"As the sun sinks in the west . . ." This evocative photograph, by Geoff Woodworth, shows the author's *Elmira* high over the west face of Ivinghoe Beacon. When the conditions are perfect, it is always a temptation to continue flying, literally until the sun goes down.

Radio Control
SOARING

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INTRODUCTION

INTEREST in radio controlled gliders has shown a marked increase during the past few years, and "soaring" must now be one of the largest and healthiest branches of the many-faceted hobby of aeromodelling. Many modellers of long-standing will have tried free-flight soaring, but it has been with the application of radio control that the model glider has really come into its own.

In addition to what might be called the "natural" attraction of soaring in its own right, there is also the fact that, with power flying becoming restricted in many areas because of the ever-present noise problem, many r/c fliers are turning to gliders and finding them a pleasant change, requiring the perfecting of new skills and techniques and giving a hitherto untasted variety to otherwise potentially jaded modelling appetites.

Not only are there no noise problems, the absence of an engine brings other advantages that have to be experienced to be fully appreciated. There is no fuel to be paid for, and no gooey mess of oil to be cleaned off the model after use. With no engines to start, there is no heavy accumulator to carry around, no burnt-out plugs—and no bitten fingers!

One becomes more conscious of the Great Outdoors, and soaring—especially slope soaring—is much more appreciated, as a rule, by the rest of the family. A day in the hills amidst beautiful scenery is, for them, far more enjoyable than spending it in the car on a flat and dreary aerodrome. They, too, appreciate the peace and quiet of soaring flight, and getting far away from the raucous power models which "have no business but dispensing round their magnanimities of sound." One can even find new side-interests, as many fascinating ancient earthworks and fortifications are to be found on and around many of the best soaring sites, as well as those intriguing chalk figures which so often share the slopes with the silent fliers.

Despite the current popularity of r/c soaring, however, there are still many existing, or would-be, model fliers who have only the vaguest idea of what it is all about. It is mainly for them, rather than for the soaring "buffs," that this book has been compiled.

Through the medium of the "Strictly for Soarers" column (a regular monthly feature of *Radio Modeller* magazine since 1966) I am continually hearing from people who, having read there a little about the many joys and delights of silent flight, are eager to start, but are really not quite sure how to go about it. I hope that, in the following chapters, enough background information has been imparted to enable them to embark on their soaring careers with some confidence and the knowledge, at least, of the paths that have already been trodden and the pitfalls to be avoided.

Like Topsy, this book has "growed" from what was originally envisaged as a modest booklet on very basic lines, to a more comprehensive treatise. And, just as r/c soaring is only one branch of aeromodelling, so even this branch has grown its numerous specialised off-shoots. On some of these, therefore (more especially on the theoretical design side, and again on thermal soaring) the appropriate exponents have been called in, for their specialised knowledge and individual views.

For my own part, I have endeavoured to adhere, in the main, to practical "go out and do it" advice, without probing too much into the whys and wherefores. For those with more questing intellects, however, the theory is also there—in a section of its own—for the reading.

DAVE HUGHES

CHAPTER 1

THE MECHANICS OF SLOPE SOARING

MANY modellers who have not actually experienced, or seen, slope soaring, erroneously imagine that it is just a case of carrying a model glider to the top of any old hill, flinging it off . . . steering it down to the foot of the slope . . . dashing down and carrying it up the hill again . . . flinging it off . . . and so on, the model staying airborne for perhaps a minute or two, with a lot of luck.

If this were the case, slope soaring would hardly have anything like the following it enjoys today. In fact, nothing could be further from the truth and, whilst this sort of thing *can* happen, if the would-be soarer chooses the wrong type of hill, or persists in trying to fly a certain type of model when there is insufficient lift (or he is insufficiently skilled in using what lift there may be), it is far more usual to find that, once launched, the average model can be kept up as long as the wind strength, daylight and receiver batteries, will allow!

It is quite usual for the flights made by weekend sports fliers, on their home slopes, to be in the region of half an hour—depending on whether or not there are others waiting to fly on the same radio frequency. World records for this class of model flying are in excess of 19 hours! However, conditions, and sites, have to be carefully chosen, as some give much better soaring than others, as we shall see.

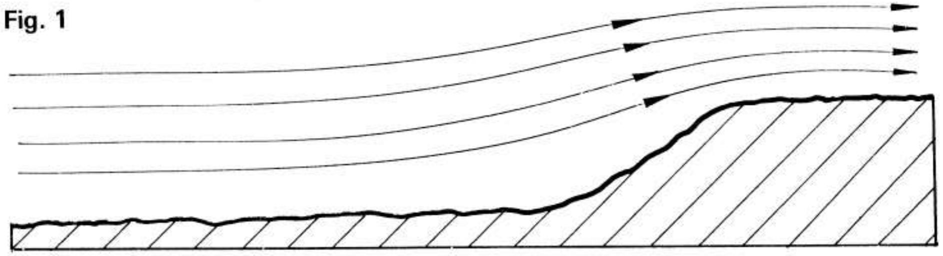
How does it all work?

Seeing the models floating silently out over the slopes—the large ones soaring to a great height with a graceful majesty, and the smaller ones busily flitting through precise aerobatics near to the hillside—newcomers always ask "What keeps them up?"

In the words of the folk ballad—"The answer, my friend, is blowin' in the wind." Or, more correctly, perhaps, and not so specifically, the answer is—"rising air." Air rises either by virtue of its temperature, or by its movement over rising ground. Slope soaring is concerned mainly with the latter, and "thermal" soaring, as its name implies, with the former—though one can often find some thermal lift when launching soarers from the slope on almost windless days. We will see the niceties of this discussed in a later chapter, and thermal soaring, from flat ground, is dealt with in its own section of this book but, for the moment, let us talk about slope soaring in the strictest meaning of the term—using wind that is rising because it is blowing uphill.

As will be seen in Fig. 1, the air rises to follow, more or less, the contours of the ground

Fig. 1



and so, in front of a hill, ridge or bluff, it is rising quite steeply. More steeply, in fact, than the gliding angle of the model. Put another way, the air is going up faster than the model is trying to come down. So the model ascends.

What seems to puzzle many onlookers, however, is the motive power. "With no engine," they say, "how do you make it go forwards into that wind, as well as going up?"

The only "motive power" our glider has is—gravity. The earth is constantly trying to pull our model down, but we have designed it in such a way that, like a dinner plate placed in water, it does not drop vertically down but slides along sideways, descending only gradually compared with, say, a knife or fork, immersed at the same time. Air is a form of fluid, less dense than water, of course, but behaving rather similarly in many ways. And our models—we hope—are rather more sophisticated than the humble piece of crockery. But gravity is always trying to pull them down—so they go forwards. This is something of an over-simplification, but it serves to illustrate the point.

Our glider, then, *is* only gliding, all the time and despite the fact that it may be getting further from the ground it is, in fact, gliding down its own downward path in the air, so to say. Like trying to run down the up-going side of an escalator. The up-going air may be carrying our model upwards quite fast, but it is, itself, continually gliding downhill, drawn by the force of gravity.

We have, in our slope, a marvellous sort of natural wind tunnel. One in which we can match our model's speed with that of the wind, so that it appears to hover, relative to the ground. Or we can make it move forwards (that is to say, more quickly downwards!) and the extra lift generated by this increased forward speed can be seen to cause our model to soar higher, as soon as we relax our downward, forward, pressure upon it.

We can, too, fly our model slower and slower, until it appears to be moving backwards, relative to the ground. And, taken a stage further, we see it lose that certain minimum forward speed it needs to maintain flight at all—and we see it literally drop out of the air. All these things can be seen to happen, quite dramatically, with a glider, on our hillside "wind tunnel," in a way that one could never hope to approach when flying powered models.

This, then, is the basic mechanics of slope soaring, put in its simplest terms. We need a hill, with a wind blowing onto its sloping face, so that it rises, to provide "slope lift" and bear our models (and the birds) up into the skies with seemingly effortless grace.

But there are many kinds of hill, and some are more suitable than others, for our purpose. Some provide magnificent lift in a variety of conditions; others are much better at certain wind velocities, while still other, perhaps innocent-looking hills, are treacherous in the extreme, with vicious down-currents and turbulence to throw our flimsy models about and smash at them like some giant invisible fist from the sky!

CHAPTER 2

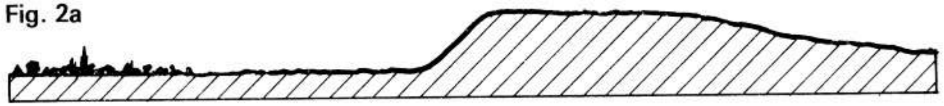
TYPES OF HILL

LET us, in the light of the foregoing, take a look at some of the main hill configurations and their characteristics. Having said that we need a slope for the air to be forced to rise, let us see the different ways in which this can happen—the different configurations of slope. We will group these into main general types, which should be fairly easily recognisable.

The "Plateau" type

The best type of hill for model slope soaring is one with properties something like this: a fairly straight-faced slope, with an angle of about 45°, rising from an otherwise flat area of land, *with no other hills in front for several miles.* The length of the face should be as great as possible—obviously, the longer one's slope, the more area in which to soar. The top will be in the form of a plateau—that is to say, there is a flat area there, and that the land does

Fig. 2a



not slope away too soon or too suddenly on the down-wind side. Fig. 2a shows this type of hill and Fig. 2b gives a closer view, showing the behaviour of the air over it.

As you will see, the air begins to rise gently quite some distance away, and tends to leave an area of more or less still, or "dead" air at the foot. There is an area of rising air, then, stretching some way upwards and outwards from the brow of the hill. The extent of this is dependent upon the angle of the hill and the velocity of the wind.

If the brow of our hill is fairly rounded, as in Fig. 2a, the air flows round the contours quite well and continues over our flat plateau top, just dropping a little, as will be seen from the diagram. This makes the plateau an ideal landing area—and we must always consider landing areas when we are looking at possible sites, or we may find ourselves in difficulties later! (We will be dealing with types of landing approach in a later chapter, when you will appreciate more fully the significance of the airflow patterns we are discussing here.)

If the edge of our hill is more sharply defined, however, as in Fig. 2c, then the air will

Fig. 2b

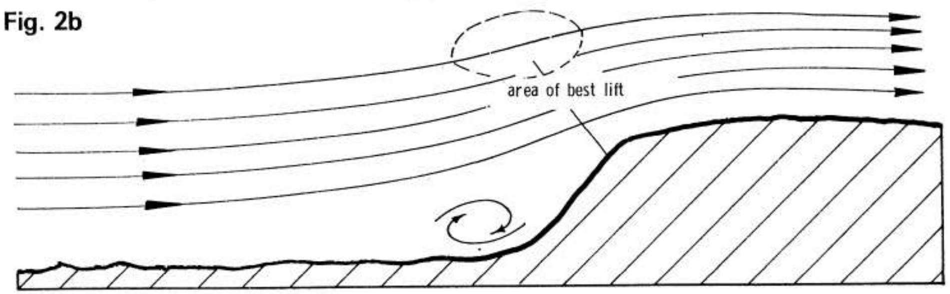
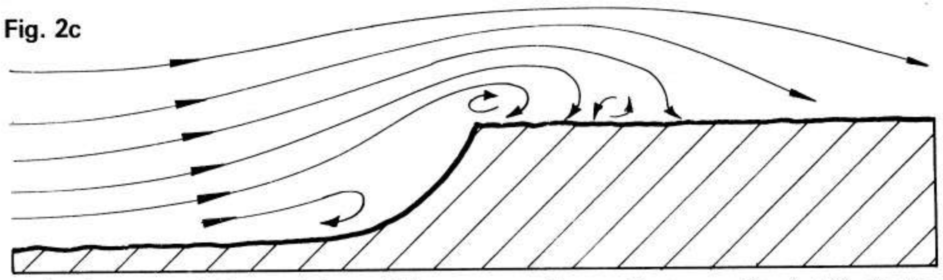
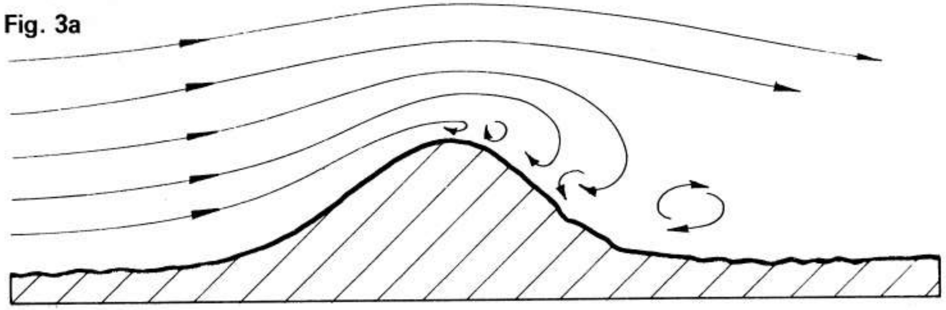


Fig. 2c



tend to become turbulent and there will be some very "bumpy" areas, or "pockets" with the air moving vertically downwards in places, and curling back upon itself in the manner shown. The higher the wind velocity, the more pronounced is this effect. The actual area of lift created, however, may be very good and, in any case, the turbulence formed in this way is behind, and not in front of, the slope from which we shall be getting our lift. Our difficulties will not be in getting the model aloft, therefore (one can launch it from a point part-way down the slope, in front of the turbulence) but in bringing it down smoothly.

Fig. 3a



The ridge

Ridges often produce really fine lift areas, and can be much longer than most of the "plateau" type of hill face, which means that the models are not so confined to one area of sky—just in front of a short "face." However, landing on ridges can be tricky, especially for the beginner, as there is not much room for error. Figs 3a and 3b show typical ridge cross-sections and, once again, the air will be seen to be curling downwards over itself, on the windward side. Further down on the windward side, it becomes completely calm, in the lee or shelter of the ridge itself, even when there is a high wind blowing onto the top.

In light breezes, the downwind turbulence of the ridge is not so in evidence and, in fact,

Fig. 3b

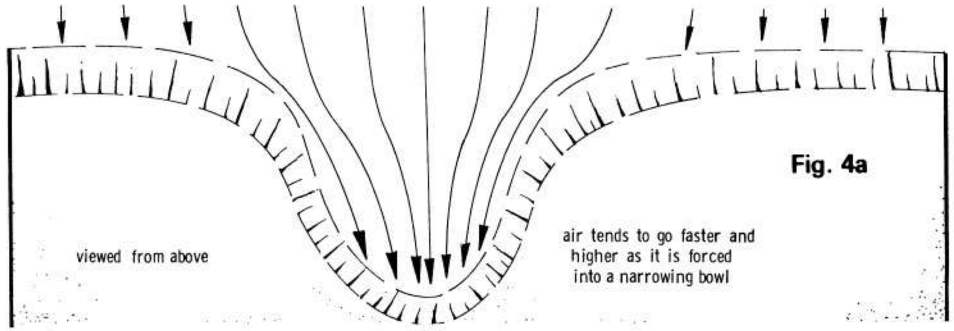


Fig. 4a

becomes simply an area of "sink" or "dead air," rather than anything more violent, and it is in these conditions that the beginner should begin to learn the technique of ridge landing. Actually landing on the crest of the ridge, or else letting the model settle down just at the back of it, in the naturally sinking air, are both methods that can be practised but, until one becomes adept—beware of the ridge in stronger winds. Again, we will talk about landing procedure fully at a later stage; it is mentioned here only to show that landing methods will depend upon not only the terrain but also the wind-speed over it.

It is not essential for the wind to be blowing exactly at right-angles to a ridge, or a "plateau" face, and lift is often present when the wind is at a very oblique angle (say 30°), though it will then usually be more localised.

Bowls

Some very fine soaring is to be enjoyed from "bowl" sites, and there are a surprisingly large proportion of soaring sites which have this configuration. The air tends to "funnel" up them and build up its speed by a sort of "venturi" effect, to give excellent lift to great heights.—See Fig. 4a. Bowls *do* tend to be very directional, however. That is to say, they require the wind to be blowing dead square on to the back of the bowl ("half-bowl" or even "horseshoe" might really be a better description). This is because, if the wind shifts to one side, so blowing over the "arm" of the horseshoe, as it were, the air at that side becomes very turbulent, and there may also be an area of dead air, as seen in Fig. 4b.

It is not uncommon to find that the lift area of a bowl site will extend a considerable way back from the crest, or launch-point, even though there may be a flat area of ground—or even one sloping away—behind it. If he does not want to have to force his model down into the strong lift, the beginner will often find that he has to fly his machine a very considerable distance downwind of a bowl site, before it will start to settle down. This means the bowl is "working" well, though it can often mean some extra exercise for our soaring enthusiast!

On other days, when the wind is not so strong, and does not go funnelling up the bowl,

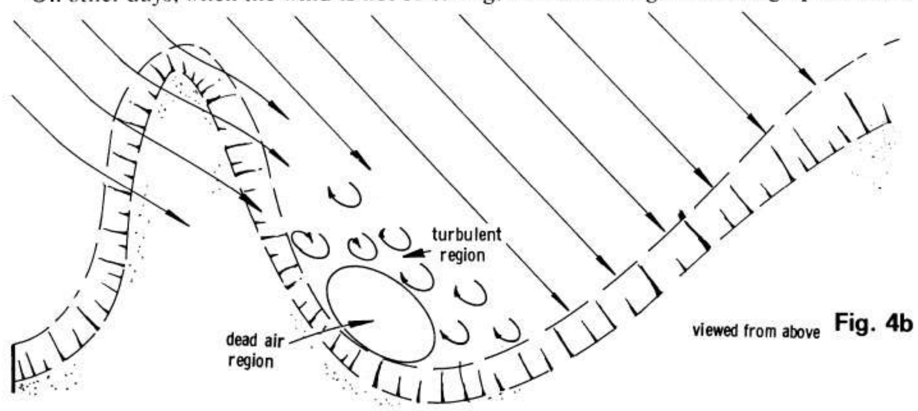
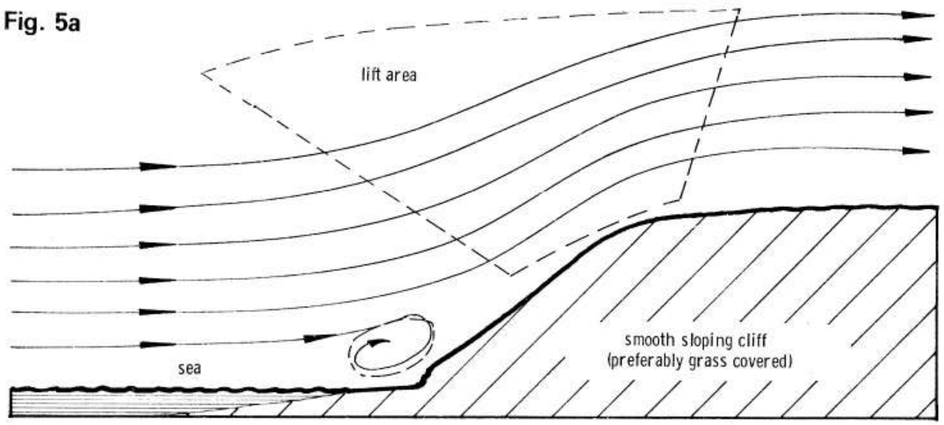


Fig. 4b

Fig. 5a



landings at the top will be easier—and the main area of lift will often be a long, long way out. Exploration and experience will show where to expect it for each particular site under different conditions.

Coastal sites and cliffs

Generally speaking, some of the best and smoothest soaring of all is to be had from coastal sites. The air flowing in from the sea is incredibly smooth and, as a result, when it does begin to rise over the land-mass, it starts doing so a long way out. The point at which it starts rising, as always, depends on its velocity and, on some days, one is not able to reach the forward limit of the lift—one starts to worry about losing sight of the model before this can happen!

The shape of our coastal hill, or cliff, of course, affects the airflow in the same way as does our inland hill, so that steep cliffs—especially those with sharp edges—are best avoided by the beginner. Good soaring can be had from them by the experienced flier, but it will probably be necessary to fly the model through considerable areas of quite frighteningly strong turbulence during the initial stages of the flight, and also very often having to land through very bumpy air. Figs. 5a, b and c show some typical cliff effects. Fig. 5a shows the best type to look for—in effect a "hill by the seashore" rather than an actual cliff.

One does not, of course, have to fly over the sea, unless one wants to, to enjoy the benefits of the coastal site. As long as our hill "sweeps down to the sea"—with no

Fig. 5b

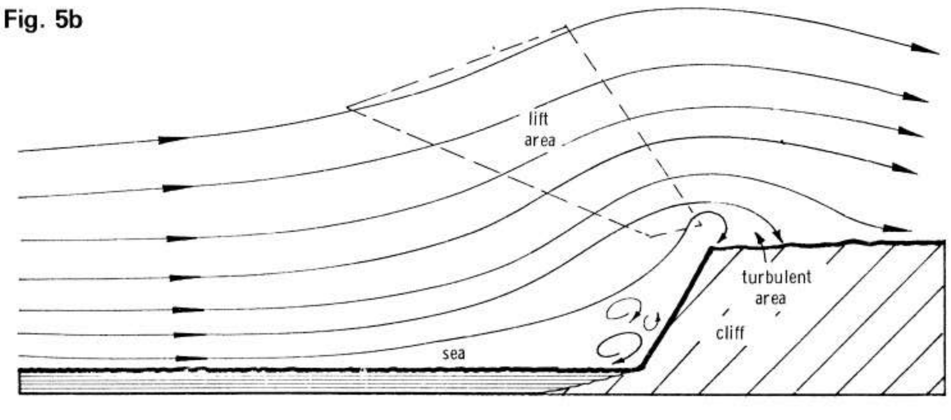
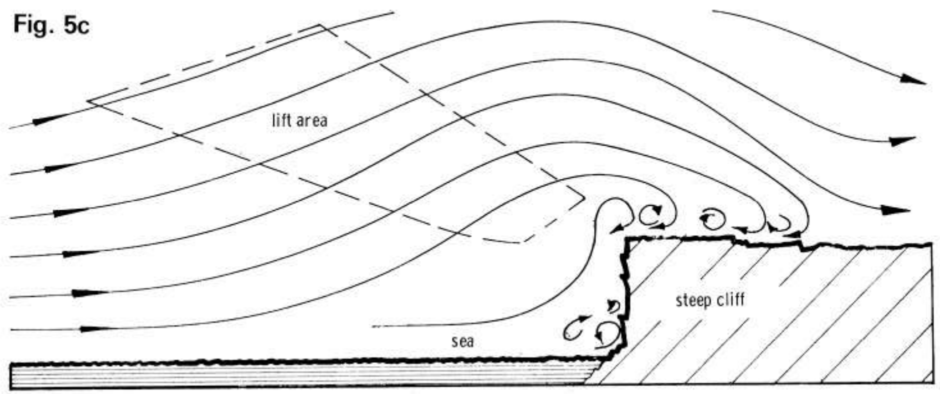


Fig. 5c



obstructions to spoil the smooth airflow, then we can actually be flying on a hill a mile or so away from the tide-line, with whatever added confidence it may give us to have solid earth all those hundreds of feet below our model, instead of the briny!

It does, however, give some added zest, to the seasoned flier, to lead his model out over the waves, with the seagulls for company, and to try and match his recently acquired skills, with their inborn instinct for soaring up on every available current of rising air.

The sharper edged type of slope, but still with a reasonable face-angle (Fig. 5b) can be very worthwhile, but the vertical, or near-vertical cliff, with a sharp edge (Fig. 5c), can be very treacherous, as there is a definite and clearly defined (but unfortunately invisible!) point at which the lift ends and the turbulence begins, with no transition areas to give a warning to the pilot.

It is surprising how much of our holiday-resort coastline has coastal slopes, or "sloping cliffs" suitable for slope soaring, and how many of these, too, have flat fields at the back of them, suitable for landing.

Another type of "sea-soaring," for those who do not have nice high slopes near their seashores, is "dune soaring," much favoured on the French and Belgian coasts. An efficient model can be coaxed to considerable heights from the upcurrents of off-sea air from quite small sand dunes, and learning the in's and outs—or rather the ups and downs!—of your particular stretch of dunes can be quite a challenge in itself.

The standing wave

This is nothing to do with "sea-soaring," despite its name, but is a phenomenon that occurs in front of most slopes when the conditions are just right.

Air tends to behave rather differently at low speeds, from the way it does at higher speeds. At fairly low speeds, it flows over our hills in the manner shown in the diagrams, in a fairly comfortable way, with the surrounding air adjusting to accommodate it. In higher wind velocities, however, the surrounding air itself tends to resist. Consider Fig. 6a. Our layers of air at (X), in rising over the hill, are becoming compressed and are, in turn, preventing the air following (Y) from getting near to the contour. This follows the line of

Fig. 6a

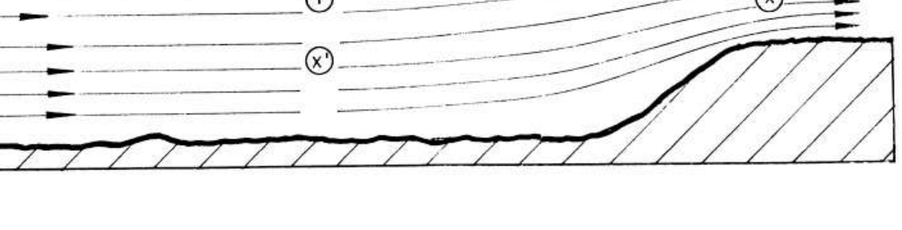
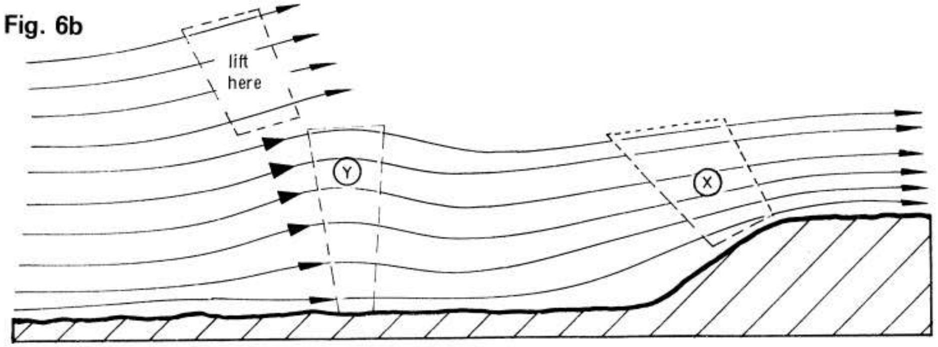


Fig. 6b



least resistance and rides upwards, also becoming somewhat compressed, and causing a further area of lift (Z).

Now, the wind following along behind (X) (call it X') is restricted from going forwards as fast as it would like, by the slope at (X) and from going upwards at this point by the already compressed layer at (Z), so it starts to ride up further out, at (Y), where the top layer (Z) has not yet formed.

The picture is now as seen in Fig. 6b, with the main area of lift at (X) and a further one at (Y). In favourable conditions, this secondary bump of air will induce yet a further lift area, acting just like a slope itself! This is what is known—to model fliers, at any rate—as a standing wave, and it can form a considerable distance in front of the hillside—anything up to half a mile.

Oddly, perhaps, there are two kinds of standing wave—the one just described, which we can call the "modeller's type"—and that used by full-size glider pilots, which they would call (rightly) the true standing wave. This occurs when a torrent of stable air flows over a line of hills or range of mountains, and the standing wave is formed on the *downwind* side.

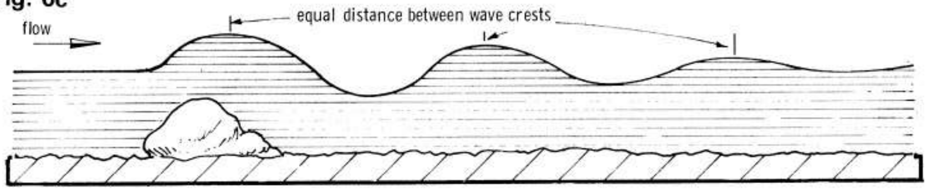
Thinking, once more, of the air as a fluid, we can draw a parallel with a submerged boulder in a fast-flowing river. This will cause a hump in the surface of the water above it, as one might expect. However, down-stream of this, the water forms itself up again into a secondary wave—with, perhaps, a further one still beyond—which maintain their positions relative to one another and the river bank. Fig. 6c shows this effect.

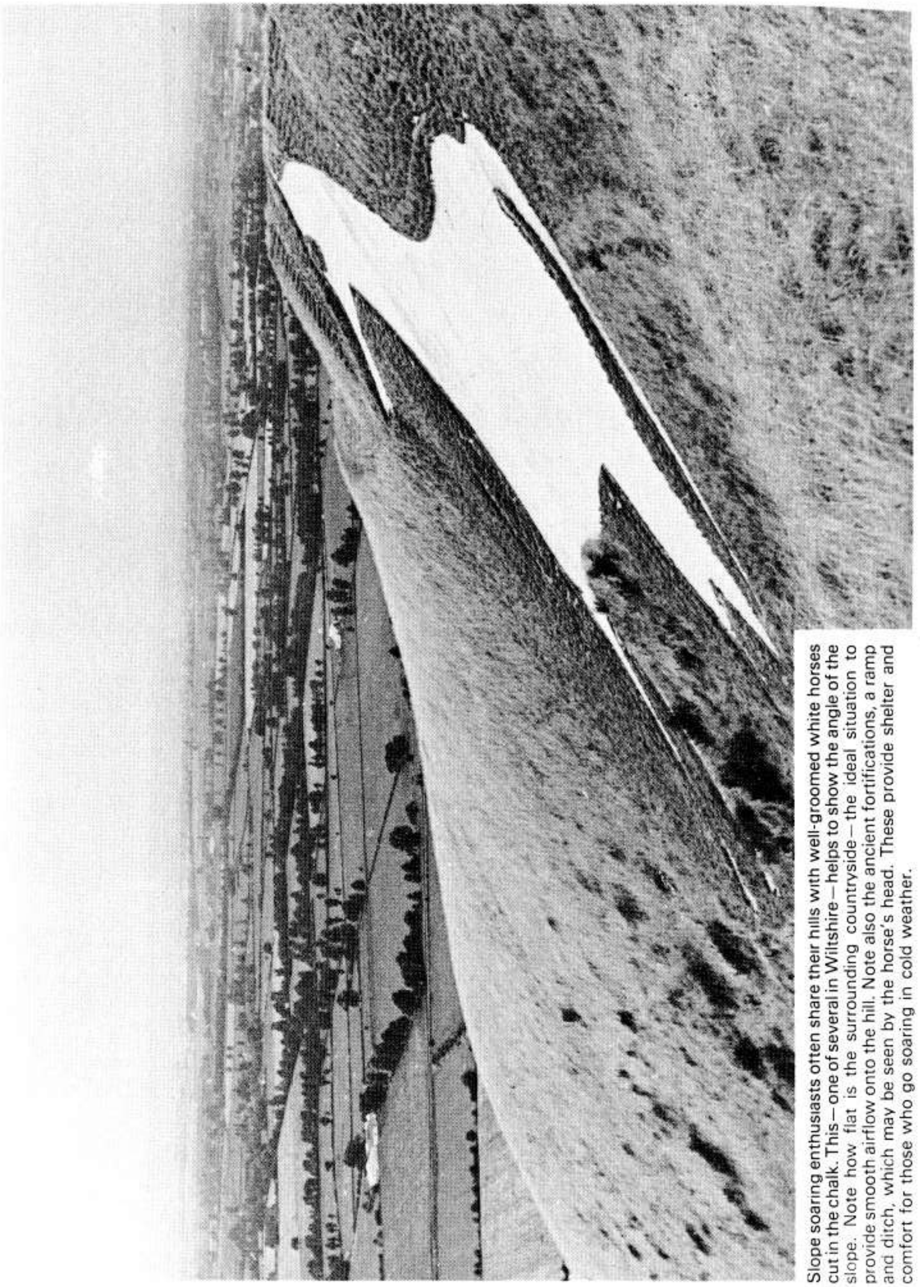
Not only is the phenomenon, over a large range of mountains, on a vastly grander scale than our river-bed boulder, but the air is so much less dense than the water that these waves can propagate at tremendous heights, and altitudes in excess of 44,000ft have been reached by full-size gliders using them. However, it is rare for our models to be caught up in genuine wave lift—which is probably just as well, for we can usually say "goodbye" to those that do!

Types of hill to be avoided

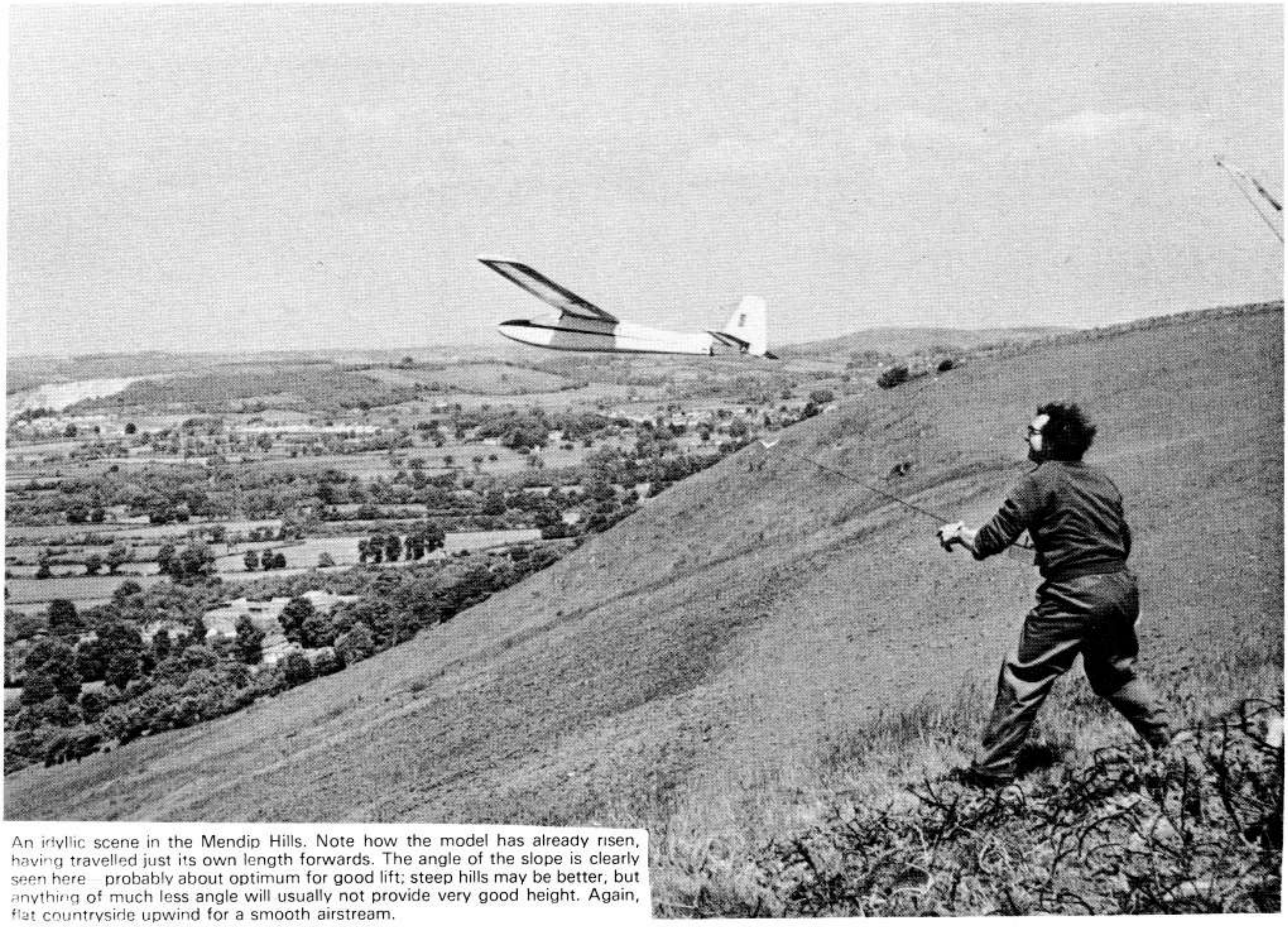
We have seen the various kinds of hill that can be useful to us and, of course, there are innumerable variations with regard to general scale, surroundings and type of ground. Now a few words about the types of hill which will be best avoided, at least until we have

Fig. 6c

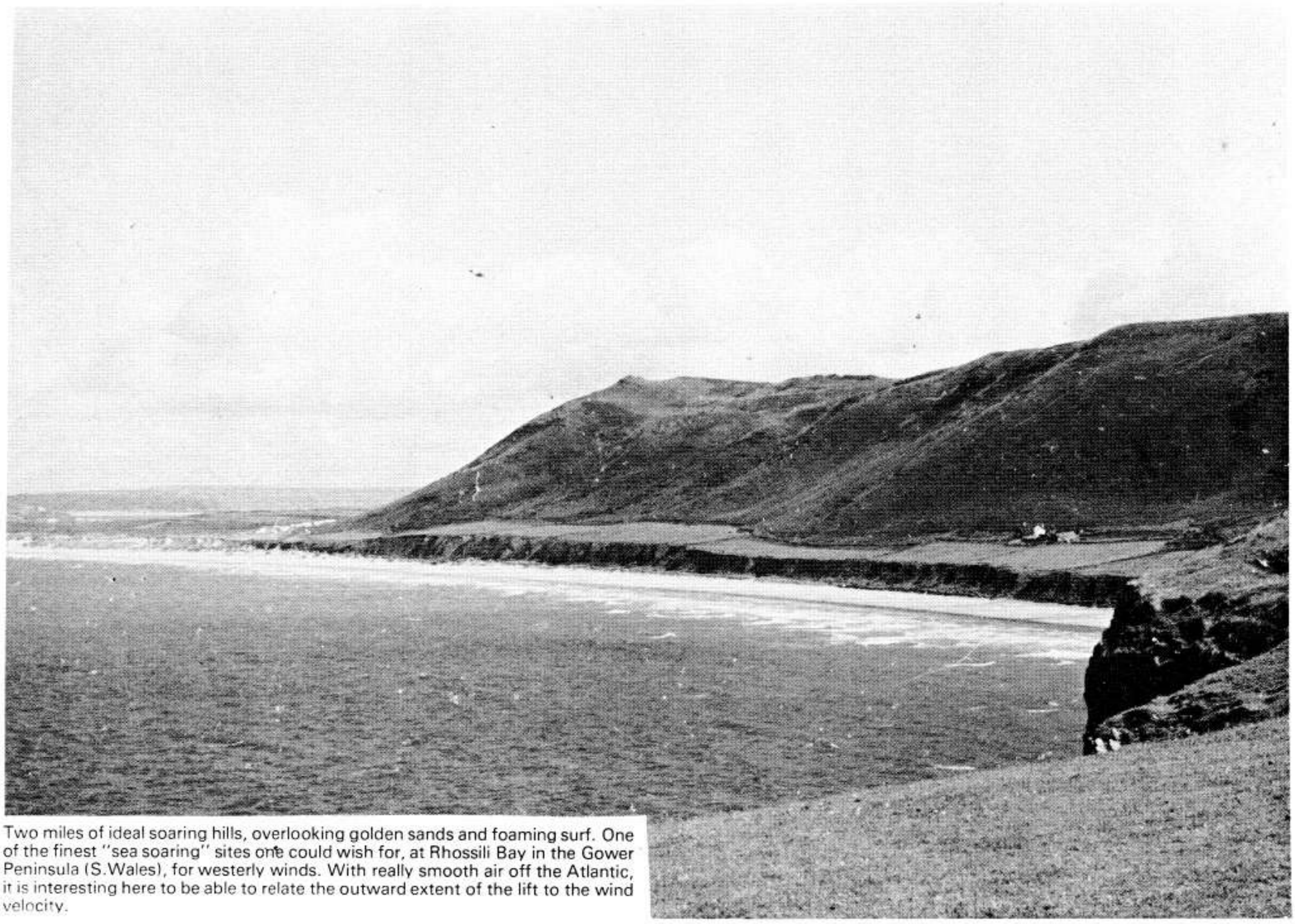




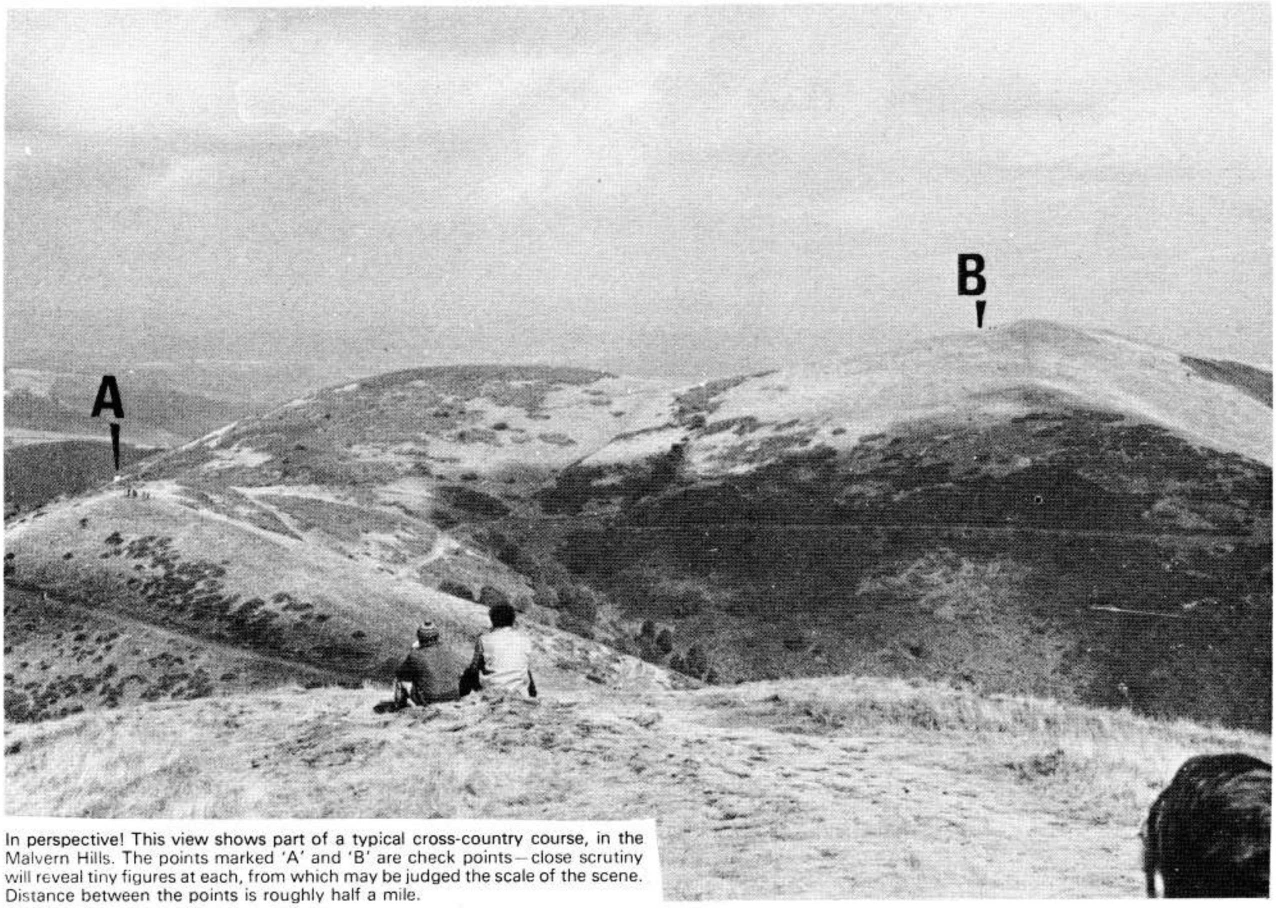
Slope soaring enthusiasts often share their hills with well-groomed white horses cut in the chalk. This—one of several in Wiltshire—helps to show the angle of the slope. Note how flat is the surrounding countryside—the ideal situation to provide smooth airflow onto the hill. Note also the ancient fortifications, a ramp and ditch, which may be seen by the horse's head. These provide shelter and comfort for those who go soaring in cold weather.



An idyllic scene in the Mendip Hills. Note how the model has already risen, having travelled just its own length forwards. The angle of the slope is clearly seen here – probably about optimum for good lift; steep hills may be better, but anything of much less angle will usually not provide very good height. Again, flat countryside upwind for a smooth airstream.

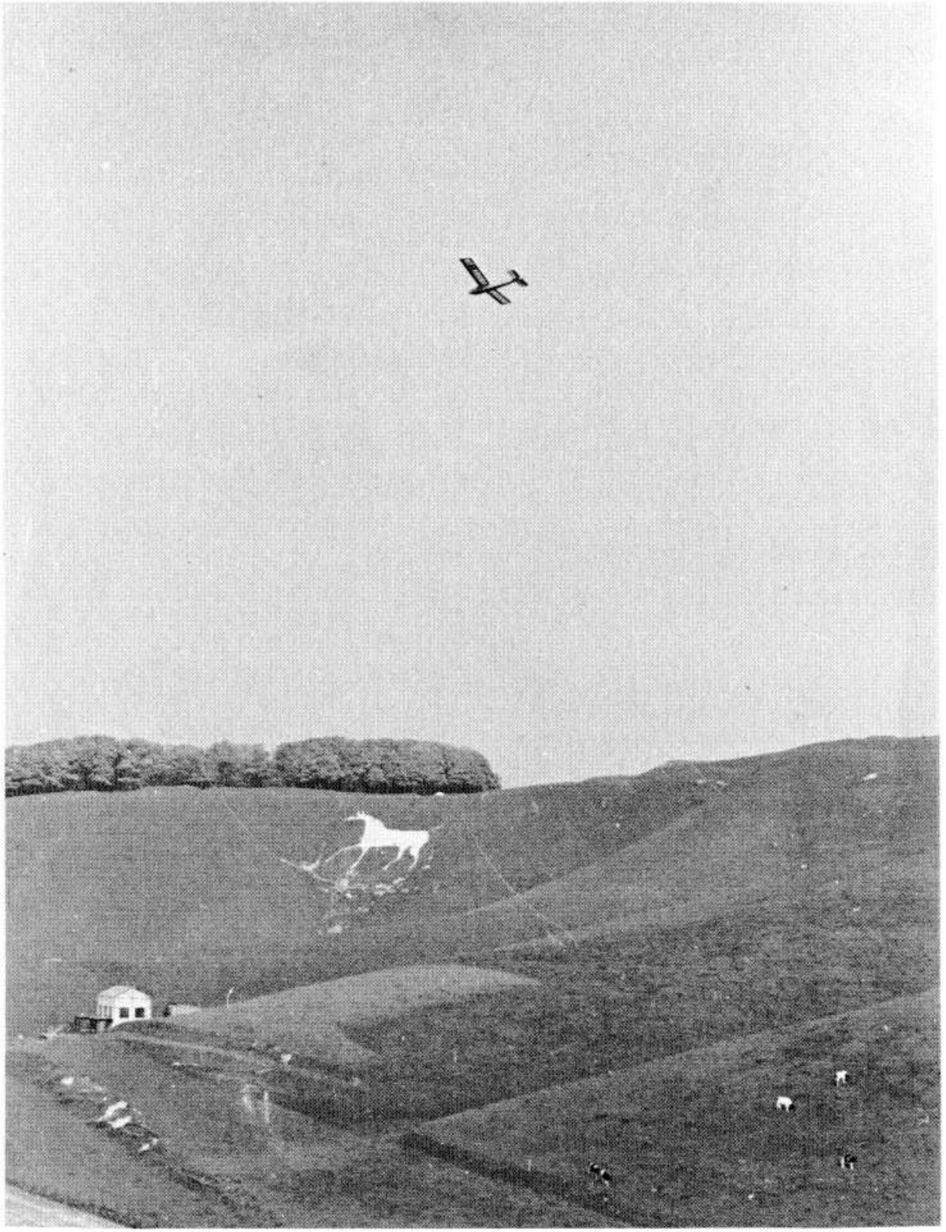


Two miles of ideal soaring hills, overlooking golden sands and foaming surf. One of the finest "sea soaring" sites one could wish for, at Rhossili Bay in the Gower Peninsula (S.Wales), for westerly winds. With really smooth air off the Atlantic, it is interesting here to be able to relate the outward extent of the lift to the wind velocity.



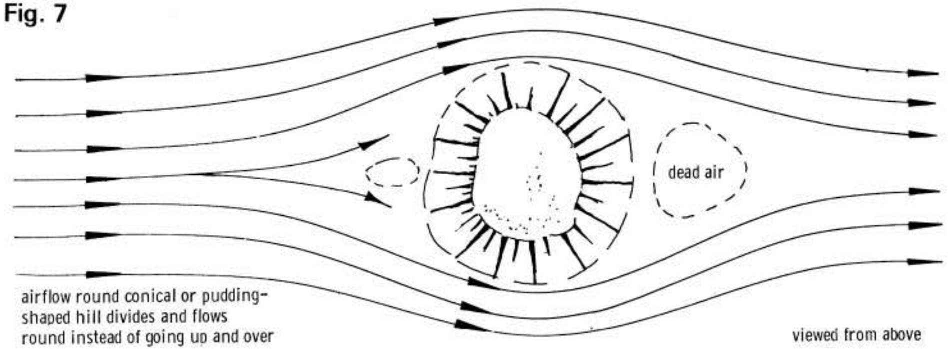
In perspective! This view shows part of a typical cross-country course, in the Malvern Hills. The points marked 'A' and 'B' are check points—close scrutiny will reveal tiny figures at each, from which may be judged the scale of the scene. Distance between the points is roughly half a mile.

This picture, taken during a soaring meeting, shows a really fine ridge giving a considerable length of slope face, a change of direction at the near end also providing a bowl effect. Note the narrow top area, then the steep drop away of the slope. Landings, for other than the most adept, are made in the field behind the wall (left). Even so, care is necessary, as the ground slopes away that side and there is an area of turbulence.



Another Wiltshire white horse, this time in one of a series of bowls, themselves forming a larger bowl. One may fly each in turn to find the best lift, or move round as the wind veers. When the wind is on the "horse" bowl, however, landing can be tricky because of the trees growing right up to the edge.

Fig. 7



considerable experience and can cope happily with turbulent and rapidly changing conditions.

The classically "useless" hill is the "sandcastle" or conical one. This is because, instead of climbing up over it, the air finds it easier to split up and flow *around* it. On small conical, or pudding-shaped hills, there will usually be no slope lift effect at all and, on the larger ones, what lift is produced is only found in a very narrow "straight ahead" area. If one is daring (or foolish) enough to launch a model into this, one is faced with either "hovering" it in virtually the same spot for hours on end, or else having it simply carried "round the corner" and right away by the air rushing past the sides—a fate which it will meet sooner or later in any case! Fig. 7 shows how the air divides in front of a conical hill, and then rushes round to join up with itself on the other side.

The same sort of effect is often to be found on a ridge site, when the wind swings to blow parallel with the ridge. (If the wind had been end-on to the ridge all the time, one assumes that you would not have been there in the first place!) Chasing the wind, one wanders over to the end of the ridge (Fig. 8) only to find that, though there may be just an inkling of upward-going air, most of it is passing to either one side or the other, and not going up at all.

Similarly, there is often a partial effect of this kind at the *end* of any face, or ridge, where the wind ceases to flow upwards over the top and commences to flow round the side (Fig. 9). This is always a treacherous area, to be wary of—more especially when the wind is fairly strong, because we have then the strength of the wind to fight against, without the upward component enabling our model to fly faster without losing height. The result, unless we are very lucky or very skilful, is that we find our model sinking downwards while making little or no progress forwards. If we are less fortunate, it may disappear around that corner, out of our sight—and so out of control.

Another type of hill to avoid, or at any rate treat with a great deal of reserve, is the one *with other hills upwind of it.* Within a couple of miles, that is—although, of course, this does depend on their size. In light breezes, these sites may prove very good (Fig. 10a) but, when

Fig. 8

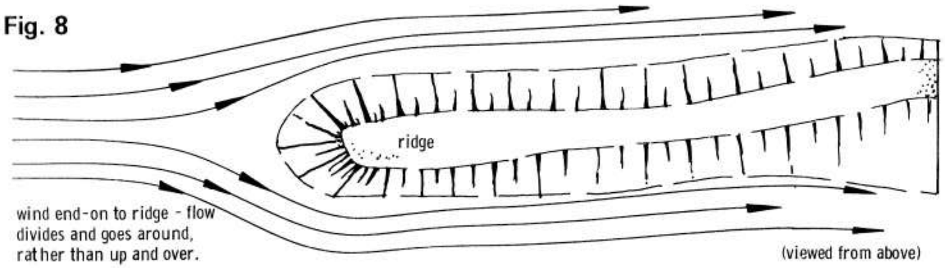
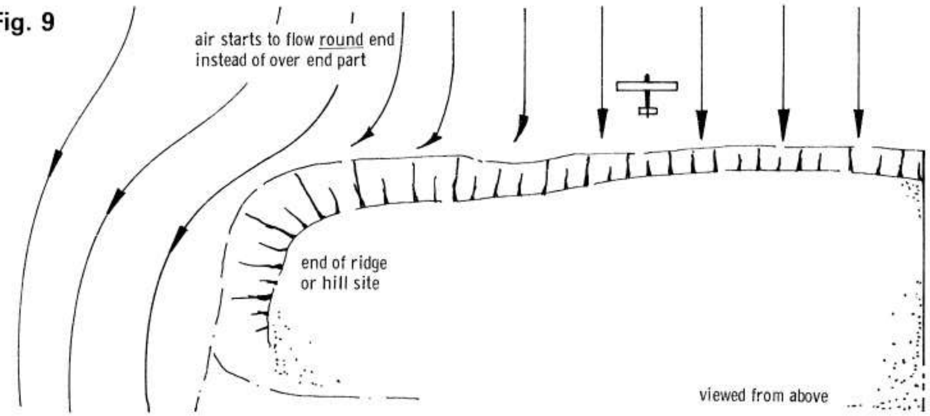


Fig. 9



the wind freshens, severe turbulence is often caused by the hills to windward. Fig. 10b shows the sort of thing that happens to the airflow.

The air may seem smooth enough at the launch point of our main slope but, as the model begins to move outwards—perhaps as little as fifty feet, perhaps as much as fifty yards—it can be severely buffeted and even find itself in air that is moving very fast in a *downward* direction.

In less strong winds, however, it is often to be found that these "advance guard" hills, when they are considerably smaller than the main hill, can produce a fair amount of lift in their own right, which can be used to great advantage by the more experienced and adventurous fliers, who are not daunted by the possibility of "running out of lift" from the base hill before reaching the outer "staging post," as it were. In general, however, the soaring to be had from hills with clear space in front of them will always be more reliable.

Thickly wooded slopes, it should go without saying, are also to be shunned. Firstly for the obvious reason that, should the lift fail, the model could well be lost in a treetop, and secondly because the trees themselves are likely to cause turbulence and make flying the model both difficult and hazardous.

Slopes that have areas of woods at the very foot, however, can often be quite efficient, provided they are high enough, as the woods could well lie in the region of "dead air" that is, as we have seen, generally to be found in this area. Again, one would be prudent only to launch a model from this sort of slope if one were reasonably certain that there would be

Fig. 10a

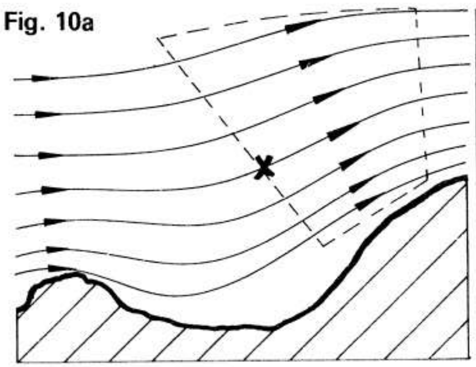
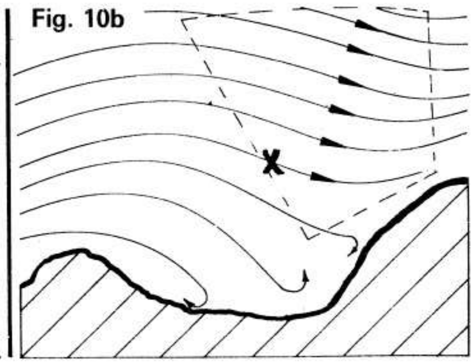


Fig. 10b



enough lift to enable it to be landed back at the launch point, rather than somewhere down the slope.

Hills with trees at the *top* do not usually create any problems with soaring, as such—only with landing, but this is simply a matter of technique, and is covered in our discussion of landing methods later on. In all things, one does well to start with as few problems as possible, and apply specialised techniques as one learns them so, for the moment, the beginner should find himself a slope of the first type we described, on which to make his first sorties.

Looking for sites

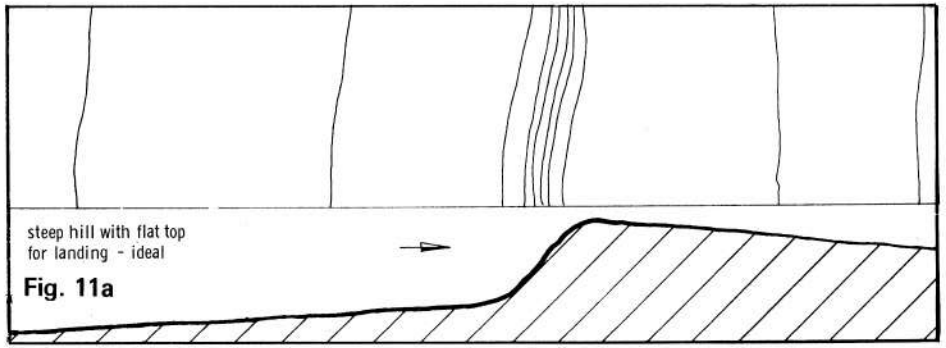
Although by now most of the sites frequented by groups of slope soarers—especially those where competitions are held—are well-known, there must be many other places around the country which have not been tried, or about which the users prefer to keep quiet. (For this latter reason, incidentally, it is not possible for us to give a *detailed* list of slope soaring sites here. We would not wish to be accused of "spoiling" sites for the local fliers, by precipitating an influx of scores of soarers from many miles around!)

If you live in a hilly area, then you should not have too much trouble finding a suitable site. Talking only in the most general terms, there are many suitable slopes, for instance, on the South Downs, also in Hampshire, Dorset and, further west, in Somerset (the Mendip Hills). Cornwall has many coastal sites. Going further north, there are the Cotswold Hills, and the Malvern Hills. North of the Severn we have the mountainous regions of Wales (starting with the Gower Peninsula, with its magnificent coastal soaring). In the midlands, the Peak District of Derbyshire offers its rugged grandeur, while, in the north-east, the North Yorkshire Moors abound with tempting sites, and the east coast has a number of inviting cliff areas, if you are prepared to face the bitter east winds. Scotland, one hardly needs to add, must be a soaring paradise, though the only named sites that have become known south of the border, are the East and West Lomonds. If, however, you live in the flatter lands of, say, south-east England, then perhaps you would be wise to consider taking up thermal soaring! Even so, there may well be small hills and possibly coastal sites, that are worth investigating for their slope-lift possibilities. It is really for those who live in "marginal" areas—neither very hilly nor very flat—that the question of searching out suitable slope sites becomes more of a task. There are many soaring enthusiasts who regularly make journeys of 50 or 60 miles to their slope sites, because there simply is nothing available nearer home.

How best, then, to go about finding a slope soaring site? First and foremost, one should make enquiries locally. Your local model shop proprietor may be able to tell you where the nearest site is. If not, he should at least be able to put you in touch with the secretary of the local club. If that worthy says they have no slope soaring members, then you will, in all probability, have to start looking further afield than you might expect to have to go for power flying.

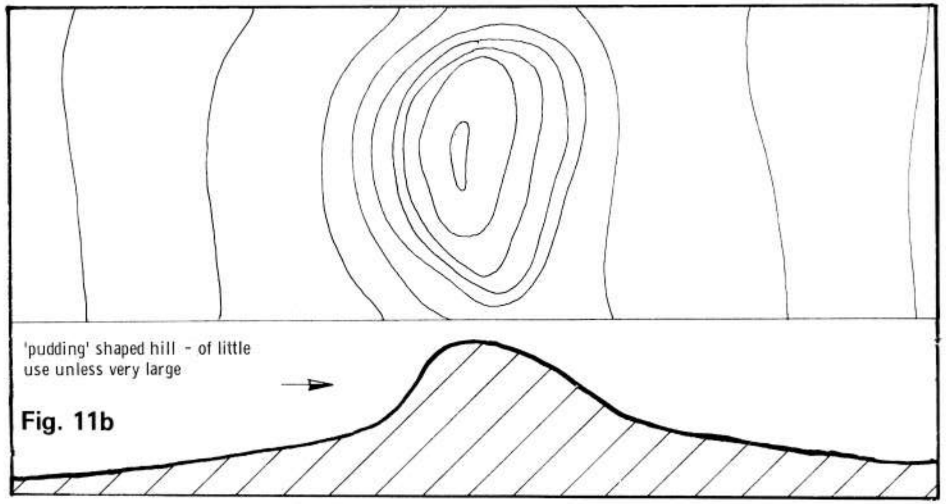
If there *is* a club, or group of people who regularly soar in a certain locality, then you should first make contact with them. It is only courtesy to do this, apart from being commonsense, to avoid possible radio interference with one another. You do not want to find yourself launching your model "just around the next hill" from the established site, or you may find that it is "shot down" by someone on the same frequency—not to mention your doing the same to someone else. For this same reason, of course, when you go to an established site, you should always make yourself known, and fly from the same area as the others. In this way you will be able to ascertain what frequencies are being used, and make sure that the other fliers are aware of yours. You will also make new friends, and learn "the ropes" much quicker.

If all your efforts to contact fellow soarers fail, and you feel you would like to see some slope soaring going on before you actually tackle it yourself, then your best plan is to arrange to go to one of the numerous contests that are held throughout the summer, the dates and venues of which are listed in the "For Your Diary" feature in *Radio Modeller.* You will also



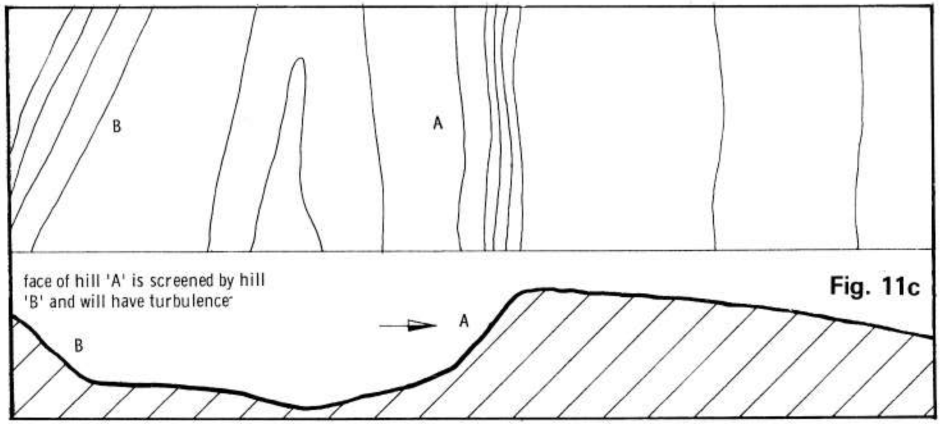
steep hill with flat top for landing - ideal

Fig. 11a



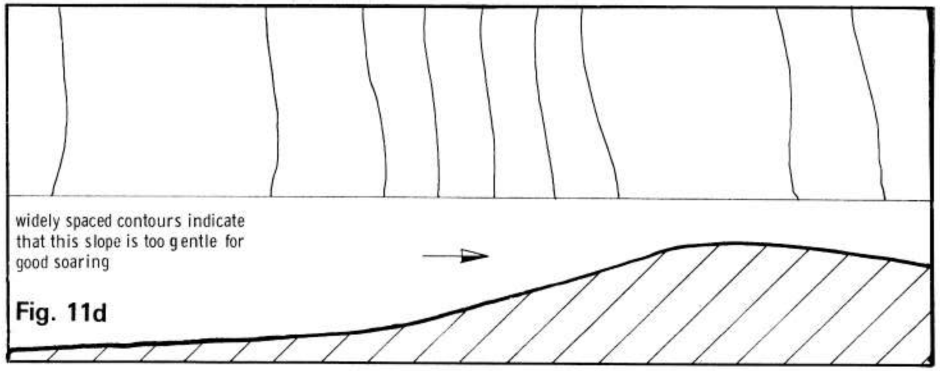
'pudding' shaped hill - of little use unless very large

Fig. 11b



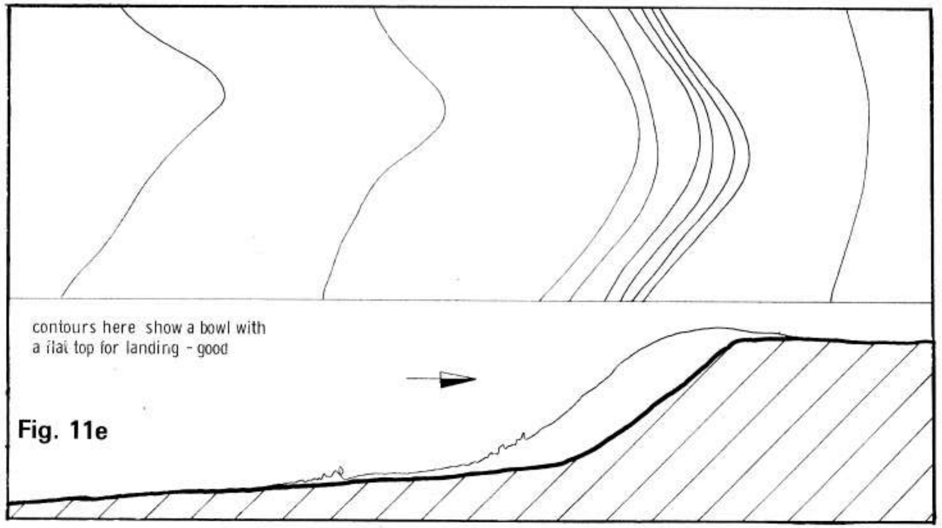
face of hill 'A' is screened by hill 'B' and will have turbulence

Fig. 11c



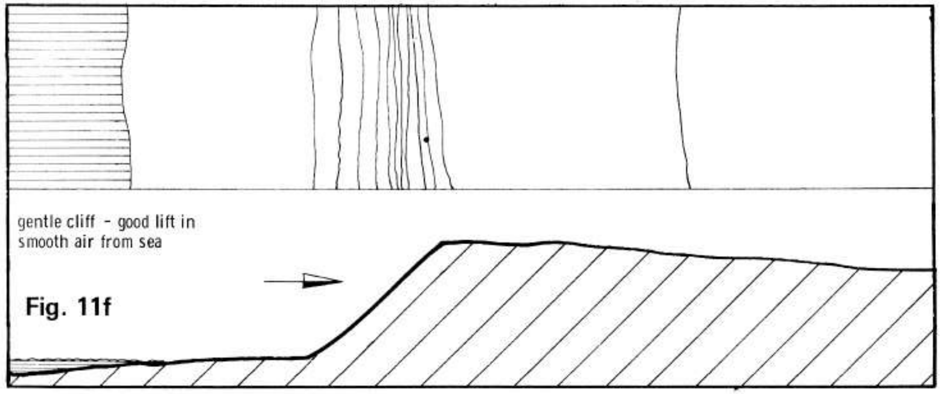
widely spaced contours indicate that this slope is too gentle for good soaring

Fig. 11d



contours here show a bowl with a flat top for landing - good

Fig. 11e



gentle cliff - good lift in smooth air from sea

Fig. 11f

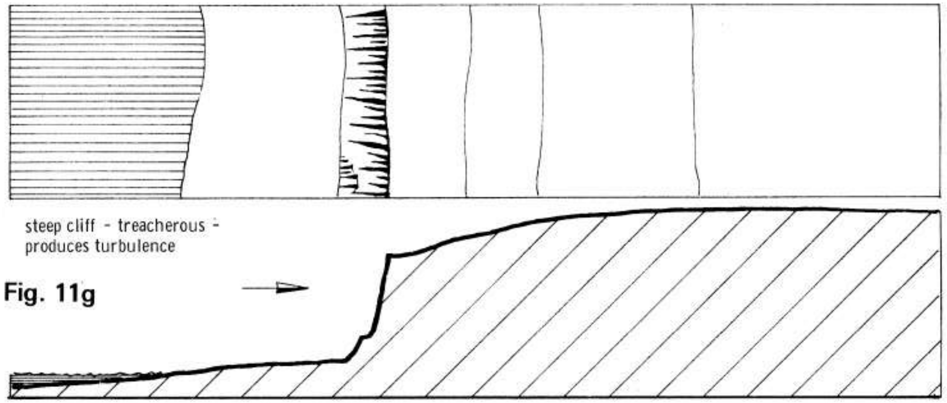


Fig. 11g

then have the opportunity of chatting to some of the participants—and perhaps finding out by this means where your nearest established site is.

However, if you live too far away from *any* of the contest sites, but still feel there ought to be some soarable slopes within a more reasonable distance, then the best plan is to obtain an Ordnance Survey map of the likely area and study the contour lines on this. Remember that you are looking for either a ridge, a hill with a more or less "flat" front face, or a bowl—and that there should not be other hills close by to windward. The contour lines should give you the general picture of the topography, and our sketches (Fig. 11a-g) show some typical formations of contour lines, together with cross-section drawings showing the sort of thing that they represent. Fig. 12 represents an imaginary hilly area, on which are shown slopes of varying steepness and direction. With reference to the Key letters on it, you will soon be able to see how to "read" your own particular Ordnance Survey map for the location of possible sites.

From the map, too, you will be able to see which direction the wind should be coming from, to make the hill "work," and if there is road or track access. Wooded areas are shown on the maps, but it is often not possible to tell from the map whether or not these will

SEARCHING FOR SITES. This is a map of a purely imaginary area, which has been drawn to include as many interesting features as possible. These would not, of course, be crammed so close together in "real life". The contours are arranged so as to show various configurations of terrain – some suitable, others unsuitable for slope soaring. The various locations indicated are as follows.

A. Sloping cliffs, with gently sloping back area. Excellent for smooth airflow from the sea. **B.** Quarry, if large, can produce lift, but often has turbulent areas which can be treacherous. If lift dies, you may have to land on the rocks! **C.** This ridge should work well, but could be tricky for landing, being rather narrow at the top. **D.** This ridge is too close, downwind, to C and will suffer from turbulence. **E.** This is an almost conical hill, so the airstream would separate and go round it. There may be a very narrow area of lift directly in front. **F.** Again, this ridge is too close to E. **G.** This area, though shown wooded, will bear investigation, as this may mean "trees" rather than "a wood". **H.** Here is a steep bowl, facing offshore winds. Should be ideal, and has only gently sloping back area. **J.** An interesting escarpment which could work well, as models should reach further wave of lift if flown high out over D and C. Landings, however, must be made well away from the road. If this is a main road, then do not risk accidents – finc somewhere else. **K.** Contour lines show that this bowl is much too shallow to be worthwhile. **L.** Ridge end is no use, as airflow separates. **M.** Valley head – sharp cleft – wind has to be dead-on, otherwise severe turbulence likely. **N.** This type of ridge end will only afford limited lift. **Conclusion:** the best areas to find good lift would be **A** and **H.**

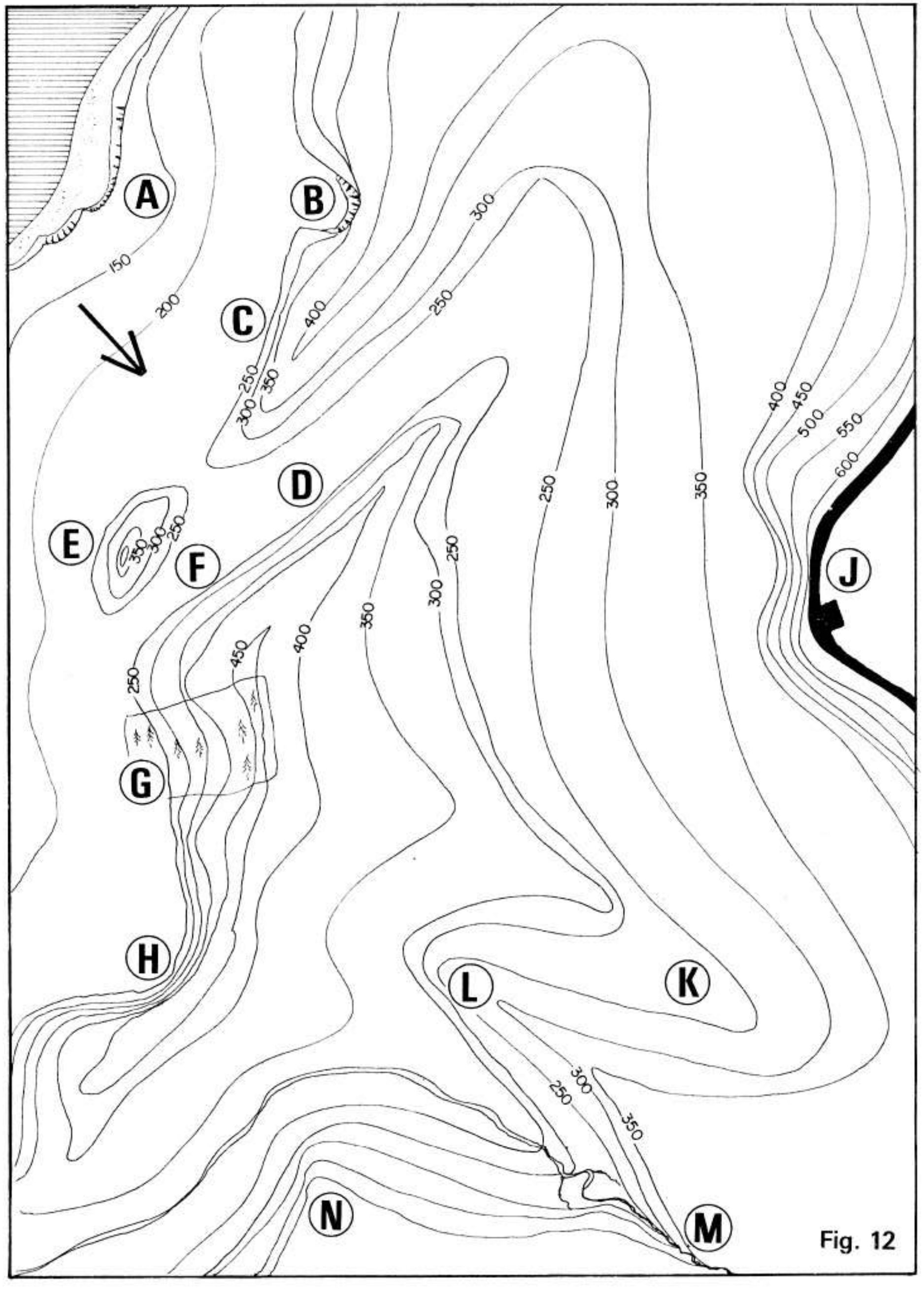


Fig. 12

interfere with flying. The map will not tell you if the area is private property, either, and these things can only be decided by a visit to the proposed site. On the other hand, a very large number of suitable sites are on National Trust land—and these areas are marked "N.T." on the map.

We have only been able, so far, to get an indication of the likelihood of a site's possibilities. The next step, having visited it and *ensured that one is not trespassing*, is to try it out for oneself. Testing out an "uncharted" site, however, can be hazardous and, strictly speaking, the beginner should learn to soar on sites that are known to produce the right conditions. With too many unknown factors, the novice will find his early days frustrating, as he will not know if—when all does not go well—it was his choice of hill, wind speed, or model that was wrong, or whether he simply made an error in flying the model. However, if everyone had soaring friends to help them and "safe" sites to learn on, there would be no need for this book! The lone hand beginners must start somewhere, so the next item to look at will be the choice of model type, and the various types of models are discussed in the next chapter.

You will be spending many enjoyable days in the countryside, and it therefore behoves you to obey the country code. Close the gates behind you. Do not leave litter—especially plastic bags, which can kill animals. Do not climb dry stone walls—use the stiles or gates. Do not let dogs chase sheep. And, if your model does crash—don't leave the wreckage all over the hillside just to prove you were there!

Having arrived at your proposed launch point, it is a good idea to spend a few minutes observing the conditions, instead of flinging your model into the air with gay abandon. See what the birds are doing. They will often be soaring from one area rather than another and, by watching them closely, you may even be able to get an idea of where the areas of strong lift—or violent turbulence—occur. If those ungainly birds, crows, are managing to soar, then the lift *must* be good; on the other hand, do not be deceived by the wily seagulls as they are past masters in the art of soaring and will be making the most of perhaps only slight lift. Nevertheless, watching *any* birds will give you some clues in helping to decide where to launch and fly your model.

CHAPTER 3

TYPES OF MODEL

THE array of different designs from which the newcomer to slope soaring has to choose may seem quite bewildering, so we will look at the main categories and their functions. It is convenient to classify radio control model types in terms of the number of controls available. Each of these categories can then be subdivided into "type" from a shape and size point of view.

We can group the types, controlwise, into *Single Channel,* (or, more correctly, *Rudder-only), Intermediate* (rudder and elevator) and *"Full House"* (ailerons, elevator and rudder). As will be seen, "full house" with soarers comprises only three functions—that is, all the controls of a full house power model except, of course, throttle. The fourth function, however, is sometimes used for such refinements as flaps, "flaperons" (variable camber aerofoils), airbrakes or spoilers.

Before we go on to look at each of these basic categories of model, it will be as well to give some attention to a consideration which is of considerable importance to both designers and fliers of slope soaring gliders—the *wing loading.*

Wing loading

Soaring enthusiasts, of both slope and thermal categories, are usually very conscious of the wing-loadings of their models. This is the relationship between the weight of a model and its wing area, and it is expressed either in ounces per square foot or, metric fashion, in grams per square decimetre. *(See the wing loading Nomogram on page 32).*

It is natural to think of large models as being heavier than small ones and, of course, this is nearly always the case, but it is not the absolute weight alone that affects the model's performance; it is the weight per unit of wing area. Thus it will be seen that we can have a small model that is highly loaded (relatively heavy for its size) or a large model that, despite a seemingly high overall weight, is really quite lightly loaded, when one considers the area of the wings that will be supporting it. Also, models can be small *and* light, or big *and* heavy.

Wing loading decides the speed at which the model will fly—and so, in turn, the speeds of wind in which it will perform best. The higher the loading, the higher the speed. Slope soarers have, in general, much higher wing loadings than thermal soarers since, as they depend on air *blowing* up a hill for their lift, rather than simply on warmer air rising, they are designed to fly in quite strong winds. For instance, a reasonable wing loading for a medium-sized slope soarer will be 14 to 16oz./sq.ft. whereas a thermal soarer of the same size will have a wing loading of only about half this.

This is, perhaps, somewhat of an over-simplification, but it will serve us well enough when thinking about sizes and weights of models generally. The subject is delved into much more deeply in a more technical, aerodynamic manner, by Fred Deudney, in his chapter, "Speed and Efficiency" later on. Suffice it to say, here, then, that the "middle of the road" figure, for our slope soarer, is 14 to 16oz./sq.ft. A slope soarer of 8oz./sq.ft. wing loading would be considered lightly loaded, and only suitable for light breezes and, at the other end of the scale, a model of 24oz./sq.ft. loading is heavily loaded, and will need "strong to gale" force winds!

Aspect-ratio

The other "technical term" which you will often see mentioned in descriptions of models—and full-size machines—is *aspect-ratio.* This is simply a way of defining whether

WING LOADING NOMOGRAM

EXAMPLE

Your 700 sq. in. model weighs 6¾ lbs. To find the loading, lay a ruler, or better still draw a line, from the 700 sq. in. point on the right-hand scale to the 6¾ lb. point on the left-hand scale. Where the ruler or line crosses the centre scale, read off the loading (in this case 22 oz. /sq. ft.).

The nomogram can also be used to find the required total weight for ballasting, by laying the ruler across the area and loading scale and reading the required weight off the left-hand scale.

In addition, each scale can be used as a conversion scale for oz. to lbs., grammes per sq. decimetre to oz. per sq. ft. and sq. in. to sq. feet respectively.

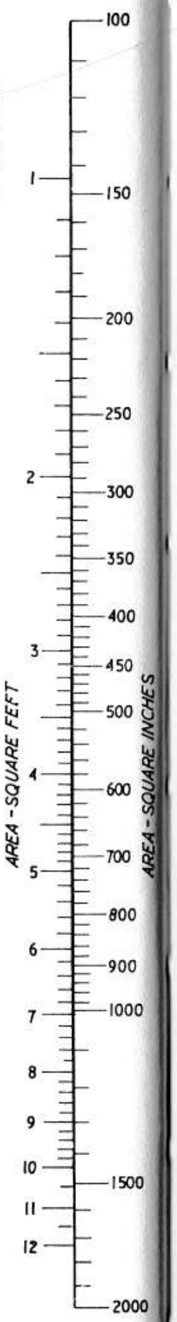
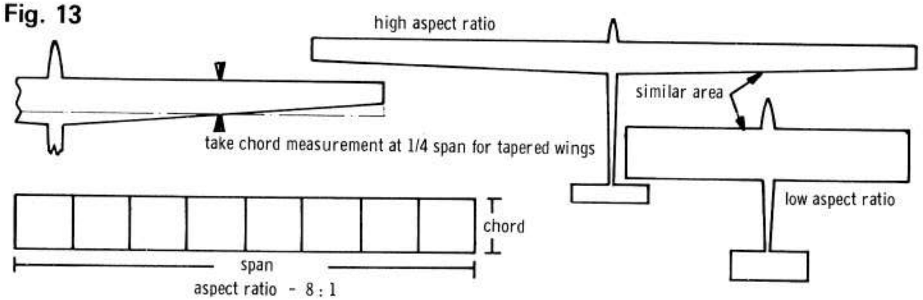


Fig. 13



the aircraft has short stubby wings or long slender ones. Arithmetically, it is the wingspan divided by the mean chord. For instance, if your model has a span of 80in. and a chord (width of the wing, from leading edge to trailing edge) of 10in., then its aspect-ratio is 8:1 ("eight to one"). We say the "mean" chord to take into account tapered wings. The diagram, Fig. 13, shows the whole thing at a glance.

Let us now take a look at each of the basic categories of model that we mentioned earlier. We will take them in turn, and see the kind of soaring of which they are capable, and the advantages and disadvantages of one type as compared to another.

Rudder-only

As with power models, the single-channel, or rudder-only models are the type that many people still choose to start with, due to the relatively low cost of the equipment. Paradoxically, however, they are, in fact, choosing one of the most difficult types of flying, since all the work of manoeuvring the model has to be done with the rudder alone. In addition, generally speaking, the conditions in which one can fly a rudder-only model are much more restricted, because trimming cannot be done in flight. When conditions change, the model can be brought down and re-trimmed—but only to a certain extent, or we upset its natural stability. Multi function models (i.e. the other two categories) can be trimmed *in flight* to cope with a very wide variety of conditions. Nevertheless, it is possible to derive a great deal of pleasure from simple rudder-only slope soarers if one is prepared to accept their limitations and wait for the right weather.

The question of size now arises. One generally thinks of rudder-only soarers as being fairly small, but this isn't necessarily the case. The larger any model, the more efficient it will be, and it is, therefore, because of practical considerations that we more often see small models being used for this purpose. This is, first of all, because single-channel radio, with its rubber driven escapements, lends itself to the smaller, lighter, types of model and, secondly, that "the larger they come, the harder they fall"—and one must expect more crashes, initially at any rate, with a rudder-only model, simply because one does not have at hand the necessary degree of control to cope with all conditions. The smaller models, too, are more agile, and responsive to the movement of the rudder, while the larger craft have more momentum and will be more sluggish in response.

The rudder-only model must be "auto-stable," and hence will need to be rigged and trimmed very much like a free-flight model. It will have a pronounced dihedral, too—and this fulfils not only the purpose of providing built-in lateral stability (as it does on the free-flight model), but also enables the model to perform a banked turn, when rudder is applied, instead of simply skidding sideways. Fig. 14 shows how the dihedral produces the banked turn effect on a typical rudder-only model.

The important point to bear in mind, with the rudder-only model, is that there is no external means of altering the pitch attitude of the model in flight. It must be rigged, therefore, to have built-in longitudinal stability of a high order. This can be adjusted, for each flight, to suit the wind velocity at the time of launch but, as we shall see in the following

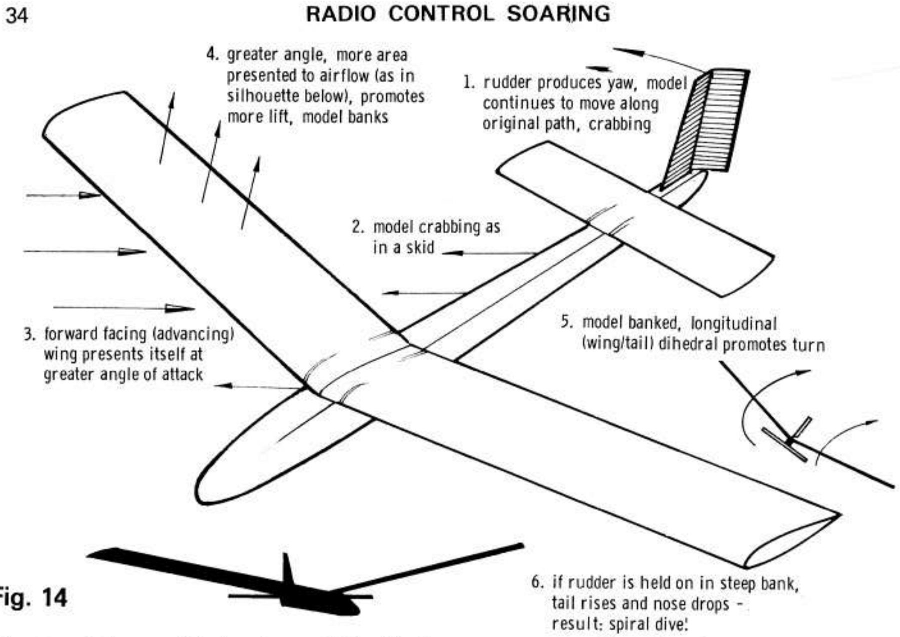


Fig. 14

chapter, this can only be done within limits or we are courting disaster.

Generally speaking*, the ideal conditions for light or medium weight rudder-only soaring are a gentle breeze of between 5 and 15 m.p.h.—steady, without gusts or turbulence, and preferably accompanied by thermal activity. If you are prepared to wait for the weather conditions to be just right, then you will be able to enjoy your rudder-only soaring, even when the heavier models are grounded through lack of wind. If you would prefer to be able to soar in a wide variety of conditions, as well as being able to manoeuvre the model much more precisely, and land in more restricted areas, then you should choose a multi-control model—either two-function (rudder/elevator) or full-house.

Intermediate

The addition of elevator control opens up a whole new world of soaring. Instead of having to re-trim his model, not only every time he goes out, but often during the course of the day, as well, the flier with elevator control—control in the *pitch* axis—can cheerfully forget most of the problems he faced with the rudder-only models' limitations. If the wind increases while he is flying, he can "feed in" a little down-trim or, if it drops, a little up-trim. (This means, aerodynamically speaking, that by the use of elevator trim, he can effectively decrease or increase the angle of attack of the model's wing, thus enabling it to fly faster or slower, as necessary). Again, of course, this is only the case within limits, and here the wing-loading of the model plays a vital part.

At the moment, however, we are concerned simply with our added elevator control. Not only does this extend the range of conditions in which the models can be flown, but the whole technique of soaring takes on a different aspect. The model can be really made to go where its pilot intends, and not just nudged in roughly the right direction. And aerobatics, of a certain kind, too, can be performed, with precision. Landings become more accurate and more satisfying. We will discuss the technique of flying intermediate models in a later chapter, however. Here we are concerned with the different types of model within this category.

*One can only generalise here, since there are exceptions—certain rudder-only models being specifically designed for flying in high winds, but these are beyond the scope of our theme here.

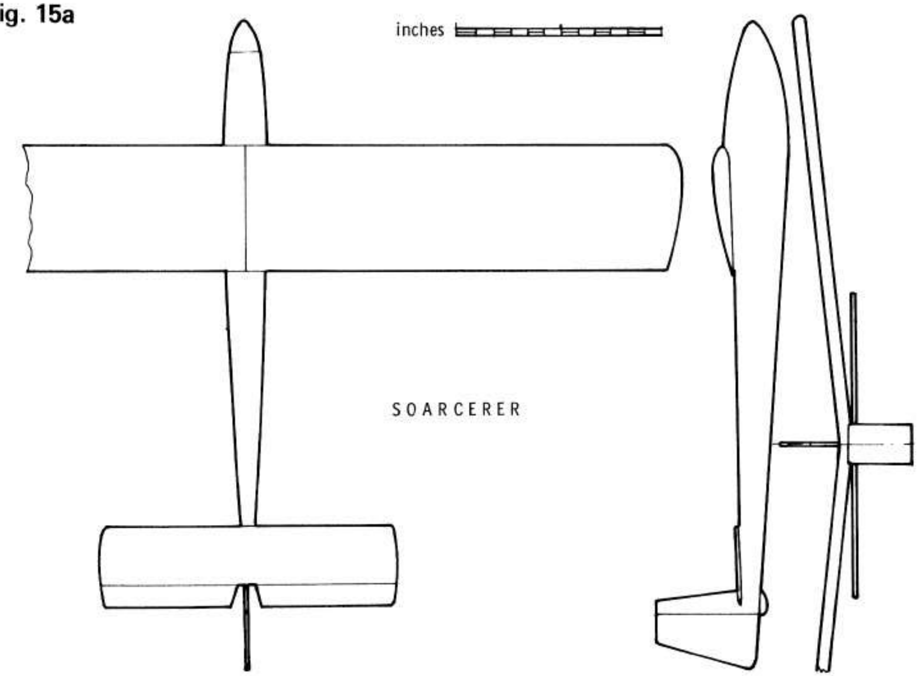
The intermediate class probably sees the widest variety of design of all, and we can roughly classify them, firstly simply into "small," "medium" and "large." Each of these can again be subdivided into "light," "medium" and "heavy," from the weight point of view, relative to size. We can then classify all these into either "functional" or "semi-scale."

The "functional" types are more compact, with relatively low aspect-ratio wings. They make the best trainers, as their very compactness enables them to withstand rough treatment better. The small and medium sizes in this class (up to, say 60in. wingspan) having less mass-inertia, are generally more responsive to the controls, and so are more manoeuvrable than the larger sizes. This means, apart from other considerations, that they can be landed in more confined spaces. The larger types, say of 7 or 8ft. span, which have considerable mass, tend to be more sluggish. Things happen more slowly: This, in a sense, makes them suited for learning with, but one has to remember that learners often "freeze" on the controls when they have done something wrong—and that any corrective action will also be slow in taking effect. Also, the landing speeds of these larger models are usually rather high, and they will need more space in which to be lined up and landed. Figs. 15a and 15b show typical small and large intermediate models.

Many of the medium and small intermediate models in the "functional" class are very like rudder-only models, in configuration. In fact, it is quite common to see rudder-only designs with elevators added. One of the best trainers has turned out to be the (originally) single-channel *Impala,* with the addition of elevator control, and it is probably safe to say that more of these models are flown as intermediate than as rudder-only machines!

The other intermediate category is the "Semi-scale" type. These are either "free-lance" designs which look something like full size sailplanes, or else "near scale" types based on a definite full-size prototype. Some of these are *very* near to scale, only departing from true scale outline, perhaps, in tail areas, and the lack of ailerons (which means they have to have more dihedral, to make the rudder turn them, as we have seen). They are thus, in nearly all

Fig. 15a



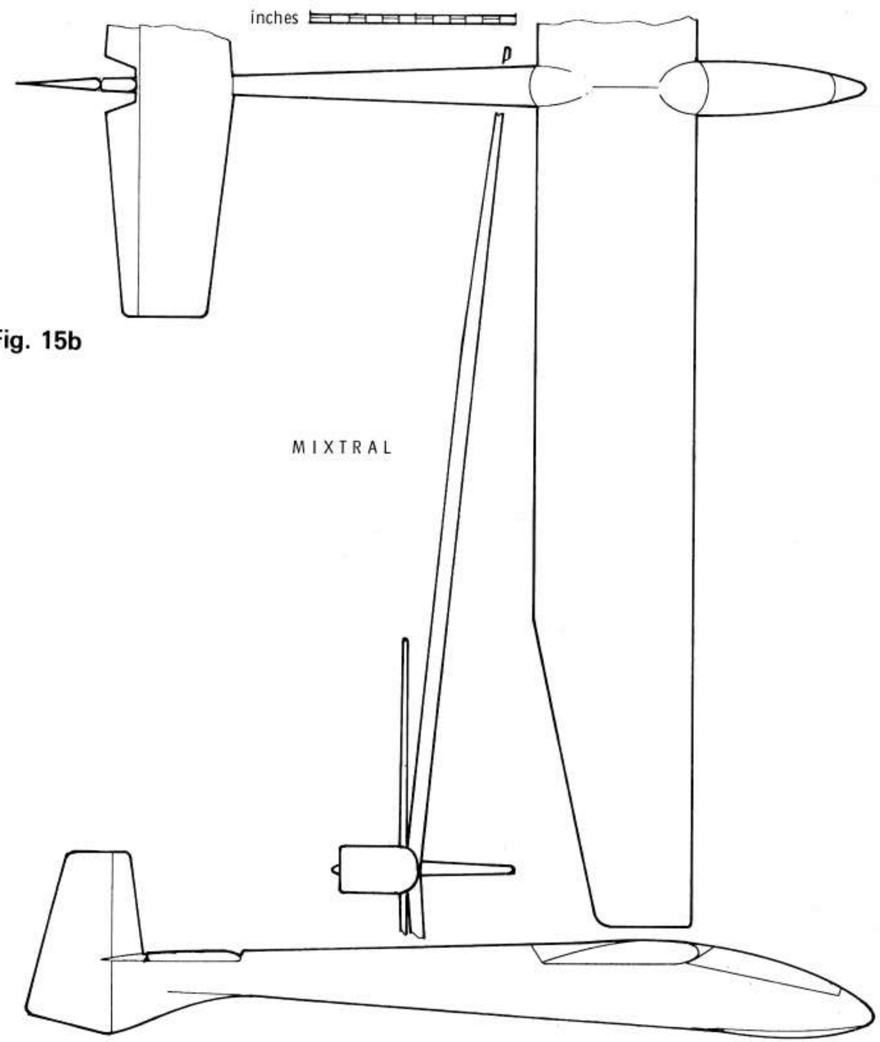


Fig. 15b

cases, elegant creations with slender, high aspect-ratio, tapering wings, and of generally pleasing line and graceful appearance in the air. Wingspans are relatively greater in this class—usually between 7ft. and 12ft. Fig. 16 shows two models typical of the breed.

Problems can, and do, arise, however, where, for the sake of appearance, the dihedral of the wings has been kept down to an "aesthetic" minimum—which often means that the rudder authority is not as great, especially when flown slowly, as one could wish. The slender, tapered wing, too, has a tendency to tip-stall if sufficient "washout" is not built in. This can result in dropping a wing very suddenly, when slowed down, so that care has to be exercised continuously to keep the flying speed up in turns and when landing—just as in full-size practice.

These, therefore, are definitely *not* models on which to attempt to learn—no matter

how appealing their appearance! However, in the hands of experienced pilots (who are used to anticipating control requirements in order to obtain the desired response at the right moment), they make very pleasant models, and are usually very efficient, soaring to great heights with ease, and are a joy to watch in the air. Many of these models would be much improved, from the control point of view, by the addition of ailerons—but that, of course, takes them into the "Full House" category, which we are now about to consider.

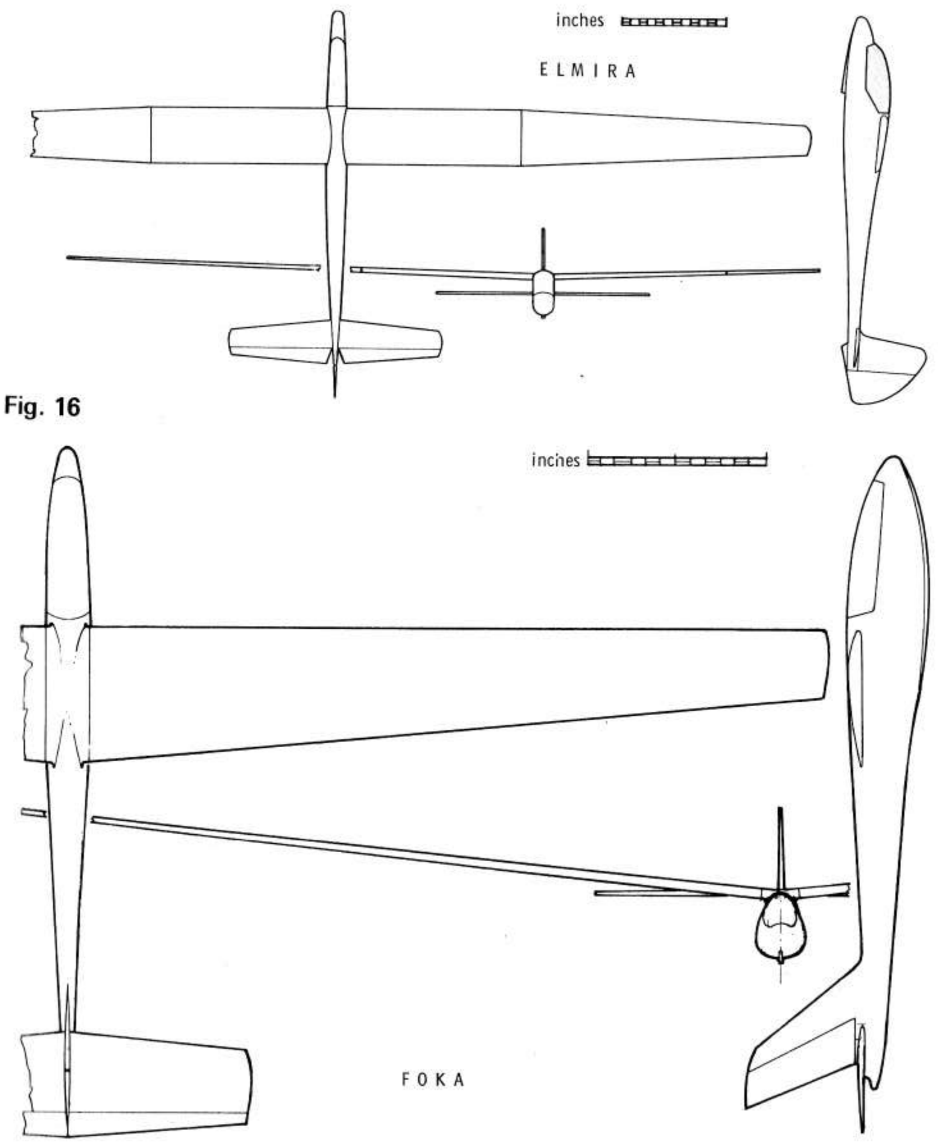
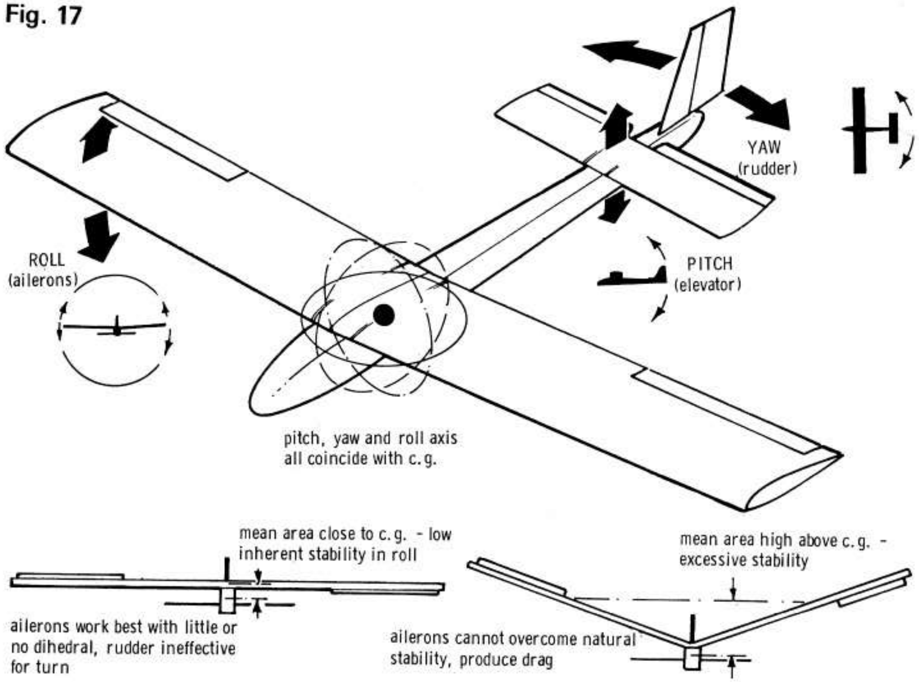


Fig. 16

Fig. 17

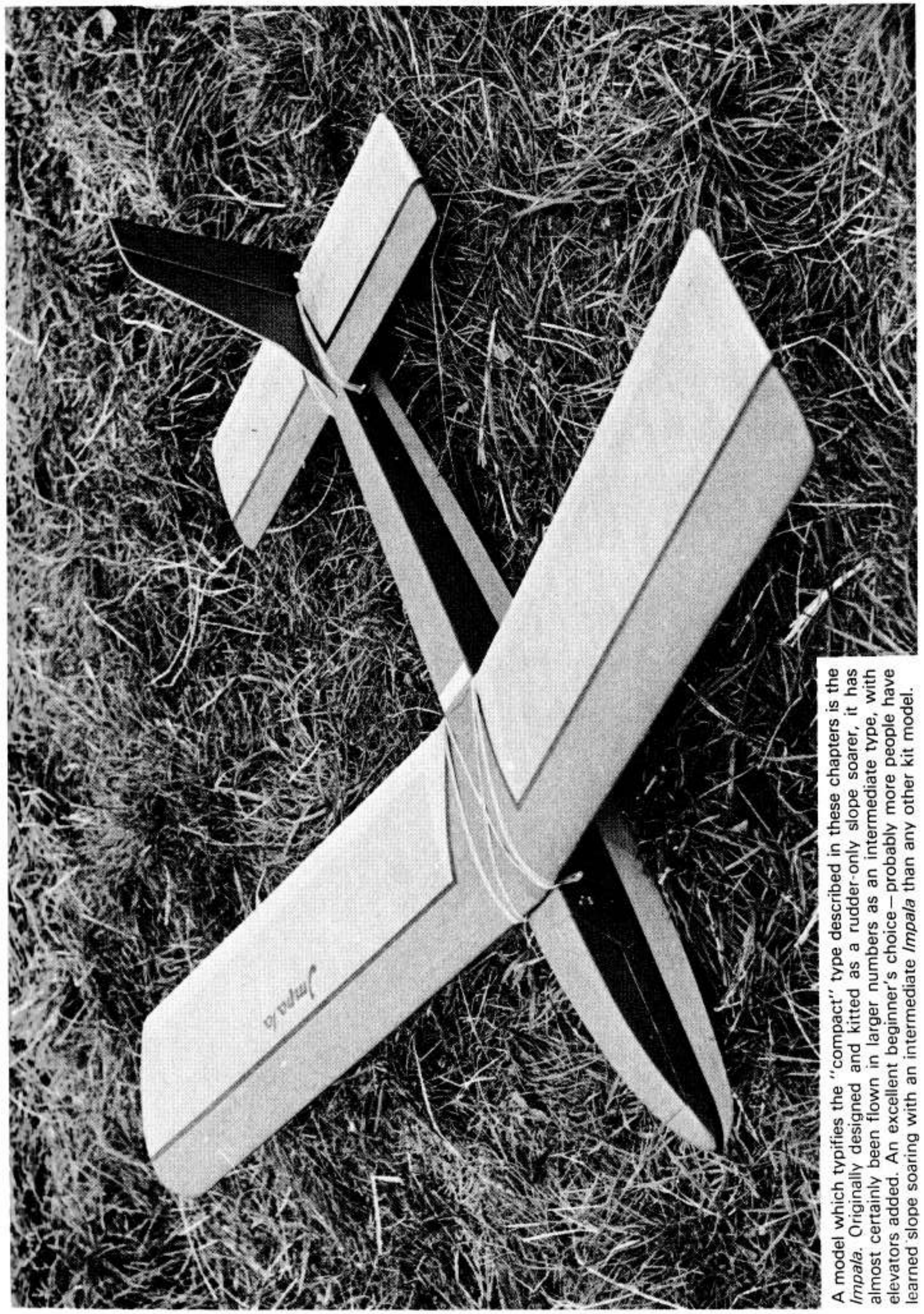


Full-house

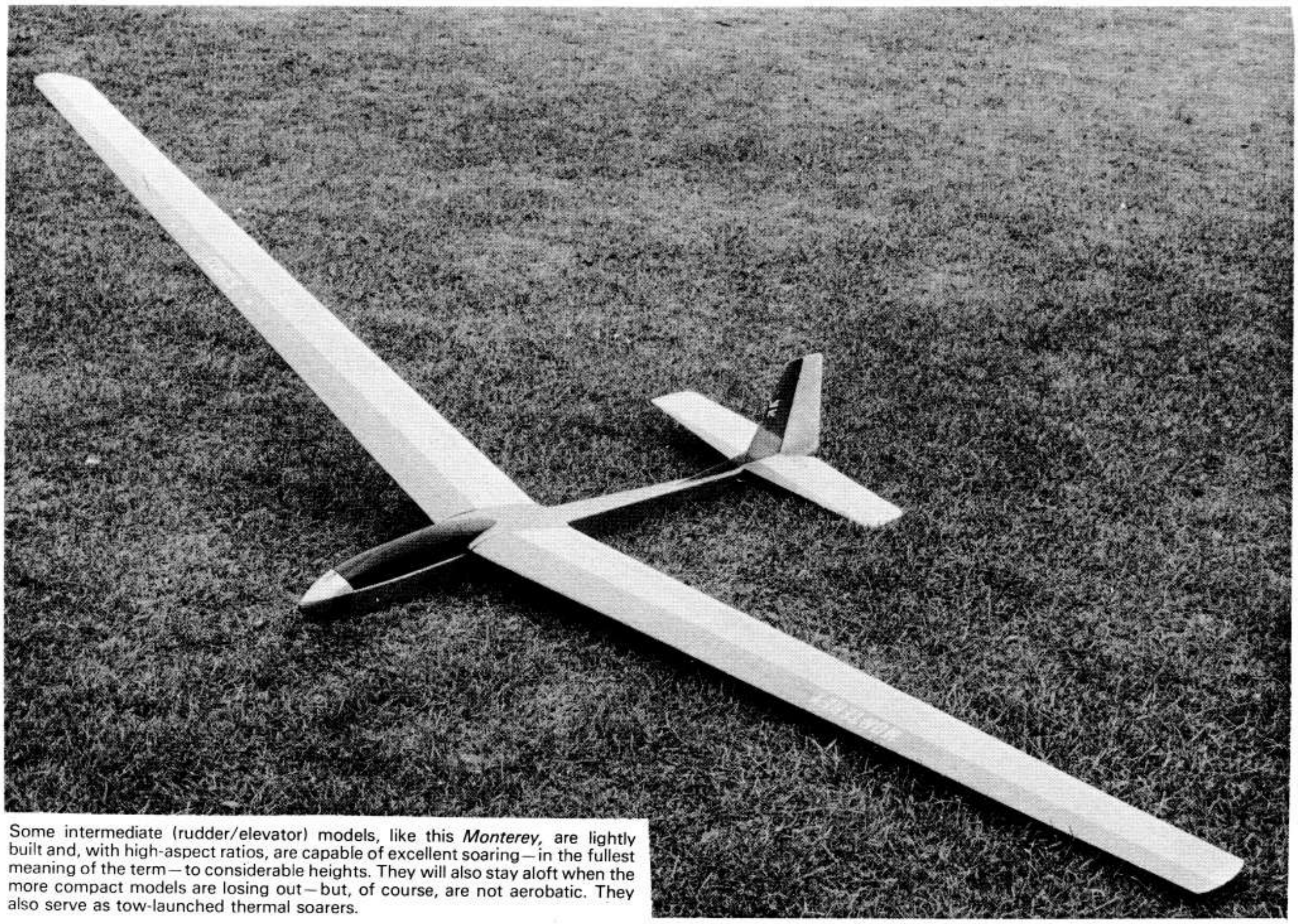
This is, of course, the *smoothest* form of flying, since the pilot has control of his model in all three axes—pitch, roll and yaw—with elevator, ailerons and rudder respectively (see Fig. 17). The ailerons enable axial rolls to be performed (as distinct from the "barrel" rolls of the intermediate model). and also really tight "pylon" turns with the model banked vertically. But, before discussing the actual flying any further, let us once again see the different types of model in this "full-house" category. These fall basically into two groups, the "aerobatic" and the "semi-scale or scale." (The latter are really two classes, of course, but can be grouped together here for our purpose, from the point of view of general attributes and the type of flying that is done with them).

Although we will deal with flying more fully in the appropriate chapter, we must discuss it to some extent in this connection, since it is the way that the models are flown, and what is demanded of them, that have produced our first sub-division—the "aerobatic" model. The fully aerobatic slope soarer is a type of glider which has been unique to Great Britain for some years, although other countries are now beginning to favour this sort of model to some degree. The reason for its development is, in all probability, the fact that there have been more contest days when the winds have been strong (20-40 m.p.h.) than otherwise. It is certainly contests that have dictated the requirements of the aerobatic model, which is, of course, in its element in conditions of strong slope lift.

Originally, once it was established that there was no longer any contest value in "pure duration," all slope contests became "speed" events, in which the fliers drove their models as fast as they could between two flags, or flagmen, stationed along the ridge. The model completing the greatest number of laps in a given time was the winner. This applied to both "single" and "multi" (the latter, in those days, being what we now call "intermediate"). Then someone added some loops, and so started the "aerobatic" class.



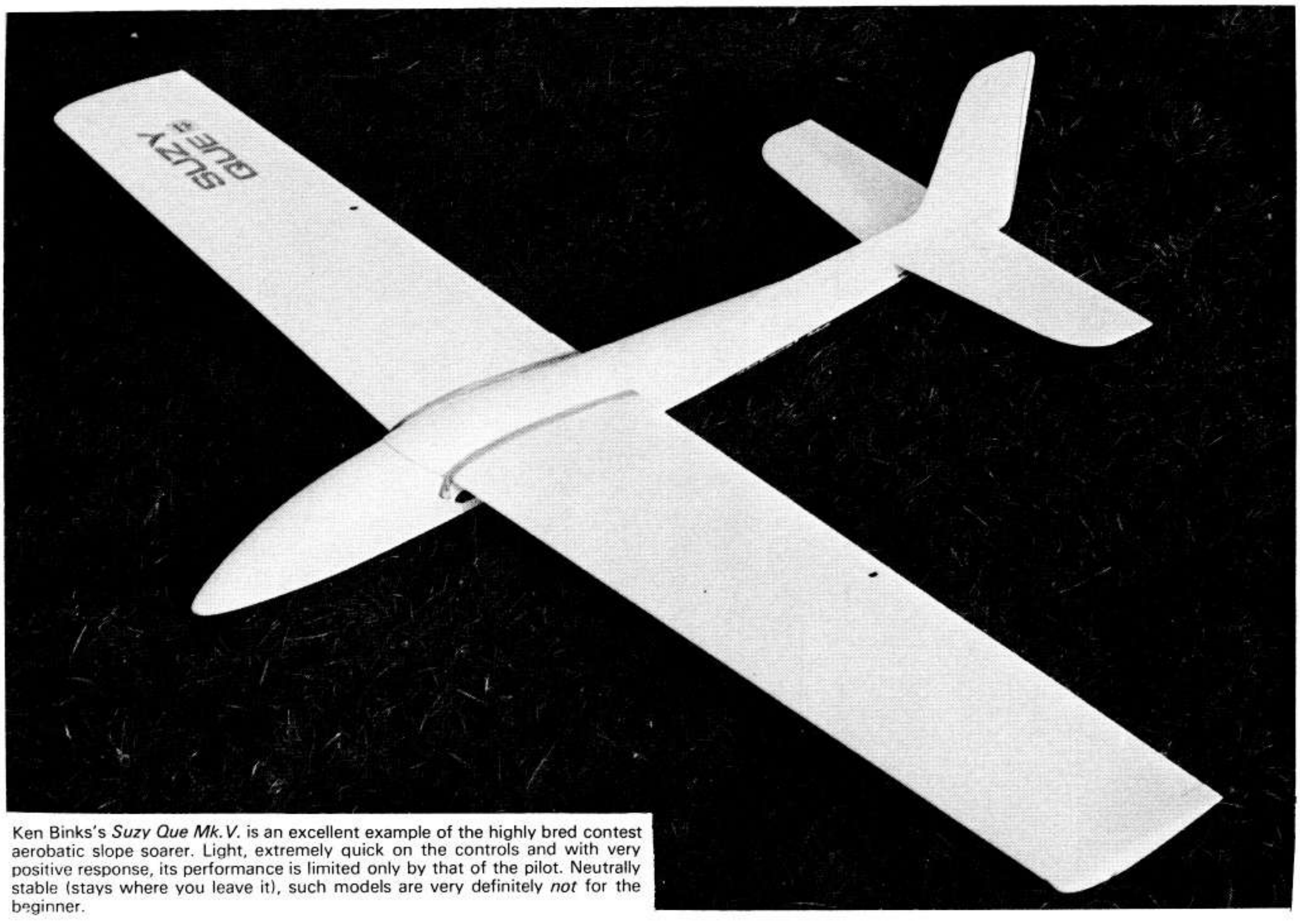
A model which typifies the "compact" type described in these chapters is the *Impala*. Originally designed and kitted as a rudder-only slope soarer, it has almost certainly been flown in larger numbers as an intermediate type, with elevators added. An excellent beginner's choice—probably more people have learned slope soaring with an intermediate *Impala* than any other kit model.



Some intermediate (rudder/elevator) models, like this *Monterey*, are lightly built and, with high-aspect ratios, are capable of excellent soaring—in the fullest meaning of the term—to considerable heights. They will also stay aloft when the more compact models are losing out—but, of course, are not aerobatic. They also serve as tow-launched thermal soarers.

Here we have a full-house sport/aerobatic model, of T-tail configuration, and quite elegant lines. The ailerons are of the "strip" type, with the hinge-lines sealed and thus not visible. The model, which has a 72in. wingspan, weighs 43 oz. and is fitted with a removable pylon and . 049 engine. *(See Chapter 17—The Power Assisted Glider.)*

A good example of a model developed specially for pylon racing. The V-tail has elevator action only (it is all-flying) for simplicity, as rudder manoeuvres are not required for racing. Here the pilot (clad for wind and weather!) holds his model to give an idea of its size.



Ken Binks's *Suzy Que Mk.V.* is an excellent example of the highly bred contest aerobatic slope soarer. Light, extremely quick on the controls and with very positive response, its performance is limited only by that of the pilot. Neutrally stable (stays where you leave it), such models are very definitely *not* for the beginner.

When sufficiently experienced in building and flying sport and aerobatic models, the scale model glider or sailplane presents a worthwhile challenge. Even if this is your sole aim, however, you should force yourself to build and fly some non-scale knock-about models and *learn to fly them.* Otherwise there are disappointments ahead.

The pictures show: Top left, *Pirat,* 148in. span. Right: Slingsby T53, to 1/7½ scale. Centre left: Slingsby T31, *Tandem Tutor* at 1/5 scale. Right: Kirby *Prefect* to same scale. Bottom left: HP14c, also at 1/5 scale, spanning 141¾in. Right: T21 *Sedburgh,* again to the popular 1/5 scale, which gives a model large enough to have realistic flight characteristics.

At first, once this was established as a distinct class, the requirements were still relatively simple, calling for consecutive loops, stall turns, and, perhaps, a spot landing. The more daring organisers added rolls and spins to their contest schedules. After this, the rolls were required to be more axial, and inverted flight was required. This is where ailerons became a necessity, and aspect-ratios became lower. (The lower the aspect-ratio, the greater the roll rate and, therefore, the better the chance of completing two or three consecutive rolls in the relatively restricted space afforded by the lift area or the length of the ridge used).

The rudder/elevator models (or, at any rate, some of them) could be made to remain inverted for short periods, but it was usually a losing battle, and the model's course was very erratic, due to the way in which the models had to be flown in order to stay inverted at all—very much a case of the tail wagging the dog—or, at any rate, the plane flying the pilot!

Ailerons changed all this, allowing sustained controlled inverted flight, and consecutive axial rolls, as well as much greater general manoeuvrability, tighter turns and easier landings in any sort of conditions, on any sort of terrain. Once the increased scope, aerobatically, of the aileron-equipped model began to be appreciated, the requirements became more stringent, the inverted circle and outside loops appearing in the schedules, to the consternation of most fliers of the time! At this point, much more attention was paid to aerofoil sections, and the use of fully, or nearly fully, symmetrical sections became widespread, thus rendering possible virtually unlimited inverted flight and consecutive outside loops—and, in fact many of the figures from the power flying schedule.

While most three-function compact type models are described as "aerobatic," the label "*fully* aerobatic" is usually reserved for those in this latter category—that is, those capable (in "good" conditions—say, steady winds of 15 m.p.h. upwards) of prolonged inverted figures (in other words, fully controlled inverted flight) and consecutive outside loops. Such additions as four-point rolls, "top hat" and "avalanche" manoeuvres are sometimes thrown in, for good measure, in contests where certain manoeuvres may be selected by the entrants.

Fig. 18a

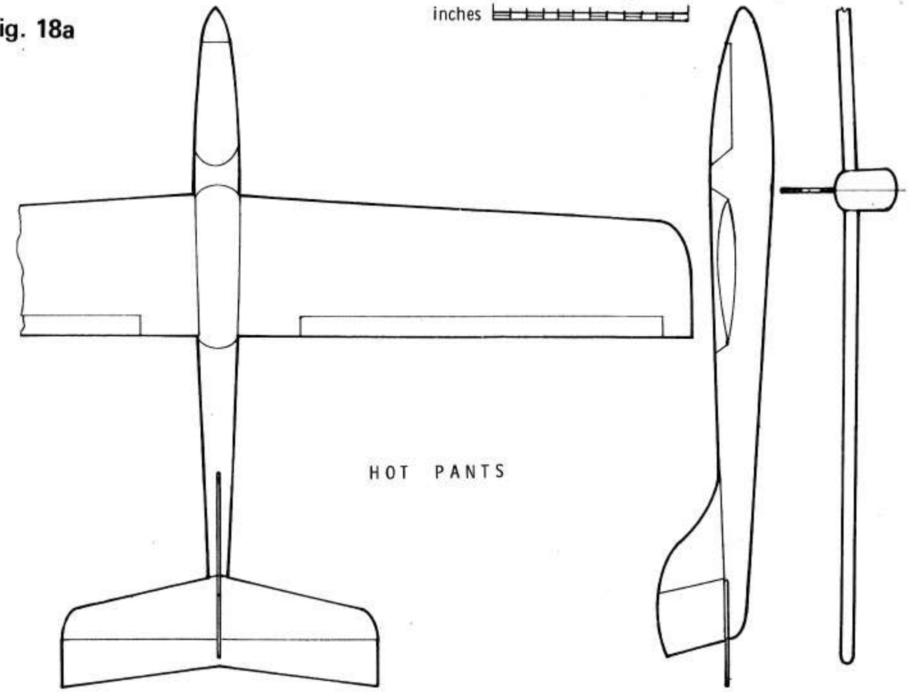
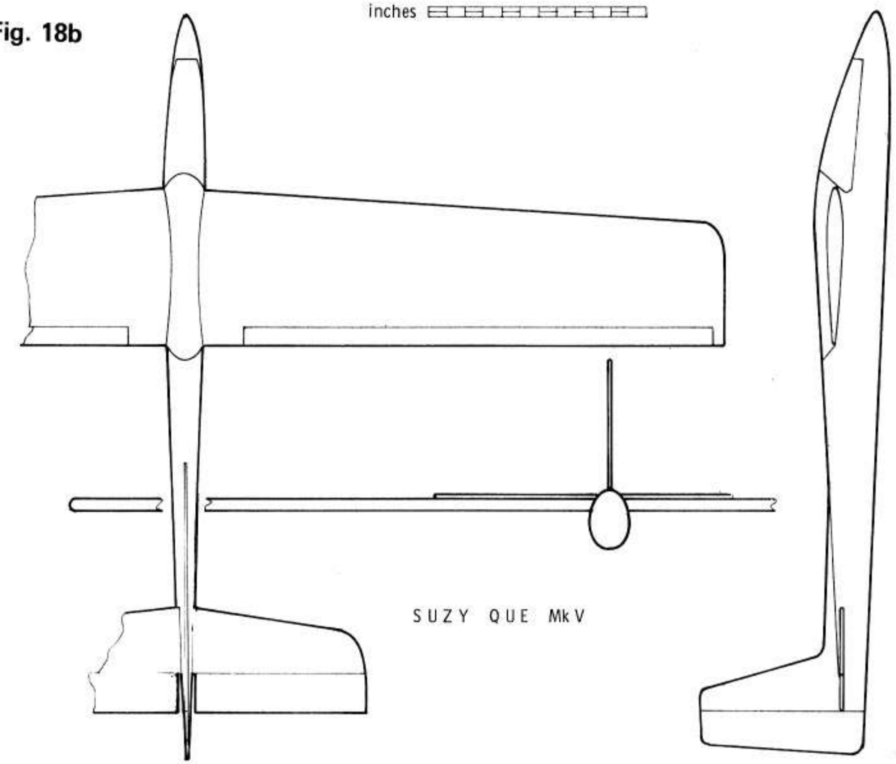


Fig. 18b



Details of these, and of aerobatic contest flying techniques, are included in the relevant chapter, later on.

Our full-house aerobatic model, then, will tend to look something like those shown in Fig. 18. It will have a fairly low aspect-ratio, a shoulder-wing, or almost mid-wing position, little or no dihedral, ailerons (usually of the "strip" type) and lines, in general, as sleek and functionally streamlined as possible. In order to be able to do very tight manoeuvres, and cope with sudden changes of attitude, it is also built as lightly as possible. (Remember, here, that the heavier the model, the greater its momentum and inertia—and thus its resistance to any change of attitude, and the slower its response to aerodynamic control surfaces.) In general, the wingspan of our aerobatic contest model will be between 50in. and 72in. After enjoying a period of popularity, the smaller types have tended to give way to those at the other end of the scale, as the models are smoother flying and can usually cope better with stronger winds.

Such models, however, although they often have a surprisingly wide speed range, do sometimes find themselves "losing out" when the wind velocity drops, say, below about 10 m.p.h. Here the "converted" (i.e. ailerons added) intermediate model may have some advantage. With its (usually) flat-bottomed aerofoil section, it makes better use of the available lift, and can often maintain or gain height better than the fully aerobatic, symmetrical sectioned, model, thus being in a position to perform at least some of the manoeuvres required, whereas the other type is requiring all its pilot's skill and attention to stay airborne at all. The keener contest man, having observed this on a few occasions, usually now carries two or more wings, with different aerofoil sections, to be used in different conditions, thus enabling him to get the best performance from his model under any given set of conditions.

This may seem, to the reader, to be becoming too much the slave of specialisation—but aerobatic contest flying is, by definition, a very specialised branch of soaring, bringing with it these specialised model designs. A variation of the "alternative wing" approach, has been the experimentation with *variable camber aerofoils*, to enable a "drooped trailing edge" to be used for increasing the lifting properties of a normally symmetrical section wing, to gain height. At the neutral position the aerofoil resumes its symmetrical section, while a further movement of the control gives a "reflex" section, to provide extra lift when the model is inverted (see Fig. 19). When incorporated with a strip-aileron system, this becomes known as the "flaperon" since the ailerons then work partly as flap and partly as aileron.

The other piece of specialisation on aerobatic models is the use of interconnected flap (or flaperon) and elevator. By arranging for the wing flap to move upwards when the elevator is moved downwards, and *vice-versa*, the lift co-efficient of the wing is increased at the very moment the most demand is put on it, and models so equipped are capable of very small diameter loops, and very tight turns. Thus, they are tending to be used on *pylon racing* models—yet another form of specialised model, but grouped under "aerobatic" at the beginning of this chapter, for the sake of conciseness.

The pylon race soarer is the latest arrival on the scene, having been developed from the aerobatic soarers which have been used for pylon racing for several years now. Once more the will to win has led keen modellers to develop a specialised craft. The pylon racer is built for speed, with sleek lines, thin wings and often a vee or "butterfly" tail. It is usually rather larger than the average aerobatic model, having a higher aspect-ratio wing. A typical pylon racing slope soarer is shown in Fig. 20. Two-function equipment is often used, rudder being unnecessary. These exciting models, as well as their special equipment—coupled flaps and elevators, and v-tail linkages—are discussed more fully in Chapter 8, as are pylon race flying and tactics.

The remaining category for us to describe here is the "semi-scale or scale" type. Here,

Fig. 19

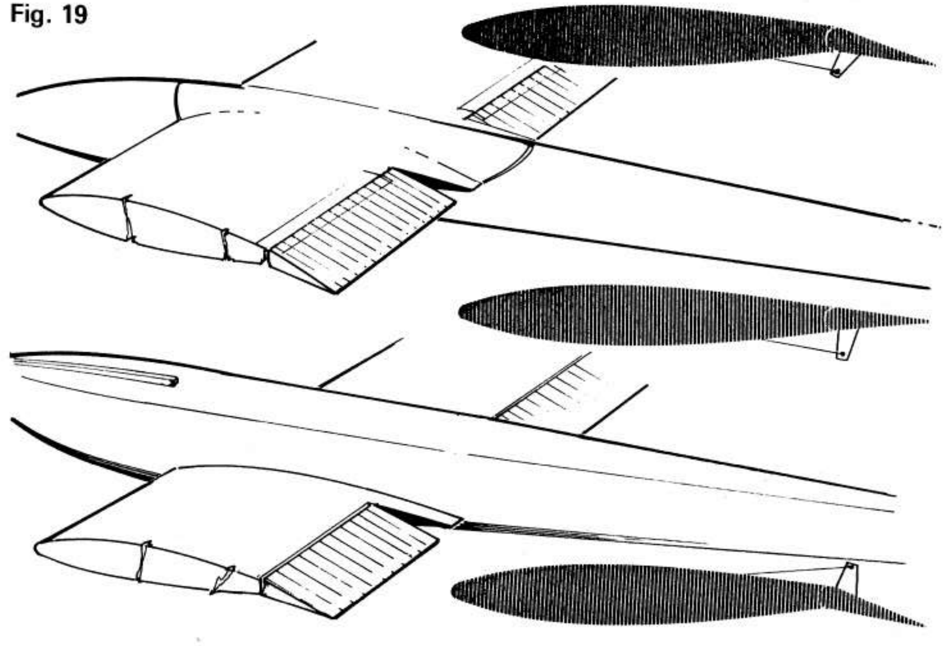


Fig. 20

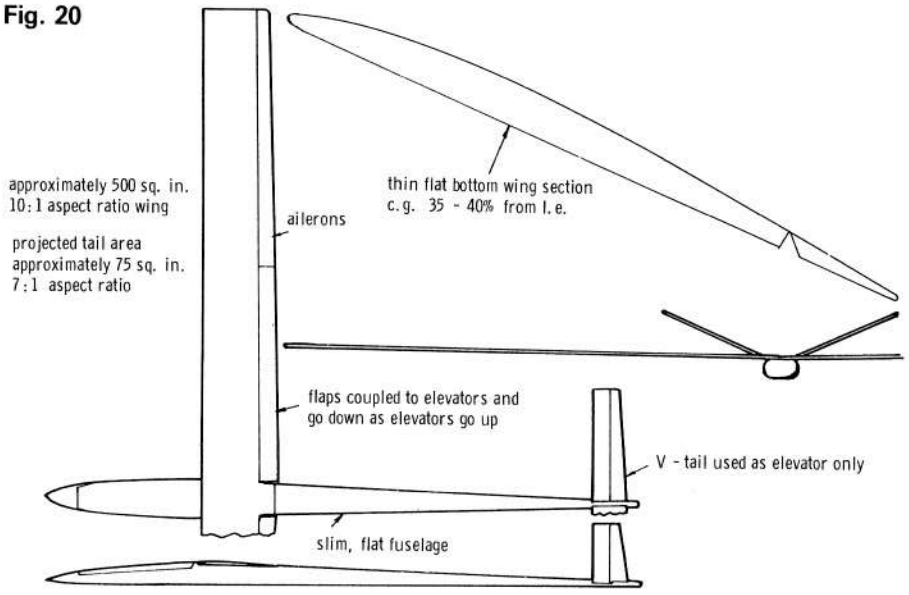
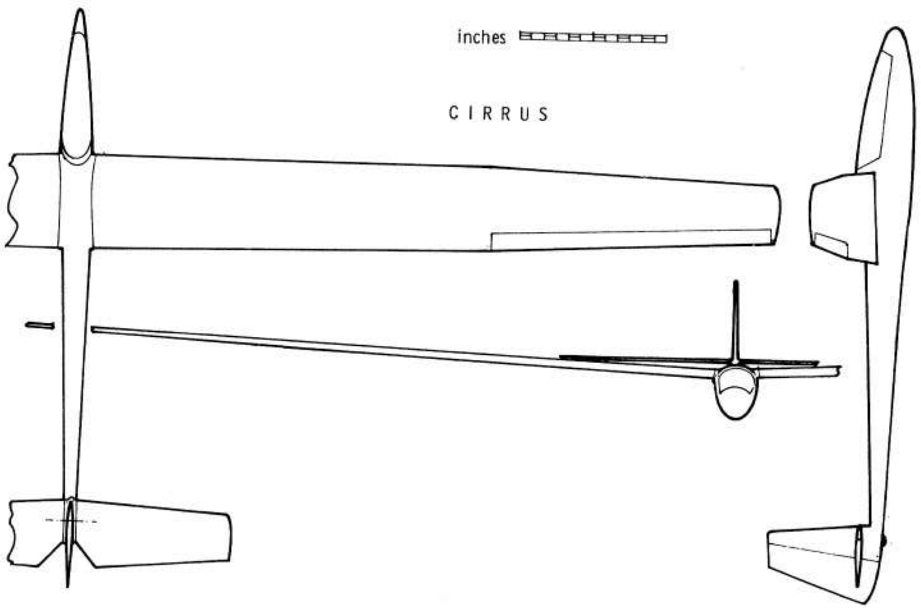


Fig. 21



as with the intermediate, we have the free-lance but realistic looking model, with a high aspect-ratio—sometimes as great as 18:1 or even 20:1 and wingspans of 8 to 12ft. They will (by definition, under our "full-house" heading) have ailerons, elevator and rudder control, and sometimes spoilers or airbrakes, worked by a fourth servo, for increasing the sink rate for landing. (We will be looking more closely at these interesting and useful devices later on). The scope for the free-lance semi-scale designer, then, is a very wide one—the limits only being the designer's imagination, constructional ability and design experience, coupled with a sense of what "looks realistic."

After the free-lance design types, we come again—as with our intermediate class—to the "near-scale" models which are actually named after the full-size prototypes they represent. Names such as the ***Skylark, Dart*** or ***Kestrel*** spring to mind, as well as that of the aileron version of the *Cirrus* (Fig. 21). Usually, the designers of both free-lance and near-scale types of model will have made certain concessions to "practicality," in terms of detail—wings and tailplane held in place with the traditional rubber bands, and so on, or with "knock-off" fixings by the "tongue and box" method.

The near-scale types are, as we have said, based on full-size sailplanes, it being largely a matter of the designer's opinion (or conscience!) just *how* near to true scale the outlines are. If we look at the drawings of the full-size *Dart 17,* for instance, we realise (if we have any aeromodelling experience at all) that it would take a brave man indeed to attempt to fly a model with that tiny (one might say almost non-existent!) tailplane. But full-size designs vary a great deal, and a careful choice of prototype will mean less departures from scale.

The performance of both the semi-scale and near-scale type of model is measured not in terms of aerobatic prowess (usually limited to loops and stall-turns, and perhaps spins) but of sheer *soaring* ability. With their flat-bottomed, or even undercambered wing sections and efficient, high aspect-ratio wings, they gain height very quickly in anything like respectable conditions. They are often quite highly loaded and fast-flying, and so have the facility of "penetrating" the wind, as well as using the slightest upward component to gain height, so moving well out and away from the slope face, unlike the more compact, "functional" models which tend to stay relatively close in.

It is interesting, when there are a variety of models being flown together in good* conditions, to note that each model seems to have its own particular "ceiling." That is, a certain height beyond which it is reluctant to go. One invariably finds, at such times, that it is the slender, elegant high-aspect-ratio semi-scale or near-scale craft that is by far the highest. So, in terms of pure soaring efficiency, if that is what we want, we find it pays to emulate full-size configurations of modern high-performance sailplanes.

There are no competitions for "height gain" (though several methods of measuring altitude have been put forward) but, as we shall see in more detail later, there are "Cross-Country" events, and the prime requirement of these is the ability to gain height as quickly as possible, coupled with fast-flying when needed. So, as one might guess from the foregoing, this is where the semi-scale and near-scale type of models come into their own. Let it be said here, however, that there is a case for using the two-function, intermediate class of model for this type of event, since, with its generous dihedral, and all-round inherent stability, it has to be "flown" less by the pilot, who can often leave it to its own devices for relatively long periods, while paying attention to where he himself is going, over rough terrain.

As we have seen, when a model is designed for control with ailerons, the dihedral angle of the wings does not have to be so great (indeed, *must* not be so great, or the ailerons will have to fight the "centralising" stabilising effect of the dihedral) and our full-house semi-scale and near-scale models will look even more realistic because of this. The flying technique for such models also more closely approaches that of the full-size craft, in that instead of turning simply by applying, firstly, aileron to "bank" the model and then elevator to tighten the turn, we now have co-ordination of aileron *and rudder* with elevator. This

*"Good conditions" for pleasant slope soaring with intermediate or full-house models usually mean: a steady wind (not blustery) of 15-20 m.p.h. blowing directly onto the face of the slope. If the wind is less than this—say about 10 m.p.h. then some thermal activity will help to make conditions interesting.

produces smooth, gracefully realistic, turns, which further add to the realism of these beautiful machines in flight.

At the risk of digressing, it must, for the sake of accuracy, be pointed out here that some advanced aerobatic fliers also use the co-ordinated rudder/aileron turn technique in certain circumstances, as we shall see later. However, whereas in aerobatic and general three-function flying it is the exception rather than the rule, the reverse is the case with the type of model we are now discussing; these *can* be turned using aileron and elevator only, but much more efficient and pleasing turns result from the correct use of all three controls. We will discuss the technique later on, when more fully discussing the actual flying of the models, whereas up to now we have only touched on this, when it has been relevant to our discussion of different model types.

Our final model type, in the full-house control category, is the fully-fledged scale model. These are relatively rare, but are now being built in increasing numbers, as the "pioneers," as it were, demonstrate that—as with power—such models really can be practical fliers. Indeed, the flying of scale models is really very much akin to that of flying the near-scale types, except that in many cases it is more critical, due to the marginal stability reserves of the scale-outline tailplane, or the easily stalled highly tapered, narrow-chord, wings.

Flying surfaces have to be fitted either in a scale manner (perhaps with functional, load-bearing struts, where applicable) or, at any rate, by some concealed means, such as faired-over nylon bolts. Not a rubber band must be seen! All this, of course, means that scale models have to be landed in a very "scale" manner or they will inevitably sustain damage. With that sort of rigid wing fixing, one does not get a second chance, and one cannot expect to get away with digging in a wingtip on landing, any more than could the full size glider pilot.

In short, the "pukka" scale model sailplane is for only the very experienced—at both building and flying! Those who aspire to the scale model would be wise to serve a full apprenticeship to the other types first. This being so, it is not proposed to discuss the design or flying of scale gliders since, by the time the modeller feels equipped to embark on such a project, he will have formed his own ideas on the subject. Illustrations of some excellent examples, however, are to be seen amongst our photographs, which may be a source of inspiration, when the time comes.

Choice of model

This is such an individual and personal matter that it is very difficult to generalise. Our best plan, therefore, is first to decide on the situation, as it were, of the person making the choice. The model chosen to commence one's soaring career will be different for different individuals, depending largely on their existing modelling experience, and r/c flying experience. It can also depend, to some extent, on the soaring site on which it is intended to make one's first flights.

If we had to be pinned down, so to say, to advise on the best *all-round* type of model to commence with, then our choice would undoubtedly be the two-function (rudder/elevator) "compact functional" type we have described. It is simple, ruggedly constructed to take the inevitable bumps and thumps to which the beginner will subject it and, being compact, manoeuvrable enough to be "set down" almost anywhere.

It may be, however, that you are determined to start with a rudder-only model—perhaps because you already have some single-channel equipment, or that you don't yet wish to commit yourself to the expense of anything more sophisticated. Then your choice of model is between the lightweight and medium weight rudder-only types. What about the lightweight? This is, given the right conditions, probably the safest and most pleasurable sort of rudder-only slope soaring—where the model "floats" around, slowly and gently, and can be merely "nudged" in the right direction, from time to time, in a relaxed, unhurried manner. Will you have the patience, though, to wait for the right sort of conditions for this sort of thing? There should only be a gentle breeze (say 5-10 m.p.h.) for the lightweight, so that you can make your initial flights with the best possible chance of

success—plenty of time to make decisions, and to be able to land the model without its being blown away "over the back" of the hill or ridge.

You may feel, on the other hand, that—British weather being what it is—you will need a model for stronger winds, if you are going to be able to soar on more than half-a-dozen weekends in a year. Winds of, say, 15-20 m.p.h. Then your choice must be the heavier, more ruggedly constructed, compact type model. Don't forget, however, that in windier weather the model will be travelling faster—especially downwind—and so decisions have to be made quicker. And, if the wrong decision is made—the model hits mother earth that much harder! The keen rudder-only man will have *both* types of model, of course, which can save much frustration.

Do not be tempted to try using, say, the larger two-function semi-scale type of model on rudder-only. It may look nice, and "like the real thing," but it is not likely to survive long when the beginner attempts to make it perform on less control-functions than it was designed for! With the rugged, compact, rudder-only model, however, it *will* be possible later on, to add elevator, should you decide to invest in some more sophisticated equipment. You will then have the added advantage of flying a model you already have the feel of, with that enormous bonus of being able to point the nose up or down at will.

We have already given our choice of the two-function compact, functional type as the best all-round choice for *any* type of beginner—and by this we mean either for the complete beginner to radio control flying, or simply to the soaring branch of the hobby. Even those who fly full-house power models would be well advised to start their soaring on the rudder/elevator model. This is not only because it can usually be flown in a wider range of conditions than the pure aerobatic model, but also because of its built-in self-righting properties—"inherent stability"—so that it will usually "sort itself out" on its own (given sufficient height, of course!) if the pilot gets into difficulties.

If you are already an accomplished aerobatic power flier and you intend concentrating on aerobatic soarers, then you *could* take the short cut of building one of this type to start with—but preferably not unless you have an experienced soaring friend who will stand by to take over in case you should get into trouble. By this we do not mean that you should have much trouble in actually piloting the model, for this will be second nature to you—except for the all-important difference that you have no engine to make it climb, should you manage to get it too low down. You have to find *lift*, and this is where there is no substitute for experience! By careful coaxing, and what almost amounts to a sixth-sense, that the veteran soarer develops, he will very often be able to find sufficient lift, even when the model seems to be a long way down towards the foot of the hill, to be able to salvage a situation which would have meant either a long walk or a broken model—and very likely both—for the newcomer to the slope. This is what soaring is all about, of course, but like anything else that is worthwhile doing, it can only be achieved by much practice and experience, so it is wise to give oneself the best possible chance by not attempting to run before one can walk, as the saying goes.

If you are a beginner to radio control, as well as to slope soaring, then the aerobatic type of model is definitely out of the question—even if you have an experienced aerobatic soarer at your elbow. It flies fast, is very sensitive to small control movements, and has to be "flown all the time," as it were. Moreover, it is neutrally stable. That is to say, instead of having self-righting properties, it tends to stay in whatever attitude the pilot leaves it. Beginners often "freeze" on the controls, and things can happen far too fast for even the most experienced tutor to salvage the situation with this advanced type of model. So, even if your ultimate aim is aerobatic soaring, you must put quite a number of flying hours in, "solo," with an intermediate model first. Any other course will lead to very early discouragement by way of "using up" a large number of models in very short order.

What about the large, heavy, sluggish intermediate model, mentioned in our survey of model types? Would this, you may ask, perhaps suit me better than the smaller type? Don't be misled by the word "sluggish." We have explained that this means sluggish in response to the controls, not in actual flying speed, and that one has to *anticipate*—to apply rudder an appreciable time before it begins to take effect, and to neutralise some moments before it is headed quite in the direction desired. Rather like steering a slow-moving, heavily loaded, boat, in fact. Such models, having considerable "mass," tend to have a high landing speed. They may *look* slow-flying when high in the air, simply because of their size, but it is when they are approaching the ground that one realises their actual speed.

Like our ponderous boat again, they take more space to stop than the lighter craft; they "steam" in and need to be well lined up and have an unobstructed approach. You should not choose a model like this unless you have a good flat landing area (the "plateau" type) which is not frequented by crowds of ramblers or spectators. Once committed for a landing, "avoiding-action" with this type of model is very difficult to take.

If you have a soaring friend with this class of model, however, try to persuade him to let you take over the controls for a brief period, while it is well up in the blue. This is by far the best way of learning! And, if your friend is agreeable, you can then extend these periods until you really have the feel of the model. If you can then use your powers of persuasion on another soarer with the other class of machine, you'll be able to compare the two types, and decide which you will feel more in tune with. But there!—we're begging the question again. We must come back to earth and assume that you are going to "go it alone" from scratch.

We are going to discuss the actual flying of the models, in the following chapters, so we will now assume that, one way or another, you have made your choice of model, and have built it, either from kit or plan. We will be discussing the flying of the rudder-only soarer first, but would advise the owners of multi-function equipment *not* to "skip" this chapter, since there will be a number of basic things to be learned, which will be applicable to all types of slope soaring.

Before setting out for the slopes, it will be as well to know what sort of clothing you should take—it can be quite cold standing in a breeze at the top of a hill, even in the summer. Some hints are given in Appendix III, "Clothing and equipment," towards the end of this book.

CHAPTER 4

RUDDER-ONLY SOARING

General principles. Manoeuvres. Landing.

LET us now assume that the reader has built his rudder-only model, and has made sure that the centre of gravity (c.g. for short) is in the correct place as shown on the plan, and that there are no warps in the flying surfaces. In the case of the light and medium weight models, a gentle hand launch on any piece of open ground near home will serve to check the overall trim, before starting out for the hills. It is safer to leave the larger models to be launched from the slope, as it may not be possible to launch them at their correct flying speed over flat ground.

The actual wind speeds at which a particular model will soar best, depend on both the model and the hill itself, so here we can only take a "typical" example. Let us assume that we have a medium sized model, with a wing-loading of between 10 and 12oz./sq.ft., and that the wind is blowing nicely onto the face of the slope at between 10 and 15 m.p.h.

Now, before launching the model, we must look first at the possible landing areas. Many an otherwise enjoyable first flight has ended in disaster because no thought was given to the landing—until it was too late. (It is very difficult, for the beginner, at any rate, to search around for a place to land, and fly the model at the same time.) We will be discussing different types of landing—dictated by different sites and conditions—later on, but it is necessary to establish, at this point, that we look at the possibilities *before* attempting to fly at all. Since we have to start somewhere, we will assume that we have a site with a reasonable "back area," of the "plateau" type described in Chapter 2.

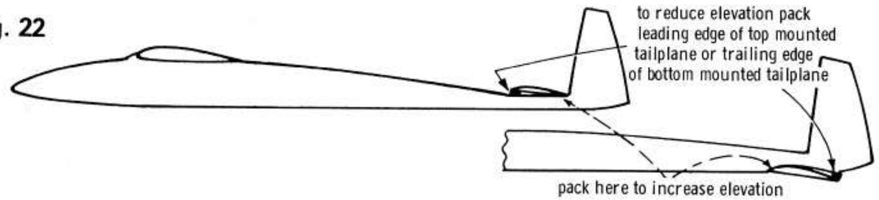
You can either launch the model yourself, or have a companion do it. You may prefer the former method, if you are not a trusting soul—or the latter if you think it will enable you to concentrate better on the transmitter end. After checking the rudder operation, the model should be held aloft to "feel" the amount of lift. This is important, because on it will depend the way the model is launched. If the wind is at the lower end of the scale, and you have to move it forwards to feel any lift, then a smooth, fairly hard shove will be needed. If you can already feel the wind tugging at the wings, and it feels as though it is impatient to get airborne, then a less powerful push will be needed—in fact you may find that you can almost simply "put" the model into the air. Either way, it should be pointed slightly downwards, aiming at a point slightly below the horizon, and launched straight out into the wind. If it takes you all your time to hold the model steady, and you are not sure how long you can hang on to it, then it might be better to wait until the wind has gone down a little—or try another day, as you have evidently misjudged the wind velocity. Launching is all a matter of "feeling" the wind with the model's wings, as it were, and this will come naturally after a few tries. Beware of launching the model so hard as to stall it, however, and *never* launch it upwards! A stall induced at the launch can be awkward to cure with the rudder-only model, and may result in the model coming in backwards against the hillside before you have time to turn.

Trim states

Now, with the rudder-only model there are broadly three states of trim, and it can be seen from the behaviour of the model which of these it is in. The states are (a) over-elevated, (b) under-elevated and (c) the correct trim for the conditions.

The most commonly seen of these states is (a) where the model rises fast, on launch, with hardly any forward movement, and goes into a series of stalls. This, in fact, *could* be due to an over-enthusiastic launch but, assuming the model has been released at about its

Fig. 22



correct flying speed, it can be taken that it is over-elevated. In this condition, if it can be kept straight, it will, in fact, fly "backwards," relative to the ground, and can thus be taken over to the area of dead air, or "sink," some little way back from the edge of the slope. The cure for over-elevation is to increase the incidence of the tailplane. We do this by adding some packing to either raise the leading edge or lower the trailing edge, according to whether the tailplane is mounted on the top of the fuselage, or underslung (see Fig. 22). Do not use more than $\frac{1}{32}$in. of packing at a time—and certainly not more than $\frac{1}{8}$in. altogether, or the model will lose too much of its longitudinal dihedral (the difference in angle of incidence between wing and tailplane) which it needs for its stability.

Do not attempt to cure over-elevation by adding weight to the nose of the model. The c.g. shown on the plan will be the optimum one. If weight is added to keep the nose down into wind then, once turned, the model will tend to dive and, in all probability, will not respond to the rudder.

If the model is *under-elevated,* it will fly outwards into the wind, but steadily losing height, instead of gaining it. Unless you want a long walk, you will have to turn it parallel to the slope and bring it in for a slope-side landing, as best you can. The cure is the opposite of that described for over-elevation—*i.e.* decrease the incidence of the tailplane, by raising its trailing edge, or lowering its leading edge.

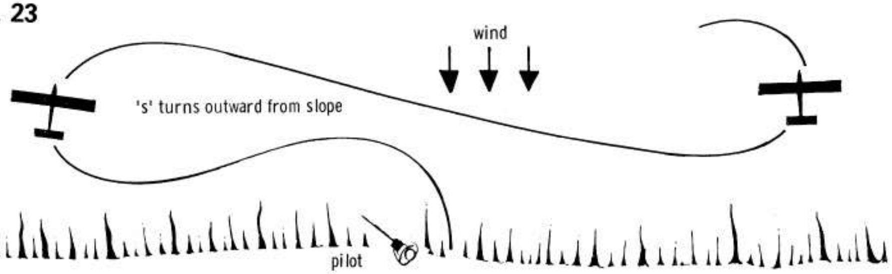
If we are lucky, and the model is in its *correct* trim state, it will move outwards from the slope and also upwards at a gentle rate.

Turning and tacking

Having achieved this satisfactory state of trim, we can now try some "S" turns. When the model is some little way out from the slope (say 50 to 75ft.) put on some turn and, *before* it is quite parallel with the slope, put on opposite rudder to bring it back into wind. As it comes into wind again the model's nose will rise and it will appear to slow down, relative to the ground, and then settle back to its normal flying speed. By tacking up and down along the face of the slope, doing these outward turns (Fig. 23) it should be possible to gain some height on each lap, until a natural "ceiling" has been reached, beyond which the model is reluctant to go. This will vary with different wind speeds and different sites.

Keep making the turns *outwards,* away from the slope, on all these first flights—even if your model is higher than the hill. Later on, when you have got the feel of your model and can anticipate its turning radius, allowing for drift, in various conditions, you will be able to

Fig. 23



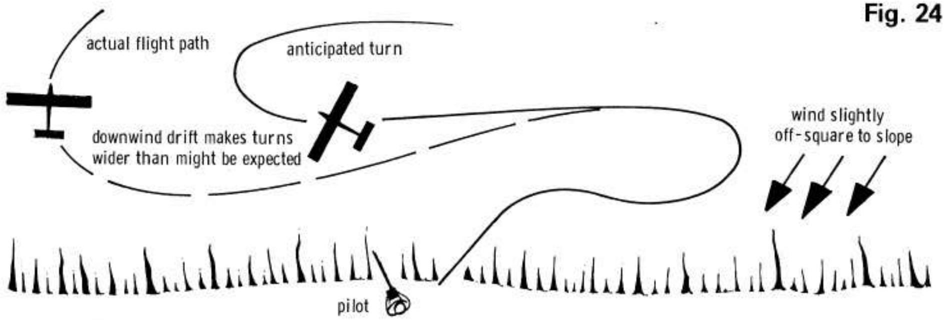
turn towards the slope with confidence. But distances and speeds are easily misjudged, so do not try it too soon!

Take things steadily and continue practising tacking up and down along the slope face, and getting those turns just right. See how you have to *anticipate* all the time, and start applying the rudder just that little bit *before* you need the model to start turning the other way. Notice again how, when turned into wind after picking up speed on a turn, the whole model becomes buoyed up—like a boat in a gentle swell—and tends to hover before, once again, easing forward into the wind. If you have turned too suddenly, and the model comes up into a definite stall, instead of simply riding up, then another turn should be made—again *anticipating* that stall—to dissipate that excess flying speed, and the model again brought more gently into the wind.

This business of anticipation is the whole key to flying your soarer, and simply must be learned, until it becomes second nature. If the model stalls, it is no use applying rudder at the "top" of the stall; that is too late. Rudder must be applied *before* the stall actually breaks, so as to put the nose down and fore-stall it, as it were! This can be practised, since, if you are too late the first time the model stalls, it will certainly stall again immediately afterwards, and you can then pick your moment to "head it off," so to say.

With time and practice, you will begin to know the "sit" of your model in the air, and realise when it is not quite right—and take the necessary corrective action before anything untoward happens. Before long, you will find that you are doing this, all the time, without really thinking about it. You are then flying the model as it should be flown.

Fig. 24



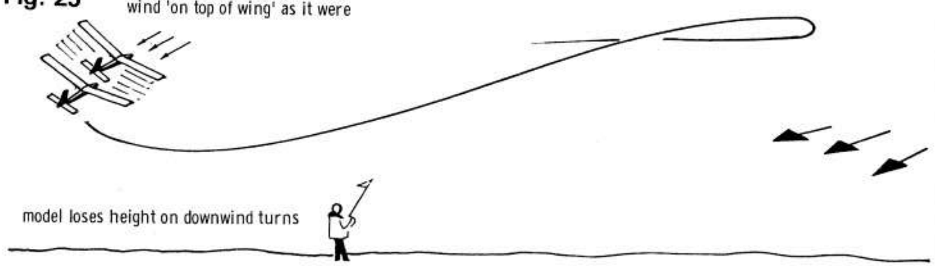
Wind "off-square"

We have assumed, until now, that the wind was blowing square onto our slope. In practice, like hurricanes in Hertfordshire, this hardly ever happens. Even if the wind is only a few degrees off-square, there will be a certain unevenness of the flight pattern, with rather wider turns on the "downward leg." This is nothing to worry about, but it must be allowed for—and *anticipated.* The model will have a greater speed (relative to the ground—and to you, the pilot) on this downwind tack and, conversely, be rather slower getting back upwind again. It will tend to drift sideways in the downwind turns (see Fig. 24) and also to lose height. When we say "downwind turns" in this sense, we mean "turns made downwind of the pilot" and not turning the model to point "down wind." The model is only turned to fly down-wind when it is up-wind of the pilot. (If you are now confused, a glance at Fig. 24 again will give the picture.) The terms "up-wind" and "down-wind" are only *relative,* in this sense, the wind coming from slightly to the pilot's right (in our diagram).

As we said, the model will also tend to lose height on these turns which are started on the downwind leg. It is as if, when turned sideways to the wind and banked, the model tends to be pushed downwards, as it were, by "wind on top of the wing." Fig. 25 shows what we mean.

It is advisable always to try to fly the model "upwind" of oneself (to the right, in our diagrams) and to start making the turns, on the downwind leg, a little before the model

Fig. 25



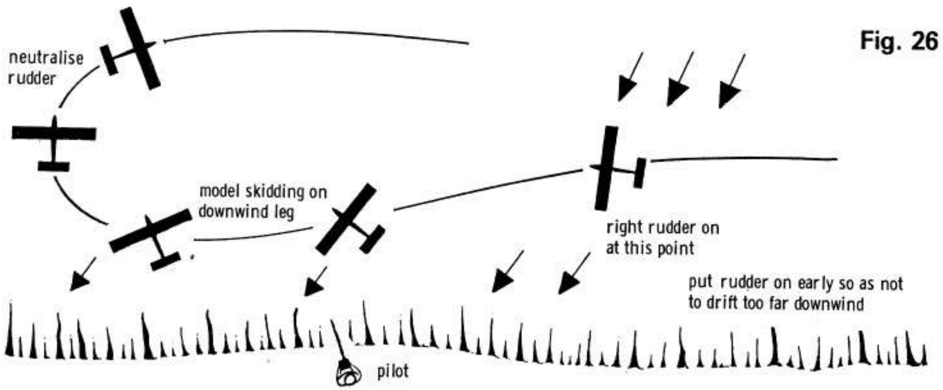
reaches you. It will then not drift too far down wind. Only practice will show you at just what point to start these downwind-leg turns, to bring the model back into wind at the desired point. Remember that you must always anticipate, and put on rudder just those few seconds before you need the model to turn, to allow for this drifting effect (Fig. 26). Some models "skid" sideways more than others in these conditions, and the models with more dihedral (especially tip dihedral) will usually come round more readily than those with less, but there will always be this sideways drifting effect to be allowed for. This skidding effect, and the slowing up of the model when coming back into wind, can be used to good effect when landing, as we shall see shortly.

"Marginal lift" conditions

What if the wind should start to die down, or should even have died to a very slight breeze by the time you reach the slope? Then we have what we call "marginal" conditions. This is a favourite term of the slope soaring veterans, and it means "barely enough lift to keep the model airborne." This is, in fact, where a great deal of the challenge and enjoyment of slope soaring is to be found. With our 10 to 15 m.p.h. wind, we had plenty of lift, but it has now dropped to (say) about 5 m.p.h. This means we not only have to pay attention to flying the model around, but we must now urgently seek out the areas of best lift, in order simply to maintain height.

We will often find that tacking nearer in towards the slope will help, in these conditions, and that the model can be made to ride the tide of air that is so very gently rising up the side of the slope. The model, when "crabbed" sideways along the slope, will ride up, almost like a boat buoyed up by an ocean swell. See Fig. 27. It is in these conditions that we can begin to break our, till now, strict "outward turns only" rule, too, and gradually increase the amount by which we point the model's nose out of the wind until we have it skidding gently towards the top of the slope and judging the exact moment we have to apply rudder to skid it round outwards again. If we leave it too late, the model will simply "sit

Fig. 26



down" on the slope—and we have done (even if unintentionally) a "slope-side" landing.

If we manage to maintain height with our crabbing up and down, hugging the face of the slope, we may notice that the model hits a "bump"—and noses up a little more in a certain spot—often tipping up its outermost wingtip. If we now turn outwards at this point we may find that there is an area of extra lift that may stretch outwards from the hill for quite some distance. We point the model outwards from the slope and see it rising—not nose-upwards, but bodily—the whole model rising "like a lift," as it were, for a while. We make a mental note of this region and, on our next trip back along the face of the slope, we turn out at the same place and—up it goes again! This can become very engrossing, as you may imagine. If the effect continues, each time we turn the model at this spot, then it is likely to be extra slope lift, induced by some particular property of the slope face at that point. If, however, the area of lift disappears after one or two useful rises, then it was

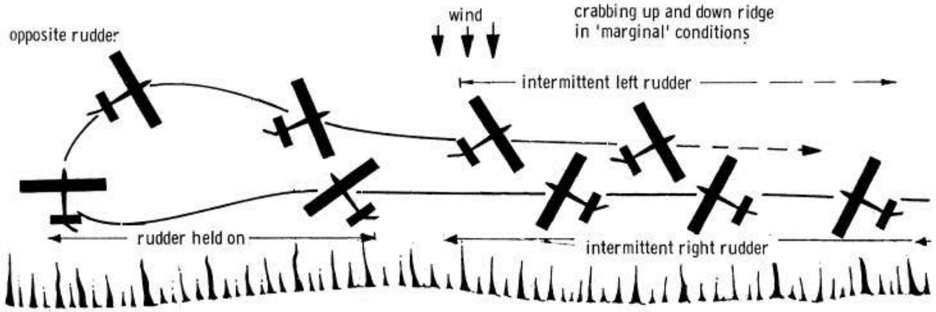
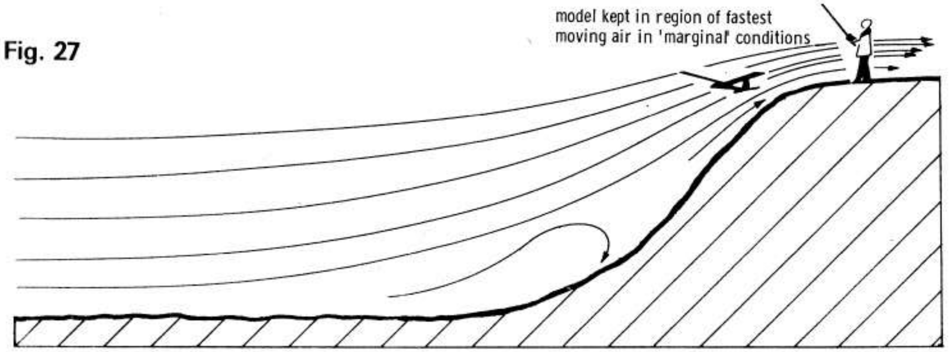


Fig. 27



probably thermal lift, due to warmer air rising faster than the gentle flow of surrounding air against the slope.

Some areas of thermal lift, on these otherwise "marginal" days, can be really useful, and take our model up to quite unexpected heights—sometimes very much higher than the model's normal slope-lift "ceiling." Once a certain height above the top of the slope is attained, in such conditions, it will often be found that it is easier to maintain height, after the thermal lift has drifted away, by cruising up and down along the top of the edge of the slope— above one's head, as it were, than it was when just "scraping" along level with the top of the slope, or a little lower. Fig. 28 shows the relative height and area where this condition often occurs.

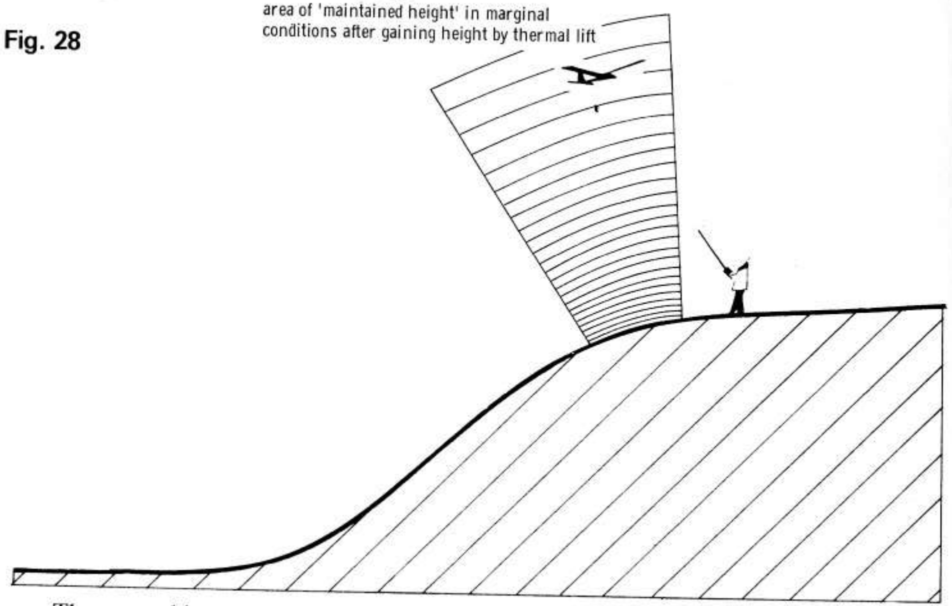
On days of marginal lift, you will soon find yourself able to detect very small amounts of lift, by the way the model rises, and stay in them as long as possible, or keep returning to them, so gaining, or recouping, a little height each time. You may even find this sort of soaring more challenging and satisfying than when there is steady slope lift, and it is probably here that the rudder-only model flier scores over his more sophisticated companion craft with their multi controls. His model is often more suited to these conditions—and, of course, he will not be impatient for a "good blow" to do aerobatics, for aerobatics with the rudder-only model are virtually non-existent, anyway, as we shall see.

Here, too, is where a great deal of the enjoyment comes from being with a group of fliers, as there is much satisfaction to be had, either in trying to be "the last one to have to land," or, if thermals are kind, to be the one who manages the best height, in marginal conditions. This is assuming, of course, that you are flying with superhet equipment, for, in this day and age, and "state of the art," it could be considered almost "anti-social" to use super-regen equipment, so that everyone else has to stop flying in order that you may take to the air for a while! Of course, if you are a confirmed "lone hand," then this does not matter, and cost may be the prime concern. But, by always flying alone, you cannot but miss a great deal of soaring pleasure.

Stronger winds

Going to the other extreme, now, what if we should arrive at the slope to find that it is much windier than we expected? As we have already said, as beginners, we would be well advised not to chance our luck. Rudder-only models can very easily be blown backwards over the top of the hill—and out of sight of the pilot—in stronger winds, and so damaged, or completely "written off"—or even lost.

Fig. 28



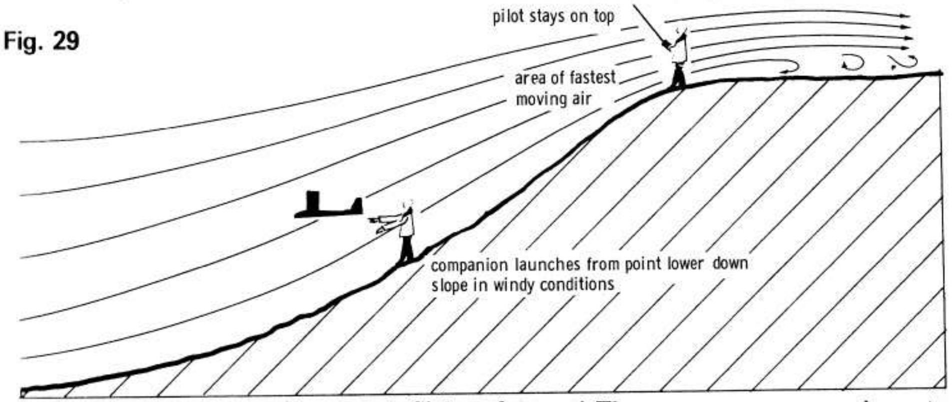
There are things one can do, when one is a little more experienced, however. One of these is to launch the model from a point part-way down the slope, as shown in Fig. 29, so that it is out of the region of fastest moving air. This way it can be made to fly outwards more easily, and not be flung backwards by the excessive wind speed, and turbulence, which may be experienced at the crest of the slope. It is preferable to have a companion launch the model, while you remain on the top of the slope; otherwise, if the model still tends to go upwards and backwards, you will lose sight of it before you have a chance to make your way up the slope again. By remaining at the top, you command a better all-round view, and will be able to see and maintain control of the model.

There will be a limit to the wind-strength in which a model of a given wing-loading will satisfactorily fly, however, and there remains but one thing to do. Increase its wing-loading. We do this by ballasting the model, not at the nose, but at or about its centre of gravity. We do not then upset its trim, but simply make it heavier. This, essentially, makes it fly faster, so that it can "penetrate" the stronger winds. The increased mass of the model then has more momentum, and will fly in a steadier way than its more lightly loaded counterpart, not being affected too much by buffeting of wind gusts. Of course, our added ballast makes the model "come down" harder, if not landed well, so this ballasting is best left until we have had quite a lot of soaring experience in less difficult conditions. (See "Speed and Efficiency"—Chapter 20).

Using ballast can sometimes endanger the structure of a model, since, if landed heavily, the lead weights used can tend to try to burst their way out of the model. For this reason, the weights—in the form of flat pieces of metal, are sometimes strapped onto the undersurface of the fuselage, below the wing, so that, in the event of a nose-in landing, they simply shoot forwards and away from the model, instead of bursting out of the structure. Some designs, however, include a built-in ballast-box, which is specially strengthened to withstand such loads. This is certainly rather a more elegant solution than the somewhat "agricultural" strapping-on of external ballast.

Full-size sailplanes use "water ballast" to increase their wing loading for speed, and this can be jettisoned by the pilot, should conditions require the wing-loading be lightened.

Fig. 29



This can only be done once on each flight, of course! There seems no reason why water ballast should not be used in models but, at present, there seems to be no record of anyone having tried it.

Alternative wings

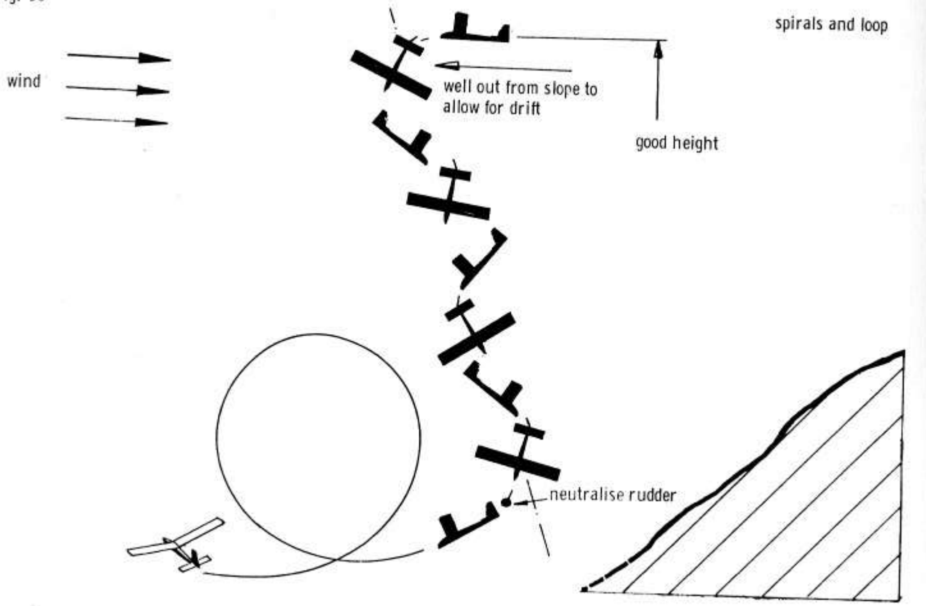
An alternative method of increasing the model's wing-loading, of course, is to *reduce the wing area.* Occasionally we see models with three-piece wings, the centre panel of which can be removed, and the outboard panels joined together, to provide a wing of roughly two-thirds the area of the original, for flying in stronger winds. Alternatively, some modellers will provide themselves with a pair of smaller wings, for the same purpose.

It is more common, however, for the alternative wing to be *larger,* for flying in marginal conditions, as this is generally more pleasant! Just as the increasing of the model's wing-loading enables us to fly it in stronger winds, so *reducing* the wing-loading enables it to remain airborne in much lighter breezes than it normally could, and make use of even the weakest patches of thermal lift. We are thus virtually turning the model into a thermal soarer—except that we still hand launch it from the slope, and pick up thermal lift rising from the valley, instead of having to tow up our model with a tow-line, kite-fashion.

Many rudder-only fliers (and, indeed, some fliers of the much more sophisticated multi control designs) therefore have a set of wings, of greater area—and perhaps with an under-cambered airfoil section, giving a higher lift coefficient—which may be used when the model would, otherwise, be grounded for lack of lift. Other modellers, as we have mentioned, will often bring two or three models with them, and choose which one to fly, according to the conditions of the day—or even according to the changing conditions during a day's outing.

Fitting the larger area wing will not usually entail re-trimming the model, as it is usually the *span*, and not the *chord* that is increased, so keeping the centre of gravity the same, in relation to the wing. Carried to extremes, however, the addition of wing area can cause a model to become longitudinally unstable, since it also effectively reduces the *relative* size of the stabilising tailplane! Most rudder-only and intermediate designs have an adequate safety factor in the size of their tailplanes, however, to cope with increases in wing area of up to (say) one-third.

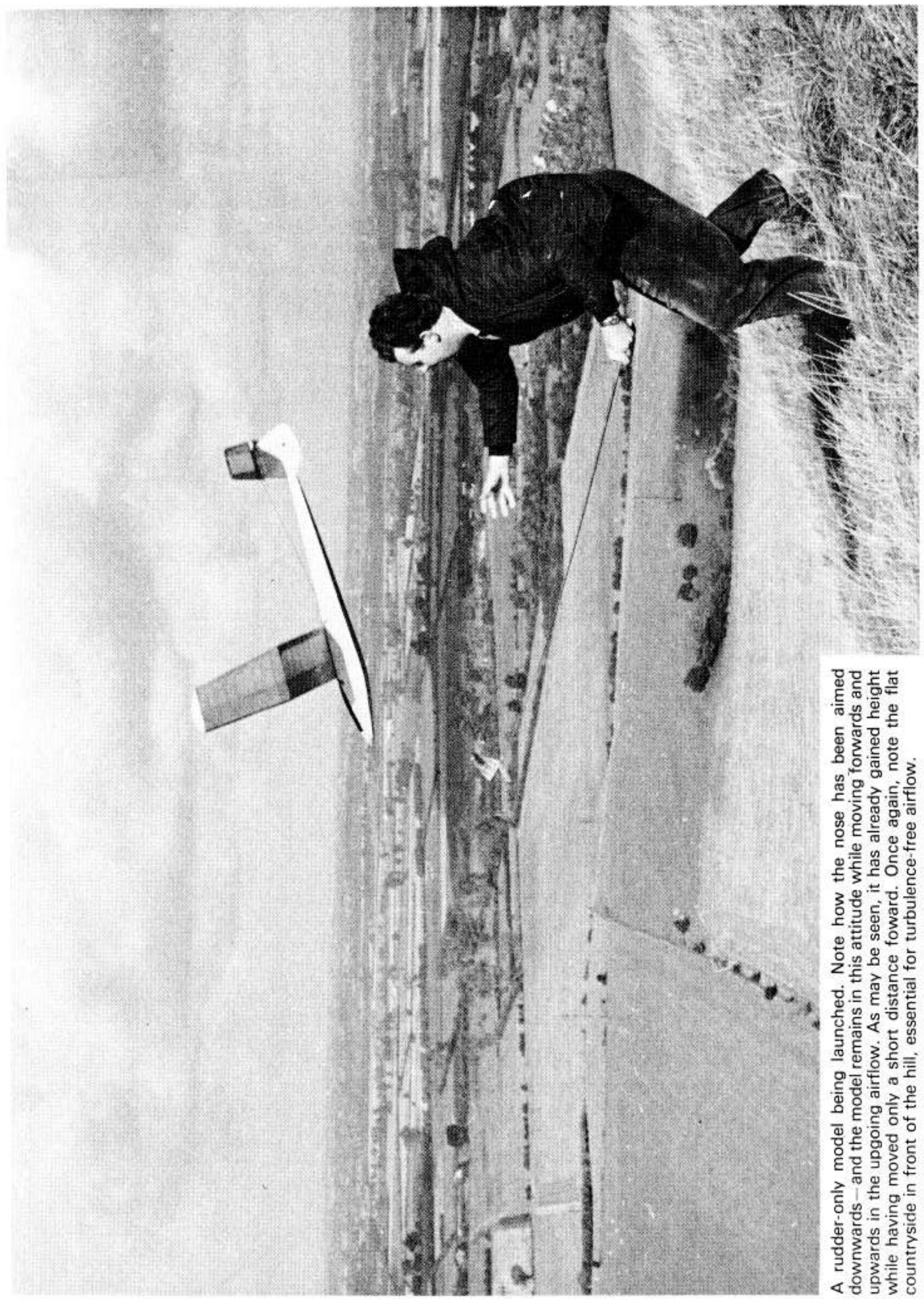
Fig. 30



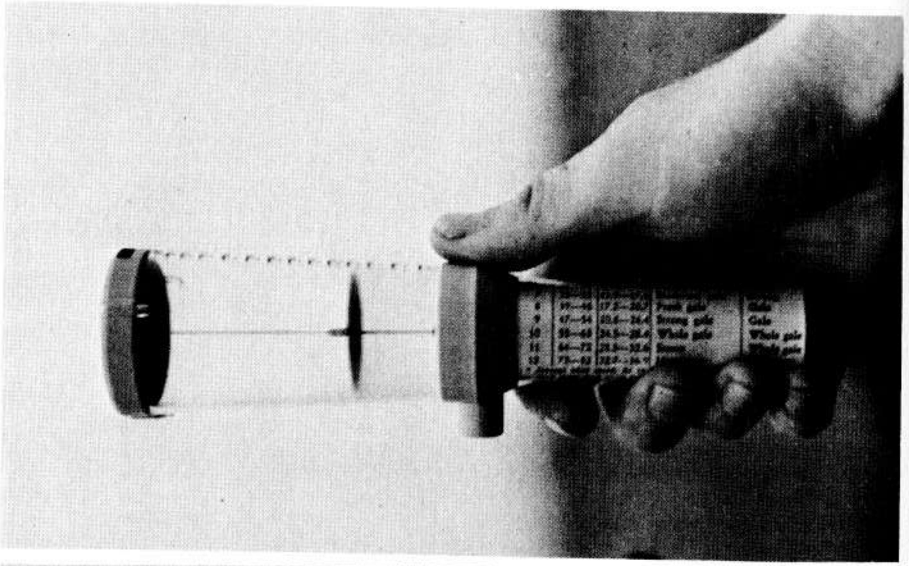
Manoeuvres

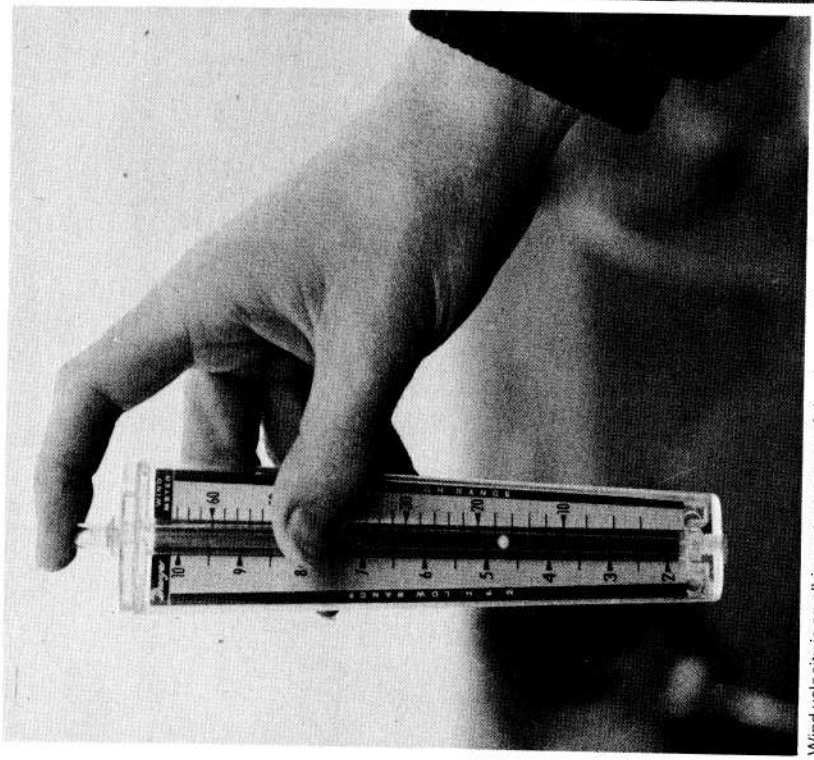
Having become fairly accustomed to the general basic principles of soaring then, what manoeuvres can the pilot of the rudder-only model expect to be able to make his model perform? The answer to this question, as far as "aerobatics" is concerned, and in comparison with the intermediate and multi control models, must be "practically none," but this does depend, to some degree, on the particular model and its trim state.

All manoeuvres for the rudder-only soarer, as with its powered counterpart, are dependent on the building-up of excess speed. That is to say, speed over and above that required to maintain steady flight. In order to achieve this it is necessary to dive. As we have no elevator, our dive has to be a spiral dive, which is achieved by simply holding on the rudder. Unless it is enormously over-stable, or rigged in an unusual fashion, the model will hold the turn and point its nose downwards. Needless to say, before doing this sort of thing, it behoves us to coax the model to a good height "above eye level," as it were, and also to keep it as far out from the slope as possible, to allow for the inevitable towards-the-slope drift, which will occur the whole time. After two consecutive spirals, the rudder should be



A rudder-only model being launched. Note how the nose has been aimed downwards—and the model remains in this attitude while moving forwards and upwards in the upgoing airflow. As may be seen, it has already gained height while having moved only a short distance foward. Once again, note the flat countryside in front of the hill, essential for turbulence-free airflow.





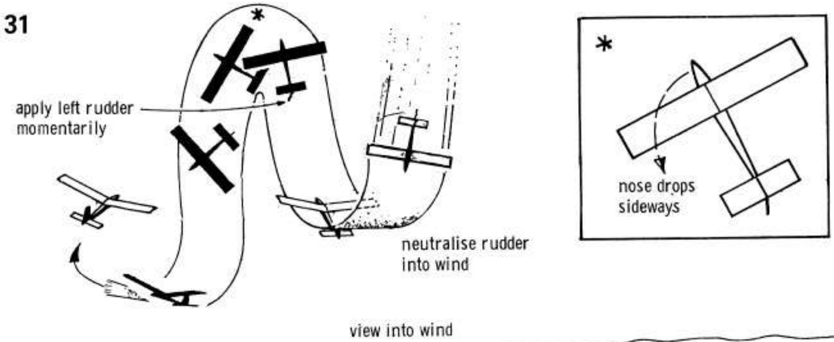
Wind velocity is an all-important aspect of the slope soaring enthusiast's world. He knows the wind speed ranges of his various models and choses to fly each according to the conditions. Wind speed meters are useful to have, and two types are shown here. One for the pocket and the other more for the haversack, they are obtainable at marine suppliers, and a few model shops.

neutralised, just *before* it is quite pointing into the wind again (see Fig. 30). With the excess speed built up in this spiralling process, the model will "zoom"—that is to say, swoop upwards in a curved flight path. Whether this zoom results in a loop, or simply in a stall, depends on the model and its state of trim, and on the relative wind speed.

If, after spiralling and neutralising the rudder, the model simply stalls, then we must apply rudder to hold it in a gentle turn—not to build up more speed this time, but to dissipate the excess speed—gradually widening the turn as the model slows down to normal speed. With proportional rudder, this is relatively easy. With "bang-bang" escapements or actuators, it is a question of holding short pulses of rudder and gradually decreasing the amount of time the rudder is held on, until, eventually, the circle widens and the model is once more in a steady state. As we have seen earlier, the secret is to apply the rudder—once the model has been seen to stall—just that fraction of a second before the *next* stall, so as to damp it out before it starts, so to speak! We make no apologies for once again stressing that this *anticipation* is necessary in all our soaring flying, and with whatever class of model we are dealing, since we must always be concerned with what our model is doing *relative to the wind*, so this is a habit which is best learned early.

If our model manages to get "over the top," in a loop, then we can consider ourselves lucky—not very many rudder-only models will do this to order, unless over-elevated to quite a degree, which can make them difficult to fly "normally," as over-elevation results in a

Fig. 31



wallowing flight pattern, with a tendency to stall easily. In any event, once over the loop, the model will pick up more speed on the way down, and, unless it is to stall madly now, must again be put into a turn to "work off" this extra energy.

The stall-turn is a manoeuvre which your model will certainly do, even if it cannot be made to loop. Again making sure that you have plenty of height, and plenty of space between the model and the slope, spiral it down once again—*one* spiral will probably do for this—and neutralise, as before, just a fraction before the nose comes into wind again. This time, as the model zooms up, give a sharp dab of full rudder, neutralising immediately. If you hit it at the right moment, and hold for just the right length of time, a nice stall-turn can result. (Fig. 31). It is all a matter of timing and judgement. Left too late, the rudder will have no effect, because the model will have no "steerage way"—having stopped, poised, nose-upwards in the stall, before plunging downwards again to find some airspeed. Rudder applied too early, on the other hand, will simply mean the model will do a tight climbing turn and not the stall-turn we are after. The real stall-turn sees the model rearing up as though to stall, facing into wind, then—when it is almost vertical—the nose drops *to one side*, and the model swoops downwards—*downwind*, towards you, having in fact moved its longitudinal axis through 180°. Fig. 31 should make this clear. Once having completed the stall-turn, of course, you must turn back into wind with as little delay as possible, and position the model out away from the slope once again.

On days when your model can be made to gain plenty of height, you may like to try out these manoeuvres, and see if you can perfect, at any rate, a controlled stall-turn, even if your model will not loop. Eventually, you will find that you are not so completely dependent upon wind-direction to achieve the desired results, and can perform a stall-turn in more or less any direction. This is not at all easy, of course, and you will find it best to start with the model facing into the wind, as we have described.

Why bother?

Many people will say "I am not at all interested in even these simple manoeuvres—there is sufficient interest and enjoyment for me in just flying in different conditions, seeking out the lift, gaining height, and so on." Fine. It is as well for the rudder-only flier to be content with this, in general. But, to be able to cope with a stall—to convert it into a stall-turn, or to damp it out by turning at the right moment—will make you that much better a flier, able to contend with sudden awkward situations without having to think about it. And, in awkward situations, there is usually very little time *to* think what to do. If you have already done enough stalls and stall-turns, and generally whizzed the model around, then the corrections necessary for a given situation will come as second nature. It is better to put the model into a stall, deliberately (at a safe height, of course) so as to learn how to deal with it, than to fly always "gingerly"—because, sooner or later, the situation *will* arise where you need this experience to avert disaster, and only if you have practised for it will you be equipped to deal with it.

Landing —the "crunch"!

As with full-size flying and gliding, the landing is the hardest part to get right—primarily, of course, because there is no room for error! We also tend to get less practice at landings, because we only do one per flight. The temptation to stretch out a flight, and put off the moment when we must land, is great. The wise man will make sure he gets practice at landings, by keeping his flights short. If one makes a mistake when the model is well up and out from the slope, there is plenty of room to recover the situation, and try whatever it was we were attempting again. Such is not often the case when landing, the ground tending to stay resolutely where nature saw fit to place it—or perhaps (as it often seems), a foot or two higher!

It is with landing that the type of slope from which one is soaring most influences the procedure used, as we shall see. Methods have to be adapted to conditions, as well as surroundings, however, and the wind velocity can be helpful in some conditions, and just the opposite in others.

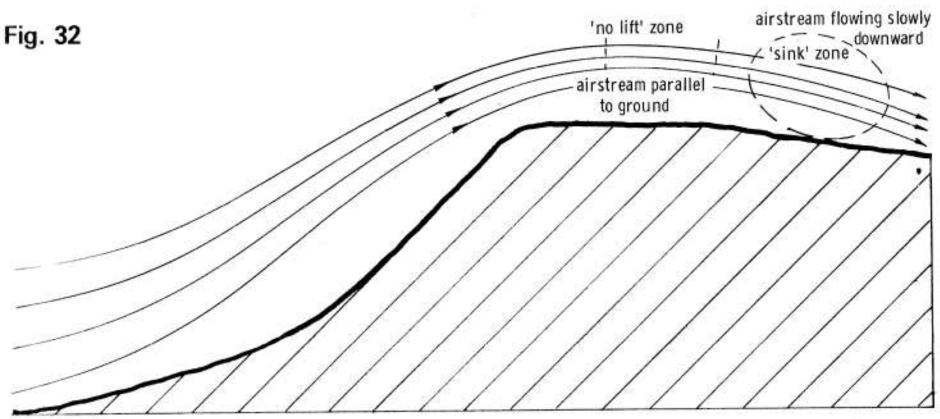
Plateau back-area landings

Taking, once again, our "ideal" site first, we have the hill with the flat, or nearly flat, area at the back of the slope. This will have a zone where the air is moving more or less parallel with the ground and, a little further back, slightly downwards. We have shown this in Chapter 2, when dealing with types of slope, but now our Fig. 32 shows it with particular relation to the landing.

Provided the model has sufficient height (say, at least 30ft. above "pilot level") we can either turn in a "square approach" pattern, to bring it into the "no lift" zone at the beginning of the last (into-wind) leg or, by keeping it headed into wind all the time, allow it to "float" backwards, relative to the ground, so that it enters the no-lift zone. Either way, when the model reaches this part of the back-area, it will begin to descend. This is because, although there may still be plenty of wind, it is now blowing parallel to the ground, and there is no upward component in it. Remembering that our model is really always gliding downwards, relative to the air—it now also is seen to begin gliding downwards *relative to the ground*—which is, of course, what we want.

How, then, do we determine the exact point at which our model is to come to earth? Well, "exact" might be putting too fine a point on it. Let us say the approximate area. This is a question of whether we *undershoot* (fall short—*i.e.* down-wind—of the desired area) or *over-shoot*—or judge it to a nicety and place the model in such a way that it comes between

Fig. 32



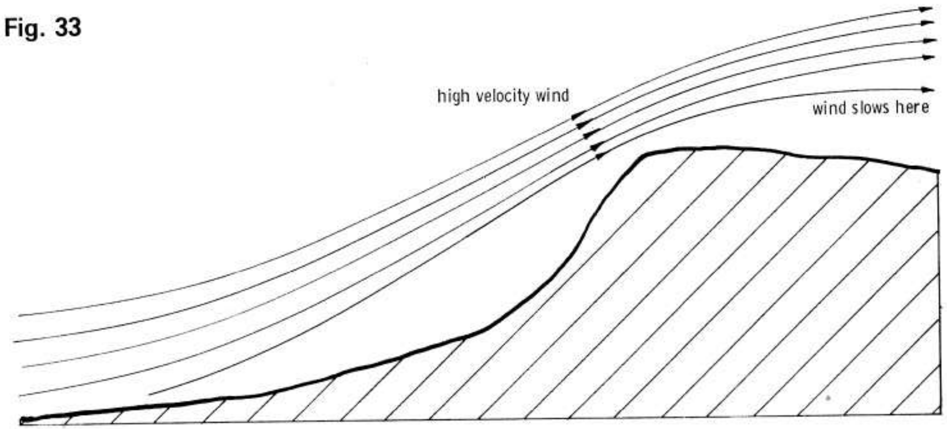
the two extremes. Obvious, you may say, but how does one actually tackle it?

There is very little one can do about undershooting. If you have left it late in turning back into wind, then the model will undershoot, and fall short, and that's all there is to it. There will be no harm in under-shooting, of course, if the back-area stretches well down-wind. Many people prefer to deliberately under-shoot rather than over-shoot and possibly get into turbulence near the slope edge. However, if the back-area of the slope drops away after a little distance, then the airflow will be moving *downwards*, and our model will descend quite rapidly, and also start to move faster in relation to the ground because the air will also be moving slower. The transition between layers of air moving at different speeds can be quite spectacular, and only practice and foresight can make the difference between the model's taking on just the right amount of "sink" for landing, and suddenly dropping its nose for lack of forward speed when it hits the area of slower, downmoving, air. Fig. 33 shows the area where this occurs.

By varying the length of our down-wind leg (*i.e.* the amount of time we let elapse before turning the model cross-wind and then back into wind) we can experiment to find the sort of approach needed for different conditions. One of the interesting things about slope soaring, of course, is that this can change, sometimes quite considerably, during the course of an afternoon's outing, with only small changes in wind speed.

Overshooting, unlike undershooting, is not completely unavoidable, once the model is

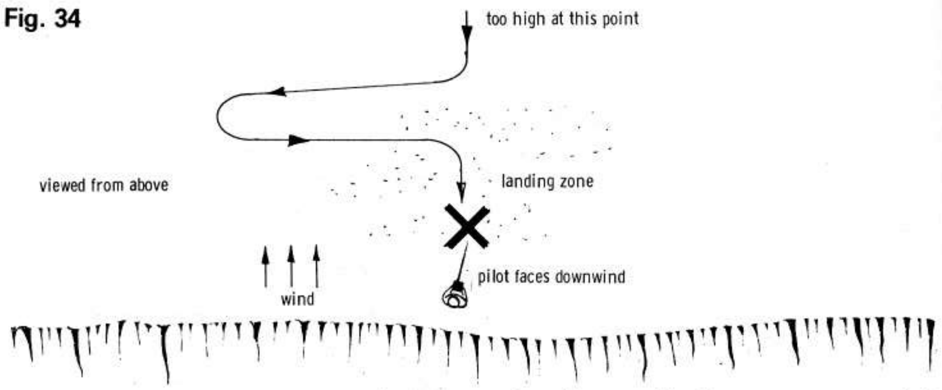
Fig. 33



headed back into wind. If, on coming into wind, we begin to realise that the model is too high, and likely to over-shoot, we can lose height by turning slightly, first to one side, and then to the other. Just one slight deflection and then back into wind may be enough (see Fig. 34) but, if we have badly misjudged, and are much too high, then some larger "S" turns may be necessary. If even this does not seem to be going to work, and the model is beginning to get near to the edge of the slope, then we will be wiser to make up our mind rapidly to "go round again." A decision to do this must not be left too long, however, or we may find the model poised over the brink of the slope, with hardly any forward speed. It is then in a most vulnerable condition, and the slightest turbulence or gusting can cause it to stall, and be blown backward, either to contact the ground tail-first, or with a wingtip. Either way, it will probably sustain some damage. Try never to be caught low down near the edge of the slope without some reserve of forward speed, in anything but the lightest of zephyrs.

We have been discussing, here, the "square approach" pattern, and variations of it (most people's idea of a square approach is probably nearer to an "elongated semi-circle," anyway!) but what, now, of that "floated backwards" approach? Floated backwards into the no-lift area, the model will pick its own moment to put its nose down and descend. We can, however, control this to a certain extent by deciding the height at which it enters the zone. Within certain limits, decided for us by the shape of the hill and the velocity of the wind, the higher it is when floated back over the edge of the slope, the further back it will

Fig. 34



begin to descend. It is almost impossible to generalise on this, because, as you might imagine, the number of possible permutations and combinations of wind speed and hill shape are almost infinite. As with most things appertaining to model aircraft, compromise is often the best way, and it may well be that a combination of both the square-approach and the floating-backwards-and-hovering method, combined with some S-turning, will be how we make our landing.

Slope-side landings

Now let us look at a rather different situation. The wind has dropped, while we were flying and, somehow or other, we find that the model cannot be coaxed back up to "pilot level," in order to set down on top of the slope. We *could* continue flying and guide it down all the way to the foot of the slope, provided there is a clear area there to land, but we would really rather not, for two reasons. The obvious one is that this will involve a long and tiresome journey down the hill, and the second one is that it becomes increasingly difficult to judge the model's distance from the ground—or above fences and trees—the further away from us we fly it, so the risk of damaging it becomes greater. We must, therefore, land the model as high up the slope (and so as near to us) as we can. This is best done, in these conditions, by "crabbing" it close in towards the slope, as described for marginal conditions (Fig. 27), but this time we will deliberately and not accidentally, let it "sit down." Try not to

let the nose of the model point in too much towards the slope, however, since—without elevator to raise the nose, this may mean a "thump" which could possibly put an end to the day's flying. Remember, we want to turn the model back into wind "just too late," so that we slow it up, and it just settles back onto the slope.

The slope-side landing has to be used in other circumstances, too, even when there is still strong lift, such as when flying from the side of a large hill, or a mountain, rather than the top. Or when there is some obstruction at the top, such as rocks or—on some lower slopes—trees. In these circumstances it is wiser not to attempt to fly the rudder-only model in anything but the lightest of breezes. However, the principle is the same—crab the model along as near to the side of the slope as possible—first having positioned it at a level somewhat *below* that at which it is aimed to land it, perhaps even pointing the nose just slightly in towards the hillside, before suddenly turning it outwards, when it should "mush"—skidding sideways—and sit itself down, vertically, flat, with little forward motion. The technique is to let it rise, with the rising air coming up the slope then, when it is turned, it will slow up, and settle. This is why we should first aim to position it a little lower than the point at which we would like it ultimately to land. If you turn outwards too early, the model will pick up forward speed and go out away from the slope again. You may have to have several attempts before you time it just right.

Landing on a ridge

If your site is a ridge, with only a narrow top, like the one shown in Fig. 3 (p. 12), when discussing types of site, then you will have the choice between landing either on the side or on top. It depends upon the wind strength, and is all a matter of timing and judgement. The slope-side landing may be used if the wind is light or moderate, and the model can be first flown in such a way that it is below pilot level. It can then be crabbed along and turned into wind at the last moment, as we have seen in the slope-side landing.

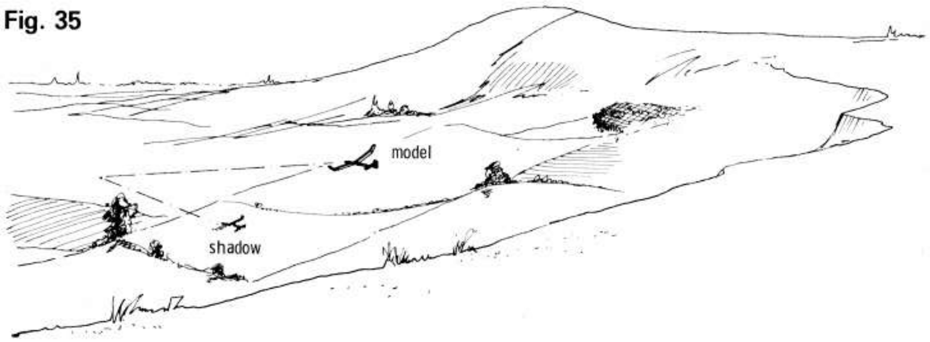
By crabbing the model a little higher, up to the top of the ridge, one can allow it to float back a little further, to "sit down" on top. This takes a great deal of practice—and possibly some broken models, as it is easy to be caught by a sudden gust at this stage, when the model can be "cartwheeled" along the ground, on its wingtips. One has to learn to judge the conditions, to decide whether to try for this sort of landing or not.

The third method is to take the model *just* over the ridge and immediately turn back towards the ridge (*i.e.* into wind) so that it sinks down on the "calm" side. This is probably the most satisfactory method for windier conditions. The important thing here, however, is not to allow the model to go too far past the top of the ridge before turning it back—otherwise it can either "drop out of the air" due to suddenly finding itself in an area of slower-moving air, or else get into severe turbulence, depending on the nature of the ridge itself, and on the wind velocity. Some "razor-back" ridges are very vicious in this respect, but if this type of ridge is all that you have, then it will pay to learn its foibles, and how the air behaves over it in different wind speeds.

It may happen that, in attempting to turn at the top of the ridge, you find that the model is not answering well to the rudder, and that it continues on, downwind. It will then probably dive, to try and pick up its natural airspeed, and may possibly go into a series of stalls. Remember what we have said about killing a stall by applying rudder on the way "down the trough," as it were—*before* the nose comes up for the next stall. This way, with luck, you will be able to level it out before reaching ground level. Once over the back of the ridge, into the "shadow" of it, so to speak, the model will, of course, have no extra lift from the air, and will be simply gliding downwards. You will, therefore, be in the position of *having* to land the model down towards the foot of the slope—on this occasion, the "wrong side" of the slope.

As we said earlier, it is very difficult to judge the model's height above the ground, when looking down on it from above. It may suddenly appear to "stop"—at what you thought was at least 20ft. above the ground—or, contrariwise, it may seem to go on and on, when you thought it must surely have landed by this time. Some people are better at judging

Fig. 35



this sort of thing than others, but one trick you can make use of, should the occasion arise, and if the sun is shining, is to watch for the model's *shadow*, on the ground. As the model sinks lower, its shadow will get nearer and nearer to it, until, at the last instant, they come together (Fig. 35). You should be able to slow the model up, just at the last moment, by waggling the rudder from side to side, fairly rapidly. By doing this, you are presenting each wing, in turn, with an increased angle of attack (due to the dihedral), and the model will tend to slow down and raise its nose slightly—just what we want for a "flared out" landing. This technique may be used at any time when we wish to slow the model down slightly, but it is most useful—and most noticeable, when the model is near the ground—Fig. 36.

Bowl landings

If your site is a bowl then, again, the wind velocity will largely determine how the model is landed. In light and moderate breezes the slope-side technique can be used to advantage, when the curving face of the bowl will help to bring the model to rest. In higher winds, the landing procedure will depend upon what sort of a back-area the bowl has. If it has a "plateau" type of back-area, then things are relatively simple, and we just lead the model over this until it starts to sink, when we turn it back into the wind. In strong winds, with some bowls, the air goes on rising for a considerable distance back, so that you may begin to think it is not going to start coming down at all! Don't panic—it *will* start coming down. If it is quite high up, you *could* help it by doing one turn of a spiral, and then "turning off" the excess lift as we have described earlier. But this should not be necessary, unless you have gained a considerable height before going back over the crest of the bowl. Once faced into wind again, further height may be lost, without increasing the flying speed very much, by doing a series of "S" turns, as described for our over-shoot correction earlier. Fig. 37 shows this as applied to the bowl with the flat back-area.

If the bowl has a back that drops sharply away, however, it becomes, in effect, a ridge. (See Fig. 38). The model must not be allowed to go so far over as to get into the region of turbulence that will exist just downwind of the ridge so formed (Fig. 39). With a bowl this can be very severe and the model could be flung around, willy nilly, and not respond at all to rudder movement. Again calling for judgement and practice, the optimum landing spot will be just towards the back edge of the ridge, but before the ground drops away sharply, as shown in side-view in Fig. 39. This does call for quite a degree of skill, however, and should be thought of as something to aim at, at a later stage. The novice may prefer to take the other extreme, and land low down on the front of the slope.

If he feels that he would not like to take the risk of "going over the back"—with its

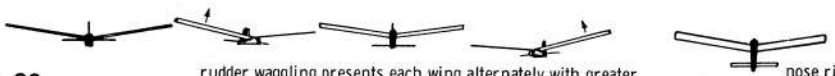
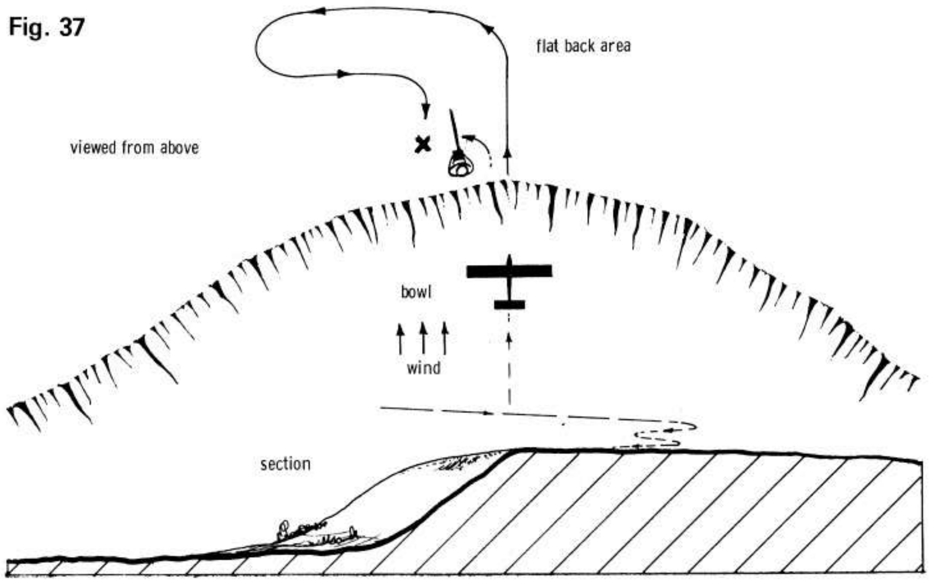


Fig. 36 rudder waggling presents each wing alternately with greater angle of attack - raises mean angle of attack - slows model

nose rises for 'flare out'

Fig. 37



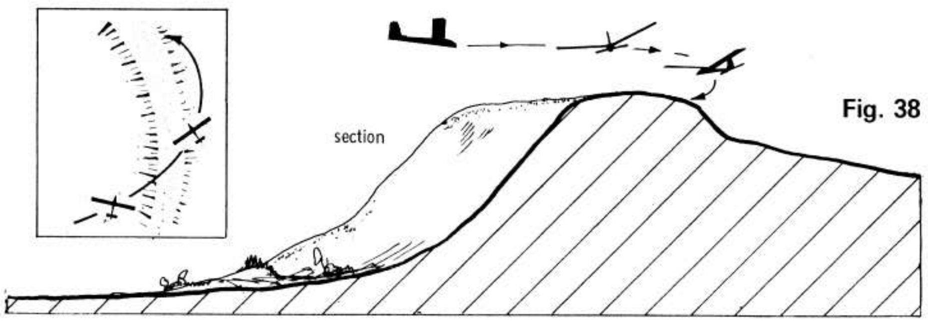
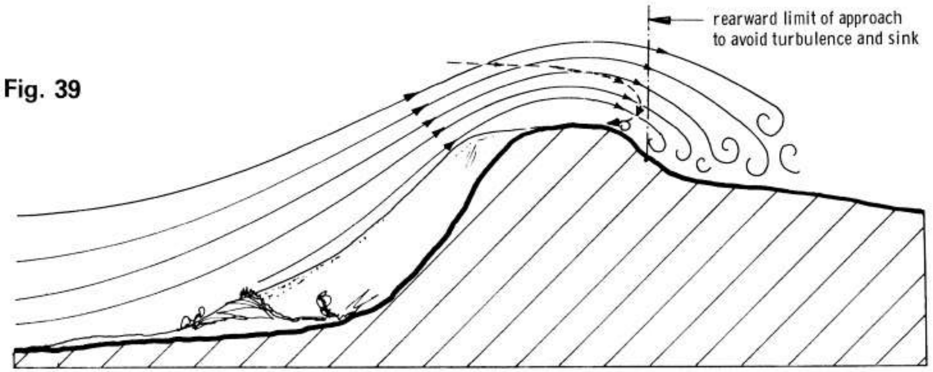


Fig. 38

Fig. 39



possibility of getting into the severe turbulence through lack of sufficiently fine control, then a safe procedure will be as follows. The model should first be flown some considerable distance out and away from the slope. Then the pilot can make his way down the slope, and bring the model down—spiralling it, if necessary, to a point about half to two-thirds the way down the slope. It will then be in an area of much less lift and, since the pilot has come down the slope, he will be able to see it well enough to land it fairly comfortably. Provided, that is, of course, that there are fields and not rocks at the lower part of the slope!

This sort of thing does, of course, mean a great deal of walking and climbing about, on the part of our pilot. But, he should look on this simply as a question of preserving the model through a few flights, until he has sufficient confidence to try a slope-side landing further up—or else aiming for the no-lift area on the ridge. If our beginner is wise, however, he will not have attempted to commence his soaring in a wind that is sufficiently strong to make this sort of safety approach necessary.

As we have said, the rudder-only model is limited as to the conditions and situations in which it can be flown safely. A model can be made to respond much more precisely—and so be handled in a wider variety of conditions and situations—when we have more control surfaces at our disposal. The addition of elevator control makes both general control and, especially, landing, so very much simpler that, once one has it, one begins to wonder how one ever managed without it!

If your model has survived the rigours of rudder-only control (it may be your third or fourth model, of course, that has survived to this point!) and you have obtained some two or three channel equipment, then an elevator can usually be added to the tailplane of the existing glider without too much difficulty. Or you may decide to build another machine of the same design, but adding the elevator from the inception. You will then know the general "feel" of the model—plus the wonderful feeling of freedom and ease of positioning that the elevator brings, as we shall see in the next chapters.

The "1 + 1" model

With the advent of the "1 + 1" r/c outfits, we really have another class of soarer—a sort of "Rudder-only—plus." This "plus" does not quite amount to another *complete* control, since the "One-plus-One" outfits usually consist of one fully proportional servo plus one *positionable* actuator, similar to a single channel secondary throttle actuator, which gives two or three selectable positions. This positions are only selectable in sequence. That is to say, that they cannot be selected out of order. From position One, the actuator must move to position Two before going on to position Three—and from position Three, it must go back to position One before going to position Two. It changes to the next position on receipt of a signal from a push button on the transmitter.

We can therefore arrange a "trim elevator," to have two or three positions, so that we have a certain degree of "in-flight trim," though this will not be nearly so fine a degree of control as we would have with the trim function on a fully proportional two-function outfit. And, since the trim is "sequential"—it will not be possible to use the control as "elevator" in the normal control sense, as we cannot apply a small amount and then neutralise, more than once, without going through (i.e. using some of) the opposite control—which is not, in fact, desired, and which would have a negating effect on the control just given.

The trim-elevator, therefore, must be used with *caution* but, if used correctly, within its limits, it does give some extra scope to the otherwise limited rudder-only flying.

CHAPTER 5

INTERMEDIATE SOARING

Rudder and elevator control

WE have seen, in Chapter 4, that rudder-only models are, for all practical purposes, rather limited in the conditions in which they can be flown, and that this is primarily due to a lack of control of the pitch attitude. By adding elevator control, this obstacle is removed, and a whole exhilarating new world of soaring is opened up to the radio modeller.

No longer do we have to consider wind strength as anything like so critical a factor; we can put the model's nose down at will and, not only prevent its being blown backwards, but make it move more rapidly forwards into the wind. Ease off our forward pressure on the control stick and the model zooms upwards—some back pressure and it comes over the top for the loop with consummate ease. A dab of 'down' next and a further zoom is prevented, bringing the model into level flight once more. Turns, once initiated with rudder, can be tightened up surprisingly by pulling back on the stick. And, again, when coming into wind, that stalling tendency is damped out immediately by the small amount of down pumped in just half a second before the stall would have occurred.

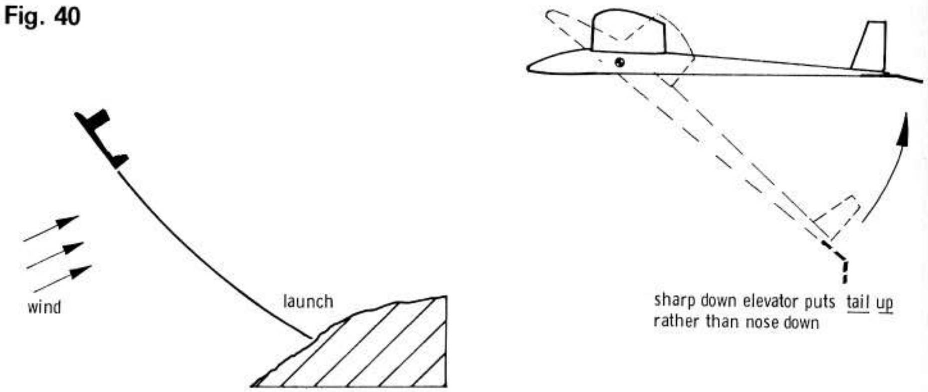
General flying

Now that we have elevator, we must be ready to make the most of it. Beginners often are taken aback at the way their models zoom upwards when launched from the hillside. They seem to be hypnotised by this uncanny phenomenon—and forget to do anything about it until it is too late, and the model has either stalled, or turned and fled over the back of the ridge.

Whenever you launch your model (or have it launched for you) *be ready to put in down elevator*, especially if the wind is fairly strong. If you are coming into soaring from power model flying, remember that, especially with the intermediate model, the control movements need to be much greater for a given response. Don't be afraid to really move that stick about. It is not until we get to the advanced contest aerobatic and pylon race soarers that the response becomes more like that of a power model. It is not uncommon for power fliers, who are trying slope soaring for the first time, to get into trouble simply because they are still giving the very small stick movements to which they are accustomed. If your model zooms up and points its nose in the air as soon as it is launched—*slam* that stick forward *before* it loses all its airspeed, to pick the tail-end up. Once again, as we have seen earlier, *anticipation* is the keynote here, as it is in all flying where the wind effect has to be taken into account. As you will see from Fig. 40, the application of down-elevator with the model at this large angle to the wind does not so much put the nose down as put the tail *up*. But, of course, once it has come up most of the down-elevator must be taken off again, leaving just enough to ensure that the model now moves forwards and out from the hillside.

Once safely airborne, the beginner should tack the model to and fro along the face of the slope, to get the "feel" of the controls. Keep fairly well out from the hillside, so that there is room for error. You will be surprised how that wind drift can catch you out. Don't forget, you are flying the model in a mass of air which is all moving towards the hill at a more or less constant rate. You have to allow for this all the time, so that eventually, like flying towards yourself, it becomes automatic. When the model is flying cross-wind, it will fly at a certain speed, and when it is turned into wind it will slow down—some models will actually *stop*, relative to the ground, and have to be coaxed forwards with some down elevator. You can, of course, make nearly any soarer "hover" like this in the right wind

Fig. 40



velocity, and, if yours wants to do it, without your help, then it means that the wind speed is equal to the model's normal flying speed, so you will need to be "leaning on the stick" for most of that particular outing.

It is often possible to gain quite a respectable height by continuous tacking to and fro along the ridge, but remember—*always turn outwards from the hill, never towards it!* This is not because it is dangerous in itself to turn the model towards the hill, but simply that the model is then flying much faster (flying speed of model plus wind velocity) and that, seeing his model hurtling towards him, the beginner will often "freeze" on the controls, letting his model either fly over the back of the hill—or thump into the hillside.

When you have acquired "second nature" reflexes with the transmitter, and the ability to fly a model towards yourself without getting confused between *your* left and right and the *model's* left and right, then it will be safe to turn your model in towards the hillside because, by that time, you will have also become able to judge turns and drift.

While doing your tacking to and fro along the front of the hill you will be using the elevator quite a lot. Mostly *down* elevator. Perhaps that surprises you? Well, you must remember that a slope soarer gains its height from *lift*, which cannot be produced by pulling the stick back. In fact, as a rule, this will only result in the model's stalling, and so *losing* quite a lot of height. To gain height we must seek out our lift, in the very air in which the model is flying. This is where slope soaring is very much akin to sailing—we are using the wind to our ends, not just barging through it by sheer brute force, like the power boat, or powered aircraft.

At each turn into the wind, the model will tend to rise—and you should be ready for this and dab in just a touch of *down* elevator *which will help it gain height.* If the wind is not blowing straight onto the face of the slope, we will have the same effect as was noted in the previous Chapter (Fig. 25) where height is only gained on the up-wind turn—and is usually only just maintained, or even lost, on the downwind one. Nevertheless, on this downwind leg and turn, do not be tempted to pull the stick back too much, or you may stall the model and could then lose so much height in recovery from this condition, that you may have no choice but to land it at the foot of the slope.

Fly your model a little further afield now, exploring what the whole length of your particular hill face or ridge has to offer. Perhaps there's a bowl shaped area at one point; position the model over it and see if it is getting more lift. Watch it closely and, again, be ready to put in that jab of down elevator as soon as it rises. As with the launch, putting in down elevator will bring the tail up, so that, in fact, the whole model has risen instead of just the front part. This way, you keep the model flying "downhill" instead of rearing up and drifting backwards, as it otherwise would.

While flying the model leisurely around, you may decide to see how far out from the hillside you can get it, without losing height. This can be interesting—and often quite

surprising, as some hills go on "working" quite an unbelievable way out. When the model is out there, you may see the nose go up, and put in a touch of down-elevator (this will become an unconscious reflex action after a while)—then you find the model is no longer riding up nose-first the way it does in slope lift, but is rising bodily. You have it in thermal lift! This is the time to sit back and enjoy—because it probably won't last long. Thermals, by their very nature, move across the country, so your model has to fly out of its thermal if it is to come back to its owner. There is a detailed description of these rising currents of warm air in the section devoted to thermal soaring, but even the most diehard of slope men will not disdain to use thermals when they pass by, even though he may never wish to build or fly a thermal soarer as such.

Turns—the use of elevator

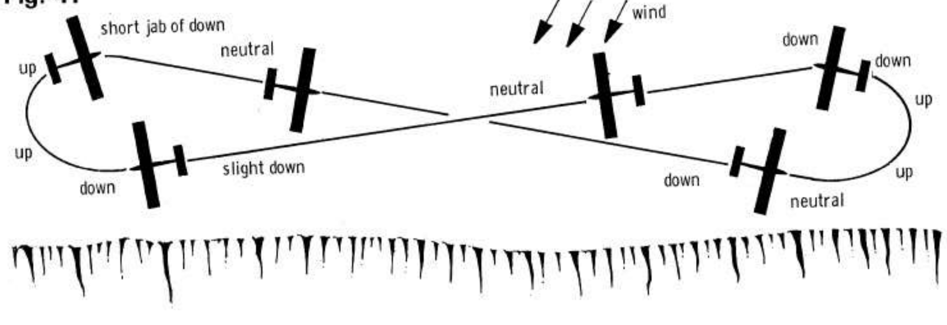
The emphasis we have been placing on down-elevator does not mean, of course, that there are not times where up-elevator is used. Naturally there are, and one of the commonest is in tightening turns, as we mentioned very briefly in the opening paragraphs of this chapter. Now that we have elevator, we become conscious of controlling the pitch axis of the model virtually all the time, instead of having to cope with changes by either turning into wind, or out of it.

To make a turn, therefore, we first put on a little extra speed, by holding just a fraction of down elevator. This is eased off, as we put in (say) right rudder, to bank the model and start it turning. We then pull back on the stick to tighten up the turn—*and, at the same time, neutralise the rudder.* If the rudder is not neutralised at this point, the model will put its nose down and go into a spiral dive. Speed must be maintained in this type of turn, or the model may stall. When the model is heading in the desired direction, we give enough opposite rudder to bring the wings level once more, plus a touch of down elevator to prevent a zoom. The actual degree of control movement will vary with different models and, in any case, can only be found with actual practice.

For the sake of simplicity in describing the turn above, we have not taken the wind direction into consideration. As we have said earlier, the wind is very rarely exactly straight on to the slope face, so wind direction must, in fact, be allowed for. Let us now attempt to analyse the elevator movements in simply turning at the end of each pass along the slope face—in other words, of executing a very elongated figure of eight.

If we imagine that the wind is coming from slightly to our right as we stand looking out from the hill, our elevator movements will vary, roughly, as shown in Fig. 41. For the sake of clarity, only elevator is shown—we can assume that the appropriate rudder movements will be fairly apparent, bearing in mind that, to complete a turn, a touch of *opposite* rudder—not just neutralising it—will be necessary. With this sort of flying, it is not usually necessary to use very coarse movements of the elevator; fairly light movements of the stick suffice, being increased proportionately to tighten up the turns. The more bank you have put on, the more elevator you can "pull"; the wider the turns (i.e. less bank) the less elevator

Fig. 41



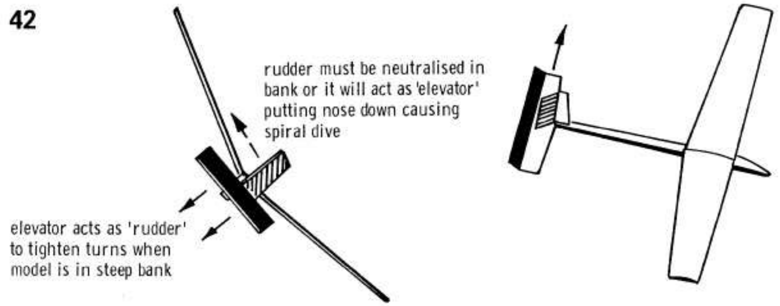
will be needed, until, with the very wide, flat, turns, elevator need hardly be used at all, except for correcting any upsets due to air turbulence.

To clarify this tightening of turns by using elevator, Fig. 42 shows how the elevator acts as a rudder when the model is in a steep bank. It also conveys why the rudder must be neutralised, once the bank has been initiated, as it can act as an elevator and put the model's nose down steeply.

It will be seen (Fig. 41) that when flying to the right—partially into wind—some degree of down-elevator is maintained, then the elevator is neutralised as rudder is applied for the turn, followed by some up elevator to tighten it. The model faces into wind at this point and rides up, gaining some height. Some down elevator is then applied to keep the tail up. This is maintained on our right-to-left pass as the wind is partially at the model's tail and we have to keep its airspeed up. It is now travelling quite fast (relative to the ground) so we start to turn well in advance of where we normally would, to allow for drift. We put on a fraction more down elevator, to build up speed for the turn, then commence the right turn with the control stick making a gradual transition from down to slight up—and then neutralising. A brief touch of down as the model comes into wind, and then neutralise the elevator . . . and so on.

It is a good plan to practise elongated figure of eight turns like this until your stick movements are thoroughly and automatically co-ordinated and you do not have to think about what your hands are doing any more. If you have a relatively responsive model, of the

Fig. 42



"compact" low-aspect-ratio type, you will be able gradually to shorten the distance between the turns, until each leg of the course, as it were, is only about 30 yards or so. Anyone watching the transmitter then will see rapid and more or less continuous stick movements! I call this "goldfish bowl flying" because the model dashing to and fro reminds one of a goldfish swimming to and fro in its bowl. It is very good practice for training your reflexes to become automatic.

The stall

We have mentioned the stall several times in the foregoing pages, but so far have not described it. As it is all too easy to induce a stall by incorrect use of the elevator, it is appropriate that, at this stage, we should think about what happens to bring about a stalled condition.

Models may be made to fly faster by putting the nose down (down elevator) or slower by giving up elevator. This has the effect of altering the angle of attack of the wing—decreasing the angle for higher speed and increasing it for lower speed. Unfortunately, every model has a certain critical speed below which it cannot be made to fly. This is the stalling speed and, when the wing reaches a high enough angle of attack, the previously more or less smooth airflow around it (Fig. 43a) which produces its lift, breaks away (Fig. 43b) and upsets the lifting properties of the wing. For lack of lift, the wing (and thus the nose of the model) drops and the model then dives until it has once again picked up flying speed.

We tend to think of the stall being sharply defined, with the model first rearing up like

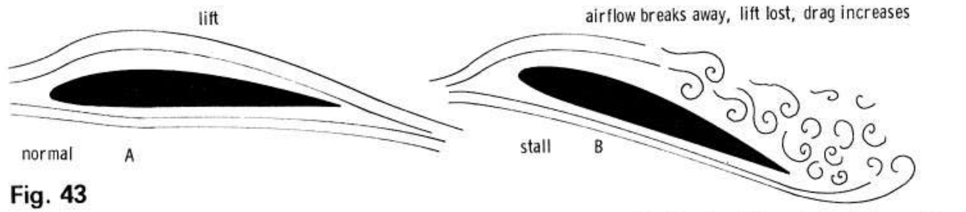


Fig. 43

a frightened horse and then dropping its nose (Fig. 44a). This is the "classic" stall, and usually only happens when a beginner fails to give down-elevator in time, after too hard a launch. Or, of course, it may be induced purposely by diving the model and then neutralising the elevator, letting the model zoom up into wind—without getting the tail up. That sort of stall we all recognise, but it is the other kind that is more treacherous—the one that sneaks up from nowhere and plucks the model out of the sky before the pilot has realised what is going on. The model does not *have* to rear up in the classic fashion. Certain models, if flown slowly enough, will simply appear to put their noses down and dive. Now, the worst thing the pilot can do at this point is to pull the stick back. The wing is already stalled and he would only be preventing recovery—even if heaving back on the stick does seem the most natural thing to do!

Often a model will not only stall in this way, but one wingtip will stall first, then the model may go into a spin. To pull the stick back in these circumstances is to ensure that the model continues spinning—right down to the ground. The best procedure is to give a dab of *down* elevator (there it is again!) to restore the airflow over the wing, and *then*, gradually, ease the stick back until level flight is attained.

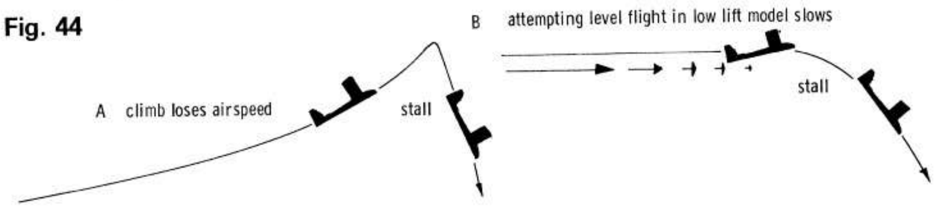
Near-stalled launch

Not only does the wing cease to work as a result of the stall, the control surfaces become increasingly less effective as the speed slows down towards the stalling speed. This is particularly noticeable on some of the larger models, especially the semi-scale types with high aspect-ratio and little dihedral. With models like this, it is vital to keep the speed up in order to maintain rudder authority. To launch them with a nose-up attitude can be fatal. They should always be launched fairly fast, and with their noses pointing well down, so that they can be "driven" well out from the slope before having to make a turn.

An example of the near-stalled launch, with this sort of model, will perhaps illustrate the point. The wind is coming slightly from our right, once more, and we are holding our model aloft, ready to launch. At the word go, we launch the model, but straight out instead of into the wind, and—somehow or other—its nose got pointed slightly upwards as we let go. . . .

The model immediately starts to head round to the left, and puts its nose up a little further . . . the pilot puts on full right rudder to try and head it back into the wind, but now the right wing has lifted and the wind gets under it, turning the model still further to the left . . . the right rudder doesn't seem to be doing anything at all . . . the model is now drifting sideways to the left and is already over the top of the slope, still in a nose-up condition . . . the pilot, for some reason, still thinks he can regain control, and continues to hold full right rudder, but seems to have forgotten about the elevator . . . but the model's

Fig. 44



nose now suddenly drops, and the pilot pulls in full up-elevator . . . and you both spend the next five minutes picking up the pieces, and arguing about whose fault it was.

Well, it was your fault initially, for not having the nose pointed well down, and the model pointing square into the wind. But it was also the pilot's fault for not recognising the condition earlier. What could he have done? First, he could have bent that stick forward, and got the nose down—even if it meant doing a touch-and-go on the hillside; he would have then had the air flowing fast enough past the rudder to make it effective, so that he could have turned into wind. If he wasn't able to react fast enough to do this, and was still holding on right rudder, he should have seen that it was not going to respond to this, and given *left* rudder as the model began to get round, over the top of the slope. The nose would then have tended to drop (the rudder tending to push the nose down in this attitude, instead of keeping it raised, as did right rudder) and, at least, he could have straightened out and landed, instead of stalling and dropping out of the air in a heap of debris.

Keep the nose down, then, especially with this type of model and, if it obviously is *not* going to turn back into the wind, then "give it best" and turn it the way it's already trying to go. This latter is not a general rule, however—only for the small-dihedral, semi-scale sort of machine. With the more manoeuvrable "compact" model, *you* must be the master, and place it where you want to, not let the model fly the pilot!

Simple manoeuvres

Just cruising the model around all day, gaining height, or just maintaining it, depending on the conditions, is completely satisfying to some people. Others prefer to liven things up with some aerobatics, or "stunts." This is where the type of model used can make quite a difference. Bearing in mind that we are talking here about "Intermediate" models, using rudder and elevator controls, there is still a wide variety of types and sizes of model, and their aerobatic capability varies accordingly. Every design has its own particular characteristics but, for our purpose here, we need simply divide them into two groups—the "compact" type, with relatively low aspect-ratio, and the more graceful, but less nimble, high aspect-ratio types.

Only the models with a fairly low aspect-ratio will roll, but all models should be capable of stall-turns and loops. The spin is not so clearly defined; some models—of both categories—will do it, and others will not. Generally the most stable models, with their centres of gravity at the "safe" forward end of the range, will not spin. Let us now look at how we go about doing some of the simple manoeuvres open to the fliers of intermediate models.

The loop. Head the model into the wind and make a long, fairly shallow dive, to gain speed. Then ease the stick back until the model is upside-down. Now gently let off some of the back-stick to keep the loop nice and round. How this is done will depend on the individual model, and trial-and-error will be necessary to achieve a good round loop. As the model returns to the straight and level attitude once more, press in some down, so as to make a clean and level exit, without zooming up again. Fig. 45 shows the sequence.

Fig. 45

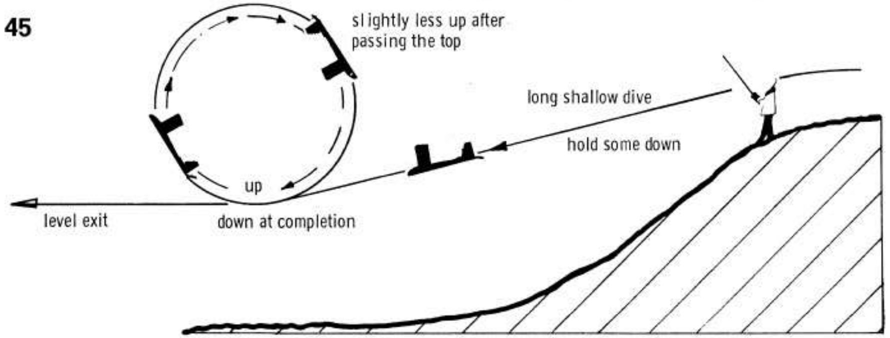
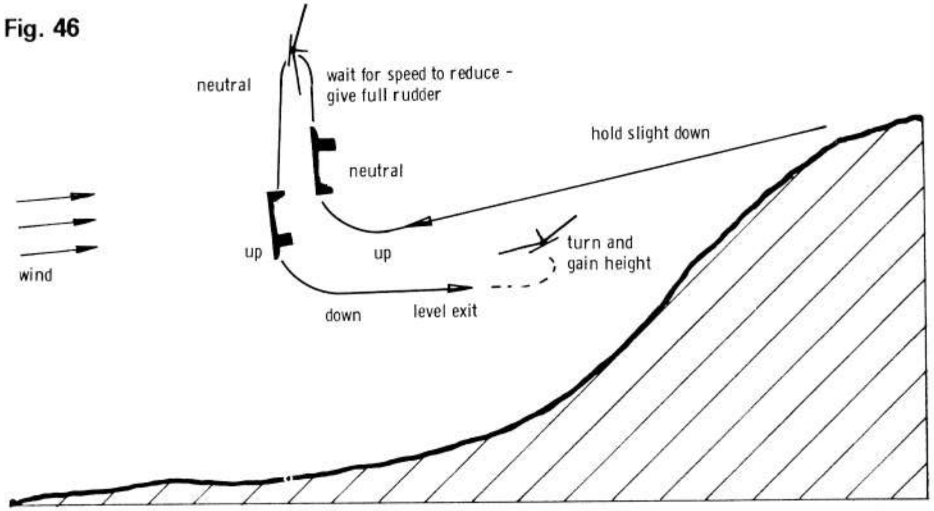


Fig. 46



A great deal depends on attaining the correct speed before entering the loop. If the model is not going fast enough, it may just *flop* over—or even simply stall, instead of flying right round the loop at a fairly even rate. Again, this will vary from model to model and so can only be arrived at by experiment, as also with the actual amount of stick movements needed.

When you can loop the model in this manner to your satisfaction, try doing the figure sideways on. This will usually mean doing it cross-wind, but you will be able to see the roundness of the loops. Rudder can be used, to a certain degree, to prevent the model "screwing out" due to the cross wind. (Only ailerons will give the lateral control necessary to do this properly, however, and we will be dealing with the "multi"—3-function—model in the next chapter.) The size of the loop is, to a certain extent, governed by the weight of the model. The large heavy model will do large loops, whereas the small, light model will perform quite tight ones. If we try to "open out" the light model's loops, we find that it slows down before it can complete the figure, as it lacks the momentum which carries the large model round.

The stall turn. Timing is the essence of this manoeuvre and, although it is a very simple figure in itself, it needs a great deal of practice to be reliably repeatable to order. Once again we dive to gain speed, but not so much as for the loop, then pull up fairly sharply, so that the model is climbing at an angle of about 70°. Now—*fast*, before it stops and drops back—bang in full left (or right) rudder, *sharply*. This will kick the tail over to one side, so that the nose drops to the other side, instead of dropping forwards as it would in an ordinary stall. Let the nose drop right down and allow the model to pick up flying speed. When you are sure it is safe to do so, gently ease the nose up into a level position and then turn the model (which is now heading towards you, if you commenced into wind) back away from the slope. Fig. 46 shows the sequence.

Where does the timing come in? It comes in deciding the *exact* moment to bang that rudder in. Too late and it will have no effect; too soon and the model will try to roll. The rudder must be able to kick the tail over, without there being enough speed for the dihedral to take effect and produce a rolling component. Quite a narrow path to estimate! Practise until you know the exact timing that will produce a nice stall turn. Later you can try doing crosswind stall turns, and then downwind ones.

For downwind stall turns you will need to take the model quite some distance out from the hill, and then turn it towards you (do an ordinary into-wind stall turn). The model will be coming towards you now, quite fast and, generally, it will not need to be dived—just pull back on the stick and—bang in the rudder. Don't forget that right stick will take the model to your left and vice versa in this situation. Let the nose drop and allow the model to pick up speed again before pulling up to the straight and level once more, facing into wind.

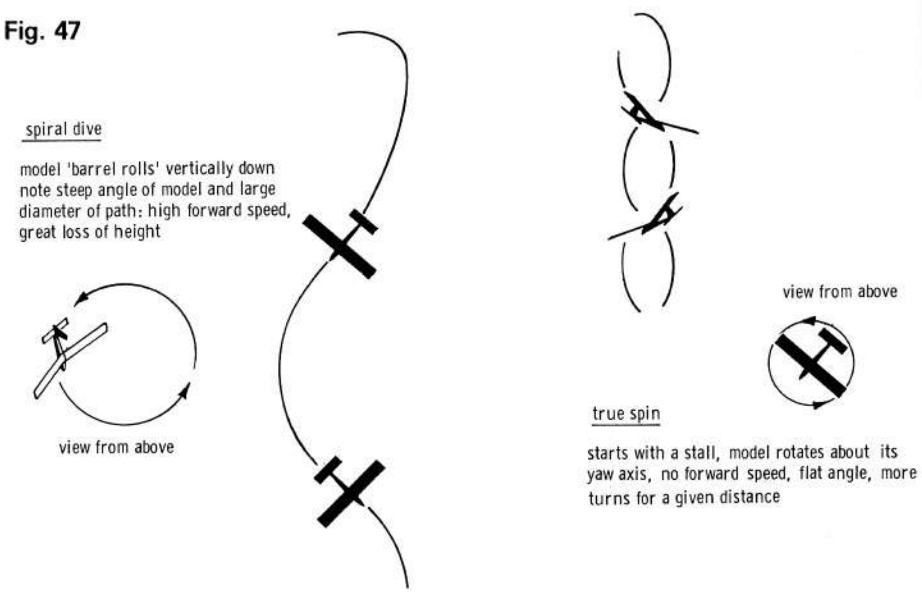
You can practise the crosswind stall turns by doing them along the slope face, rather as we did with the figure eights, going into one stall turn to your right, passing along the slope face and then doing one to your left, and so on. This can be made into one continuous sweeping pattern, and you will find that you get into a kind of rhythm, which makes it easier.

The spin. We have seen how a stall occurs, and this background knowledge is important as the stall is the first requirement for entry into a spin. This fact is not always appreciated by the beginner, and we have witnessed an almost incredible example of this, which will illustrate what we mean.

A group of fliers were soaring their models about in a quite haphazard manner for a while, and then two of them began doing spins. They had "compact" type models which were performing quite a pretty manoeuvre. A third flier, obviously a relative beginner, thought he would try to spin his model (of the same type) too. But it went into a rather vicious spiral dive, from which he only just pulled it out in time. He worked the model back up to starting height and announced that he was going to have another try. By this time suspicion was nagging at us so, instead of watching the model, we watched his stick movements . . . and our suspicions were confirmed. He hadn't the slightest idea *how* to spin! He pushed the stick forwards until the model was diving almost vertically, then to one side, so that the model performed a sort of downward roll.

The difference, as we explained tactfully to this game, but uninformed, beginner, is that the way he was doing it was *driving* the model downwards—and putting considerable stress on the wings in so doing—whereas, in the true spin, with the wing in a stalled condition, it is simply dropping. The speed does not build up as it does in a spiral dive and there is virtually no strain on the wings. Fig. 47 shows the difference between a spiral dive and a true spin. The *stall,* then is the key. Let us try doing a spin now, and follow the sequence. . . .

Fig. 47



First gain some height and take the model well out from the hillside (remember it will drift in towards you while it is spinning). Now, head it into the wind and pull the stick back—right back, so that the model does that classic stall—and, at the instant the nose begins to drop, put in full rudder, while still keeping in full up-elevator. The model should now spin, and keep on spinning, until you release the controls. We say "release" rather than "neutralise," because most people find it best to let go of the stick(s) momentarily, to ensure correct and speedy neutralisation of the control surfaces. Let the model dive straight for about half a second, to unstall the wing, then gently pull the nose up level, and go about regaining your lost height.

Models vary in the amount of time and space they need to recover from a spin, once the controls are centred. Some will only continue spinning for half a turn—others for 1½. It pays to watch closely and see how much your particular model needs, and allow for this, so as to complete an even number of turns, and pull out on the same heading as you entered the spin (*i.e.* into wind). For instance, if your model takes half a turn to stop spinning, you should release the controls after 2½ turns, and then the model will complete a 3-turn spin and straighten up into wind, ready to be pulled out onto an even keel.

As we have seen earlier, when examining the stall, if we *hold* on up-elevator the wing will stay in a stalled condition and the model will continue to drop. Some models (though fortunately very few) actually require a touch of down elevator and opposite rudder before they will stop spinning. The down-elevator reduces the angle of attack of the wing and restores the airflow over it.

If your model does not seem to want to spin, first try increasing the amount of travel of the control surfaces. This may be done by using the inner holes of the control horns or, if you have rotary output servos, using extended output arms on these. If this does not do the trick, then suspect that the centre of gravity is a little too far forward. Try removing some ballast from the nose (a very small amount at a time!), but if the model then tends to be unstable generally, stalling with the slightest provocation, or even with apparently none, it must be accepted that it isn't a spinning-type model. Let's hope your next model will be, because the spin is one of the prettiest and most satisfying manoeuvres, and it does not take an advanced aerobatic model to perform one.

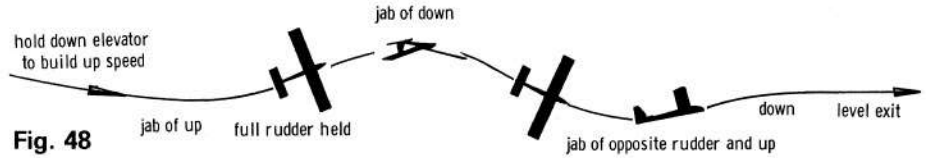


Fig. 48

The roll. This is a manoeuvre that can only be performed by the lower aspect-ratio models. (There are, of course, the odd exceptions, but this is a general rule.) If your intermediate model is of the "compact" type, you may like to try. As with most manoeuvres, except the spin, this needs a dive to generate a reserve of speed. At least as much as for the loop, and preferably a little more. When the model is going nice and fast, level it out and immediately apply full rudder. Now, as the model banks to the vertical-bank position, apply a small amount of *down-elevator,* holding it on while the model is inverted and releasing it as the opposite vertical bank is reached. Then, applying a little up-elevator, pick up the nose as the wings come level once more.

The timing of the elevator movements, and the degree to which they are moved, make an enormous difference to the neatness, or otherwise, of the roll. You may find that, if you put in too much down elevator, the model slows down when it is inverted. As a result of this slowing down, the effect of the rudder decreases, and the model is reluctant to continue rolling. You are then presented with the problem of how to bring it out of the inverted position! Don't take too long to ponder over it; things tend to happen quickly in these circumstances and you may find yourself running out of sky. Your choice, at this stage, is between pulling back on the stick and so pulling the model out by tucking it under, as it were, or doing the more scientific thing (if there is room!) and simply increasing the speed once more by just taking off a very little of the down-elevator so as to put the nose down (having kept on full rudder all the while) when the model should continue its roll. You will probably opt for the first method, as it will seem the natural thing to do, at least until you have had much more practice. Try not to pull out too suddenly, or tightly, however, as this sort of thing can pull a lot of "g" and impose quite a strain on the wings. (Fig. 48).

One can easily spend whole flying sessions just practising rolls and getting the timing right. If the lift is good and it is possible to take the model well out from the hillside, see if you can do two—or even three—consecutive rolls. The rudder is held on all the time, of course, and the elevators will be alternating between down (while inverted) and up (as it comes upright). Remember, the model should emerge from the rolls pointing in the same direction as it started. Incorrect timing of the elevator movements can easily upset this and result in the exit from the manoeuvre being anything up to 90° off the original heading.

Of course, with intermediate models, even the best rolls are not the true axial rolls of the aileron model, being all rather more like barrel rolls. The true barrel roll, however, requires the use of up elevator, so that the model performs a much more corkscrew-like figure. We shall see this when we come to fly the full-house aerobatic machine, in the following chapter, when the difference between the axial roll and the barrel roll will be more apparent.

Inverted flight. If your model will roll reasonably well, you may like to see if it will stay inverted for any length of time. If it momentarily paused inverted while you were trying your first rolls, as just described, there is a good chance that it can be kept that way, at least for a limited period. Nearly all intermediate models have flat bottomed wing sections, which makes them poorly suited for inverted flying. Some of them, however, can be coaxed into it, at least to some degree.

For the first attempts, you may prefer to start from a half loop (which should be commenced with the model flying towards or parallel with the slope) putting in the down-elevator when the model is upside-down at the top of the loop. If it does not seem to like this treatment, then you can simply continue the loop, and no harm done—except that you have performed a loop with a flat top—or perhaps a wavy one. If, on the other hand, things appear to be promising and the model is not losing too much height, then try to *steer* it a little, *but make sure all the time that you have sufficient height in which to pull out.* If the idea of half-looping into inverted flight does not appeal to you, then by all means half roll, which is, of course, the correct way.

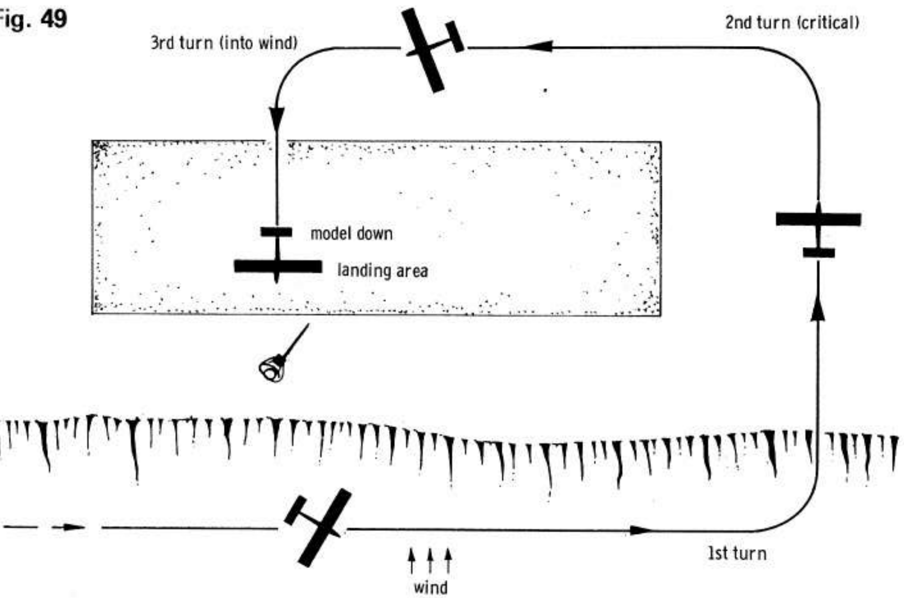
When we come to steering an inverted intermediate model we are confronted by a curious and interesting phenomenon. Although we have to "transpose" our elevator movements—giving "up" for "down" and "down" for "up"—we do *not* have to do this with the rudder. The model is inverted, and we give right stick; the rudder moves to our left but the model turns to our right! This may sound like so much nonsense, but the reader may check it for himself. It is the combined effect of the wing's dihedral (inverted) and angle of attack. So we "steer" normally while inverted, but transpose our elevator, mentally.

While flying inverted, try to avoid giving too much down-elevator, or you will stall the model. Keep the speed up by easing out some of the down, which will give better rudder authority, too. Don't be disappointed if all your model's inverted flying is "downhill." After all, that flat-bottomed airfoil section must be having a pretty hard time of it generating any lift at all, with its flat side uppermost, so that we can expect it to lose out, except in the most favourable conditions. It was fun trying, though, wasn't it?

Landing. With the elevator we have now very much more control over the landing of our model than we did with the rudder-only machine, especially over its speed. All the basic types of landing described in Chapter 4 still apply, except that the model can now be positioned with much greater precision.

If unsure of how the airflow is behaving at a new site, we can still employ the "float it backwards" technique, and augment the effect considerably by easing in some up-elevator, when the model will raise its nose and ride backwards (relative to the ground) more rapidly. An actual stall need not worry us unduly here, as we will be aiming to lose some height

Fig. 49



anyway. When the model is back as far as we feel is right (*i.e.* when it is just beginning to sink, in the slower moving air) we can feed in some down elevator to increase its airspeed for landing, finally easing off to "flare out" for the actual touchdown. This latter must not be overdone, however, or the model may rise up again and be caught by the wind, when it will undoubtedly turn over on its back or, worse, "cartwheel" with resultant damage to the tail. We want it to "sit and stick," so a gentle but firm and positive guidance is necessary.

Provided you have a flattish area at the back of the slope, the square approach will be your more normal landing pattern, though just how literally *square* it is will depend upon the conditions. Most people tend to clip the corners, so that, if we drew the actual path of the model, it would resemble more an inverted letter "J"—or even simply a large semi-circle. The general idea, anyway, is the same, namely to bring the model downwind over the slope, and then turn it back into wind in time to put down on the landing area.

With the model about 30 yards out, upwind of the hillside, and at a height of between 30 and 40ft. above the top of the slope, get it going parallel with the face of the slope and then turn it (say) left, which will take it on the downwind leg, roughly over the edge of the landing area (see Fig. 49). At this point it will be "mushing" somewhat—in other words, tending to sink vertically, much more than it usually does in relation to its forward speed (Fig. 50). This effect must be expected and allowed for in positioning the model for the next turn. This next turn points the model crosswind once more and is the critical one which decides whether or not we get down in the landing area.

The ability to judge the precise point at which this second turn is made (allowing for wind speed and the particular characteristics of the slope itself) will only come with practice. Left too late, the model will be into the "sink" area and drop down much quicker than

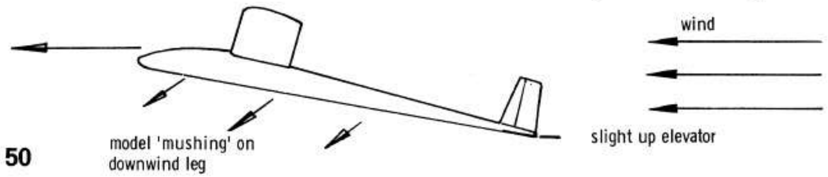


Fig. 50

normal (Fig. 51) (and, since the model is in air that is sinking, up-elevator will have little effect). Judged correctly, the final turn is made, towards the pilot, back into wind, to land the model nicely in the desired spot. But, if you turn too soon, you may find that the model is still too high when you turn back into wind, and is in danger of over-shooting the landing area and going out over and away from the slope again.

There is nothing much you can do about undershooting; if the model is too low at the point where it is lined up into wind, downwind of the landing area, it just lands short, and you will have to go and fetch it from the "rough" (which we hope is not *too* rough!) There are, however, ways of dealing with potential overshooting.

If, having flown the model into wind, and towards yourself, you now appreciate that it is too high and will overshoot, *do not attempt to force it down by giving down elevator,* as this will increase its speed too much. It is a better plan to make some "S" turns, which will shed height without increasing the speed. What we are doing here is, in effect, "using up" the excess height by flying more distance without the model travelling forward very much. And, of course, we lose height in the turns themselves.

Having lost sufficient height, line the model up into wind again and aim for a pre-determined spot for touchdown, having first ascertained that the area is clear of people, and having called out a warning to other fliers that you are landing. At this point it usually pays

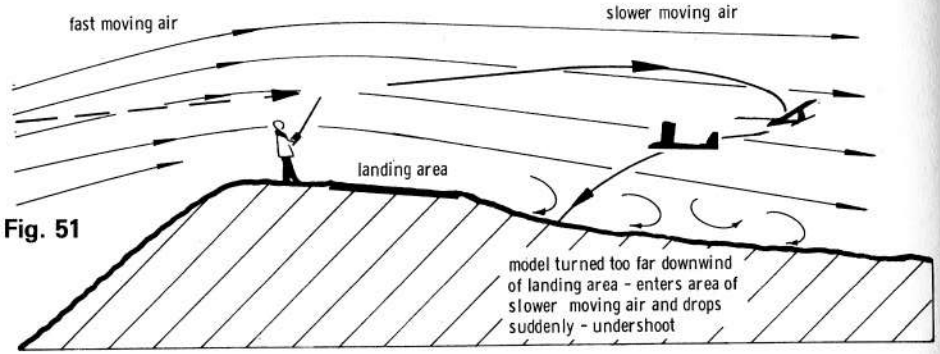


Fig. 51

to have some speed in hand—especially if there is some turbulence about. Not so much as one would have had by diving off that excess height, of course, but enough to keep the control response positive. Fig. 52 shows the pattern of this approach.

In really strong winds, the amount of speed one needs for a safe landing increases and one has to land the model very firmly, so that it does not get blown off course and generally tossed about by gusts. In light breezes, however, when there will probably be only slight air movement at the back of the slope, it is possible to float the model in very gently, flaring out and holding back on the stick until it just drops that last inch or two as stalling speed is reached.

The actual tightness, or otherwise, of the turns made during the landing approach is largely governed by the type of model being flown. The larger, heavier model (or even the larger light model, for that matter) will need to make a larger "square"—and, in fact, this will probably be one continuous turn, resembling a large semi-circle. But you will have to learn to judge the size of that semi-circle, in order to be able to set down at the desired spot. The smaller "compact" models, on the other hand, are usually very nimble and can almost be "turned around the pilot" and landed at his feet—with practice. What is more, the "rollability" of the low aspect-ratio models means that they will pick a wing up much more easily, when rudder is applied, than will the larger high aspect-ratio machines. This makes them easier to land in smaller and more awkward areas. Some of the larger models are very sluggish in this respect and, therefore, have to be lined up well in advance.

As an alternative to making the "S" turns described above, to prevent overshooting, we

may, of course, elect to let the overshoot actually happen. That is, to fly the model over and beyond the landing area, out from the hill to gain more height, then round again to have another-go at landing. You can perform any number of these "dummy runs" (provided you are not interfering with other fliers' landing approaches) until you feel you have the model in exactly the right position for landing. When overshooting and going out again, however, be very careful not to let the model slow down too much and be caught, over the lip of the slope, with insufficient forward speed. It is very vulnerable in this condition, and could easily be caught by a gust and thrown to earth. No amount of control movement will help here, as there is not sufficient airflow over the surfaces. Speed is essential for full control response, so if you intend to overshoot, ease the nose down to pick up the speed to see you safely through any turbulence at the edge of the slope.

Slopeside landing. As we saw with rudder-only flying, in the previous chapter, some slopes do not have back areas conveniently situated for our landings, so other methods have to be employed. Some slopes may have trees at the top, or hedges—or even outcrops of rock, so we have to do a slopeside landing. This simply means flying the model along the face of

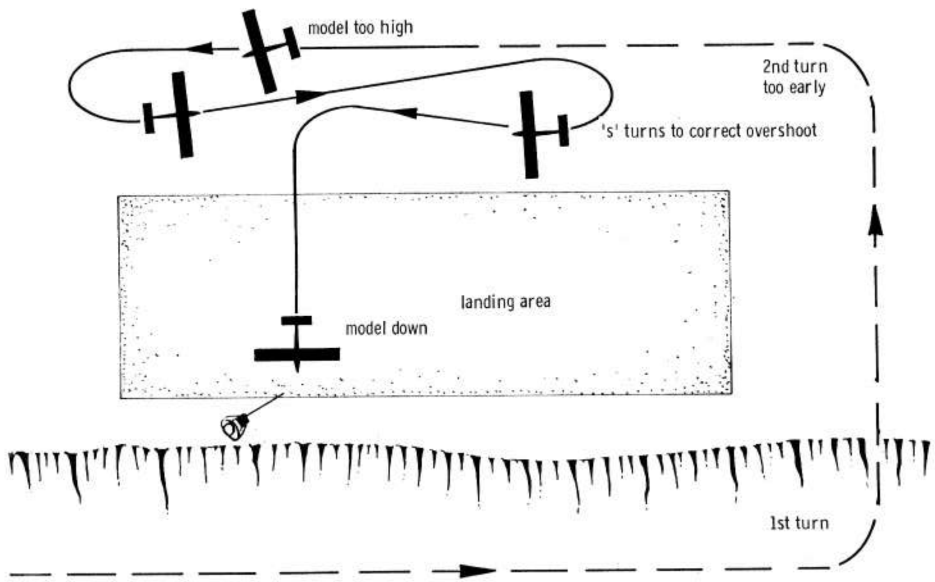
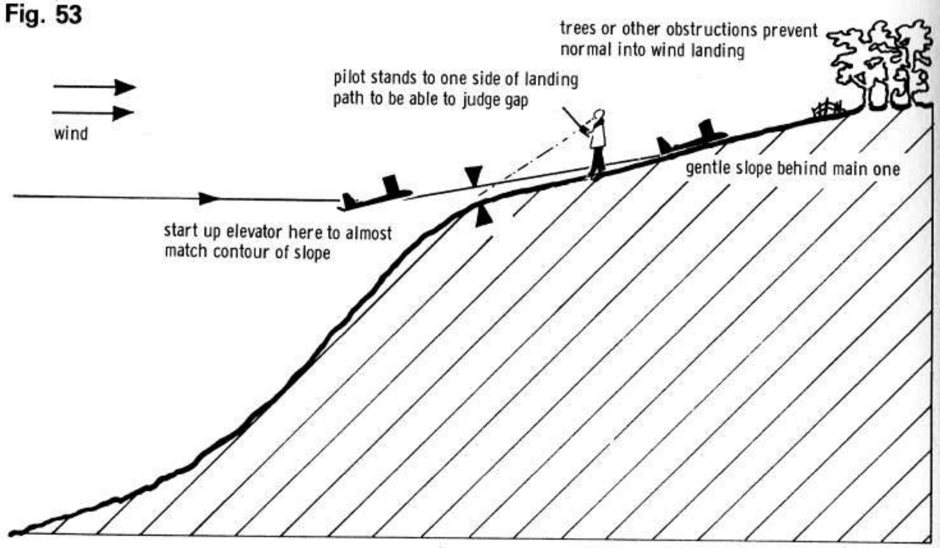


Fig. 52

the slope, as near as possible, and then slowing up by pulling in up-elevator until it settles onto the surface. If the angle of the slope is such that, before the model can be brought sufficiently near in, the inner wingtip will touch, then we must turn the model in towards the hillside and at the same time pull up the nose. Thus it should stall a few inches above the ground, and come to rest with little forward motion.

This sort of landing technique can also be used in bowl sites, and a variation of it is brought into use when the bowl is comparatively shallow—and, in fact, on any site that has *gently* sloping areas before the main drop starts. The procedure is simply to fly the model downwind *at* the slope, but gradually feed in up-elevator so that the model itself follows the contour of the ground, rising with it. Now gradually reduce the amount of up-elevator, so that the ground rises to meet the model, as it were. This is not actually as hazardous as it

Fig. 53



may sound—but we do emphasise that *it should only be attempted on the gentlest of slopes.* Fig. 53 shows the sort of thing.

The model will, of course, be travelling pretty fast, downwind, and will cover a lot of ground in a short time. This sort of landing should, therefore, only be made if there is a good expanse of gentle slope available, which has a fairly smooth surface (short grass) free from obstructions—and people! The pilot should be stationed to one side of the intended landing path, so as to be able to judge the gradually diminishing space between model and ground.

Flying towards you . . .

The business of flying the model towards themselves is often a great stumbling block for beginners to r/c flying, but can be especially so for the slope soaring beginner, because he tends to keep his model pointing into the wind for most of the time—pointing, that is, away from himself, and, indeed, in the early stages is advised to do so. The only time he experiences flying towards himself, therefore, is on the landing approach—where a wrong rudder command could mean a crash! If we are to improve our landings it is essential that we practise flying towards ourselves as much as possible, as soon as we feel we can fly well enough, generally, to do so.

The prime rule is NOT to turn your back on the model and look over your shoulder at it. This may enable you to push the stick to the correct side, but this way you will never learn to do the mental transposition that is necessary. Such behaviour reminds us of the early days of control-line flying (if the reader will forgive the mention of such a thing in a book on soaring!), when for inverted flying, we used to turn the *handle* upside down! This meant that we did not have to adapt to the model's being inverted, as "up-handle" was still "up-model." But, of course, this wasn't really inverted *flying* at all; it was just flying a model that happened to be upside-down. *We* weren't doing anything different, except turning clockwise instead of anti-clockwise. It was not until we forced ourselves to keep the handle the same way up, and *invert our responses,* that we learned how much more satisfying and sensible this was.

It is well worth persevering, therefore, until you no longer have to think about which way to push the stick. Stand squarely facing the oncoming model, and practise turning it to *your* left (*right* stick) and then to *your* right (*left* stick). When you have instinctive reflexes

about this, you will see how much more confident your landings become.

Eventually, with constant practice, you will find yourself not thinking in terms of which way you move the stick, but simply which way you wish the model to go. The model has become an "extension" of yourself and you simply "will" it into position—without even realising what stick movements you were making. This what you should aim at. The time it takes varies considerably. Some newcomers attain it in a month or two, others take as many years. Some never really reach this instinctive relationship with their models at all, but they still derive enjoyment from their flying.

Left or right circuits

A similar sort of thing applies to landing approaches. Don't always do anti-clockwise circuits; try changing over every so often, landing from left to right instead of from right to left. It is a great advantage to be "ambidextrous" in this way, as you will, sooner or later, find yourself at a site where it is only possible to make clockwise landing approaches and, if you have not learned beforehand, this lesson may come expensive.

Plan ahead

To conclude this chapter on intermediate soaring, we would like to reiterate the advice given at the beginning of the first chapter on flying. Look at each site you may go to, from the point of view of where you are going to land your model. Do this *before* you gaily launch from the hilltop, so that you will be prepared, in case, for any reason, you should need to set down in a hurry. Have a "flight plan," so to speak, with an alternative landing area (slope-side, or at the foot of the slope) should the lift suddenly disappear and catch your model lower than it started. This little bit of forethought could save you not only some embarrassing moments, but possibly a damaged model.