift and at the same time look for suitable out-landing areas. In the lower quartile, the survival level, the priority is to remain airborne and reduce risk. Risk is controlled by having a suitable paddock

[1] Convection Room is the height from ground level to the top of the thermals.

selected in which to land. The committal point for landing will be affected by the experience and recency of the pilot. The following table is given as an example.

CRUISE LEVEL 50%	**Aim to fly in the cruise level.** **If over convection occurs stay in top 30%.** **When climb rate reduces to 2/3 move on.**
INSURANCE LEVEL 25%	**Aim to return to the cruise level. Reduce speed. Select out-landing options**
SURVIVAL LEVEL 25%	**Ground read. Fly over trigger points. Have a suitable paddock selected**

Eventually, clouds may fill most of the sky leaving little blue between them. This is termed "over convection" or "over development" Convection Room is the height from ground level to the top of the thermals.)



Before flying research and plan the flight and question other pilots who are familiar with the terrain over which it is intended to fly. Always depart on task with the expectation of a possible out-landing; this also applies to pilots flying sailplanes with a sustaining or self launching capability.

Procedures should be reviewed prior to take-off, with a clear plan of what to do in the event of a ‘failure’ during the launch, this may be a rope or tug engine failure. On release from the tug aircraft or winch, the flight has then to be managed with the primary aim of a safe landing.

Experienced pilots continually scan both the sky and ground for indications of both lift and landing options when cruising at or below half the convection room; the flight profile is under constant monitoring and management until the sailplane stops safely.

On descending into the lower levels of the convection room, the priority will change from searching for lift to finding a suitable area in which to land. Be aware that the workload will increase as the search for lift intensifies.
The emphasis should now be on ground reading, searching for lift and at the same time looking for ‘out-landing’ options. Remember that the wind will change the search distance. For example search distance will be less when flying into wind and more when flying downwind. If flying downwind gliding range will be increased, allowing flight over more lift sources, trigger points, and suitable landing fields. This may improve the chance of finding a saving thermal. Remember a diversion from track may also be necessary when the opportunities to land are few or non-existent.

From 2000 feet there will be on average 10 minutes of flight time remaining. In most sailplanes flying at 60 knots this gives an air distance of approximately 10nm/ 19km, or looking at it another way, with a glide of 36/1 a sailplane will fly 6nm per 1000 feet or 13 km. It will be better than this if there is rising air or reduced sink and worse off in sinking air.

Below 1500 feet above the ground, options are reduced, and a specific paddock should be selected. The first priority in selecting a paddock should be the safest landing option rather than the simplest retrieve. Try to visualise the flight path to get down safely onto the landing area. Ignore the altimeter; it’s **angular distance** that counts from now on. Know the wind and check for obstructions.

Whether or not the search for lift is continued will be depend on:

- The meteorological conditions; i.e. broken lift and wind gradient.
- The experience level of the pilot, how the flight has been managed, and the remaining options available.
- Familiarity with the sailplane type.

If you feel uncomfortable, then do not persist, but land.

If lift is found and the thermal has form, but not necessarily strength, and it feels **comfortable**, accept the climb but always remain in a position to return to the planned approach; never lose sight of the landing area when low. If there is any possibility of out-landing get the checklist out of the way early, stabilise the sailplane, check the wind for **direction, strength, and drift** and land safely. Then if lift is contact with a successful escape retract the gear and remember to drink.

HUMAN PERFORMANCE

Never hope that luck will get you out of trouble. Low-level soaring is a demanding task but with training, briefing, practice, and disciplined flying it is safe.

The best insurance is to fly regularly, but if out of recent flying practice it is recommended to seek training, or at least review out-landing techniques, and visualise procedures before flight. This is particularly important at the start of the soaring season when the combination of weak spasmodic lift and maturing crops and grasslands demand that there is an adequate margin to allow time to assess the conditions. This margin is carried to ensure that a pilot is not rushed, and that there is sufficient time to complete all checks and make adjustments to the final flight profile.

Stress Levels

The amount of stress, which a pilot experiences, influences the ability to perform tasks so pilots should always fly within their capacity at all times The stimulation from cross-country flying increases arousal, which is favourable. However, if very high levels of stress are placed upon any pilot, the mental and physical demands may put him or her in a position beyond the ability to cope. This can be further exacerbated by the onset of dehydration which can be rapid, but which can be countered by fluid intake. Failure to drink may result in confusion and fatigue. It is recommended a minimum of 4-5 litres be carried to counter dehydration during flight and after out-landing. A pee system is thus also essential. Do not plan to limit drinking because you do not have a pee system. Dehydration is dangerous in that it leads to impaired mental function.

One of the features of stress is that an event, which causes high stress in one individual, may not have the same effect on another. And what may be stressful for one individual may not be stressful on another occasion. It is important that pilots are aware of their limitations. If you feel uncomfortable or frightened make changes to the flight in order to remain relaxed or perhaps don't fly at all.

SAILPLANE PERFORMANCE

The design and performance of a sailplane may also affect the out-landing. Two speeds are worth remembering when flying at a low level:

- The minimum sink speed, [Vsink min], is the best speed to stay in the air the longest thus giving the maximum time to survey suitable paddocks for landing. It is also near to or is the best speed to climb in a thermal. However, be aware that it is close to the stalling speed and extra speed may be needed if the thermals are broken or rough.

- **Minimum sink should not be confused with best L/D which gives the maximum distance per unit of height.**

- To travel the maximum distance, fly at the speed for best lift to drag ratio [V best L/D]. Fly slightly faster than this in a head wind and slower in a tailwind. In many sailplanes the V[best L/D] speed is close to the approach speed of 1.5 Vs. This is a particularly useful speed as it balances both performance and safety.

Both the minimum sink and best L/D speed can estimated from the polar curve published in the sailplane manual.

The minimum sink speed will give the most endurance and time to think, or better still, to climb.

The best lift to drag ratio speed will give the maximum distance to search for lift and suitable locations for out-landing.

Warning

Energy in a sailplane can be unintentionally lost through wind- shear, and/or downdraught, and both will be amplified by maneuver. Remember that when turning, the rate energy loss is greater than when flying level and the steeper the turn the greater the energy loss.

Increase in Stall Speed with Maneuver	
0 degrees of bank angle	O%
20 degrees of bank angle	5%
40 degrees of bank angle	20%
60 degrees of bank angle	50%

It can be seen that a low level, steeply banked turn, combined with wind shear and down-draft becomes a lethal combination. To guard against this fly at the appropriate speed, say 1.5 times the stall speed (Vs), plus additives if required, such as half the wind speed over 10 knots.

POSITIONING FOR AN OUT-LANDING

When positioning for out-landing it helps to have some idea of the approximate distance a sailplane can cover per 1000 feet in still air. Most modern sailplanes will travel 11km 1000 feet or 5.5km per 500 feet in still air. If flying a modern sailplane and busy think in terms of 10km per 1000 feet, until out of trouble.

L/D giving distance per 1000 feet in still air

48/1	8nm	15km
42/1	7nm	13km
36/1	6nm	11km
30/1	5nm	9km
24/1	4nm	7km
18/1	3nm	5km

A strong head wind will reduce the range and a tailwind will increase it: If flying into a strong head wind reduce the estimated distance by half.

THE APPROACH

Never become rushed, as out-landings are demanding and checks are easily forgotten.

Be prepared to dump water ballast early as the discharge rate can be slow and it can take some time before all water is lost. The dropping of ballast reduces the wing loading and thus the stall speed (and makes it easier to stay up in weak thermals). Then fly at the recommended circuit speed of 1.5Vs. In most modern sailplanes this will be close to the Vbest L/D speed of 50-55 kts. Remember that as soon as the bank is increased, the 50% safety margin in speed that is being carried will be progressively lost and at an angle of 60 degrees of bank this margin is reduced to zero.

Wind shear and convection will exacerbate the horizontal and vertical movement of air and may cause either a temporary increase, or a decrease, in the glider's airspeed. If wind shear is expected, counter any sudden loss in speed by adding extra compensatory speed to the approach speed. In a flapped sailplane it may also be advantageous to consider adjusting a lesser flap setting to reduce drag in wind shear conditions. This should be done before commencing the approach so as not to destabalise the approach path, this helps to maintain energy within the sailplane. However, remember to adjust the approach speed for the new flap setting.

Whilst it is imperative to maintain energy in flight, with an adequate safety margin, excess flying energy causes the touchdown and landing run to be longer and can thereby pose increased danger of other types. By flying at the right height and speed for the conditions the energy on landing needs to be at a minimum consistent with conditions. On final approach **weight** should be at a minimum, which is nil ballast with a speed of [Vs 1.5], plus any additives required to offset wind gradient and gusts. This permits the lowest speed at threshold [Vat], which reduces the landing run and helps protect the integrity of the landing gear.

SUITABLE SURFACES

When traveling by road it is a good idea to study the lay of the land, and note how it is shaped and the type of vegetation. Then try to visualise an approach into a suitable landing area. Imagine what would be the effect of a downwind or a cross–wind landing, perhaps into a setting sun. It is worth stopping to take a walk, to look at the different types of surface and crop. These will change with the seasons and be modified by the impact of drought or heavy rains or over stocking. This background is helpful because with any misjudgment of slope, the sailplane once in ground effect will go a very long way before touching down, unless drag is increased. Armed with this information, in subsequent flights look at these factors from various altitudes in order to get a better perspective of what might be expected during out-landing.

THE LANDING AREA

The choice of the landing area needs care, and to assist in selection **an easily remembered mnemonic is 5S and a W.** The five 'Ss' are:

- SIZE AND SHAPE
- SLOPE
- SURFACE
- SURROUNDINGS AND OBSTRUCTIONS
- STOCK

SIZE and SHAPE- there is no specific length in terms of absolute measurement; if it looks big enough then it usually is. However, there is the proviso that a small paddock among even smaller paddocks may appear large. This is more often the case near hills where paddocks in general tend to be smaller. Beware of model aircraft strips, these can be a perfect replica of an airfield and may include a windsock. Pilots of sailplanes have successfully landed on these shortened and narrowed strips, safe but shaken!

When flying locally compare the surrounding paddocks with your own airfield and relate these to known objects on the ground, buildings, animals, vehicles etc. From this you will get a sense of scale, which helps in the judgment of height.

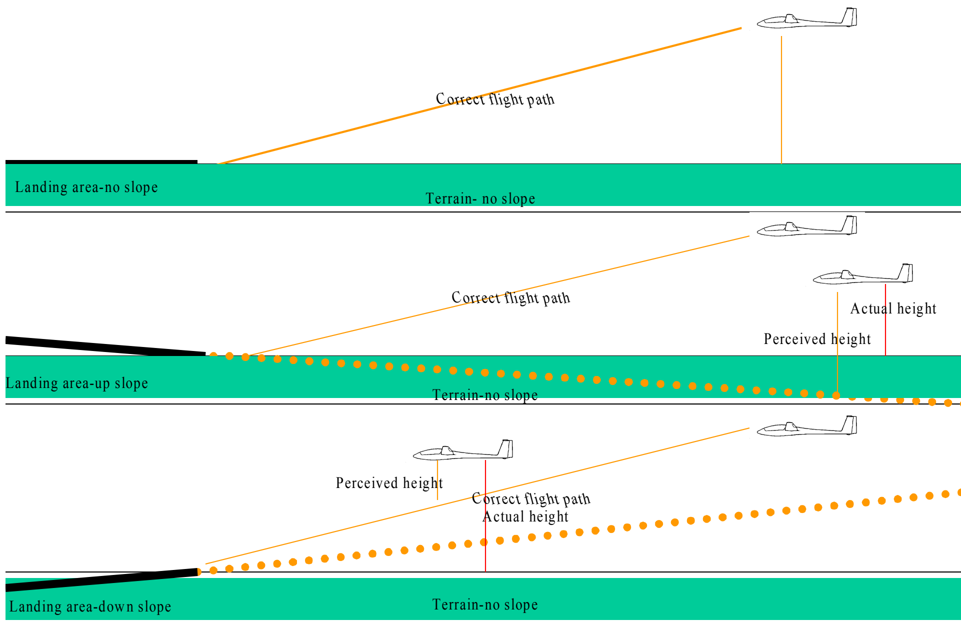
The shape of the chosen field is useful in identifying the location if it becomes necessary to turn away for positioning reasons. Generally, it is inadvisable to turn one's back on a landing area below 1000 feet, but occasionally this may be expedient. Identify the field by its shape and any features as well as its line relative to wind and slope.

SLOPE- can give the false illusion of being too high or too low.

Pilots may incorrectly perceive they are too high if:
- The landing area slopes upwards from the aiming point
- The approach is flown over featureless terrain
- The visibility is significantly better than usual

Pilots may incorrectly perceive they are too low if:
- The landing area slopes downwards from the aiming point
- The visibility is poor

The following diagram amplifies the above points, **proving what you perceive is not necessarily the flight path you want.**



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The average glide-slope of a glider with open air brakes is between 10:1 and 14:1. If we relate this to a highway this is not a steep slope. However, if an attempt to land is made down slope the glide angle and ground effect will prolong the flare as well as the deceleration.

The rule here is, landing up-slope is very much preferred to landing down slope. This may be the best case even in a tailwind.

The problem associated with an up-slope downwind landing is that the ground run may be short as the sailplane decelerates quickly, but the ground speed will be higher due to the speed of the wind over the ground. That is, the glider speed over the ground will be air speed plus wind speed. This combination may lead the pilot into thinking the airspeed is too high and traps the unwary into reducing air speed on the approach. An additive of 5-10 knots may be desirable so that a positive flare can be made through the greater than normal angle to cope with the rising ground. Be cautious of landing with full brake at the flare, as the associated sink rate has caused damage to sailplanes and back problems to pilots. To guard against this be prepared to reduce air brake before the point of flare. A long stabilized final approach will assist in the accurate control of speed and adjustments in glide-slope to counter the effects of slope.

Slope is difficult to detect from directly overhead, whereas if an oblique view is taken the gradient becomes more evident. Try not to cramp the circuit and the approach, and if time permits view the landing area from more than one side. Remember, water always runs downhill, and small streams, dams and drainage ditches may be but not always at the lower end of a sloping area.When the sun is off its zenith, hollows and rises are highlighted and this can be used to advantage later in the day.

Ideally, it is not good practice to land on a paddock with a discernible slope.

SURFACE- selection is governed by season of the year, crop, and farming techniques. Colour and texture best determine suitability. It may help to have an order of preference during field selection**.**

- Preferably seek an area that has previously been cropped, or is in pasture, but avoid any paddock with bales of hay.
- Be cautious towards an area with live-stock.
- Avoid paddocks with high crops, such as rape, sunflowers and root crops. These are usually either bright or dark coloured.
- In some countries, and in some areas of Australia, stubble paddocks offer a good surface as the crop is cut short. In many parts of Australia only the head is harvested, and with some grain crops a long stem remains. This has the ability to score the wing under-surface, and generate a ground loop.
- If there is a well-defined line of change in colour or grass appearance, beware, as this may indicate an electric fence The grass will be different due to the stock eating the grass down on the side they are restricted to.

In farming, generally the flattest and smoothest fields are kept for cultivation. If a landing must be made on a ploughed or harrowed paddock, preference is to land along the furrows and keep the sailplane straight to avoid damage to the gear and doors. In spring, when the crop is short there will be very little damage but the ground may be soft so be conscious that a retrieve vehicle may become bogged. If landing in a recently cut paddock land between the swathes of crop.

Rough landings can be encountered on river flats. During winter and spring when cattle are pastured on soft ground, their hooves make indents in the ground; these harden with the onset of the summer heat, and can give a rattling good finish to a flight! This has the capacity to injure the pilot and cause damage to sailplane gear and canopies. To counter this, the **harness should be tightened and loose articles secured before all landings.**

Gliders dropping onto golf fairways are never popular, but the surfaces are smooth, well drained and undulating.

Racecourses are usually clear of obstructions, but make sure that it is unoccupied as horses are a problem being highly-strung and sensitive, with a tendency to bolt.

If you have misjudged and are forced to land in a standing crop ensure that the approach is stable and flare just above the crop, reducing speed so that the sailplane settles close to the stall. It is imperative that the wings are kept level in order to avoid a wing drop, with a resultant ground loop and possible structural damage.

Landing on airfields can also be hazardous, unless you can check on the availability and suitability of the grassed areas it is always preferable to land on the runways. Airfields by design are well drained and grassed areas can hide ditches and obstructions.

SURROUNDINGS and OBSTRUCTIONS- a careful survey of the surrounding area should be made to pinpoint high obstructions. Pylons, which may be up to 150 feet are usually clearly visible, unless badly weathered, and in some parts these are painted green for aesthetic reasons!

Power lines servicing farms and trees are probably the most lethal of hazards in Australia. Both reduce the effective landing distance and the latter may cause turbulence. Allow extra 20 meters of landing distance for each 10 feet of obstruction height. Power lines are difficult to locate but if there is any farm building assume that there will be lines radiating in all directions, the trick is to search for the poles and follow the wires. The lines often follow roads and as pilots are attracted to landing areas near to a road to ease the retrieve this can be a trap. Be particularly wary during any approach between trees where lines may be masked by foliage. Again the trick is to locate the poles, although in hilly and mountainous terrain cables may pass over gullies and valleys without support, some being difficult to locate.

STOCK- Injury to any animals, particularly bloodstock, could be expensive. Horses should always be avoided, as they are easily startled, and have a tendency to bolt with resultant injury. Cattle are often a problem, and bullocks can be both inquisitive and aggressive, however cows with calves are more likely to be protective. Bear in mind that in some of the dry country favoured for sheep, dust–encroached fleece can make them hard to see when searching for suitable landing fields and if it is hot there will be little or no movement until scared by the approach of a landing sailplane. In this situation sheep can be both erratic and nimble. Most animals are not aggressive, and contrary to tales there are no man eating kangaroos!

After landing, secure the sailplane. If it is left unprotected, cattle can and often will, trample and rub against any novel object such as a sailplane. They also commonly associate any vehicle with stock feeding and so may quickly converge on the glider in the expectation of feed. Check the surrounding fields for open gates through which curious animals may wander. An added attraction in the case of fabric aircraft is the smell of dope and they may damage the aircraft by licking at the dope!

WIND- A pilot must be aware of its direction at all times, and before setting off to fly cross–country should have some idea of approaching fronts, the likelihood of storms, and the effect of the airflow over mountains in respect to down draught both on the lee side and possible wave. As well as the overview of the weather also check wind gradient. If this changes more than 3 knots per 1000 feet turbulence and distorted thermals can be expected placing greater demands on piloting performance in the lower levels.

Throughout the flight monitor the wind by observing movement of the cloud shadows on the ground to indicate the wind at the top of the convection room, and by observing smoke and dams for the surface wind. The wind on the ground may change in direction by as much as 20-30 degrees or more from that at altitude and a marked variation between the two may indicate the likelihood of wind sheer.

In the lower survival height level where the possibility of an out landing becomes a reality, check the dams. Here, water is a good indicator of wind direction on the ground. Not because the ripples on a dam or lake, but for the lack of them in the sheltered areas below the windward banks. Back this up by observing changes in the movement of crop. Crop ripples will indicate the presence of wind, but will generally not give direction with any reliability.

Note any drift between the sailplane heading and track. Drift should be obvious when flying cross wind in strong winds, but less so in light conditions or when flying up or down wind. It is also more obvious when low, such as when flying on base leg.

On final approach, buildings, obstructions, trees and the surface of the terrain may also cause turbulence. A speed additive to counter gusts may be required.

THE RIGHT APPROACH

Once committed to landing do not change your mind at the last minute. Keep to your plan, monitor obstacle clearance and maintain a safe speed.

A good rule is to never to turn your back on the landing area and use angular distance to the aiming point for landing rather than relying on instruments.

Many inexperienced pilots are wary of losing sight of their chosen field and miss the cue of ‘angular distance’, and as a consequence remain ‘close in’ during the circuit. This should be avoided as it allows less time to make a considered judgment. The tendency is to modify the circuit, with the result that the checklist is missed, the approach rushed, and the final profile unstable. This can lead to a result where the flare is deep into the landing area with the possibility of running out of available space.

Although less common, misjudgement of height and drift may place the sailplane on its limit of performance if the circuit is too wide or if it is extended significantly on the downwind leg. Should this happen, keep the aircraft clean, until such time as the approach profile for landing is resumed.

Never attempt to stretch the glide by reducing speed below best L/D at low altitudes. Best L/D gives the maximum distance.

A well-planned circuit will place the sailplane in the optimum envelope for approach, once ‘stabilised’. It then becomes an easy task to control airspeed, glide-slope, and drift. Aim to touch down a quarter to one third into the field, by using sufficient air brake to maintain a steady descent, but be prepared to reduce or close the air brake to prevent excursions below glide-slope.

If the only option is to land cross–wind, it is preferable to make the circuit on the downwind side of the selected field. This allows a better view of the landing area, as the heading to compensate for drift will assist in keeping the landing area in view, making any change in angle with the touch down point more apparent.

The alternative is to have a tailwind on the base leg. If the wind component is strong there is a tendency to overshoot the center line, which then makes any correction to offset for drift on final approach more difficult. A further trap is that the airspeed plus the wind component gives a visual allusion of high airspeed, and this may trap the unwary into reducing speed. To guard against this it is essential that the airspeed of [Vs 1.5] plus any additives is maintained throughout the final turn and on to the approach path to protect against the increase in stall speed due to maneuver.

THE LANDING RUN

Once the sailplane is on the ground keep the wings level with the nose of the sailplane pointing along the landing line. The landing run should be as short as possible to reduce the chance of hitting hidden hazards, rocks and holes. Firm application of brake as soon as the aircraft is firmly running on the ground, is highly advisable. Do not delay.

‘Airspeed, altitude, brains- at least two are always needed to complete a successful flight’!

If you are undershooting because of heavy sink, you must avoid hitting the boundary fence. One way out is to land before the fence by applying full air brake. Make sure your hand is on the blue airbrake lever and not the flap. However attempting to land before the fence may place the sailplane on the ground in a high-energy flare with insufficient space to stop before the fence.

If there is a risk of collision with a far boundary obstruction, there are several options. With a retractable gear this can be raised with a slight risk of damage. A set of under carriage doors is decidedly cheaper than the prospect of major damage. If the speed is low, say ten to fifteen knots, a ground loop is an option. The technique used is dependant on the aircraft design. In most cases the stick should be fully forward before the windward wing is dropped and the rudder applied. Keeping the stick back and thus the tail down will almost certainly result in breaking the fuselage. However, a number of sailplanes have a nose wheel In this case if the stick is pushed forward, the weight on the nose wheel will serve to resist any rotation. With a wooden glider, raising the tail will rub off speed with the nose skid. A more desperate move might be to aim the nose of the glider right alongside corner post of a fence with the intention of the wings hitting the next posts first. This will allow the wings to take the impact ~~first~~, but will save the pilot. Similarly, it can be arranged to hit any trees with the wings rather than the fuselage, if a collision is unavoidable.

During any of the above maneuvers, know your sailplane, because with any configuration change the control loads may also change and be careful not to over control as this may cause a pilot induced oscillation [PIO]. This is often the result of excess speed at the flare. If this should happen, avoid over-controlling, hold the controls steady to allow the inherent stability to settle the sailplane.

After any ground loop the sailplane will need a full inspection by a qualified engineer before further flight. This precludes an aero-tow retrieve.

To move a sailplane will take only few minutes, a de-rig takes a little longer, but a breakage may take months, so review, plan, and always fly within your limits.

A BRUISED EGO COSTS NOTHING