MODULE THREE

OUTLANDING

OUTLANDING

INTRODUCTION

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. The final result will be either the joy of a successful final glide or the adventure of an out-landing.

The purpose of chapter is to prepare you for that adventure, the 'out-landing'.

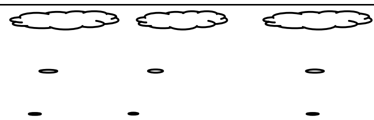
Given the high performance of modern FRP sailplanes, an informative pre-flight briefing, and supportive coaching techniques, the likelihood of out-landing should be rare. Indeed, many soaring pilots fly a whole season without out-landing, and a current and well-practised pilot flying in Australian conditions may land out on only one in twenty flights. Others of less experience, perhaps, would land out on one in ten 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, and the need to prioritise. The following table is given as an example.

THE CONVECTION ROOM

Altitude	Priority	Action
50% -100% Cruise level		Aim to fly in cruise level
 **LOOK-OUT**	⇒⇒⇒ Speed	Stay in lift by using cloud streets If sky overcast, over-convected, or broken stay in top 30%
	⇒⇒⇒Speed ⇑ Lift	Move on when climb rate reduces to 2/3
25%-50% Insurance level	⇒⇒⇒speed ⇑⇑ climb	Aim to return to cruise level
	⇒⇒⇒speed ⇑⇑ climb	Cloud and ground read. Stay out of sink
LOOK-OUT	⇒ speed ⇑⇑⇑ climb ⇓ land	If cloud cover >6/8s be cautious. Use optimum glide to reach sunny spots
	⇑⇑⇑⇑ climb ⇓⇓ land	Ground read
0 %-25% Survival Level	⇑⇑⇑⇑ climb	Look for heat sources, trigger points, check wind. Use dams
LOOK-OUT	⇑⇑⇑⇑ climb	Forget about the task, concentrate finding lift
	⇑ climb ⇓⇓⇓⇓ land	Paddock should be selected
0% Ground Level	Land Safely	Check for slope, surface, obstructions, wires, and wind indications

If intending to soar cross-country should always depart on task with the expectation of a possible out-landing.

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. On release from the tug aircraft or winch, you have then to manage the flight with the primary aim of a safe landing.

Experienced pilots are continually scanning both the sky and ground for indications of lift, and at the same time landing options at or below half the convection room. The flight profile is under constant management until the sailplane stops safely.

As you descend to the lower level of the convection room, marked by the inversion or cloud base and the ground, your priority changes from searching for lift to finding a suitable area in which to land. The emphasis should now be on ground reading, searching for lift and at the same time looking for 'out landing' options. A diversion from track may be necessary when the opportunities to land are few or non-existent. If it is the only safe option go back on track.

Remember that if you fly downwind it will increase the range, allowing flight over more lift sources and suitable landing fields. This will improve your chances of finding a saving thermal.

Once in the bottom quartile, specific-landing areas should have been located. Be aware that the workload will increase as the
search for lift intensifies.

From 2000 feet you will have on average 10 minutes of flight time remaining. Flying at 60 knots this gives an air distance of 10nm or 19km. Or to look at it another way, with a glide of 1/36 a sailplane will fly 6nm per 1000 feet or 12nm or 22km. You will do better than this if there is raising air or reduced sink and worse off in sinking air.

Use you time below 2000' wisely

Below 1500 feet your options are now reduced, you should have a field selected. The selected field should be the best landing option rather than one, which may simplify the retrieve. Visualize 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 you continue to search for lift will be dependent on:

- The meteorological conditions; broken lift, wind gradient.
- Your experience as a pilot, and how you have managed the fight, the remaining options available and your judgment.
- Familiarity and recency on sailplane type.

Spatial Awareness

If you find lift, and the thermal has form, but not necessarily strength, and you **feel comfortable**, accept the climb. However, you must always be in a position to fly into your planned approach. If this happens, keep to your plan, as you do not have time to hesitate. Get the checklist out of the way early, and maintain energy in your sailplane. Stabilize the sailplane, check the wind for **direction, strength, and drift** and land safely.

HUMAN PERFORMANCE

Never under estimate the fact that low-level soaring is a demanding task but with adequate training, frequent practice and disciplined flying it is safe.

'Never trade luck for skill'

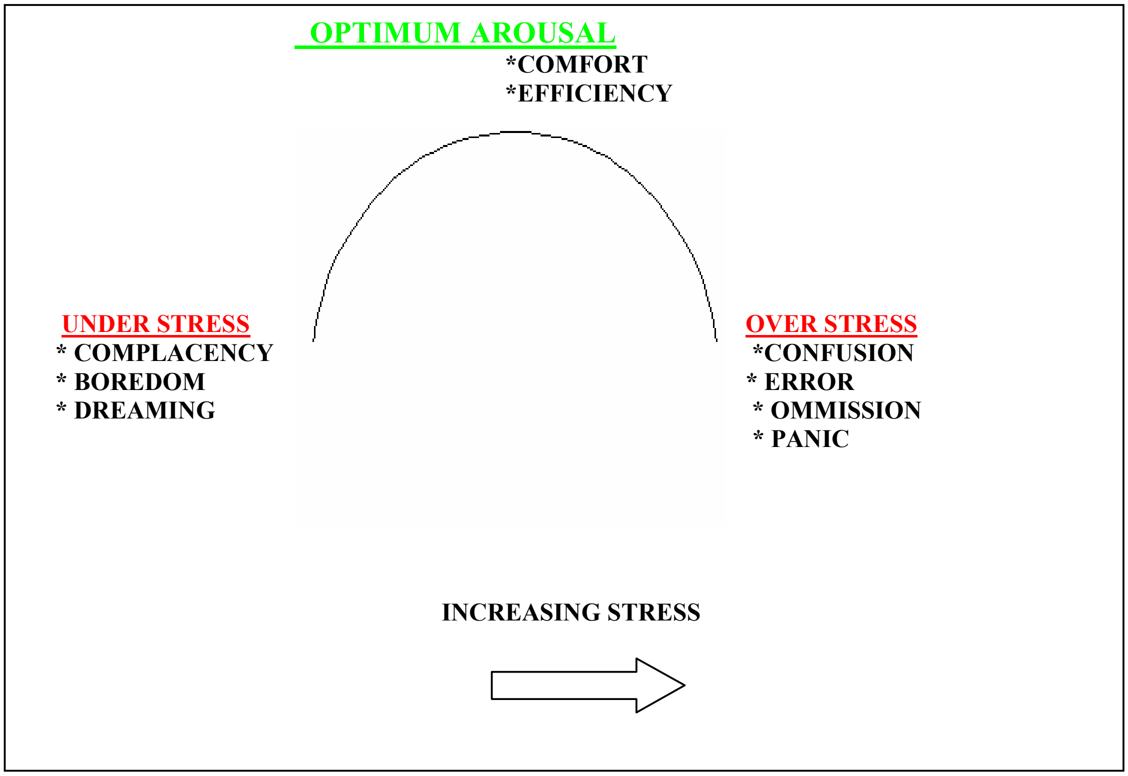
You will need to fly regularly, but if out of recent flying practice it is recommended that you seek training, or at least review out-landing techniques and procedures before flight. This is particularly important at the beginning of the soaring season when the combination of weak spasmodic lift and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

STRESS LEVELS

The amount of stress, which we experience, influences our ability to perform tasks. The stimulation from cross-country flying increases arousal, which is in our favour, however, if high levels of stress are placed upon an individual the mental and physical demands may put him or her in a position beyond the ability to cope.

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 you know yourself, and your limitations, as stress is hard to quantify. Strive to maintain optimum arousal and if you feel uncomfortable or frightened make changes to your flight so that you remain relaxed.

EFFECT OF STRESS ON PERFORMANCE



- Dehydration
- Medication
- Fatigue

As an example, cross-country flying conditions are usually best in countries where the temperature is high and the dew point low, these factors often give rise to high based cumulus which is the case in Australia .

Unfortunately, not all flying is at high levels and a significant proportion of flight may take place at low altitudes in a demanding regime of high temperature and low humidity, with resultant rapid dehydration if not controlled by fluid intake.

Be aware that dehydration is insidious and that it may lead to a reduction in concentration, and confusion. As well as fluid intake, suitable clothing should be selected to protect against sunburn and temperature. The body copes comfortably in normal clothing at between 20-30 degrees Celsius, however the danger is that when flying at low altitudes, temperatures under a plastic canopy can be extreme, sometimes reaching more than 50 degrees, with the pilot either distracted from, or too busy to drink.

In the days before a long flight or competition, pilots should control the intake of alcohol, coffee, and caffeinated drinks. Any excess of these, which may be considered as normal doses, could affect performance.

Remember that if your are thirsty you are already de-hydrated

Fatigue is frequently evident during a long flight, and in a competitive environment this may be compounded by stress. In order to guard against the onset of fatigue, pilots should always maintain satisfactory hydration and blood sugar levels, and place some thought into the selection, stowage and availability of fluid, food, clothing and ventilation.

Some medications have side effects, and it is essential that you check with your physician that these do not compromise your ability to fly. Be particularly aware of non-prescription drugs, as many of the preparations sold over the counter for colds and hay fever have side effects such as drowsiness and are unsuitable for pilots.

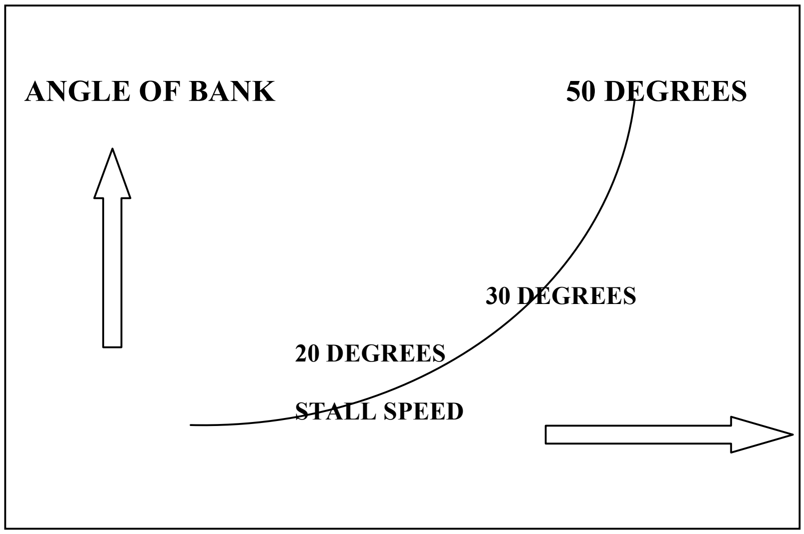
SAILPLANE PERFORMANCE

This section reviews sailplane performance as it affects the out-landing.

All aircraft need energy in order to fly. It doesn’t matter whether the aircraft is a heavy jet, light aircraft, or sailplane. In the case of powered aircraft the energy source is fuel, whereas in a sailplane, when soaring cross-country solar energy is garnered and transferred into potential and dynamic energy. A heavy jet on encountering severe downdraught or extreme wind-sheer could have insufficient energy to fly and subsequently impact terrain. However, warnings, along with procedures, techniques, and training have all been developed to manage the energy so that any encounter with severe weather is survivable.

The same principal applies to a sailplane. Energy can be lost through wind-sheer, and or downdraught, and both will be amplified by manoeuvre. You, as the pilot are required to observe, assess the conditions, manage and trade the energy so that the efficiency and safety of the sailplane is maintained until the aircraft stops. Remember that when you are turning, the energy required is greater than in level flight, and the steeper the turn the greater the energy loss.

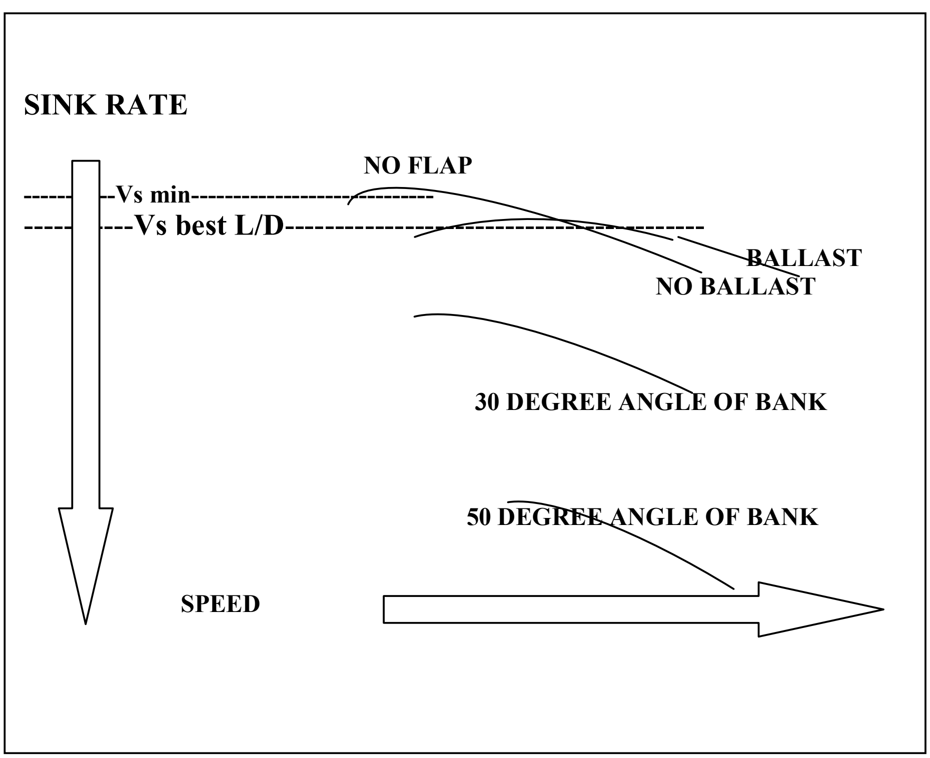
Increase in stall speed due to manoeuvre



Energy usage may be varied by: Speed, Manouvre,and Ballast

This can be demonstrated by the study of the polar curve. Note that the sink rate increases with increased speed, and manoeuvre. Ballast will have an adverse effect on sink at low speed but will be advantageous at higher speed.

The Polar Curve indicating loss of performance



The configuration and speed of the sailplane should be set to meet the operational requirement. This will be a trade between the potential and dynamic energy.

As an example consider the speeds for best endurance and the best lift to drag ratio speed. Should you wish to remain airborne as long as possible then fly at minimum sink, [Vs min]. This is the best speed for remaining in the air or climbing in the thermal. However, be aware that it is close to the stalling speed and an additional allowance should be carried if the thermals are broken.

If you wish to fly the maximum distance then fly at the speed for best lift to drag ratio [V best L/D], slightly faster in a head wind and slower in a tailwind. Flying downwind may further extend flying range. The best lift to drag ratio speed is a useful target when low as it is very close to the safe speed [Vs 1.5] in the circuit of, this gives a safety margin of 50% above the stall speed

The minimum sink speed will give the most endurance and time to think. The best lift to drag ratio speed will give the maximum distance to search for lift and suitable locations for out-landing

POSITIONING FOR 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. If flying into a strong head wind reduce this distance by half.

In most modern sailplanes you can travel 11km from 1000 feet or 5.5km from 500 feet in still air. If you are busy think in terms of 10km per 1000 feet, until you are out of trouble.

L/D giving distance per 1000 feet in still air

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

THE APPROACH

Once a decision is made to land, check that the ballast has been dumped, this reduces the wing loading and stall speed. Then fly at the recommended circuit speed of Vs 1.5. Remember that as soon as you manoeuvre the 50% margin that you are carrying above the stall speed will reduce, and that at an angle of 60 degrees of bank this margin will be lost completely.

Wind sheer and convection will exacerbate the horizontal and vertical movement of air and may cause either an increase in airspeed or a decrease in airspeed. If wind sheer is expected, counter any under sheer by a speed additive. In a flapped sailplane it may also be advantageous to consider a lesser flap setting to reduce drag. This helps to maintain energy within the sailplane. However, remember to adjust speed for the new flap setting.

Whilst it is imperative to maintain energy in flight, on landing energy needs to be at a minimum consistent with conditions. On final approach **weight** should be at a minimum, that 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], as a result this reduces the landing run and helps protect the integrity of the landing gear.

SUITABLE SURFACES

Do you look at the sky and dream, and do you look at the ground with the same intensity?

The ground is where you are going to end up on every flight, you should always know where it is, and what you are approaching over, and landing upon.

When traveling by road observe the lay of the land, how it is shaped, the type of vegetation, then try to visualize the effect that weather patterns may have on an approach into a suitable landing area. Try to visualize what would be the effect of a downwind, or cross wind landing into a setting sun. It is worth stopping to take a walk, and 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.

The cross-country pilot should study both the weather and agriculture, taking into account the slope of the ground. 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, during 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 6S and W.**

THE SIX 'Ss' ARE!

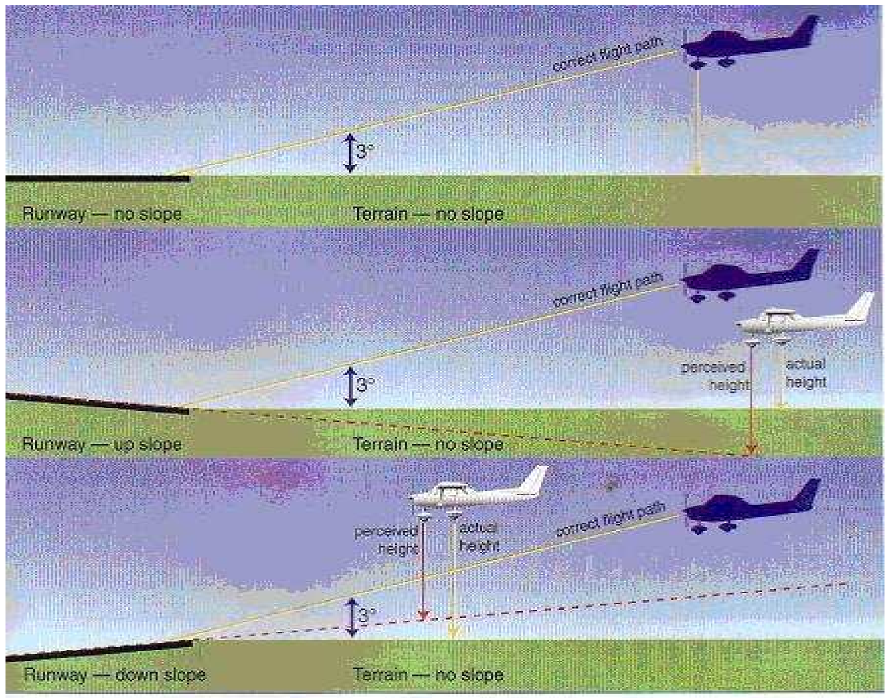
- SIZE
- SLOPE
- SURFACE
- SURROUNDINGS AND OBSTRUCTIONS
- STOCK
- SHAPE

SIZE – 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 field among even smaller fields may appear large. This is more often the case towards the hills where fields 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 fields 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.

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

Perceptual problems on approach with slope



Adapted from 'Flight Safety Australia' September/October 2002

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

The average glideslope 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 if you have to land, up-slope is the preferred option and this may be the best case even in a tailwind.

The problem associated with an up-slope downwind landing is that the ground run will be short as the sailplane decelerates quickly, but the ground speed will appear to be high. It is this visual effect, which traps the unwary into reducing 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 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 will be at the lower end of a sloping area. A field with large trees, or a hedged boundary may have a stream or ditch along it.

When the sun is off its zenith, hollows and rises are highlighted.
This point can be used to advantage later in the day.

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

1.Preferably seek an area that has previously been cropped, or is in pasture, but avoid any paddock with bales of hay.

2. Be cautious towards an area with live stock

3.Avoid fields with high crops, such as rape, sunflowers and root crops. These are usually either bright or dark coloured.

4. In some countries, and in some areas of Australia, stubble fields 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.

5. If there is a well-defined line of change in colour, beware, as this may indicate an electric fence

In farming, generally the flattest and smoothest paddocks are kept for cultivation. If a landing must be made on a ploughed or harrowed field 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 field 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 landing.**

Gliders dropping onto golf fairways are never popular, but the surfaces are smooth, well drained and undulating. It is hard to put golfers of their game, apparently a number 5 iron permits a successful chip over a sailplane wing!

Racecourses are usually clear of obstructions, but 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.

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 countries these are painted green for aesthetic reasons!

Single wire earth return lines [SWER] and trees are probably the most lethal hazards in Australia. Both reduce the effective landing distance and the latter may cause turbulence. Allow an extra 20 metres of landing distance for each 10 feet of obstruction height. SWER lines are difficult to locate but if there is a farm building assume that there will be a line or lines near by. 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 the lines may be masked by foliage. 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 and injure them. Cattle are often a problem, and bullocks can be aggressive, however cows with calves are more likely to be protective. Most animals are not aggressive, but naturally respond erratically when an unknown object appears towards them.

After landing, secure the sailplane. If left unprotected cattle can, and often will, trample and rub against any novel object such as a sailplane. Check the surrounding fields for open gates through which curious animals may wander, and an added attraction in the case of fabric aircraft is the smell of dope!

SHAPE- and orientation 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.

WIND-You should be aware of its direction at all times. The forecast will give a clue, and before setting off to fly cross–country you 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 is 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 the cloud shadows to indicate the top of the convection room, and by observing smoke and dams for the surface wind. The wind on the ground may change 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 survival 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 profile for landing is resumed.

Never stretch the glide by reducing speed below best L/D at low altitudes

A well-planned circuit will place the sailplane in the optimum envelope for approach, once 'stabilized' 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 centre 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 [Vs1.5] 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 manoeuvre.

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.

'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 a boundary fence. One way out is to apply full brake and land before the fence, however this may place the sailplane on the ground in a high-energy flare with insufficient space to stop before the obstruction.

Another way out of this dilemma is to trade the available energy by cleaning up the sailplane and accelerating down into ground effect. This reduces the induced drag but you must ensure that you have an adequate margin over the stall speed to carry out the following manoeuvre. As the fence approaches, pull up to clear the top wire, consider having the wheel up as this reduces drag and a clean fuselage is less likely to snag the fence wire. Once across the fence, land wheel up if the landing run is short. If you need to extend the flare to over-fly a ditch, hollow, or small obstruction, close the air brake to take advantage of the ground effect.

If there is a risk of collision with the far boundary, 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 risk of major damage. If the speed is low say ten to fifteen knots, then a ground loop is an option, and in this case the stick should be fully forward before the windward wing is dropped and the rudder applied. Keeping the tail down will almost certainly result in breaking the fuselage. In the case of 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 at a corner post. This will allow the wings to take the impact first, but will save the pilot.

During any of the above manoeuvres, know the configuration of 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]. If this should happen hold the controls steady to allow the inherent stability to settle the sailplane.

After any ground loop the saiplane 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 COST NOTHING!