Southern Soaring League

New Member's Handbook

As the writer, or should I say the compiler of this booklet, I would like to thank all those members who have contributed to it.

- To Martin Simons who gave permission to reprint parts of his manual for beginners and who gave me so much help in the layout.
- To the instructors who let me "listen in" on the flying field.
- To all the writers of the section on flying sites in S.A.
- To the club for supporting such a project.

Ian Moreland.

Sec S.S.L. 1990.

Edition 2 updated December 1993

Edition 3 updated September 1997

WELCOME TO SSL

Since you are reading this you have joined the SOUTHERN SOARING LEAGUE. Being in a club is half the fun of soaring. You should soon receive your first copy of our regular newsletter, the SSL Flyer. In it there will be a list of events and some information about club instructors, club meetings and our elected officers.

The club was formed in 1973, and is affiliated with the South Australian Associated Aeromodellers (S.A.A.A) and the Model Aeronautical Association of Australia (M.A.A.A.). From the beginning we have specialised in model sailplanes, with our favorite soaring sites being in the Adelaide Parklands and at Hallett Cove. Other sites are used from time to time.

At present there are about 90 active members. Members of Southern Soaring League are covered by third party insurance.

The club members will know which models are suited to the local conditions and terrain, knowledge that will have been gained by hard experience. In addition they will have a wealth of experience concerning radios, launching apparatus, building, finishing and flying. Some members are also interested in electric powered aircraft as well as gliders.

THE FIRST MODEL

With good instruction the first model should not be regarded as a total sacrifice on the altar of learning, but it will very probably end up looking very battered if not broken. So it does not pay to take a "pride & joy" attitude to the first model, in fact it does not pay to get too attached to your first three or four models, or any model for that matter. The point that needs to be made here is you must never be frightened of losing a model. If it's too precious to risk then you will be frightened when flying it. This will slow down your learning and the crashes when they do happen will be harder to take. If you are frightened about breaking models then it would be better for you to make plastic scale models.

So what should you look for in a trainer? A simple two function model is suitable, that is, one that uses only the elevator and rudder for control. Do not be tempted to get a trainer that has ailerons (buy it as a second model) as rudder for turn control is far more forgiving than ailerons when you are learning to fly.

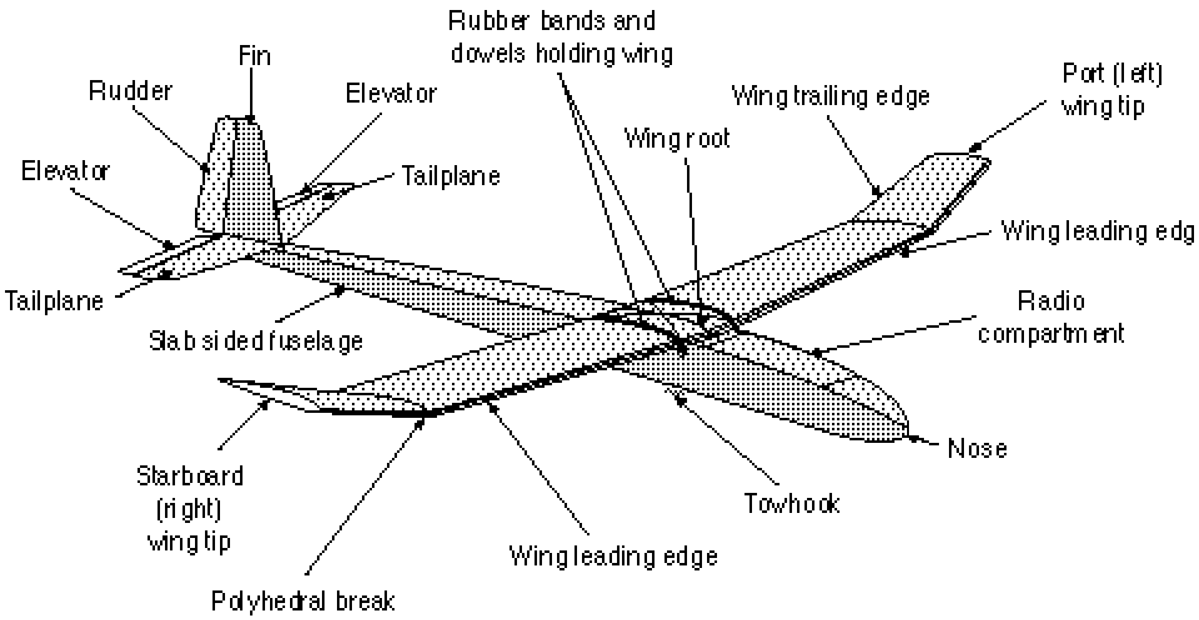
Repairability is most desirable for reasons already mentioned. The ability to repair a structure depends to a great extent upon how well you know the structure, and for this reason it is better if you have built the model yourself rather than bought a model prebuilt. So if you have some building skills use them. If you haven't, don't worry, as you will learn as you go along.

For the most part the club members have their own "pet" theories about what to start with. By asking members at club meetings or at the flying field you will get some ideas to work on. Many good fliers have started out on one or more of the following kits. Please note the recommendations are far from exhaustive and are offered as a guide only.

1. EASY ANSWER
2. QUIET ADVANCER
3. LUMINA
4. ALBATROSS
5. GENTLE LADY

Note: it is not essential to buy a kit. Models can be built from plans, but it is probably best to start off with a kit to save time in the early stages.

The diagram on the facing page illustrates the features of a simple model sailplane and names the parts.



The Wing

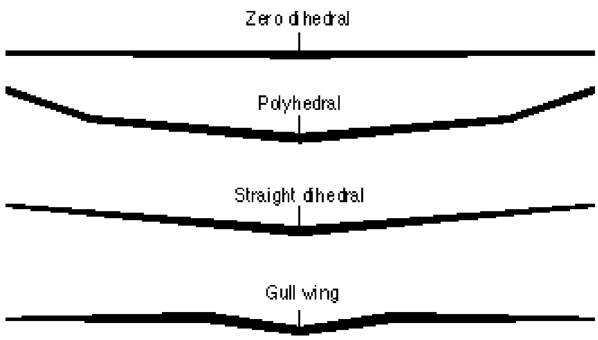
The distance from tip to tip is the wingspan or simply the span. A good span for a beginner's model is 2 - 2.5 metres (up to 100 inches). The span has a very great influence on the behaviour and performance of the model. The span is also important when considering mundane things like getting the glider into the family car! To make wings easier to carry about, they almost invariably divide into two or more pieces. The two wings will be joined, possibly by steel rods sliding into brass or aluminium tubes.

The measurement directly across the wing from leading edge to trailing edge is called the chord of the wing. This may be constant or the wing may be tapered.

The wing needs to be large and strong enough to support the whole weight of the glider without itself being very heavy. It is set on the fuselage at a small positive angle called the angle of incidence. The tailplane is normally set at zero angle of incidence. Do not confuse these fixed angles with the angle of attack to the air.

If a glider is viewed from directly in front, it will be seen that in most cases the tips of the wings are higher than the root. This upward angling is called dihedral. In some models the dihedral is continuous. The slope at the root continues unchanged to the tips. This is described as straight dihedral. In other cases the dihedral makes a fairly sharp change, increasing markedly toward the tips. This is called polyhedral. Aerobatic models often have no dihedral.

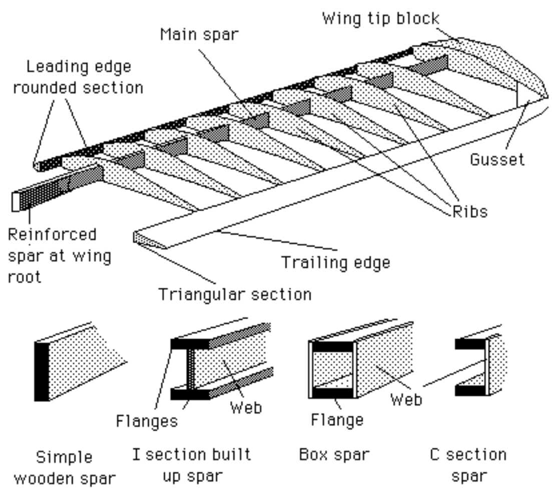
If control is by rudder and elevator only, like the typical beginner's model, much dihedral is required and polyhedral is common. If the dihedral is not enough, the rudder becomes ineffective, as explained later in the section on control functions.



Wing Structure

Two main kinds of wing are in common use. The traditional built-up framed structure is still preferred by many model fliers. There is a wooden main spar, running from the root to the tip and positioned about a third of the chord back from the leading edge. This spar may be a simple strip of wood, or may be more complicated, with top and bottom flanges and webbing between. The main spar takes most of the bending loads. There may be a second spar further aft, which helps to cope with wing-twisting forces. Some wings have additional light multiple spars to give additional support to the covering of plastic film, fabric or even paper. Set crosswise will be a number of wing ribs shaped to give the wing its airfoil section or profile. In a kit, these ribs should be provided ready cut to shape with slots to fit the spars. A trailing edge, of triangular section, is glued to the ribs at their rear ends. The trailing edge should have a sharp rear edge rather than being blunt. The leading edge, which should be shaped round to make a smooth entry to the air, is glued to the front of the ribs. The wing tip may be formed by an extra thick rib, or by a block of balsa carved and sanded to a pleasing shape.

At the wing root, spars will usually be doubled or strengthened in some way. Bending and twisting loads at the centre of the wing are large, so it is always important to build the wings strongly in the centre. Such a wing will probably be covered with plastic film (eg Solarfilm or Profilm), stuck on by the pressure of a moderately hot clothes iron and shrunk by heat to give a smooth, airtight skin. Some of the wing may be skinned with sheet balsa wood. The plastic film goes over this too.



A built up wing is almost always repairable after damage. Spars and leading or trailing edges can be re-joined and strengthened if they crack. New ribs can be cut out from sheet balsa of the same thickness and weight as the original. The covering can be patched. After repairs the wing should be as strong as ever, although often a little heavier. The extra weight is not necessarily serious although some re-balancing may be required.

The second very popular type of wing has a core of expanded polystyrene or some other foamed plastic material. Onto this a veneer of balsa, obechi, very thin (0.4 mm) plywood, or a layer of glass cloth is glued, with leading edges and tips added and internal reinforcements in places of high stress such as the roots.

In most kits the foam-cored wing is provided with skins already glued on. In other cases the core is provided bare, packed between the remnants of the block it was originally cut from (the sleeve), with sufficient sheet wood to finish. The sleeve pieces should be kept, since they are necessary to complete the skinning process and for repairs. The adhesive chosen to glue veneers to the plastic requires care because some glues will dissolve the foam. The instructions with the kit should cover these points. If not, seek advice before starting.

After the skin is on, it is still important not to allow paints, thinners or any other liquids or vapors of the wrong kind, to penetrate to the underlying plastic, which they can do even

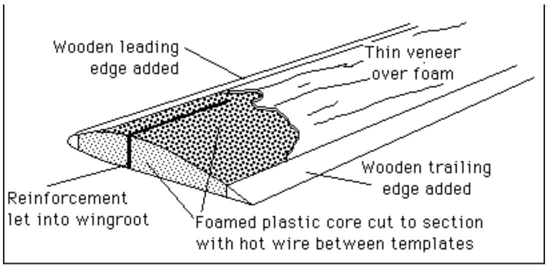
A veneered wing can be covered with heat shrinking plastic film, but other treatments are possible, including skinning with light glass cloth and epoxy resin, smoothing and painting.

Such wings are very robust and will stand more abuse than the built-up variety. They may survive unharmed in crashes which would break a built-up wing but they tend to be slightly

Foam cored wings can be repaired unless they have suffered extensive crushing. Small dents can be filled in and sanded, to be re-painted or re-covered. Larger dents can be cut out, new

wing breaks right across near the root, with little chance of restoring the original strength, it is often best to make a completely new wing. This may entail buying new foam cores, since

equipment. Someone in the club will know how it is done!



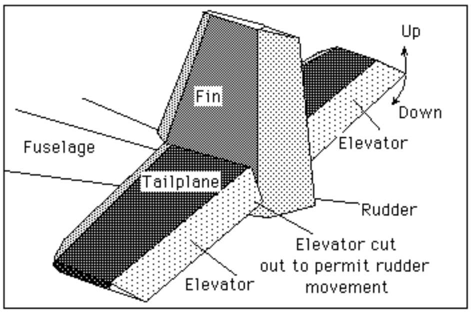
The Tail Unit

The tail is really a small set of wings whose work may be likened to that of the fletching on an arrow, keeping the glider heading into the airflow and also directing the flight.

The horizontal tailplane, often called the stabiliser (stab for short), is there to balance and damp down or stabilise any up and down pitching. In straight and level flight the tailplane operates at a slightly negative angle relative to the wing. The elevator controls nose up and nose down motion and hence the flight speed and glide angle. Some models have a fixed tailplane to which the elevator is hinged. In other cases, an all moving or slab tailplane (in some older texts called a pendulum elevator) is able to pivot about a crosswise rod, so the entire tailplane surface becomes also the elevator.

The vertical tail surface or fin stabilises side to side yawing motions. The rudder is hinged to the fin and is used to yaw the glider to left or right as required by the pilot.

The tail is lightly built but it has to be strong enough to do its job even at high speeds when the controls are being operated, and to survive the occasional heavy landing.



The tail unit

The fuselage

The fuselage exists mainly to house and protect the radio gear and to join the wing and tail of the glider together.

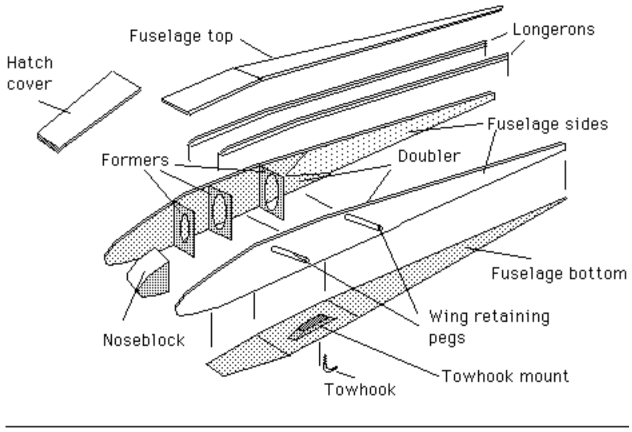
Fuselages take a lot of punishment even when the model is well flown. Model gliders do not often have any real undercarriage but land on the belly. Even in a perfect landing the model slides along the ground and may scrape against stones and gravel or even concrete. In bad landings it is the fuselage which hits hardest. It also provides the attachment point for the tow hook which comes under strain during launching. Fuselages have to be strong and are quite heavily built by comparison with the wing. The front part where the radio is, and often some heavy trimming ballast too, is one area where a very heavy landing can result in the fuselage bursting open. Another common point of breakage is at the rear, just in front of the tail.

A beginner's kit will normally provide materials for a squarish or slabsided wooden fuselage. This will be a long, narrow box, with sides, top and bottom of sheet balsawood, probably strengthened at vital points with plywood doublers and cross frames or formers, and longerons running from nose to tail. There will be compartments ahead of the wing for the trim ballast, battery, receiver and servos, and control pushrods will run through to the tail. Details of how to fit all this in will depend slightly on the type of radio and control rods to be used.

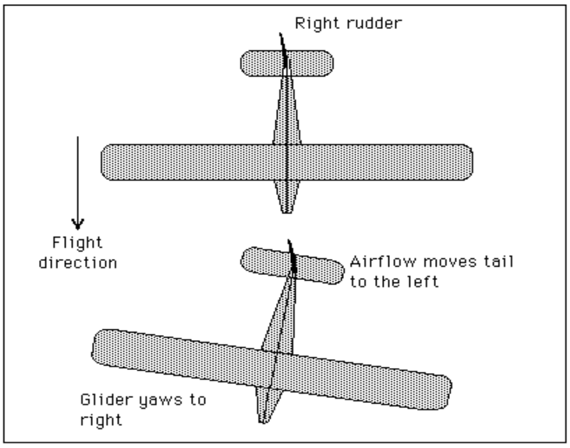
The instructions with the kit may recommend skinning the front of the fuselage with glass cloth, mainly to resist wear in landing and the occasional heavy blows. It is worth doing this, if possible, even if the instructions do not mention it.

If the wings are to be held on with rubber bands, which is a very popular and reliable method, crosswise wooden dowels will be fitted just behind and just in front of the wing to make a secure anchorage. It is wise always to use about six bands on such a wing, in case some of them snap in the air.

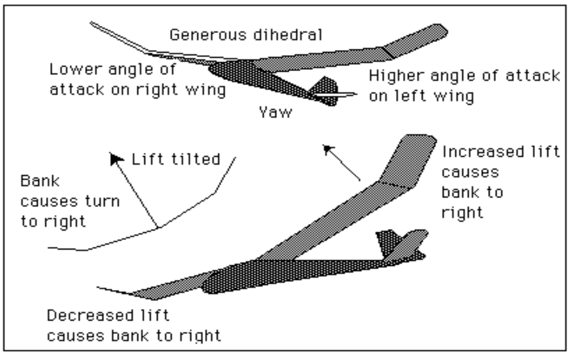
Otherwise the fuselage may provide for wings to plug on. In these cases some way of preventing them working loose in flight is required. There may be a pair of hooks on the wing root ribs, allowing a stretched rubber band to pass through inside the fuselage and pull the wings together, or a spring clip of some type may be used. Some modellers rely simply on electrical tape to hold the wings together but this marks the model and may strip the wing covering. A detachable hatch cover or canopy will be required, to allow access to the radio and the switch if this is internally mounted. Mounting the switch externally is easy and makes for convenience, but it has been known for a pilot or helper to knock the switch off accidentally just before launching. It is slightly safer to have the switch inside with the receiver or battery compartment so that access to it is obtained only by removing the hatch cover. In either case, make quite sure the switch is on before every flight!



Components of a simple slab sided fuselage



Primary effect of rudder:right rudder, yaw to right



Further effect of rudder with dihedral: right rudder right bank, right turn.

Control functions

The three control axes of an aircraft are.-

Pitch: controlled by the elevator (or all moving tailplane),

Yaw: by the rudder.

Roll: by the ailerons

It is a matter of some surprise to many pilots of fullsize aircraft to learn that the sole directional control of most thermal soarers (and many other r/c aircraft) is rudder. They naturally assume that aileron is necessary, as with a full size aircraft, to give roll control and enable properly coordinated turns to be made. This is not so, and when coupled with the correct amount of dihedral on the wing, rudder can produce smooth, banked turns due to a phenomenom known as "rolling moment due to sideslip". In simple terms, applying rudder to, say, the left causes the model to yaw, right wing forward. Since the model is now flying sideways through the air, the lift of the advanced wing produces a rolling moment tending to lift this wing and bank the model into the turn. If the glider has little or no dihedral, it will tend to skid sideways through the air, but still travelling in a straight line; in such cases ailerons are needed to produce a satisfactory turn. If, however, the model has adequate dihedral, a bank will develop in the direction of the turn. This then, is the reason why rudder - elevator soarers can make properly banked turns. The only situations where the shortcomings of the rudder/elevator model become apparent are when a very quick banking effect is required; for example, to pick up a wing when travelling crosswind near the ground.

THE RADIO CONTROL GEAR

The model flier can operate modern radio control gear without any knowledge of radio or electronics, except for a few very important things like ensuring that the equipment is switched on, batteries fully charged, wires not about to break, and that miniature plugs are properly inserted. Flat batteries and broken wires are probably the chief cause of loss of control of model gliders. Launching the model without switching the radio on is also more common than it should be.

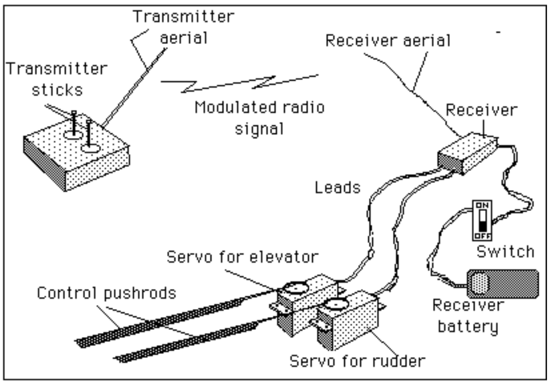
Assuming all such details have been attended to, the pilot operates the transmitter which translates movements of thumbs and fingers into coded signals, actually a series of high speed digital impulses or 'bleeps', imposing these on, or modulating, the radio signal from the aerial.

The receiver in the model, tuned to the appropriate frequency, picks up the signals coming in through its own aerial, decodes them and passes them to the small electric servo motors which, in turn, respond with a mechanical movement. The servo arms are connected, by pushrods or cables, to the controls of the glider.

Modern radios are crystal controlled. Small wafers of crystal, ground very accurately to thickness, are plugged into the circuits of the transmitter and receiver. The crystals vibrate at a set rate and keep the transmitted frequency very exactly to its specified value.

The crystals look like small two pinned plugs and fit into sockets so that they can be changed when necessary. A receiver with the wrong crystal for its transmitter, or no crystal at all, will not work.

It is best to leave the crystals in their sockets as much as possible, since damage can be done by too much handling. They can, however, be changed to alter the operating frequency of the radio. This is useful if many people are trying to operate on the same channel at a particular site.



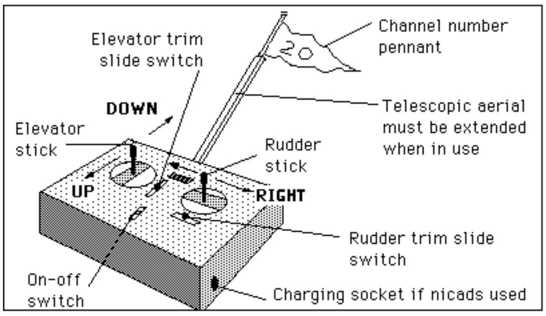
Components of a two function radio control system

Two Function Transmitters

For a two channel set of radio control equipment there will be a self contained transmitter, small and light enough to be held in the hands. It will have an on/off switch, and an access panel to allow for changing the batteries. The crystal may be hidden inside the case but more likely will be accessible from outside. If nicad batteries are fitted there will be a socket for the charger. A small meter or at least a light will indicate whether the set is switched on. The telescopic aerial requires to be screwed on and must be fully extended when the set is in use. In some older transmitters, switching on without the aerial could cause damage, but modern equipment avoids this.

On the face of the transmitter will be two control levers or sticks, one capable of moving back and forth, the other side to side. The right hand stick will be the one which moves sideways and this is for working the rudder on the glider. ie stick to the right for right rudder and stick to the left for left rudder. When the glider is viewed from behind, right rudder means the rudder goes to the right as the transmitter stick also goes to the right. When connecting the controls of the glider, make sure that this is correct.

The left hand stick then is for the elevator. The trailing edge of the elevator goes down when the stick moves forward; stick back, elevator up. Light springs inside the case return both sticks quickly to the central position if they are released. Close to each stick will be a small slide switch for trimming, that is, making minor alterations to the setting of the controls in flight.



Two function radio control transmitter

Four Function Transmitters

On a four channel set the two sticks will be mounted on universal gimbals for movement in any direction. The centreing springs are fitted as before, except that the fore-aft motion of one stick will be governed by a ratchet. In the forward and back direction, this stick will remain in any position without automatic re-centreing. With gliders, this stick may be used to control airbrakes or spoilers. (In powered models it works the engine throttle.) Radios with more than four functions retain the same kind of sticks. The additional functions are controlled by sliders, knobs, switches and special buttons.

The Receiver

The receiver in its own small case with an aerial wire (which must be uncoiled to lie or be suspended straight in flight) will have sockets for the servos and battery to plug into. The instruction book will explain which socket is for which control, and these may also be marked or numbered on the receiver. There will be a simple slide switch, with wiring harness and plugs to connect the receiver to the battery.

Servos

In a first set of equipment the servos will be of standard size. Later, smaller, lighter and more expensive ones may be obtained, or servos with ball bearings which respond more quickly and precisely, or larger servos with more power for bigger models.

Operating range

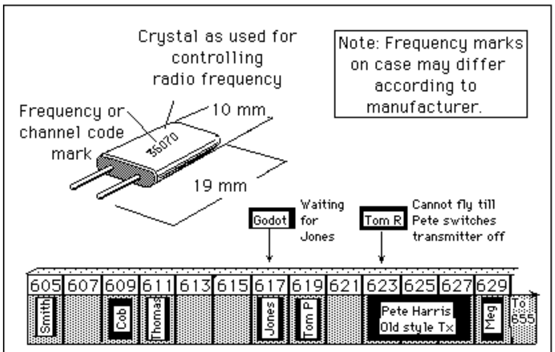
Given fully charged batteries and with all the equipment in good condition, a model glider can be controlled in the air until it becomes difficult to see. The model will be out of sight before the radio range is exceeded. It is of course very risky to let a model get so far away. It is very easy to lose control simply by being unable to see what the model is doing.

However, various things can cause a model to go out of range while still in sight. If the aerials are not extended this cuts the range down to a very short distance. Make sure the aerials on both the transmitter and the receiver are fully extended before flying.

With long use, the transmitter aerial may become loose in its socket, or the joints can develop electrical faults, either of which can cause loss of range. Have the aerial checked from time to time.

If the receiver aerial is run loosely inside the fuselage of the glider a heavy landing can cause it to bunch up to the front and if this is not discovered the next flight becomes a disaster. The fine aerial wire can get broken too. Inspect it to make sure this has not happened.

Some kinds of paint, especially with lead or other metallic content, on the fuselage, can shield the receiver aerial. Some materials, such as carbon fibre, also prove to have bad effects and some model fliers have had trouble with metal control pushrods and cables. For all these reasons, the receiver aerial is best arranged to lie outside the fuselage, either taped to the side or stretched lightly to the top of the fin.



Frequency control board. Free channels unoccupied by keys

Ground Testing

As will be explained later, in the section "AT THE FIELD", your instructor will do a "range test" of your radio equipment prior to your first flight. What it entails is getting someone to hold the model off the ground while the instructor walks away from it with the transmitter, operating the sticks to see if the controls are, or are not, working correctly. Any defect in the system usually shows up as a rapid 'chattering' with the servos running to one extreme position and staying there. If there is a problem and the cause of this cannot be found and corrected easily, you will be advised not to risk flying but have everything checked by a qualified radio servicer.

Radio Frequencies

Any radio transmitter that will be operated at the flying field must be checked to ensure that its bandwidth is within legal limits. If you have any problems in getting your transmitter checked ask your instructor or one of the club's executive members for the details of an MAAA authorised inspector.

The frequency bands permitted for radio control equipment in Australia are 29, 36 and 40 Mhz. 27 Mhz is not used for models now because of interference from Citizen's Band radios. This should be remembered as old radio gear does appear on the secondhand market. Radios bought overseas will often be tuned to 35 Mhz or some other frequency which is not legal in Australia. 35 Mhz sets can usually be re-tuned but new crystals will be needed.

Know Your Channel Number

If two transmitters on identical channels are switched on simultaneously, they interfere with one another, resulting in one or both models crashing. Anyone who switches on a transmitter without first ensuring that the frequency is clear, is likely to become very unpopular in a very short time, and WILL be held financially responsible for damaging someone else's model. Do not, for example, switch the transmitter on 'just for a quick check', even with the aerial down, in the car park before taking the model out to fly.

Make sure the exact frequency of the transmitter crystal is known and, if it is not already marked, write it down clearly and label the transmitter case and your frequency key. If there is any doubt, a typical crystal should have its frequency marked in small figures on the side of its case, such as 29.785 in the 29 Mhz range, or 36.050 in the 36 Mhz band.

The 29.785 Mhz crystal, for example, is Channel 16, 36.050 Mhz is Channel 605. Radios on 29 Mhz used to come with a small pennant with the correct number, to be attached to the transmitter aerial. There is much to be said for making such a pennant for 36 Mhz sets, for which they are not provided.

The usual system of frequency control is to set up a board with all the available channels marked and numbered. Anyone wishing to switch on a transmitter checks the board first. If the required channel is clear, that spot must be reserved by placing a key with your name and channel number in the board. Make sure that you always carry your frequency key so that you can use the frequency control board when you fly at any flying field. If you have any doubt ask your instructor. No-one should switch on a transmitter unless their key is in place. It is also important to remove your key quickly when the channel is no longer required, to let someone else use it. In large contests, a system of keeping all transmitters in a 'pound' may be used, the only ones allowed out being those to be used immediately for a contest flight.

Ch	**Freq**	**Ch**	**Freq**	**Ch**	**Freq**	**Ch**	**Freq**
10	29.725	601	36.010	629	36.290	50	40.665
12	29.745	603	36.030	631	36.310	53	40.695
14	29.765	605	36.050	633	36.330		
16	29.785	607	36.070	635	36.350		
18	29.805	609	36.090	637	36.370		
20	29.825	611	36.110	639	36.390		
22	29.845	613	36.130	641	36.410		
24	29.865	615	36.150	643	36.430		
26	29.885	617	36.170	645	36.450		
28	29.905	619	36.190	647	36.470		
30	29.925	621	36.210	649	36.490		
32	29.945	623	36.230	651	36.510		

34	29.965	625	36.250	653	36.530
36	29.985	627	36.270	655	36.550

Interference

Interference is still possible in some circumstances, even between different channels. A cheap transmitter, for instance, may tend to swamp the adjacent channels on either side. In this case, the club will require the member to use a wide key on the frequency control board so that all the channels affected are closed while this radio is operating. One of the points to ask about when buying the gear is whether it will be acceptable in this respect.

Interference can also arise, though rarely, due to harmonic effects between two transmitters even though they are widely separated on the frequency board. It is risky at any time to fly a model very close to someone else's operating transmitter, since occasional breaking through of their signal can occur.

Interference from other sources

If someone is working a radio controlled model car or a boat and a glider on the same channel flies nearby, then the glider will crash. This is particularly worrying since the sailplane may easily fly several hundred metres away from its transmitter and can pick up signals from a source quite unsuspected by the pilot. Cars and boats do sometimes operate on the same channels as aircraft, even though the 36 Mhz band is supposed to be reserved for flying and competition boating. This point too should be considered when buying equipment. 29 Mhz is safe if there are no other radio controlled models of any kind in the district, but this is not easy to guarantee.

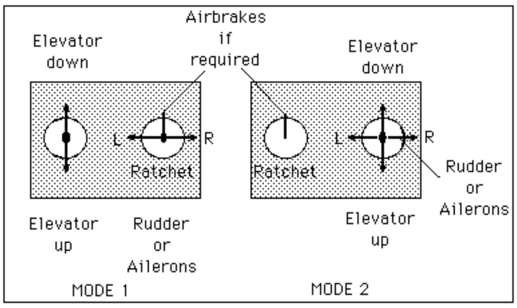
Occasionally model pilots have complained of interference from paging systems in nearby offices or hospitals. Modern receivers do not seem to suffer much from this problem.

Control modes

Most Australian glider pilots fly with the elevator control worked by the left hand and directional control by the right. This is called Mode 1. Airbrakes might be operated by the right hand stick which has the ratchet fitted.

Some pilots with four-function radios adopt Mode 2. The elevator and directional control are both worked by the right hand stick. The ratchet is then fitted to the left stick.

Suitable four function transmitters can be obtained for either mode, and it is usually easy to move the ratchet and centreing springs to suit the pilot.



Alternative control modes on the transmitter

Which mode is used will probably depend on the preferences of the instructor who teaches the beginner to fly. It is possible to change over later. Although there is much argument, there really is not much reason to prefer one mode to the other. Mode 1 is liked by many because it separates the two main functions. The pilot after a time automatically associates the right hand with directional control and the left hand with fore and aft pitch. Co-ordination of the separate hands is more quickly learned.

Mode 2 appeals immediately to people who have experience of flying full-sized gliders and aeroplanes, since they are used to having ailerons and elevator controlled by the right hand, air brakes or throttle on the left. (Rudder control on full-sized aircraft is by the feet, which is one of the differences.)

Probably the most important thing is to have one's models set up like everyone else in the club. In the S.S.L. The majority of the pilots fly MODE 1. If you choose this mode it is possible to hand over control to someone else if necessary and to fly one anothers' models.

More Details About Radios

Like domestic radios, model radio control sets may be amplitude modulated (A.M.) or frequency modulated (F.M.). A.M. was on the market many years before F.M. appeared. A.M. is somewhat more prone to interference and swamping from random sources than the more up-to-date F.M. equipment. Many A.M. radios are still operating successfully and they appear on the secondhand market from time to time. Older A.M. transmitters may have to use a wide key in the frequency control board.

Pulse code modulation (P.C.M.) is a yet more recent innovation which gives even more resistance to interference. Naturally, a higher price is paid for this improvements.

Servo Reversing

Modern radio transmitters usually have provision for reversing the direction of the servos. This is very useful if for some reason the linkages inside the glider come out the wrong way round, so that left on the transmitter stick gives right rudder, or back stick gives down elevator.

Such problems should be avoided by planning during construction. If you rely on reversing switches, one day you will forget to change them. A good many models have been wrecked by taking off with the reversing switches set the wrong way around.

Other luxuries include control throw adjusters, exponential and rate switches, control mixing (e.g., rudder working with ailerons, elevator with flaps or air brakes, and V tail combinations.) All such devices have their value, reflected in the cost of the equipment, but the beginner is advised to leave them alone until experience has been gained with a simple two control model.

BEFORE FLYING

By way of explanation for the uninitiated, the term "trimming" is widely used by aeromodellers to describe the whole process of test flying a model and adjusting it to give the best performance. A properly trimmed model is easier to fly well, and will make better use of any "good air" which may be found.

In The Workshop

The process of trimming starts long before we reach the flying field. The following is a list of the routine checks which should be carried out on the model when it is completed, or in some cases during assembly:--

1) Check the wings and tail surfaces carefully by viewing them from front and back to ensure that the leading and trailing edges are parallel i.e. that there are no "warps". If the surface is twisted it should be gently heated with a fan heater or steamed in the jet from a

kettle, and then twisted and held straight whilst cooling. Several applications of heat may be necessary to remove a stubborn warp. Many models with tapered wings have equal "washout" (warps deliberately built into each wing tip, the wing being built with a slight twist, trailing edge higher than leading edge), to help prevent tip stalling and this must be borne in mind when checking for other warps. Even in models which do not incorporate washout, a slight trailing edge up twist at the tips is tolerable, provided it is equal on both wings. "Washin" - that is leading edge high - should not be tolerated under any circumstances. Do not neglect to check that the rudder is true and unwarped.

.

2) Assemble the model with all the radio equipment in place, and carefully balance it with a finger underneath the wing roots on either side of the fuselage to establish where the longitudinal balance point lies. This point must coincide with that shown on the plan, and often marked as the "c.g." (centre of gravity). Its position is normally quoted as a percentage of the root chord back from the leading edge; for example, on a 250 mm chord wing, a c.g. position of "30% " would indicate that the model must balance 75 mm back from the root leading edge. A slightly forward balance point is safe to start with, but if it is behind the marked position, add lead to the nose until it is correct. By the time the modeller progresses to designing his own models, he will have also developed his own ideas of how to "rig" an aircraft, setting the relationship of wing and tail incidences and c.g. position. But, for the beginner working from kit or plan, the rule is "stick to the instructions"; put a piece of masking tape on the fuselage and mark the c.g. position on this for further reference.

3) Check the assembled model for lateral balance about the fuselage centre line. Unless you are an extremely accurate (or lucky) builder, one wing tip will be heavier than the other. This must be corrected by adding weight to the light tip in the form of small nails or lead slivers pushed into the tip.

4) Place the assembled model on a large flat surface, so that it is resting naturally on the fuselage, and chock it in position with the wings level. Note on which points of the fuselage the model is resting and, using a straight edge, draw a corresponding line on the fuselage side view on the plan. The incidence angles of the wing and tail can then be checked by measuring the distance from the line to the wing and tail leading and trailing edge positions on the plan, and checking this to the corresponding distances between the flat surface and the model's leading and trailing edges. For models which feature "plug in" two part wings (as most thermal soarers do) a very important part of this check is to ensure that both wings are at the same angle of incidence. It is all too easy to build in a slight difference between the two wings, and a model with this problem is impossible to fly accurately. Similarly, where an all moving tailplane with plug.in halves is used, the incidence must be equal. While the model is still on the board, check that the dihedral of the wings is equal and that the tailplane tips are both the same distance from the board.

5) Using a piece of string, check that the distances from the nose to each wing tip, and from a fixed point on the fuselage centreline to each tailplane tip, are equal; this is to ensure that the surfaces are square to the fuselage in plan view.

6) Switch on the transmitter and receiver, and set the rudder and elevator trim levers to neutral. Remove the hatch on the model and check that the output arms of the servos are correctly set at 90° to the line of the control linkage. Some servos use a four sided output shaft, in which case no simple fine adjustment of the neutral position is possible, but others have a splined shaft which does permit adjustment, by releasing the central self tapping screw, lifting the arm slightly and moving it, then retightening.

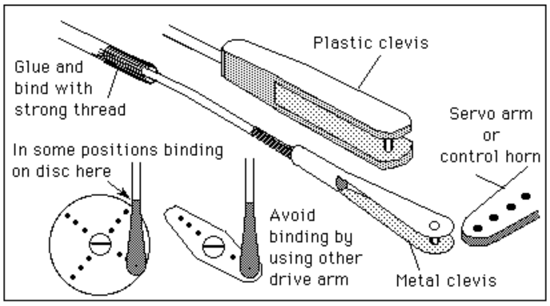
7) Now check that all control surfaces are precisely central (or, in the case of an all moving tailplane, in the position previously determined in check 4. Adjust the threaded control clevises

at the surface end of the control linkage to achieve this. Switch off the receiver, followed by the transmitter.

8) Check that the tow hook is in the correct position as per the plan.

9) Carefully "eyeball" the model to ensure that the wing and the tail are correctly aligned when viewed from the front and the rear, especially that the wing's dihedral is equal.

At this point you are ready to proceed to the flying field, although it's probably dark by now! But do not forget the old adage "act in haste, repent in leisure."



Pushrod ends and clevis attachments

At The Field

1) Introduce yourself.

2) Have your model checked out and do all you can to help in the preparation of your model for its flight

3) Listen carefully to what the instructor tells you and follow the advice as closely as you can.

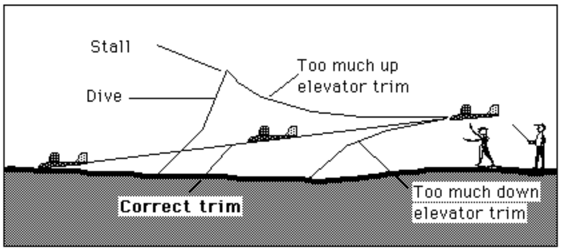
Firstly you will introduced to the frequency "key board" before you touch your transmitter. If you do not have your frequency key the instructor will use a club spare with your name and frequency written on it. Do not forget to return it to the instructor.

Some modellers dispense with test gliding and in truth, it will not tell you very much, other than giving approximate confirmation of the trim. There is little point in trying to adjust a model properly in strong wind conditions, so choose a day with no more than three or four knots blowing. If all the steps laid out here have been followed, the test gliding stage should be a formality.

With the frequency key in the board the radio equipment switched on and transmitter aerial extended, the instructor will hold the model overhead, slightly nose down, and push it smoothly forward into the wind. Watch the flight path closely. If the model "stalls" - that is, noses up gently and then enters a slight dive - the instructor will add a couple of "clicks" of down trim. If the model glides steeply (dives) the instructor will adjust the trim with a few clicks of "up" trim on the trimmer controls on the transmitter. If the model follows the middle of the three flight paths, no corrective action is required.

Once the glide path is correct (and, as implied, no very great adjustments should be necessary if the model is accurately built to a reputable design) rudder and elevator controls may be tried out gently during the next few glides. The instructor will point out that care is required here, since over energetic use of the controls at such low altitude can easily cause a stall or wing tip landing. There is now nothing to be learnt from further hand gliding, and the next stage is a tow or bungee launch.

Prior to this first "real" flight, the instructor will get you to do a "Range test on the model". To do this the instructor will get you to walk away from the model and while the transmitter antenna is collapsed, or removed, he will operate the controls until the model no longer responds accurately to the transmitter. If all is well it will be time for your new creation to take to the air.



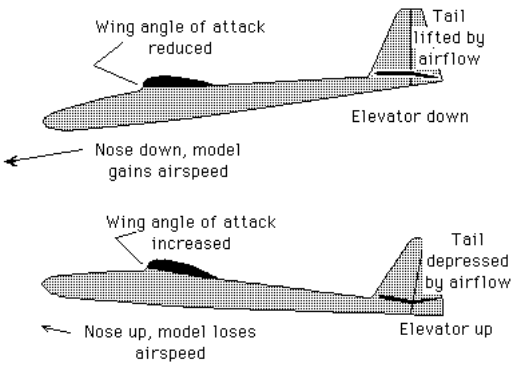
Note that there is no single "correct" ground range. Yours should be comparable with another set of the same brand and model. You should record the results of your test so that in future you will know if you have lost range.

We will ALWAYS take the utmost care of your new model but MURPHY and his laws are forever lurking, so be prepared!!

As the model comes off the launch the instructor will watch the model closely and adjust the elevator trim for a steady flying speed suitable for instruction and then turn his attention to the directional controls. Is the model flying straight? If not, he will carefully move the trim lever for the primary direction control, that is the rudder, in the opposite direction to any turn, a little at a time, until the model will fly straight "hands off" at its normal flying speed.

He will now gently increase the speed by applying a little down and note the effect on the directional trim. Does the model start to turn again in the same direction as it did originally? If it does there is undoubtedly a warp in the flying surfaces, probably in the wing, which is cancelled out by the rudder trim at lower speeds, but becomes more effective as the speed builds up. If, on the other hand, the model starts to turn in the direction of the applied trim as speed increases, then the probable cause of the original turn is an offset fin, warped rudder, tilted tailplane or heavy wing tip.

All these adjustments will probably take two or three flights to complete. In any case your instructor will show you what to do. After completion of this series of trim adjustments, the model should fly straight, hands off at the slowest possible speed without stalling. However, the surfaces and transmitter trims may not be central. To correct this, the following procedure applies:-



1. If some rudder offset is necessary for straight flight, find the cause (wing or tail warp, offset fin or twisted rudder, tail tilt or unbalanced wings) and correct it. None of these problems should arise, of course, if the initial setting up procedure is followed. If the rudder is central and the transmitter trim is not, adjust the linkage on the model until central rudder coincides with central trim on the transmitter.

2. If an all moving tailplane is used, carefully mark on the model the neutral position which has been determined by testing. Switch on the transmitter and receiver, return the elevator trim to just on the "up" side of neutral and adjust the elevator linkage in the model to bring the tailplane back to the marked setting. If a "separate elevator" type tailplane is used, the same procedure can be followed. Further test flying, making a little adjustment at a time, is necessary to do this.

Since the transmitter trim is set slightly "up" for absolute minimum sink (slowest flight without stalling), then if it is moved to neutral for normal flying, this should coincide with the best compromise trim for flying in light winds. In flat calm it can then be eased back to slow the model right up and conversely a little "down" can be fed in to facilitate 'penetration' in higher winds. All this procedure for arriving at the correct trim with the transmitter trim controls at neutral may sound rather long winded. However, the availability of in flight trim should never be used as an excuse for flying a badly adjusted model.

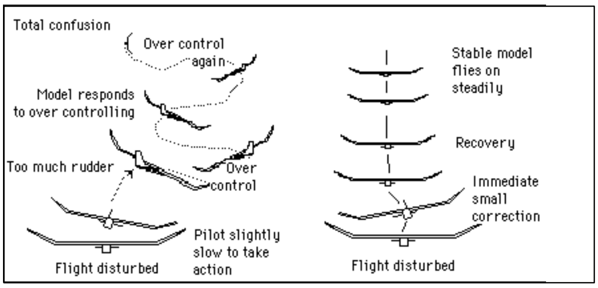
The value of central trims assumes much more importance when the pilot has more than one model. If they are not all set up the same way then the first part of each flight after changing models will be spent in establishing the correct trim. This is acceptable (if inconvenient) for sport flying, but disastrous in a contest if a hurried model change is forced by damage to the number one model.

The instructor will help you during most of the above and with the next few launches. You will note however that you will be doing more and more of the flying and the landings. If you get to this stage and you can fly the model up the towline and land within a reasonable distance from your feet you are becoming a competent pilot and the log book that you are keeping of your flights will show that the flights are becoming longer and longer.

TAKING CONTROL

A well trimmed aeroplane or glider is stable. If the controls are left entirely alone in one position, the aircraft will fly itself.

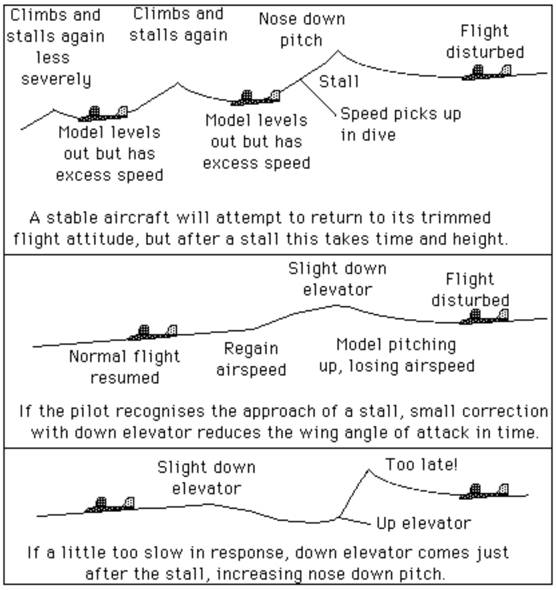
The beginner should therefore let the glider manage itself to a large extent and use the controls gently to persuade it to do what is required, rather than violently 'giving it a lot of stick'.



Over controlling, a common fault with beginners.

The most common mistake is over controlling. Suppose the model is tilted over to the right by a sharp gust. The beginner tends to push the rudder hard to the left to correct this. Such a heavy handed action causes the model to lurch sharply too far that way and, seeing this, the pilot slams on hard right rudder. The model yaws wildly over, seriously upset, and soon it is cavorting all over the sky as the pilot desperatly thrashes the stick to and fro. Yet that small disturbance would probably have requires only a very gentle corrective movement of the rudder or maybe nothing at all.

The same with the elevator, only more so. If the nose of the model is canted up by rough air, there is a danger of stalling. Stalling is only dangerous if it happens near the ground, so there is usually no need to panic. If left alone the model will try to correct itself by nosing into a gentle dive to regain airspeed.

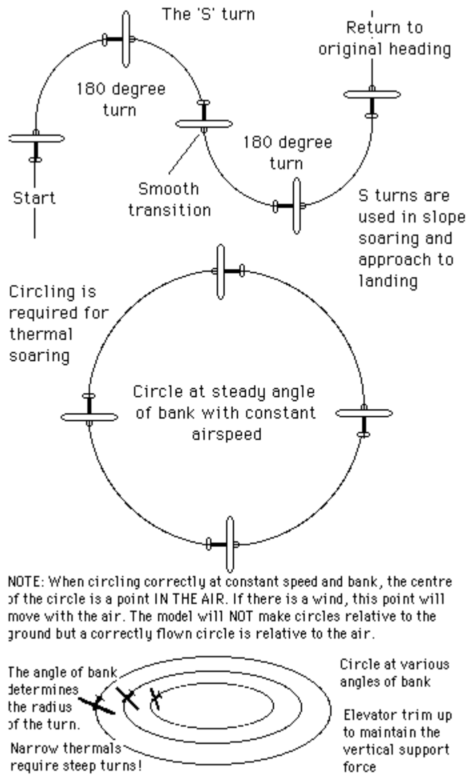


Coping with a stall

But seeing the nose go up, the beginner tends to push in a lot of down elevator control. Probably this violent action takes place just as the model's own stability was bringing the nose down anyway, so the two coming together pitch the glider violently forward. In the ensuing steep dive it picks up speed and loses height rapidly, the pilot panics, yanks the stick back like a pump handle and the model careers upward in response, often into a violent stall; the very thing that the pilot wanted to avoid!

All the required actions are quite small. Watch an experienced pilot's hands on the transmitter. You will be surprised at the small stick movements that are used, most of the time, to achieve the required control.

If things go really wrong and you do not know what to do, and if the instructor is out of reach, remember the models' stability, if left alone, will try to sort things out. Centralise all the controls and give it a chance to recover. If you have got things into a really bad situation you may not save a crash, but at least you will not have made things worse!



Some useful flying exercises for practice

GETTING INTO THE AIR

You can go on using the club winch and bungee for as long as you like and depending on it being used for instruction there is little need for you to make your own. But there will come a time when you will need to own some method of getting aloft indepedently of the club's resources. It may be that the club's equipment is being serviced or that there is no instruction on the day that you want to fly (contest days). If you have made several flights and have completed most of the tasks in the log book (that is included in this kit) and you feel confident, launch yourself on you own hand line, bungee or winch.

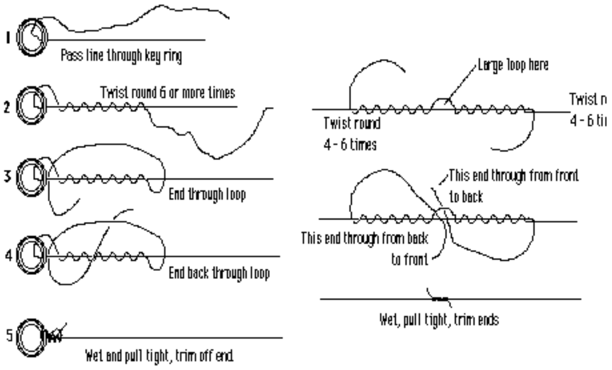
You can go to the local model shop and hand over more of that hard earned cash or you can make your own.

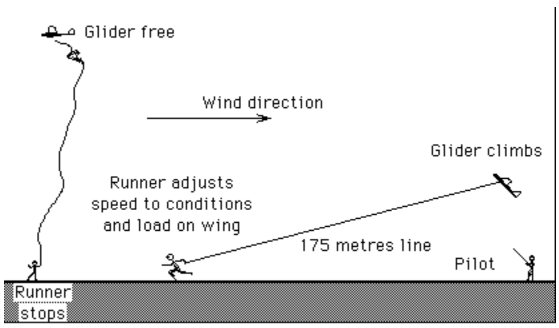
The principles of launching a model sailplane with a towline are the same whether a hand tow, rubber bungee or winch is used.

For line launching, the glider has an open hook on the underside of its fuselage. A ring, such as an ordinary key ring, attaches the line temporarily to the glider, which is pulled up like a kite. The ring falls off the hook when the tension is slackened at the top of the launch. There is a pennant or a small parachute to help the pilot to see when the line has come off and to keep it straight as it falls. Fishermen's knots are essential for joining the monofilament line and repairing breaks.

The hand towline

Sometimes the best way of launching a glider is by hand towing. The pilot needs the help of a runner to get his model up this way. 30 kg (60 lb) fishing line is strong enough. The figures refer to the nominal breaking strain of the line. For competitions there is usually a limit on the length of line allowed to prevent anyone gaining an unfair advantage. A spool of some kind is needed to wind the line on when not in use. Wooden winding frames like those used for kite strings can be made easily. Special geared hand winches for towlines are available but are not cheap. These enable the line to be wound in very quickly after launching, which is required in competitions. A good hand towline launch can take the glider up to the full length of the line, i.e., 175 metres (574 ft) from the ground.



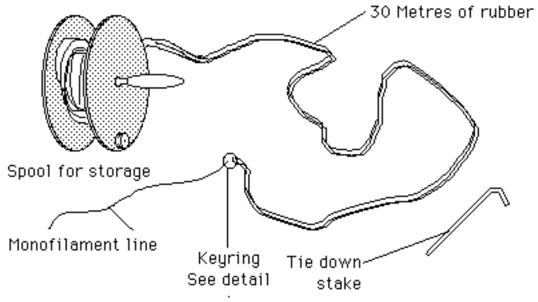


Hand towline launching

To Make A Bungee

Purchase about 30 metres of surgical rubber tubing. eg 5/16" outside diameter. This tubing will stretch about 6 times its unstretched length, ordinary rubber will normally only stretch about 3 times. This is where surgical tubing has an advantage. The ability to exert a long and steady pull will gain much more height than a quick short burst of power from ordinary cotton covered bungee rubber or shock cord.

Detail of Bungee winding drum

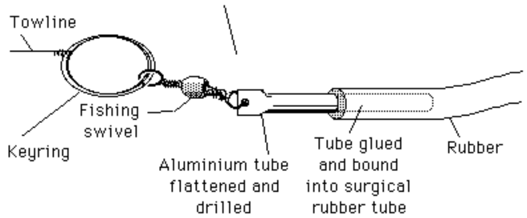


1.Find an electrical cable drum. These make good storage reels for the bungee. You may wish to fit a winder to one of the cheeks to help you wind in after a good days flying. Attach one end of the the rubber tube to the centre of the drum.Try not to cut the rubber tube with your attachent method.

2. Wind on LOOSELY the 30 meters of your new surgical rubber tube. Glue into the end of the tube a length of aluminium tube that has been flattened at one end.

3. Attach about 150 meters of 25 kg nylon fishing line to the aluminium tube that you have just inserted in the surgical rubber tube via a fishing swivel and a keyring (see diagram). Wind on the reel (now you can see why it's a good idea to put a winder on the reel in the first place!

4. Attach another fishing swivel to the end of the nylon line. Now attach your new parachute to the swivel. DO NOT get Mum to sew your parachute up for you; do it your self so that if it fails to open you can blame the maker!! P.S Old shower curtains make fine parachutes. No, not the plastic ones.

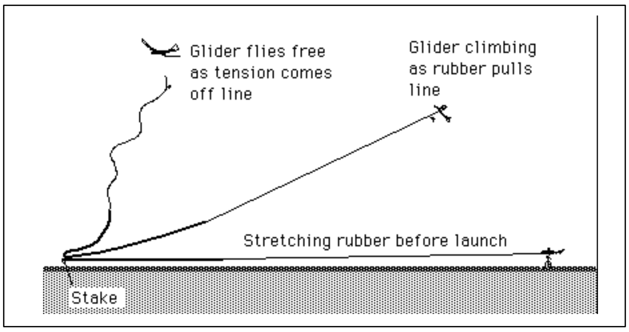


Detail Of Rubber To Towline Join

Suggested amount of stretch (in normal paces) - a rough guide only!

MODELWEIGHT	PACES STRETCH
0.7 - 0.8 kg	30 - 40
0.8 - 1.0 kg	50 - 65
1.0 - 1.3 kg	70 - 80
1.3 - 1.8 kg	85 - 95
1.8 - 2.3 kg	95 -110
2.3 kg plus	120 maximum

Large heavier models will not gain full height unless there is a breeze of about 6 knots blowing.



Make sure that you secure the drum end of the bungee to the ground when you are using it or you may well launch the drum!!

Any bungee will give the best results when there is a breeze blowing. When releasing the model always throw hard in the direction of the pull, extra height can be gained and there is less chance of you getting a bad launch. Your instructor should have told you this and you have gained a signature on the task sheet so what I'm saying now should be "Old Hat"

Care And Storage

Never leave a bungee stretched out on the field, it will weaken the rubber.

Do not drag your bungee over rough or sharp objects or you will need to join it where you have cut it.

Store in a box out of the sunlight preferably in the cool of the wine cellar. In this way you can check up on the bungee and sample some of the good stuff at the same time. If you are really keen, dust once or twice a season with french chalk.

Now you can pack a model into the car together with the bungee and if on holiday you feel like trying out a new field (first get permission) away you go!!

Winch

To make a winch you will need some skills and access to equipment that you may not have at home. If you have the skills and the equipment then go ahead. The plans are straight forward. If in doubt ASK at the club field, look at the winches, ask the owner of a winch about what it takes to build one. Ask if you can use the winch (in return collect the pennant a few times).

If you are very lucky someone may have a second hand winch for sale BUT don't hold your breath waiting; it doesn't happen often.

BASICS OF FLIGHT

An ordinary aeroplane or sailplane can fly because as the wing moves through the air, at a suitable angle of attack, an aerodynamic reaction force is generated. Some of this total reaction can be directed upwards as LIFT to support the weight. The rest of the reaction force is DRAG which resists the motion and tries to bring the aircraft to a halt.

It follows that the forward motion or AIRSPEED must be maintained and this in turn requires a force to counteract drag. With powered aeroplanes, an engine provides a thrust force but with gliders the airspeed can be kept up only by inclining the flight path slightly downwards. A snow skier keeps moving forward by sliding down a slope. A free wheeling car or bicycle keeps moving by rolling down an incline. The glider keeps its airspeed by following a downward path in much the same way. The difference is that if the slope used by the skier or vehicle is not steep enough, drag simply brings the motion to a halt. With a glider, if the drag slows the airspeed down too much the aerodynamic lift will no longer support the weight. The aircraft will stall and fall out of the sky.

After a stall, normal flight can be resumed by diving briefly to pick up airspeed again. This is easily done if the glider is not too near the ground, but stalling low down is a common cause of accidents.

So the sailplane in normal flight is always descending through the air. This may seem to contradict what you see when sailplanes are SOARING, that is, gaining height. What happens then is that the whole mass of air in which the glider is flying is going up faster than the sailplane is descending. The sport of sailplane flying consists largely of seeking out and using such rising air masses in order to gain height and extend the flight. More about the various kinds of upcurrents appears in the section on soaring. To achieve soaring flight, especially when the upcurrents are feeble (ie rising slowly), a sailplane which can be flown with a very low rate of descent or sinking speed, is required. This is achieved by trimming the wing's angle of attack to maintain an airspeed rather close to the stalling speed, but not too slow.

A model designed for minimum rate of sink will have a large wing span and wing area, and will be built very lightly. It will often be described as a "FLOATER". It may also be rather flimsy and not suitable for flying in rough weather.

The trim, or angle of attack, for minimum sink corresponds to the condition requiring theleast power for flight, or what is sometimes termed the best power factor.

When a sailplane is searching for upcurrents it is important to cover as large a distance as possible in the search, while losing little height. To do this requires a faster airspeed than that for the minimum sink. What is done is to trim, not for the best power factor, but for the flattest glide, which is determined by the ratio of LIFT to DRAG or the L/D ratio. Even though at best L/D the glider descends through the air faster than at its best power factor trim, it will have a greater airspeed and will cover more distance for each metre of height.

More often than not, if a sailplane is not soaring in an upcurrent, it will be in air which is actually coming down. To get through such bad patches of sinking air and, with good luck or good judgement, to reach an upcurrent, the pilot will trim for a much faster airspeed even than for best L/D. The model will then escape from the area of downcurrent with less sacrifice of height. The ability of a sailplane to fly fast while still managing a fairly shallow glide angle, is called penetration. Models with good penetration also cope better with windy weather, so are versatile and generally more useful than the specialized lightweight floater. Naturally, an advanced competition sailplane will be designed as far as possible to be both a good floater for the days of light winds and weak upcurrents, and still a good, fast penetrator. The requirements are somewhat conflicting but designers do their best!

For penetration the model needs a thin slightly cambered wing section, rather than the thicker, more cambered airfoil of the floater. The fast model will have a greater weight in relation to its wing area and may even be fitted with ballast compartments in the wings to increase the total weight. The fast contest model will also have a very carefully designed, streamlined, fuselage to cut drag at high flight speeds.

It will also be a good deal stronger than the floater, capable of withstanding fast launches and surviving in rough air.

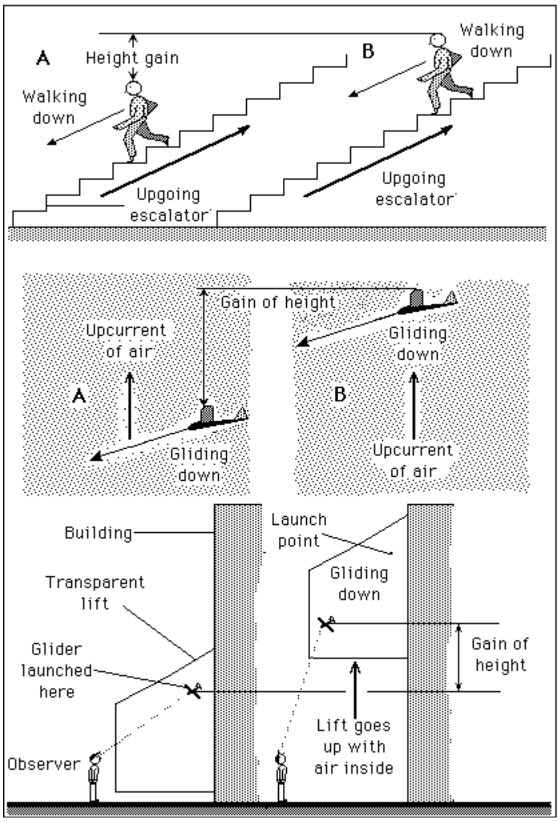
To control a fast, heavy model when landing, air brakes or spoilers are almost essential. Without them the model will tend to glide for a long distance just above the ground before touchdown, making judgement of the landing very difficult..

SOARING

How soaring is possible

In order to make a long flight the glider pilot must find air which is going up at least as rapidly as the glider is descending. If someone walks slowly down an escalator which is going up, although the person is stepping constantly down, the escalator moves up faster and so carries them higher. If a glider flies in air which is rising faster than the rate of sink, the glider will gain height.

Another way of thinking about soaring is to imagine a small glider flying in a transparent lift or elevator going up the outside of a tall building. A certain volume of air is rising, enclosed in the lift. The glider, trimmed for minimum sink, glides in this air but the air package as a whole is rising faster than the sinking speed of the glider, so someone outside the lift sees the glider rising relative to the ground. The actual rate of climb is the speed of the lift going up, minus the sinking speed of the glider through the air contained inside the lift. If now the building and the lift are imagined out of existence and the package of air is thought of simply as a mass of air going up 'like a lift', the way a glider can gain height in an upcurrent becomes clear.



How soaring is possible: ways of thinking about it.

If a glider is flying in an upcurrent which is rising at exactly the same rate as the glider's rate of sink, this is like someone walking down the up escalator at a speed which just matches the escalator's upward motion. The glider will stay at the same height. Pilots often refer to this situation as flying in zero sink, but the glider is still sinking through the air. The upcurrent just happens to equal the rate of sink so there is zero gain of height.

Glider pilots commonly speak of being in lift, or strong or weak lift, searching for lift, etc., meaning by 'lift' in each case, an upcurrent strong enough to carry the glider up despite its sinking speed. (This use of the word 'lift' should not be confused with the lift component of the air reaction on a wing.)

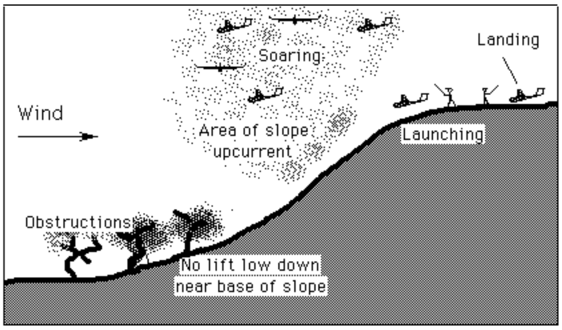
Whenever there are upcurrents in the atmosphere, there will be corresponding downcurrents. As one lot of air rises, somewhere there must be air coming down. Upcurrents are often very powerful, but strong upcurrents are likely to be balanced by strong downcurrents. The glider pilot refers to downcurrents as sink. On days of weak lift, sink is also likely to be weak. The problem of soaring is finding and remaining in lift, and avoiding sink.

Two types of upcurrent are easily recognised and commonly used for soaring. These will now be described, but do not be surprised if things somtimes happen which do not seem to fit these simple explanations. The air always has something new to teach.

Slope soaring

When the wind blows against a slope, the air cannot go straight through. If the hill is long and presents a continuous barrier to the wind, the air rises over it. All the way along the windward face of such a slope, there will be a region of upcurrent or, in glider pilot's language, 'slope lift'. A steep slope and a good breeze produce strong upcurrents but relatively gentle slopes and light winds can yield lift which the skilful pilot may be able to use. For model gliders to soar, the slope need not be very high. Sand dunes may be used. Large mountain slopes are also extremely productive of slope lift, perhaps too much so, for a small model can easily be lost in such country. Where the ground falls away again, the air also will go down, so on the leeward face of a hill there is always a region of sink.

If the hill is an isolated peak, most of the air will divide and pass round on either side. The upcurrent on the windward side is likely to be narrow and rather weak. If the ground in front of a slope is very irregular or if the wind is blocked by other hills, the slope lift may fail or be turbulent.



Hill Soaring Weather

The slope soaring glider pilot keeps an anxious eye on the wind and weather and goes to the site which suits the expected conditions. Days with moderate breezes are best for learning. If the wind is too light the model will not stay up and if too strong it will be blown away. Later, the model flier will know when to take a heavy and fast model, and when a lightweight will be needed.

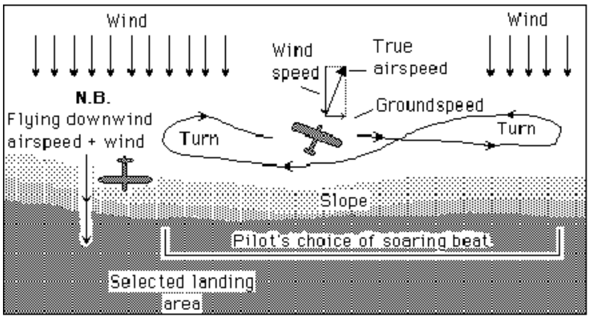
Whenever the wind blows over rough country, the air near the ground is stirred up and becomes turbulent. Gusts may come from any direction and both up and downdraughts will occur. For the model, to fly safely through such rough air demands more airspeed to give the controls the necessary power. Compared with flying over flat sites, the hillsoaring pilot will generally need more down elevator trim when approaching to land and launching.

Keeping In The Lift

Having launched by hand directly into wind from the top or from some little way down the front of the hill, the pilot flies the glider so that it remains above the windward slope. The most convenient way to do this is to perform a series of beats or stretched out S turns. Most of the time the glider is flown straight and level, but not heading directly into the wind. Since the wind is always trying to carry the glider away to leeward, the sailplane maintains its position over the slope by heading slightly off the breeze. From below, it then appears as if the glider is moving partly sideways, 'crabbing' along, but this does not mean the air is flowing sideways over the wings or fuselage or fin. The crabbing is simply the combination of the glider's airspeed and the windspeed, as the diagram below shows.

Before long an outward turn is made. The next beat is flown on a heading which will allow the glider to continue in the lift until the pilot turns it back again and so on indefinitely, back and forth along the hill. Turning downwind at the end of the beat is a mistake, unless planning to land, since the wind will quickly carry the sailplane out of the upcurrent. If such a mistake is made, allowing the model to be carried too far downwind, it may be possible to dive back to penetrate through the sink on the leeside and reach the front of the slope low down but fast. Otherwise the pilot has to land as safely as possible on the wrong side of the slope.

The lift area extends some way in front of the slope but is not limitless in this direction. Upwards, the strength of the lift becomes less as the glider ascends until eventually the zero sink situation is reached. The glider can stay at this height so long as nothing changes.



Slope soaring

Hill soaring in this way can go on as long as the wind blows against the slope with sufficient force, and as long as the pilot can see and control the glider. The life of the radio batteries becomes important, for it is easy to stay up for several hours, or to make several long flights in one afternoon. A standard test for the LSF Level 5 is an eight hour slope flight. (for explanation of LSF see last section.)

When some experience has been gained, slope soaring will be found possible on days with quite gentle breezes. On such a day, the model never gains very much height but by careful use of the lift, the pilot can enjoy following the contours of the ground quite accurately, finding a little extra lift here and there, and using these good patches to gain height to cross the weaker zones. When turning the model, it is best to do this in lift rather than in an area of sink. In turning, the model's drag rises and the rate of sink therefore increases. If the turn is made in lift, the height is more easily maintained whereas turning in sink can bring the model down very quickly.

On a day with more wind the lift is abundant and this may be used for aerobatics, any height lost in a manoeuvre being regained quickly in the strong upcurrent. Models with symmetrical wing sections and large ailerons are used.

Thermal soaring

When the sun heats the ground, currents of warm air called thermals will rise and gliders which can find and stay within these upcurrents will soar. A thermal may go on rising until the moisture contained in it condenses to form a cumulus cloud. The downcurrents on such a day are often strong too.

The model glider pilot may not always be able to find usable thermals, but they are almost always present once the ground has warmed a little and the pilot should never fail to look for the signs. A thermal does not have to be very hot in order to rise. Even on a cold day, if a small mass of air becomes slightly less cold, it will make a thermal. In overcast weather, if the ground is warmed slightly, there will be thermals, although they may be weak.

Thermals come in different shapes and sizes. The whirling dust devil often seen in semi arid regions is a type of thermal. Another, gentler type behaves like a rising bubble which develops its own internal circulation and becomes a ring vortex.

The outer parts of the rising bubble are slowed by the surrounding air, while the inner core of the thermal is almost unchecked. The bubble turns itself inside out over and over again as the core rises, spreads out, slows down at the margins and is overtaken, then drawn in again to the centre andup through the core and so on. A ring vortex, if visible, would look somewhat like an irregular doughnut of rising air with the strongest lift going up through the 'hole' of the imaginary doughnut. Probably in many cases the rising 'bubble' type thermal is fed from below by a spinning dust devil type, although there may be no dust to show this.

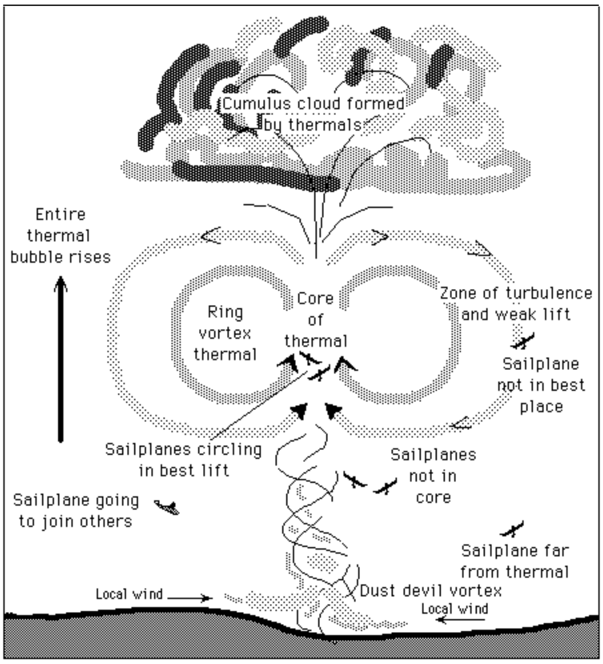
One thermal 'bubble' may be followed up by another and then another, making a whole chain of them in a more or less vertical column. A small thermal ring may be sucked in and up through a larger one.

Thermals also tend to expand as they rise. One which is quite narrow near the ground will be hundreds of metres across higher up. A model glider in such a thermal may quickly rise so high as to be almost out of sight, and getting it down again may be difficult. Model gliders have occasionally been sucked into cumulus clouds and lost. Brakes or spoilers are particularly necessary to prevent such losses. The brakes are opened in good time to prevent the model going too high in a really strong thermal.

In thermal soaring the pilot's most difficult problem is to find the upcurrent and stay in it. The beginner who runs into a thermal by accident may not recognise it. The rising air mixes with the surrounding atmosphere and the result is a good deal of churning around. The model entering this rough air may be thrown about and the novice pilot hardly has a chance to appreciate the signs, struggling to keep the model under control. Whenever unexpected turbulence disturbs the glider, it has probably touched the edges of a thermal. It is often very difficult to tell if the glider is rising or not, but judgment comes with experience.

Some pilots looking for thermals use a geometrical search pattern, flying along a certain line for a time, then turning at right angles, then turning again to a different line to try to explore as much air as possible before having to join the circuit for landing. The idea is to avoid flying through any 'bad' air twice, always sampling a new area. If there are no other clues at all to the location of lift, such a pattern is worth using, but do not be too rigid about it.

More often than not, if the signs are looked for, there will be something to suggest where lift will be found. Look for indicators and head the model in the direction that seems appropriate, watching carefully.



**Probable structure of a simple thermal.
In practice, many variations occur.**

Occasionally there will be some obvious sign. Soaring birds such as gulls, hawks, eagles and pelicans circling are excellent indicators. Small birds such as swallows do not do much gliding but they often chase tiny insects which are sucked up by thermals, so a flock of swallows or swifts flying excitedly round and round probably indicate lift. Follow the example of the birds, circle round in it, trimming for minimum rate of sink.

If you see another sailplane circling, it is probably in a thermal. Fly over that way at once unless you already have your own. Do not be too proud to follow another model if it is climbing better than yours, but try to avoid getting too close. Mid air collisions are quite common, with one or both models usually being destroyed. If you join another circling sailplane, your circles should go round the same way as the first model, to reduce the chance of a mishap.

Don't expect always to catch a thermal by flying underneath other circling sailplanes or birds if they are very far above. The thermal does not necessarily extend down very far. It may be a detached bubble which has risen out of reach, taking the others up but leaving only rough air in its wake. Using other gliders and birds as indicators works best if they are about the same height as your own model and not too far away.

Sometimes model fliers who have flown for some time at a particular site, will know of a few favoured 'hot spots' on the ground which seem to produce lift on most days. Find out, and try them.

The wind on the ground may also indicate a thermal near by. If the wind changes direction fairly suddenly and increases in speed, it may be because the air is being drawn in to the base of a passing thermal. Such a sudden breeze may even cause flags and streamers to point to the thermal and a model that flies in the direction indicated may well find lift. Some glider enthusiasts equip themselves with light streamers on posts for this reason.

Occasionally, the wind where the pilot is standing suddenly dies away altogether. This may be accompanied by the feeling that the air is warmer. Very likely, the thermal is passing immediately overhead. If the model is near, it will probably go up.

As soon as it seems likely that the model is climbing or at least keeping its height, settle it into a steady circling pattern, watching constantly. Trim the model so that it will circle nicely with the controls held in one position. Do not worry too much if the rough air upsets the flight pattern a little but keep turning as smoothly and steadily as possible. As usual, a stable model will fly most efficiently if the pilot leaves it alone and unless the air is very rough it will continue to circle quite well once it is correctly trimmed. After two or three complete circles, if the sailplane still seems to be rising, continue circling, keeping the angle of bank constant, and climb.

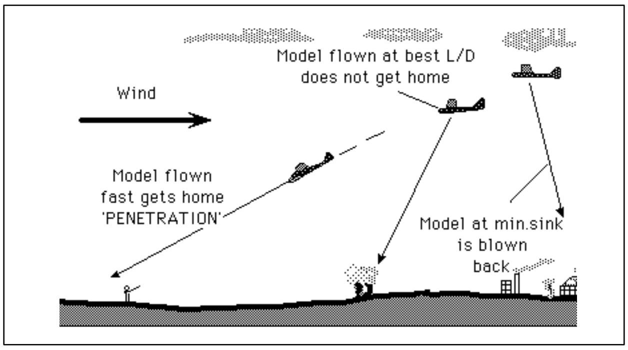
Do not keep varying speed and bank, or changing direction. Working the controls too hard is bad, because the glider will respond by bouncing up and down, making it impossible to tell if it is really in a thermal or not. An apparent surge of lift which is really caused by the pilot's clumsy handling, is called a stick thermal.

Centering the thermal

After a few circles the pilot may feel sure that the glider is not fully centered in the strongest lift. This sometimes shows up clearly. On one side of the circle, the glider rises faster than on the other side. Do not be deceived by tricky effects of perspective. Viewing from below, a false impression is easily gained, but if the glider really does seem to be off centre in the upcurrent, make a deliberate move to locate the core. As the glider points towards where the stronger lift seems to be, straighten out for a few seconds and if the model does rise faster, start circling again. If there is no improvement, turn back to the known lift area and try again.

Just as other sailplanes may show where lift is, a glider coming down indicates an area of sink, to be avoided. The main thing is to get away from this area as quickly as possible, so fly somewhere else - it hardly matters where so long as the bad air is escaped, but obviously if there are signs of lift somewhere within reach, head in that direction rather than merely wandering. Quite often, such sink-avoiding action takes the model into the thermal. The downcurrent is the atmosphere's reaction to an upcurrent, so it is not surprising that sink and lift are often close to one another. But in any case do not let the model hang about in sinking air, or it will soon be time to join the landing approach.

After a while, the pilot develops a feel for thermals, and takes off every time with the expectation, rather than the mere hope, of finding something. If, on a day when other people are finding thermals, you are not, get help from an experienced instructor to find out what you are doing wrong.



Getting home

Getting home again

Circling and climbing in a thermal involves quite long periods of circling, so if there is any breeze the model drifts as it climbs. Once again, remember that the movement of the glider through the air cannot be correctly judged by referring to the ground. Thermals move relative to the ground more or less with the general wind. In addition the wind aloft is usually different from that felt on the pilot's face and may be much stronger. Having circled up, the sailplane will therefore also have drifted some distance away. Keep an eye on this, and turn for home before the model gets too far off to glide back safely.

The model now must penetrate against the wind and get through any downcurrents that may lie between its position and the home base.

Remember this mental aid; keep the model heading directly towards the pilot by moving the stick to the downgoing wing to bring it up again.

Once the model is established in its homecoming glide, the pilot must watch it carefully. The difficulty is to tell if the model is making sufficient progress over the ground or not. With the sailplane pointing directly at the pilot in a steady glide, if the model is clearly rising in the field of vision, it is going to get home with height to spare and will eventually arrive overhead. The model itself will of course usually be losing height, but from the pilot's position if it is going to get back, it will appear at higher and higher angles against the background.

If, on the other hand, the glider seems to be dropping down steadily, it will not get home. This requires action but not, perhaps, what the beginner expects. The trim for best sinking speed, which has been used while circling in the thermal, is at a slow airspeed, say 8 knots. Suppose the wind speed is 10 knots and the glider, at its minimum sink trim, is flying against this breeze at 8 knots. The glider will actually move backwards relative to the ground and land further away than it started. Of course this does not mean the glider is flying backwards through the air. It is still gliding ahead through the air, but the air as a whole is moving faster than the glider's airspeed, so from the ground the glider is seen to be getting further and further away.

The beginner's next reaction is to think of trimming a little faster than minimum sink, to achieve the best glide ratio. This is better but if the best L/D airspeed is, say, 11 knots, the glider will make very little progress against a 10 knot breeze. The trim required to get home against the wind is always faster than the best L/D. trim. More down is required on the elevator, even though this at first seems quite strange to the beginner. In fact 20 or 25 knots airspeed might be required. This is a much faster trim than the best glide. The model will come down quite steeply, even appearing to be in a shallow dive with its nose well down, but it will make headway over the ground, which in this situation is essential.

This general argument applies to all sailplanes and all wind speeds. To get home against the wind requires a fast trim, even though this causes a rapid rate of descent. Despite instincts, trim further forward if the model is being drifted too far back. Continue to watch the angle. If the trim is fast enough, the model heading homeward will rise in the pilot's field of view. Although it is losing height rapidly it is making headway and will get home with some height to spare. Continue to monitor progress because there may be sink and strong gusts of wind on the way.

If the model seems to remain at the same angle, neither gaining nor losing elevation, it will just get home for an immediate landing. Speeding up a little may bring it back with more altitude.

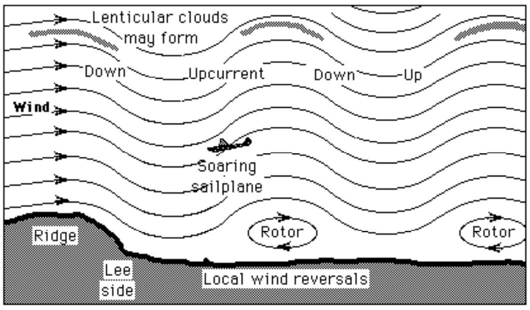
With some lightweight models in a stiff breeze, it may not be possible to get home at all. Such models have poor penetration. When flying fast they loseheight very rapidly. Even so, to fly fast is the best hope. It may not be possible to get all the way back, but trimming forward will get the model down as close to home as possible. Slowing down under these circumstances will have the model being carried away far downwind and out of sight. This is one important point where the more advanced sailplane has an advantage over the relatively slow and light beginners' models. Because they can fly fast without much increase of sinking speed, advanced models can make rapid headway against quite a stiff breeze.

Waves

Waves in the air sometimes develop when the wind blowing down the lee side of a range of hills sets up a wave like pattern which extends downwind sometimes hundreds of kilometres. Favourable conditions of air temperature aloft are required. Waves which form early in the morning may break up as the day goes on, to re-form, perhaps, near nightfall. Large atmospheric waves in the lee of mountain ranges have been used by full-sized sailplanes to reach 15,000 metres (50,000 feet) above sea level. Such huge lee waves are usually marked by distinctive whale-backed lenticular clouds aligned parallel to the mountain range and stacking in layers up to the stratosphere.

Model fliers also speak of 'wave' soaring when there is a patch of lift which they can use almost as if it were a wave, but which probably is a particularly persistent thermal which provides lift for some time over one place on the ground and then fades away. A true lee wave usually continues for many hours and may even go on for days at a time. The upcurrent of a true wave is very smooth, very different from a thermal.

Model sailplanes have, on rare occasions, found small but genuine lee waves and used them somewhat in the manner of slope soaring, by keeping on the upwind side. Little waves are probably quite common but are not marked by clouds, so they are not often discovered. There is plenty of scope for exploration and investigation.



WHAT NEXT

Once the basics are mastered there are many exciting things to be done. Contest flying is one way of improving one's skills. Something is learned on almost every flight and one finds oneself launching and flying in a wide variety of conditions, sometimes on days when otherwise the model would not even be assembled.

Thermal soaring contests

Thermal soaring competitions usually involve attempting a flight of a specified duration, such as six minutes, and trying to land within a marked circle. Points are lost for going either over or under the six minutes, and for missing the landing circle. Since such contests are popular, special rules have to be applied to make sure everyone has a fair chance to compete in the limited time available. The luck factor is controlled as far as it can be by grouping competitors into rounds and heats, five or six gliders (on radio channels that do not clash) all being launched within a narrow time slot to make what use they can of the air at that time. The winner of each heat scores 1000 points and the others are scaled pro-rata, so that if one entire heat strikes a bad period with no thermals, the scores are still comparable to those of the luckier groups. Several rounds are arranged during the day to try to arrange for every pilot to fly against every other, though this is not possible when two share the same radio channel.

In the International F3J thermal soaring class, models tend to be very large but are launched only by 150 m hand towline. In less important club competitions, winch launching is usually allowed.

Multi-task competitions

The International F3B Championships for thermal soarers, at the time of writing, require each pilot to fly three distinct tasks, (A) duration with spot landing, (B) distance, and (C) speed. Rounds and heats are arranged, to remove the element of luck as far as possible.

The duration task in this type of competition is similar to that described above but with a more rigidly defined spot landing system.

The distance task requires the pilot to complete the greatest possible number of laps of a 150 metre course, within a time of four minutes. Twenty laps (3 km) would count as a good performance but would probably be exceeded by the winner. An average flight speed of 45 km/h would be required, with a good glide ratio at that speed.

In the speed task, four laps of the same 150 m course are flown as fast as possible. Times of around 18 to 20 seconds would be good, but the winner might do better than this. Speeds over 120 km/h are required to win.

Models for this type of contest are normally launched very fast by powerful electric winches, and are loaded with ballast for the speed and distance tasks. They need to be extremely strong and aerodynamically very refined.

Pylon racing

For pylon racing, markers are set up at the ends of a slope soaring beat, with observers and flags or some other type of signal. The pilots compete to fly a given number of laps as fast as possible against the stopwatch. In strong winds the models are flown low down and very fast. Pylon racing is still possible in light winds, becoming a more subtle test of skill and experience.

Cross country flying

Cross country racing is also done by slope soaring and/or thermal soaring. Where there is a suitable stretch of country, the pilots have to launch at a designated point and fly the models around one or more distant marks to complete the course without landing. Planning the route is up to the pilot, who has to walk or run, or travel by car, to keep pace with the model as it is controlled around the aerial course.

Aerobatics

When slope soaring, since the pilot can rely on the upcurrent being there as long as the wind goes on blowing, a sailplane may perform almost continuous aerobatics. Height lost can be regained easily so not only the occasional loop but every kind of manoeuvre can be performed. To achieve some of these a specially designed model is needed. Those interested in this kind of flying soon find suitable designs.

The League of Silent Flight

The League of Silent Flight (LSF) began in the U.S.A. but is now an international organisation with branches and members in many countries. The LSF has a programme of accomplishments for model glider fliers, in five levels. Anyone completing the first level tasks can become a member of the League and receives an international number recording it. Level 1 requires the pilot to make a thermal flight of 5 minutes and a slope soaring flight of 15 minutes. (A second 5 minute thermal flight may be substituted for the slope flight.) In addition, three spot landings within 3 metres of a pre-selected mark have to be made. All the flights have to be witnessed by someone un-related to the pilot. The higher levels are progressively more difficult and only a few reach the fifth level.

Contact with the League can be made through the S.S.L and furthur information can be obtained by contacting Mal Pring who was the first person outside North America to achieve "Level V".

WHERE DO I FLY

As a fully paid up member of the SSL you are covered by insurance and so you can fly at any of the sites shown on the maps that follow BUT you must inform and ask other clubs if you are flying at their fields. You must also obey all of their rules.

Victoria Park.

This site is the club field and is one of the best in SOUTH AUSTRALIA if not the whole of the country. Many of our more travelled members say it is one of the best fields in the world!! Where else can we have a flying site that is in the center of the city and maintained in such a manner? It is up you as a club member to look after it and to protect it from unwise use.

Flying normally starts at about 9:00 am each Sunday and will go on untill about 1:30 or later depending on conditions and commitments of the members. On contest days there will be no instruction but you are welcome to watch what happens, retrieve a towline, or to partake in the contest if you feel up to it. Contests are not "Win at all costs affairs" for most of our members but a more formal way of sharpening up reflexes under a more pressure situation.

For general sport flying the instructor is the safety officer and you will be expected to follow his direction.

By law the height limit is 300 feet and will be under the control of the safety officer.

Good thermals can be found at most times of the year and good company with a variety of models can be the order of the day on most days.

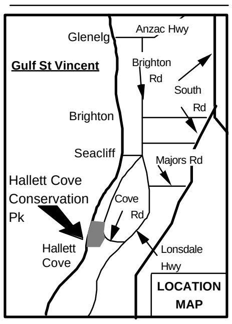
Hallet Cove Slope Soaring Site

Suitable for south westerly winds

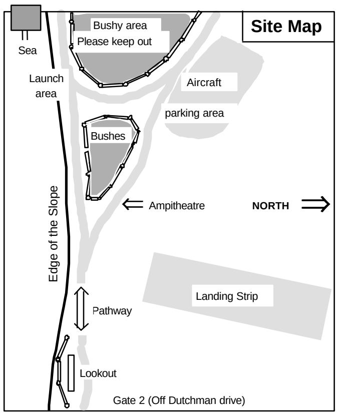
Because it is not possible to programme teaching sessions at the slope (we haven't found a way to con the wind genie) especially during winter and spring, be sure to regularly attend the programmed flying instruction sessions at the Victoria Park Racecourse for continuity (and breadth) of the learning experience. Summer and autumn provide the most suitable conditions more consistently.

When you attend Victoria Park after a session at the slope, take your slope skills register card to acquaint your flying instructor with your new skills

If coming from the City of Adelaide: use Anzac Highway, Main South Road, Majors Road and Lonsdale Highway to Hallett Cove. Turn off at the Cove Road and travel toward the sea. Cross the bridge over the railway and turn left onto Dutchman Drive at the roundabout. The entrance to the park (Eastern entrance, gate 2) is on the sea side of Dutchman Drive and less than 50 metres from the roundabout. Enter by gate 2 and walk on the path toward the sea. The Amphitheatre and the spectacular erosion of glacial deposits there will be visible on the left within 150 metres of the entrance. Walk along the edge of the Amphitheatre to the fenced off bushy areas as shown on the SITE MAP. Note the positions of the aircraft park (the Pits) and the landing strip.



How to get there.
Consult the location map (above)



Frequency Control

Unlike the Victoria Park Racecourse site a frequency board is rarely present at the Hallett Cove Conservation Park, so seek out the owner of every radio and ask for the frequency and give yours. If another radio has your frequency you need to make arrangements to share the frequency. You may switch on your radio when you are sure no other radio using your frequency is switched on. Keep a wary eye on new arrivals to the slope!

Safety

Slope soaring sites require special safety precautions, especially at the Hallett Cove Conservation Park. This park is used by large numbers of the public for recreation and for viewing and studying the geological record. For this reason we need to take special care:

• Watch for people walking on the paths near the cliff face and near the landing area and keep a separation of at least 30 metres between our aircraft and other park users.

• Do not overfly the pits, launch area, or paths, at an altitude of less than 30 metres, except when landing.

• Use the Landing strip as shown on the SITE MAP. Aircraft may over shoot during landing and cross the path at low altitude, so avoid making landing approaches if people, especially children, are near the landing area.

• Use frequency control as outlined earlier.

• Launch from the cliff edge between the two fenced off bushy areas as shown on the SITE MAP

Wind Direction

The lift is usually smooth and steady when the wind blows over the Port Stanvac jetty or "within three "Jetty lengths or so to the east and west.

The slope can be flown with the wind deviating from ideal (above) as far to the east as Lonsdale Highway, but the lift will increase in turbulence as it approaches this end point. Expect a sudden loss of lift as the wind veers further east.

As the wind changes progressively to the west the lift will become patchy especially if it is light, but remains flyable with experience and skill.

If the wind becomes westerly to west nor-westerly pilots can relocate to the northern end of the fenced off bushy area and launch from the path, but please do not enter the fenced off area

Friends of Hallett Cove Conservation Park (FHCCP)

Many SSL members that fly on the slope are also members of the Friends of the Hallett Cove Conservation Park. This gives us an opportunity to make a contribution to the care of our flying site and enhances our prospects for the continuing use of this area.

In the past we have planted trees, erected fences to encourage revegetation and participated in artichoke and rubbish control. Cost of membership is only $5 pa and can be paid at a club meeting.

Tapanappa Slope Site.

(see map in the appendix)

The Tapanappa slope site is located approximately 90 kms south of Adelaide in the Deep Creek Conservation Park. It takes about one and a half hours to drive there, well within reach for a full day outing, but with a camping site available there it makes a wonderful weekend or a long weekend trip. A permit from the NATIONAL PARKS AND WILDLIFE SERVICE at Tapanappa, is required (BEFORE YOU WANT TO FLY) an application form along with a map is included in the kit. The site can be best used when a South Easterly or a Southerly breeze is blowing. It can also be used on a South Westerly but it can be a bit marginal for the less experienced when the wind is from that direction. The air is smooth, coming straight off the Southern Ocean and up a mainly smooth slope for several hundred metres, with the turbulence associated with cliffs well below flying level. The landing area is smooth and is generally rock free, but not very wide for into wind landings. I prefer to land along the top of the slope, cross wind, which gives me a longer approach and more room for error.

The scenery from the site is SUPERB!! with The Pages and Kangaroo Island in front, and the long sweep of Tapanappa Beach to the East. Kangaroos are common and reasonably compatable with humans present.

And now for the words of caution. The site is also used by hang gliders and you should be very careful when they are also flying. Generally after launching they fly off down the coast and it is preferable to land and wait until they are well clear of the air you are using. Common sense should prevail at all times. Many of the glider pilots have a slope soarer in the boot of thier car, and they respect and understand our hobby. Eagles also use the slope, but don't get cheeky with your "floater" because in a dive the eagle is quite fast. An F3b type model can usually outpace them, but always remember that you are in a conservation park and the delicate balance between man and the wild life can be easily upset by thoughtless acts.

There are a variety things to do in the general area of the Deep Creek Conservation Park if the wind drops or changes on you. Great bush walks (the Heysen trail runs along the site), the Raywood Nursery has cheap and healthy plants, and the Talisker Mine is worth a visit.

So the Tapanappa is a fabulous slope soaring site if the wind is in the right direction at the right speed.

Remember: Don't fly without a permit.

Respect the the rules of the park rules.

Be sensible if you are sharing the site with hang gliders.

APPENDIX 1

Further Reading

BOOKS

A few books are listed below which any glider flier could read with profit. If you would like to find out where some of these books can be found in South Australia, see Graham Garner at the next club meeting night for a library list.

George Stringwell Radio Control Thermal Soaring, Argus Books (U.K) New edition 1988. A very comprehensive text covering all aspects of thermal soaring.

Dave Jones Radio Controlled Gliding Argus Books (U.K.) 1987. A shorter book written in lively personal style, containing much valuable advice for the inexperienced, with chapters contributed by Keith Thomas, a specialist in slope soaring.

Chas Gardiner Flying Scale Gliders A comprehensive work about an aspect of the sport which is growing in popularity. Published in 1989 by Argus Books (U.K.)

Martin Simons Model Aircraft Aerodynamics Argus Books (U.K.) New edition 1987. A text covering all aspects of model aerodynamics with minimal mathematics. The only book of its kind in English.

Martin Simons Model Flight Argus Books (U.K.) 1987. A very simple introduction to the theory of flight as it applies to models of all types.

Eric Lister Sailplane Designer's Handbook and Drag Reduction and Structures Handbook , 410 Regina Drive, Clarksburg, Md 20734, USA. A useful pair of handbooks with practical guidance for the amateur designer. Not professionally printed.

A.G. Lennon R/C Model Airplane Design (1986) Chart Hobby Distributors Ltd., Littlehampton, West Sussex, U.K., and Motor Books International, Osceola, Wisconsin, U.S.A. A book for the technically minded, full of useful data with emphasis on powered models but some attention to sailplanes.

Ferdinando Galé Aerodynamic Design of Radioguided Sailplanes Obtainable directly from the author, Via Marconi 10, 28042 Baveno, (NO) Italy. A fairly advanced text requiring some mathematics, with parallel Italian and English text.

Dave Boddington Building and Flying Radio Controlled Model Aircraft Argus Books (U.K.) 1978. Still the most useful work covering every aspect of radio controlled powered model airplanes, with some reference to gliders.

MAGAZINES

There are many magazines for model fliers which contain regular columns on radio controlled gliders, kit reviews, new plans, construction articles etc. These are available from newsagents and direct subscription. Specialist R/C gliding journals are also listed.

AUSTRALIAN

Airborne Every two months: Ropomod Productions Pty Ltd., Unit 11, 67 Garden Drive, Tullamarine, Victoria 3043, Australia.

Radio Control Model News.

BRITISH MAGAZINES

Radio Modeller Monthly: Argus Specialist Publications, Argus House, Boundary Way, Hemel Hempstead, Herts., HP2 7ST, England.

Radio Control Models and Electronics Monthly: Argus, address above.

Radio Control Model World Monthly: Traplet Publications, Traplet House, Severn Drive, Upton-on Severn, Worcestershire, WR8 0JL, England.

AMERICAN MAGAZINES

Flying Models Monthly: P.O. Box 700, Newton, New Jersey NJ 07860, USA

Model Airplane News Monthly: P.O. Box 428, Mount Morris, Illinois, IL 61054, U.S.A.

Radio Control Modeller Monthly: RCM Corporation, P.O. Box 487, Sierra Madre Boulevard, California 91024, USA

Model Aviation Monthly: 815 Fifteenth Street N.W., Washington D.C., 20005, U.S.A.

SPECIALIST RADIO CONTROLLED GLIDING MAGAZINES

Silent Flight Quarterly, published by Argus, Subscriptions Ltd. 5 River Park Estate, Billet Lane, Berkhamstead

Herts, HP4 IHL England.

R.C. Soaring Digest. Monthly, by direct subscription to Judy Slates, P.O. Box 6680, Concord, CA 94524, U.S.A. Full of interesting material, with American background.

Soarer. Quarterly, published by the B.A.R.C.S, to members, Secretary Alan Cooper, Hillcrest, Top Road, Hardwick Wood, Wingerworth, Chesterfield, Derbyshire S42 6RQ England. Often contains valuable articles about construction methods and design as well as BARCS competition news.

The White Sheet. Quarterly from Sean Walbank, 29 The Gardens, Acreman St., Sherborne, Dorset DT9 3PD, England. A lively club magazine with many interesting articles.

Soartech. Occasional technical publication, from Herk Stokely, 1504 Horsheshoe Circle, Virginia Beach, Virginia 23451, U.S.A. Of special interest to designers and leading contest fliers.

Quiet Flight International

APPENDIX 2

Glossary

Airfoil (Aerofoil) section: - The shape of the cross section of a wing or tail surface.

Aero-tow:- Launching a sailplane by towing it with a large powered model airplane.

Ailerons: - Hinged control surfaces on the wing trailing edges, controlling the model in roll.

Airbrakes: - Surfaces deployed vertically to disturb the airflow and increase drag.

All-moving tailplane: - A horizontal tail surface which moves as a whole to provide an elevator.

Altitude: - Strictly, height above sea level. Often, merely the height above the ground.

AM: - Amplitude Modulation: - Signals carried as variations of the amplitude of the radio wave.

Angle of attack: - The angle of a wing, tail, or other part of an aircraft to the flight path.

ARTF: - Almost ready to fly, a kit requiring little work to make the glider ready for flight.

Aspect ratio: - The ratio of the span of a wing to its mean (average) chord.

Ballast: - Mass added to a model to increase its flight speed. (See also Trimming ballast.)

Balsa wood: - A species of light wood imported mainly from Ecuador or New Guinea.

Bank: - The angle of a model wing tilted to left or right in order to turn.

Brakes: - See airbrakes, above.

Bungee: - Method of launching depending on a length of stretched rubber with attached towline.

Camber: - The general curvature of the centre line of an airfoil section.

Centre of gravity: - The point at which a model balances.

CG: - Centre of gravity, see above.

Channel:- A specified radio frequency used by a transmitter with a tuned receiver.

Chord: - The distance measured across a wing or tail surface at right angles to the span.

Clark Y: - A famous and popular wing section, with mostly flat bottom.

Clevis: - An adjustable connector at the end of a control pushrod or cable.

Control horn: - The small lever near the hinge of a control surface.

Crystal: - A small wafer of quartz ground accurately to control the frequency of a radio.

Cyanoacrylate: - A very rapid setting, hard adhesive developed from acryclic acid.

Dihedral: - The angular setting of a wing such that the tips are higher than the root.

Doubler: - A piece of wood used to increase thickness and strength of some structure.

Downwind: - Going along with the wind.

Drag: - The component of the air's reaction which acts directly in opposition to motion.

Duration contest: - A contest where pilots fly to a set time.

Elevator: - The control surface, normally part of the tail, which controls the glider in pitch.

Epoxy resin, epoxy glue: - A two-part waterproof adhesive.

F3B: - The international class for multi-task radio controlled sailplanes

F3E: - The international class for electrically powered radio controlled model aircraft

F3J: - The international class for duration thermal soaring sailplanes

F3F:- The international class for racing radio controlled slope soaring sailplanes

Fin: - The part of the vertical stabilizer which is fixed rigidly to the fuselage.

Flaps: - Hinged control surfaces which enable the camber of a wing to be changed in flight.

Flaring out: - Flattening the glide just before touch down on landing.

Flat bottomed section: - Any wing section with a flat bottom making for easy construction.

Flutter: - A rapid oscillation which may affect wing, tail or control surfaces in fast flight.

FM: - Frequency modulation, variation of the radio frequency to carry a signal.

Foam-cored wings: - Wings based on cores of foamed plastic covered with veneer.

Former: - A crosswise frame or bulkhead in a fuselage to join the sides, top and bottom.

Free-flight: - Flying a model aircraft without radio or any other form of control.

Frequency: - The rate of oscillation, here of a radio wave.

Glide ratio: - The angle of glide expressed as a ratio of height lost to distance through the air.

Ground loop: - The glider drags a wing tip on landing and spins round or turns over.

Heat shrink film: - Plastic film used for covering models, tightened by applying heat.

Hi-Start: - American expression for Bungee; see above.

Incidence: - The fixed angle at which a wing or tailplane is set to the fuselage.

Induced drag: - See vortex-induced drag.

Leading edge: - The foremost part of a wing or tail surface.

Lift (a): - The component of the air reaction force which acts at right angles to the flight path.

Lift (b): - The glider pilot's name for any upcurrent used in soaring.

Longeron: - A long structural member of a fuselage, providing strength and stiffness.

Minimum sink or Min Sink: - Least possible rate of descent of a glider when flying in still air.

Mode 1: - Directional control on the right hand transmitter stick and elevator on the left stick.

Mode 2: - Both the main directional control and the elevator worked by the right hand stick.

Monofilament line: - Nylon fishing line consisting of a single strand.

Multi task: - The F3B type of gliding contest involving duration, distance and speed tasks.

Nicad: - Re-chargeable Nickel Cadmium battery.

Nose ballast: - See trim ballast.

Overshooting: - Missing the intended landing point by flying beyond it.

Parasite or Parasitic drag: - The drag caused by all the non-lifting parts of a glider.

Penetration: - The ability of a glider to fly fast without much loss of height.

Phillips entry: - an outdated term referring originally to a bulging under the leading edge of a wing but now wrongly used to describe a leading edge set above the bottom surface of a wing.

Pitch: - Changing of the glider's attitude in flight, by nose up or nose down motions.

Polyhedral:- Dihedral which increases at some point part way towards the wing tips.

Profile drag: - The drag of a wing (or tail surface) caused by air flowing over the profile.

PSS: - Powered scale soarer. A glider made as a scale model of a full-sized powered aircraft.

PVA glue: - Poly-Vinyl-Acetate glue, a commonplace timber glue, not waterproof.

Pylon race: - A race round a course marked by pylons.

Re-kitted: - The model has been reduced to many small pieces in a catastrophic accident.

Rib: - A part of a wing, shaped and set chordwise to give the wing its airfoil section.

Ring vortex: - A horizontal, ring shaped vortex, probably the form taken by many thermals.

RTF: - Ready to fly, a model which is bought completely finished and ready for use.

Rudder: - The vertical control surface hinged to the fin, which controls the model in yaw.

Rx: - Abbreviation for Receiver

Sailplane: - another name for a glider, especially one capable of soaring.

Semi-symmetrical section: - A wing section, convex on both sides but with unknown camber.

Servo: - A small motor translating the radio's signals into mechanical motions to work controls.

Sink: - Air which is coming down, as opposed to lift in the sense (b) above.

Slope soaring: - Using the upcurrent on the windward side of a hill, to soar.

Snake: - Colloquial term for a flexible type of pushrod.

Soaring: - Using upcurrents in order to gain height.

Span: - The distance from the extreme wing tip to the other tip, with the glider fully assembled.

Spar: - The main spanwise structural member of wing or tail surface.

Spoilers: - Hinged surfaces which spoil the airflow over a wing when raised, similar to airbrakes.

Spot landing: - A landing where the model comes to rest within 1 metre of a marked spot.

Stabilizer; - The horizontal surface of a normal tail unit, or tailplane.

Stall: - The breakdown of airflow over a wing or other surface, caused by large angle of attack.

Stick: - General term for the control levers on the transmitter.

Stick thermal: - The glider appears to be soaring but this is an illusion caused by the pilot.

Street: - See thermal street, below.

Sweepback: - Angling the wing in plan view towards an arrowhead shape.

Sweepforward: - Angling the wing in plan so that the tips are ahead of the root.

Symmetrical section: - An airfoil section without camber, such as a fin section.

Tailplane: - The horizontal tail surface, or stabilizer.

Taper: - The narrowing of a wing or other surface towards the tips.

Thermal: - An upcurrent caused by uneven warming of the ground.

Thermal street: - A series of thermals in a line, giving an almost continuous belt of lift.

Tip stall: - One wing stalls before the other, and the stalled tip drops sharply.

Towhook: - The hook on the glider to which the towline is attached for launching.

Towline: - A length of fishing line used for launching a glider.

Trailing edge: - The rear edge, usually sharp, of a wing or tail surface.

Trimming ballast: - Ballast added to the nose or tail of a glider to adjust the centre of gravity.

Trim: - The setting of the controls so that the glider takes up a particular attitude in flight.

Tx: - Abbreviation for transmitter.

Undercambered:- A general term for a wing which has its underside partly concave.

Undershooting: - Failing to reach the intended landing point.

Upwind: - The opposite of downwind, the direction directly against the wind.

Vortex, vortices: - Any whirling of the air, especially behind wing tips.

Vortex induced drag: - The drag caused by the vortices trailing behind wing tips.

Warp:- An error in construction, a distortion of wing, fuselage or tail.

Washout: - A twist deliberately introduced into a wing, reducing the incidence towards the tips.

Wave: - Strictly, an oscillation set up by the air on the lee side of a hill.

Web: - Part of a spar connecting top and bottom flanges to prevent shearing apart under load.

Wing: - The main supporting surface of a glider.

Wing Area: - The total projected area of a wing viewed in plan.

Wing dropping: - See tip stall, above.

Wing Section: - See Airfoil section, above.

Wing thickness: - The depth of the wing from top to bottom surface.

Winch: - A launching device, usually electric motor with drum, turn-round pulley and line.

Xtal: - Abbreviation for crystal.

Yaw: - Swinging from side to side, stabilised by the vertical tail and controlled by the rudder.

CONSTITUTION