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GLIDER FLYING

Glider Flying

ANN WELCH

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British National records can be set up by citizens of the United Kingdom in any country.

Single-Seaters

Distance:	P. Lane, 460.5 miles
Height Gain:	G. J. Rondel, 29,100 ft.
Abs. Altitude:	H. C. N. Goodhart, 37,050 ft.
Goal Flight:	H. C. N. Goodhart, 360 miles
Goal and Return:	D. O. Burns, 351 miles
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Distance:	L. Welch & F. G. Irving, 254 miles
Height Gain:	C. Morgan & Stanbridge, 16,453 ft.
Abs. Altitude:	C. Morgan & Stanbridge, 19, 685 ft.
Goal Flight:	W. A. H. Kahn & J. S. Williamson, 194 miles
Goal and Return:	F. A. O. Gaze & Rosemary Storey, 170 miles
100-*km. Triangle:*	D. B. James & D. Marshal, 35 m.p.h.
200-*km. Triangle:*	F. A. O. Gaze & Rosemary Storey, 27.03 m.p.h.

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United Kingdom records can be set up by pilots of any nationality with flights starting from the U.K. All the following holders are U.K. citizens:

Single-Seaters

Distance:	H. C. N. Goodhart, 360 miles
Height Gain:	G. J. Rondel, 29,100 ft.
Abs. Altitude:	G. J. Rondel, 30,580 ft.
Goal Flight:	H. C. N. Goodhart, 360 miles

Goal and Return:	A. J. Stone, 222 miles
100-*km. Triangle:*	F. Foster, 46.3 m.p.h.
200-*km. Triangle:*	A. J. Stone, 40.54 m.p.h.
300-*km. Triangle:*	H. C. N. Goodhart, 41.2 m.p.h.
100-*km. Goal:*	M. Bird, 71.09 m.p.h.
200-*km. Goal:*	I. W. Strachan, 71.1 m.p.h.
300-*km. Goal:*	E. A. Moore, 57.4 m.p.h.

Multi-Seaters

Distance:	L. Welch & F. G. Irving, 254 miles
Height Gain:	A. D. Piggott & B. Whateley, 12,240 ft.
Goal Flight:	W. A. H. Kahn & J. S. Williamson, 194 miles
Goal and Return:	F. A. O. Gaze & Rosemary Storey, 170 miles
100-*km. Triangle:*	D. B. James & D. Marshall, 35 m.p.h.
200-*km. Triangle:*	F. A. O. Gaze & Rosemary Storey, 27.03 m.p.h.
100-*km. Goal:*	D. B. James & K. O'Reiley, 60 m.p.h.
200-*km. Goal:*	J. S. Williamson & D. Kerridge, 34.9 m.p.h.
300-*km. Goal:*	W. A. H. Kahn & J. S. Williamson, 43 m.p.h.

WOMEN'S RECORDS: SINGLE-SEATER

International

Distance:	Olga Klepikova (U.S.S.R.), 465.5 miles (6.7.39)
Height Gain:	Anne Burns (Gt.B.), 29,918 ft. (13.1.61)
Absolute Altitude:	Betsy Woodward (U.S.A.), 39,994 ft. (14.4.55)
Goal Flight:	Pelagia Majewski (Poland), 349 miles (30.8.59)
Goal and Return:	Anne Burns (Gt.B.), 268 miles (9.1.61)
100-*km. Triangle:*	Anna Samossadova (U.S.S.R.), 57.85 m.p.h. (27.6.60)
200-*km. Triangle:*	Anne Burns (Gt.B.), 49.09 m.p.h. (11.161)
300-*km. Triangle:*	Anne Burns (Gt.B.), 41.57 m.p.h. (8.1.61)

British National

Distance:	Anne Burns, 326.56 miles
Height Gain:	Anne Burns, 29,918 ft.
Absolute Altitude:	Anne Burns, 34,590 ft.
Goal Flight:	Ann Welch, 328 miles
Goal and Return:	Anne Burns, 268 miles
100-*km. Triangle:*	Anne Burns, 52.20 m.p.h.
200-*km. Triangle:*	Anne Burns, 49.09 m.p.h.
300-*km. Triangle:*	Anne Burns, 41.57 m.p.h.

United Kingdom

Distance:	Anne Burns, 282 miles
Height Gain:	Anne Burns, 16,750 ft.
Absolute Altitude:	Anne Burns, 18,400 ft.
Goal Flight:	Anne Burns, 192 miles
Goal and Return:	Anne Burns, 134.2 miles
100-*km. Triangle:*	Anne Burns, 37.3 m.p.h.
200-*km. Triangle:*	Anne Burns, 32.6 m.p.h.
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300-*km. Goal:*	Anne Burns, 39.7 m.p.h.

1 *What Gliders can do*

A VISITOR to a gliding club usually sees gliders being launched, flying about overhead, and coming into land. This is pleasant to watch as the aircraft are colourful and quiet. Occasionally, he may spot a glider much higher than the others, circling in the blue haze, but it is distant and without interest – a mere dot in the sky. So the visitor's gaze returns to the one that's just coming in to land, and although he thinks that gliding must be really rather enjoyable, he will probably have difficulty in understanding why some people become quite fanatical about it.

Possibly the uninteresting dot high up contains one of those fanatics, for although he is an object of little interest as seen from the ground, in his cockpit the situation is very different. For ahead of him lies the unexpected and the unknown. He is endeavouring to fly his glider to a destination perhaps hundreds of miles away using only the invisible currents that he can discover in the air, and finding his way by map and compass. If the weather holds, if he selects the right clouds, if he avoids getting lost, and if his flying is accurate, he may reach his destination: if not he will fail, and will have to land in a strange field. But the glider pilot has more than just pleasurable excitement, for he goes on his way in surroundings of great beauty and colour, and, apart from the gentle whistle of the air over his cockpit canopy, in silence and alone. For those who live in cities and work in noisy factories, gliding can give

the greatest delight. The visitor to the club does not, of course, see this side of the sport, and probably also does not realize how much gliding goes on, or how increasingly popular it has become. But many thousands of miles are flown every year by gliders which are not noticed because they are not heard. It is noise which makes people look up at aeroplanes, otherwise they do not often look at the sky unless there is a dramatic sunset, or drops of rain fall, when they glare at it in disgust. But on a good day in the summer there may be as many as a hundred gliders floating overhead far from their home clubs, searching out the cumulus clouds, recognizing a town or village as being on course, and slipping away into the distance. Sometimes, but rarely, a chance look upwards will reveal, perhaps, two gliders circling together quite low down. To the watcher there is something fascinating about their random wanderings across the sky, but they are noticed by very few.

Gliding is not, however, either mysterious or particularly difficult, although like most sports in which a person becomes keen it takes up a good deal of time. It is not one of the cheapest sports, although by no means out of the reach of students, or impecunious people. There is a fairly wide distribution of sites and clubs in Britain. No special skills or equipment are required in order to start, and it is safer than driving on the roads.

Sporting gliding began a bare forty years ago, and for a long time it was thought of as a limited, even futile, but amusing pastime. Now the World Records stand at 550 miles for distance, and over 40,000 ft. for height: average speeds at which cross-country flights are made may be as high as 70 m.p.h. In competitions, races over 300 miles long have been set, although this means searching out upcurrents for 8 hours with no pause for a cup of tea.

The world's best pilots will fly gliders to a chosen destination with a startling degree of certainty, and it is not unusual for all but one or two gliders to complete a triangular race of 70 miles length, arriving over the finish line sometimes within seconds of each other. But these are merely statistics. They give little idea of what is involved in such flights, whether they are a real human achievement or just a pleasant relaxation. How much is due to the glider? or to the pilot? – or are they both merely swept along by the weather?

One day, a few years ago, two pilots at Lasham in Hampshire, called Lorne and Frank, were hoping that the day would provide some soaring weather so that they could fly across country in a new two-seater. The forecast was hopeful, giving weather conditions in which it was possible that warm air upcurrents – thermals – would develop quite strongly. The wind was from the North-West. Although it is possible to fly a glider against the wind, the greatest chance of a long distance lies in flying with its help. The map showed, however, that the longest possible distance downwind was only 100 miles, to Dover, and after that there was the Channel over which no upcurrents would form.

It would be possible to reach Dover, if the lift was strong, in two hours, but on such a day thermal activity would continue for perhaps six or eight hours. It would be a waste merely to fly to Dover and land. The alternatives were to try to fly back to Lasham against the wind, or to attempt to get across the 22 miles of cold wet sea. If they could reach the other side there would be some chance of finding more lift, and of soaring on into Europe – to France, to Belgium, perhaps even to Germany. If they could reach the other side? The Channel had been crossed by glider

only a few times before, but never by a heavy two-seater. In theory, there was no reason why it should not succeed, but it is one thing to risk your own neck, and quite another to take someone with you. This is what Lorne argued, but Frank disagreed and said the risk was negligible. If they could not get high enough in the clouds on this side to glide across in safety, then they needn't set forth. They decided to try.

Quickly, the glider was got ready, and maps and sandwiches installed. Two small inflatable life-jackets were found, and they took driving licences because their passports were at home. At four minutes to ten the 'Eagle' was towed into the air, released at 2,000 ft. upwind of the field, and soon found lift. Lorne circled round and round in the thermal steadily gaining height, while Frank busied himself with the navigation. The 'Eagle' reached cloud base at 3,000 ft. and then set off in the direction of Dover, finding more thermals on the way without difficulty.

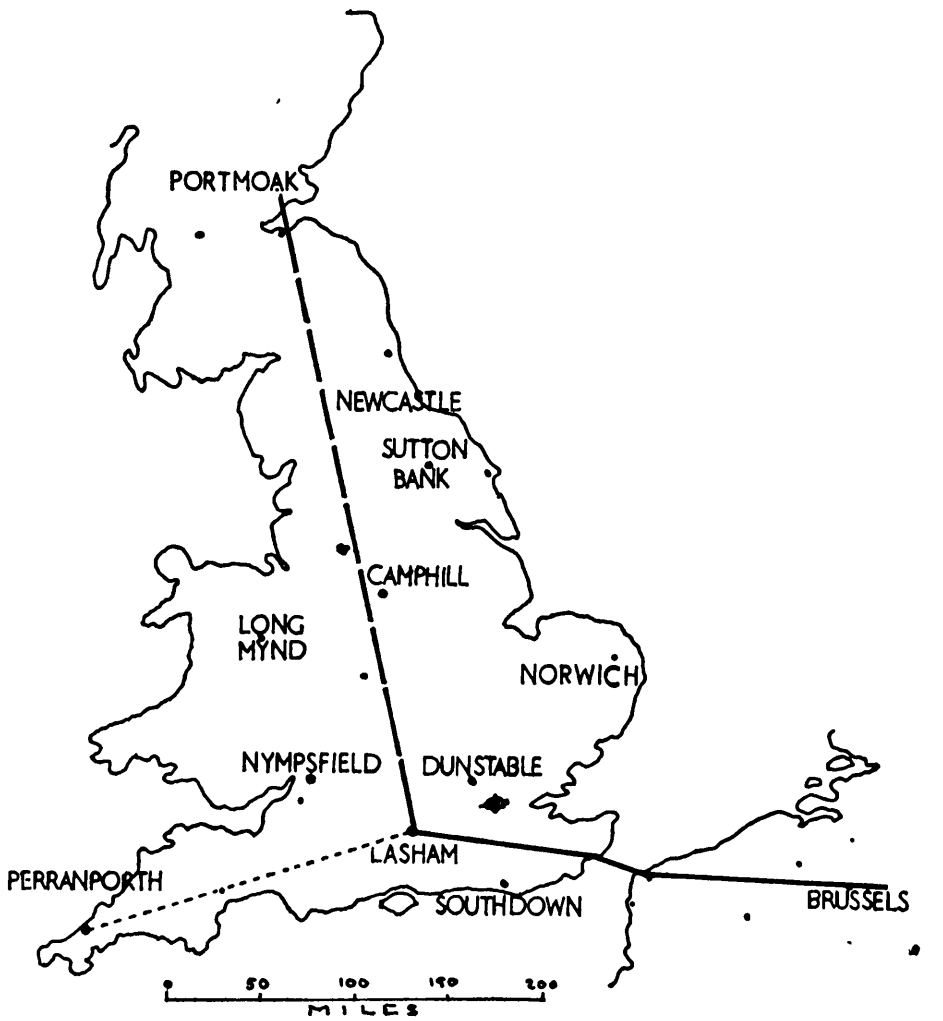
The coast was reached just before 12.30, and now came the big problem: to find a cumulus in the right place which would go high enough. If they could discover such a cloud, it would be possible to circle up into it, soaring on the rising air within it and on coming out at the top to race out over the sea towards the distant, and at present invisible, coast of France. They calculated that they needed 7,500 ft. in order to arrive on the Continent with enough spare height to search about for more lift. It was important to have enough in reserve because climbing high in the clouds would take them above freezing level, so that ice would build up along the leading edge of the wings, temporarily spoiling the performance of the glider. After nibbling at one or two clouds they found a good one nearly over Dover itself and circled up in its wet, dark and

turbulent interior. At 8,100 ft. the glider burst out into brilliant sunshine, surrounded by the dazzling whiteness of the clouds. The sky above was clear blue, and the view tremendous. They had already drifted out over the coast while rising in the cloud and the sea far beneath lay crinkled and glittering in the sun, while far ahead – too far to reach it seemed – lay the coast of France. They flew straight towards it furiously doing mental arithmetic. They *knew* that they had all the height that was needed, but somehow as the coast of England receded behind them, and the coast of France did not seem to get any nearer, they began to have doubts, and to do their calculations of glide ratios over again. In spite of the sun shining through the perspex from a clear sky, it was cold in the glider, and they shivered, and ate sandwiches for encouragement.

As they expected, but could not really believe, the glider arrived over Calais with enough height, and jubilantly they flew on over the town looking for lift. The first thermal they found was weak and difficult to circle in, but it was enough. With the boost to their height that it gave they were able to glide on, and a few miles further inland found a stronger one. Circling round and going up at about 300 ft. a minute, they were soon back at cloud base, now at 4,000 ft., and set course for Brussels and Aachen. There were good cumuli on the way, and they hopped from one to the next, although near Roules, about 80 miles from Calais, there was nothing, and the 'Eagle' sank lower and lower, while Lorne searched desperately for an upcurrent, however weak. Fortunately he located one when only a few hundred feet above the ground, and with relief circled up once more. At about 3 o'clock Brussels was reached, and the 'Eagle' from England flew silently high across the city.

But now the lift was beginning to weaken, and they could not go into the clouds because they were in controlled air space—air reserved for airliners. Soon the 'Eagle' was down low again, and this time there was no last-minute reprieve. At 15.42 it landed in a field 17 miles East of Brussels, having flown 254 miles and averaging about 44 m.p.h.

The unexpectedness of gliding was shown up in the 1959 National Championships at Lasham. The competition task



1. Some well-known gliding clubs with the route of the flights described and the 'milk run' to Perranporth.

was Free Distance, which meant that pilots had to go as far as they could go in the direction of their choice. As the wind was Southerly, the greatest distance possible was up the spine of England towards Scotland. The weather for soaring was not particularly good, with only weak thermals in the morning.

One of the top pilots, Nick, was not having much luck. He had been launched, failed to find enough lift to get away and had landed back, in company with quite a number of others. Some pilots, however, were managing to get up and away, and so Nick took another launch. The same thing happened, and he was soon back on the ground again, fed up with his own lack of success, but sure that the day was poor, and that although others had flown off, they would not get very far, so he went to lunch, thinking that he probably would not bother to take the last of his three permitted competition launches. Some pilots were still continuing to get away, however, so Nick decided, without much hope, to use his last chance, and went back to the launch point. On the way there his crew asked him if he was going to declare a goal. It is always worth doing this on any glider flight, however hopeless the pilot may feel about reaching it, because if the landing is made at a pre-declared point, there is always a chance of setting up a new speed or goal record. This is quite apart from the simple satisfaction that the pilot has in arriving at his destination. So Nick declared Portmoak, the home of the Scottish Gliding Union, climbed into his glider and was towed off. His declaration was almost a joke, since it was far too late in the day seriously to expect to soar 360 miles further than had ever been flown in the U.K. before, or for that matter, even half the distance.

By now in the control room reports were coming in

from gliders which had already landed. Fields in Oxfordshire, airfields in the South Midlands, all had their quota of gliders, and there were still more which had come down only a few miles away and were hurrying back for another go.

As the afternoon wore on, telephone calls gave the landing positions of more gliders, and the pinpoints on the map showed a straggly line of dots which slowly crept Northwards up England. There was a pause and then two calls came in close together, both from Yorkshire. By 5 o'clock there were very few 'missing' pilots and by just after 6 there was only one – Nick. The last pilots to report had done so from the Newcastle area, reporting thunderstorms, and big areas of 'clamp' – grey sky devoid of upcurrents – and had been working their way Northwards among the hail and lightning of big storms. No more calls came, and the telephone crews and pilots who had already returned went on waiting, looking at the hills pictured on the map, and thinking of the storms breaking about their tops.

No word.

At 8 o'clock, the telephone rang and jarred everyone's nerves. But it was just the driver of a retrieve car with some complicated story about running out of petrol, and could the chap who'd borrowed his reserve can, etc., etc. He was hurried off the line and the waiting went on.

At 8.30, after dark, the telephone rang again. It was Nick and he had reached Portmoak. The tension broke with wild excitement. It was unbelievable. What had happened was this:

Almost immediately after his third launch, Nick found that the weather had improved, and he connected with a good thermal, climbing rapidly in it to cloud base at

3,000 ft. There he found a 'street' of clouds lying exactly in the direction that he wanted to go. Forty minutes later, with the help of a strong following wind, he sailed past Oxford, having averaged 70 m.p.h. This was a much better start than he had expected, but life was not going to continue to be so simple. By four o'clock, he had only reached Chesterfield, where he was encouraged to meet up with a close rival in his red and white glider, whom he had thought must be well ahead, and they then entered the same cloud.

Nick found very strong lift and when he reached 10,000 ft. put on his oxygen mask while still circling. The lift was wildly turbulent, but it carried the glider to a useful 18,000 ft., although giving him an electric shock. He was surprised at this, as the darkness of his cloud had not been made eerie by lightning flashes. He came out of the huge cloud and continued on a Northerly compass course, unable to see the ground because of the film of ice on his canopy, and the murkiness of the air below. His friend had vanished. In spite of heavy icing on the wings, Nick managed to reach another band of big cumulus about 20 miles ahead, and climb in them to 15,000 ft. Again he set off to the North, somewhat concerned about what might be underneath him. Having no knowledge of the upper wind direction, and having been out of sight of the ground for over an hour, he reckoned that it was quite possible that he might be out over the North Sea. This impression became stronger when, through the haze, he thought he could see only water. As he sank lower, and penetrated the murk further this fortunately turned out to be moorland, bleak, but at least land. While worrying about his position, the ice suddenly broke away from the wing, and Nick watched the 20 ft. spear of frozen water sailing away astern, and wondered idly whether it would

have melted before it pierced the ground at the feet of some unknown hill walker.

At last he recognized a railway, as he continued to glide down. It positioned him 20 miles East of Carlisle, and he was now at only 4,500 ft. There was little likelihood of further lift, and the end of the flight was near. Suddenly he discovered that the glider was very gently, imperceptibly rising. There were no thermals, and no sign in the sky of anything which indicated upcurrents.

However, the unexpected rise persisted, and Nick realized that it was wave lift, an upcurrent caused by huge ripples in the atmosphere that sometimes develop downwind of mountains and ranges of hills. But it was possible to gain only 500 ft. in the feeble wave, and then Nick set off Northwards on the final glide. He just managed to reach the next valley, and was selecting a field to land in, when he ran into more lift near the hillside. Hastily forgetting about landing he concentrated on seeking out this new upcurrent. It was strong in places and difficult to locate but three-quarters of an hour later Nick, to his intense surprise, had worked the glider back up to 10,000 ft. He could now cross Edinburgh and did so at 6,000 ft., realizing that it would now be possible to reach Portmoak, which only thirty minutes before had seemed too remote even to consider. At his goal on the shores of Loch Leven the wind was very strong and Easterly, and after landing Nick had to wait in the glider so that it would not be blown over, until the astonished members of the Scottish Gliding Union, who had already put their own gliders away for the night, noticed he was there and came out to help him. This flight broke three British Records.

Not long afterwards another pilot, flying from his club in the Midlands, declared an Out-and-Return flight to a

goal some 120 miles distant. He had hoped that he might have a go at a record, but the weather was not very good. There were thermals and cumulus, but weak. However, he was launched, picked up an indifferent thermal, climbed slowly and drifted out of sight. About seven hours later, his friends were astonished to see him reappear at quite a good height, and then glide into land. It had not seemed possible that the record flight could have been made in such conditions, and they crowded round to congratulate him. Then the truth came out.

Having left in the morning, he had struggled on in sketchy thermals for about an hour, when he finally lost all hope of staying airborne, and was forced to land. As he was in reach of another gliding club, he went in there. He knew several of the members, and was delighted to find that they were flying a new type glider they had just bought. He had a ride in this, soaring for nearly an hour and doing a few loops, thoroughly enjoying himself, and landing just in time for a late lunch. After a rest lying in the sun, gossiping with his friends, he had a winch launch in his own glider, managed to connect with a thermal, found a few others in the right direction, and arrived back home in time for tea. As he said, 'A thoroughly satisfactory day's gliding.'

Travelling by glider in this way is becoming more usual each year, as the number of clubs increases which can give a visiting pilot lunch and a launch for an attempt to soar home again. For those pilots who either do not aspire to become record breakers, or who do not wish to be 200 miles from home in the evening, but who enjoy meeting their friends and having a good talk, flying from one gliding club to another high above the summer traffic jams is most enjoyable. Sometimes, of course, the pilot messes it all up,

and fails to get back, so his trailer has to come out after all and collect him from his ignominious field beside the traffic-laden main road!

People who fly gliders come from almost every trade or profession, and are of all ages, except that they may not fly solo at less than sixteen years old. Since flying a glider is not a matter of sheer physical strength, it can be enjoyed by both sexes. Pilots fly for many reasons – to be alone in the air, or to be with their friends; because they think it is excitingly adventurous or because they consider it comfortingly safe; because it is a highly scientific sport, or because gliders are simple to fly.

Almost anyone can learn to fly a glider. The only necessities are time, enthusiasm, reasonable fitness, and to go solo the possession of sixteen years. Children can fly dual as soon as they are big enough to reach the controls, so that they will be ready to go solo on their birthday. Men and women compete equally in competitions, and some fine record flights have been put up by the lighter sex, even though they sometimes need to carry ballast in the glider to offset the effect of slimming.

Gliders can be flown both well and safely by pilots who have been unfortunate enough to lose a leg, or have other crippling disabilities, and who obtain very real pleasure in the freedom of movement they have in the sky.

The only trouble about gliding is that it is dependent on erratic weather, is time-consuming, and often infuriatingly frustrating, but its adherents do not mind; they would not, could not, give it up.

2 *Gliding Clubs*

A GLIDING club is an organization run by its members, which owns training and soaring gliders and the necessary launching equipment. It operates either from a site of its own, or from someone else's airfield. Anyone can join a club, and learn to fly and soar using club gliders.

Almost all gliding in the British Isles is carried on in the Clubs. This is because it takes more than just the pilot to operate a glider. Quite a lot more people, in fact, because on the ground a glider is an inanimate, expensive, and easily damaged piece of equipment. It has to be pushed or towed about, carefully inspected and maintained, and launched into the air by mechanical equipment, which has to be operated by competent people.

If these jobs were carried out by professionals, the cost of gliding would be very high; instead they are done entirely by the members themselves, except that in the larger full-time clubs a small number of professionals provide the necessary continuity. This means that on joining the new member will find that in addition to learning to fly there will be many other things to find out about and do.

Obviously he will not be expected to inspect gliders or become an instructor for a long time, but even in his first weeks he will learn to handle aircraft on the ground, signal gliders into the air, and even to help with launching them.

For many people much of the fun of gliding is the work on the ground, and getting to know their fellow members.

All sorts of people go gliding; and the new member is sure to find others with the same interests as himself, as well as the same enthusiasm for flying. Occasionally, a few people find that perhaps they are not so keen as they thought they might be on the actual flying, but they continue to come regularly to the club, partly because they have made many friends, and partly because there is some other aspect of the sport that they enjoy, such as looking after the aircraft, retrieving them after long flights, or becoming involved in the mechanical work of launching. Even for the uninterested wife of a madly enthusiastic husband there is plenty to do. There are tea huts to help run, or even new club houses to design; there is always a need for a Committee secretary, or a keeper of flying records, or an organizer of dances and raffles, but if she wants to fly herself she can do so just as well as her other half.

Gliding is not a particularly good family sport if the children are very small, unless the mothers get together and organize suitable play facilities for them, but for those of about ten or eleven and upwards, whose parents are fully involved with gliding there is plenty of fun to have. In many clubs the bigger children of members have learnt to drive tractors, splice ropes, navigate retrieving cars, and are competent and responsible at looking after aircraft out on the field, while waiting to grow big enough to fly themselves.

There are some forty-five clubs in the U.K. distributed fairly generally over the whole country, details of which will be given on page 203. These clubs are either Members or Associate Members of the British Gliding Association, 75 Victoria St., London, S.W.1, which is the body responsible for central organization and control of the sport.

The Association is run by a small full-time secretariat, with volunteers who have been elected to office by the clubs themselves doing the technical and policy work in their spare time. There are no pilots' licences, or other government controls; instead, supervision of airworthiness, instructor testing, and competition regulations, etc., are dealt with by sub-committees of the Association, as are the National and International pilot proficiency certificates. Other sub-committees look after the problems of club sites, publicity, etc., and liaise with the Ministry of Aviation over matters concerning legislation and control zones. The members of the Council and the Chairman of sub-committees are all pilots themselves, and prominent members of their own clubs. They well understand the difficulties and do a great deal to keep down the cost of the sport. There is thus a very close link between the National Association and the Clubs themselves.

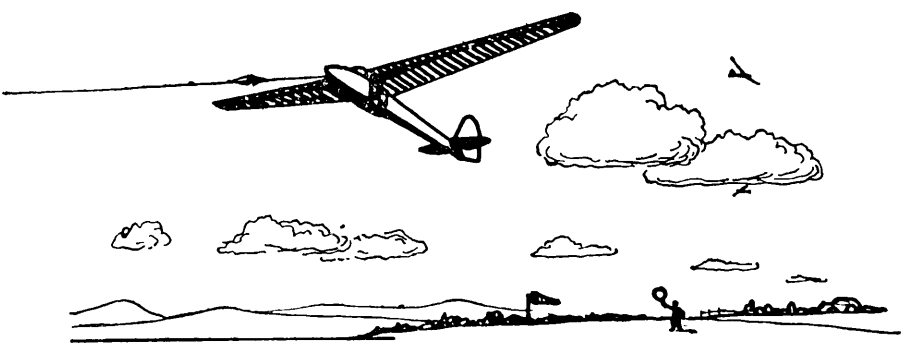
Anyone interested in joining a club should first write to the B.G.A. which will supply information on all its Clubs, including instructional courses, and costs, etc. Having discovered which is the most convenient or suitable one, the best thing is then just to go and visit it. Unless it is a full-time club, a Saturday or Sunday should be chosen, and it is not necessary to give advance notice of arrival.

If the weather is fine it is worth making a full day visit, taking a picnic. It is often colder on an open airfield than in a garden, so suitable clothes should be worn. On arrival the car should be parked in the car park or clear of the flying-field. If in doubt, any club member wandering about should be asked where it is possible to park in order to see as much of the flying as possible. He should also be asked how the launch point can be reached, without getting in the way of gliders coming in to land. Most clubs are

very happy for visitors to come and watch, as long as they do not create any hazard. If they want to know anything, they should not be afraid to ask. Most clubs have dozens of spectators who have no intention of joining, and to even attempt to look after them individually would mean that no one would have any time to fly.

It is usually possible for a visitor to get a flight in a two-seater glider for between 10/– and 15/– to see if he enjoys it. He will have to become a temporary member of the club in order to obtain this trial lesson, but this is a simple formality and the membership fee is invariably included in the price that he pays for the ride. Under 21's have to have their parents' consent.

The aircraft is likely to be a two-seater with an open cockpit, and the pilot and passenger sitting side by side. The glider will be launched by winch or car, to a height of 800–1,000 ft. and the flight will last about five minutes, unless some lift is found. The pilot will see that the passenger is comfortable and that the safety straps are adjusted properly; he will explain how the glider flies, what the instruments indicate, and what the flight will feel like. The launching cable will be attached, signals for the launch given, and the glider will run along the ground and take off.



2. Glider being winch launched.

After a few bumps on the grass, the smoothness will tell the passenger that the glider is now airborne. Soon after this, the pilot will start to climb the glider more steeply upward, and it will not be possible to see much ahead. The rush of air past the cockpit will make quite a noise during the launch so that talking is more difficult. To many people the initial upward surge of the launch may feel slightly alarming, but this is only because it is strange. Learners get used to it very quickly, and after half a dozen launches, the instructor will have difficulty in restraining his charge from climbing much too steeply.

As the glider nears the top of the launch, it will be flying in a more level attitude, and it will be easier to look around, and admire the ever-widening view. On a clear day it may be possible to see as much as 30 miles in every direction – an area of over 2,000 square miles. Somehow the open cockpit, and the gentle airflow after the glider has released the cable and is floating free, enhances the clarity of the scene. Often sounds on the ground, such as motor-cycles or barking dogs, can be heard above the soft whistle. Perhaps the gentle scent of hay or a heath fire will pervade the air through which the glider flies, or a bird will wheel past quite close and not be frightened. While the passenger is taking in the scenery, the pilot will have pulled the release knob to get rid of the cable, and turned gently away to make his circuit of the field. He will point out landmarks, or the distant coast, speaking little louder than his normal voice. He may show his passenger the indication of speed, height, or the rate of sink or rise on the instruments, and if the weather is calm, let him hold the controls to get an idea of what they feel like, and to show him that far from strength being required, they only require very light and gentle handling. The passenger will be able to look down

at the airfield from which they were launched, and see other gliders on the ground and little ant-like figures pulling and pushing them about. A feeling of elation or superiority may set in. A few more turns and the glider, much lower now, will start its approach to land. The pilot will be adjusting his height carefully because he will want to land as near the launch point as he can so as to save a walk. He will increase the speed slightly, and open the airbrakes hidden in the wings to steepen his glide. Although these will enable the glider to come down faster, there will be no sensation of dropping unless the air is very rough, in which case the passenger would be warned in advance and probably would not fly. Even though the rate of descent is quite marked, the glider feels so firmly supported by its wings that there is no feeling like that of descending in a fast lift. As the glider nears the ground, the passenger will probably find the earth a blur, and then with a gentle rumble as the wheel touches, the sound will die away, and the glider come gently to rest. As it does so one wing will sink to the ground, and the flight will be over.

If the passenger decides that he would like to take up this gliding, he can then join the club as a flying member, starting either with a course, or as a weekend pilot. This aspect will be dealt with in the chapter on learning, but when considering joining the future pilot may want to think also about the more mundane questions such as distance from home, the availability of public transport, the cost, food, accommodation, and other attractions that may exist either at the club or in the district for those members of his family who do not wish to fly at the present time.

Many people like to come to their gliding club for the whole weekend, and so clubs usually have some residential

facilities in the form of bunkhouses or bedrooms. The standard of comfort is rarely high, but the cost of a bed for the night is only a few shillings. The possession of a good private sleeping-bag is advisable, because club blankets never seem to be quite adequate for cold or damp nights. Some clubs allow members to bring their caravans on to the site, and this naturally makes life not only more comfortable, but more acceptable for the whole family. All the bigger clubs supply regular canteen meals. These are also quite cheap, but in some places must be booked at least an hour or so in advance. Smaller clubs may not have clubhouse facilities, and make do with a hut or caravan which combines the jobs of store, map room, shelter and everything else. At such a club it is necessary to bring food and a thermos, although at most of them some public-spirited members will brew up tea, coffee or hot soup at suitable intervals.

For some extraordinary reason it always seems to be colder and windier at a gliding club than anywhere else, and suitable protective clothing is advisable. This does not necessarily mean that anything special will have to be bought. Clothes intended for skiing or sailing, with the addition of shoes or boots to give protection against cold and wet ground, are almost ideal, although it is astonishing how dirty it is possible to get in what at first sight seems a very clean sport. In summer a hat to shade the eyes and face against glare may be necessary, or alternatively good dark glasses. If the prospective pilot is not equipped for other outdoor sport, then two pairs of trousers, a couple of sweaters and a short coat or thick jacket, plus a cap or woolly hat are perfectly adequate. Most clubs know the nearest supply source for the thin grey poplin ex-service flying suits, which sell for about 35/– each, and

make almost ideal over-garments for gliding. So popular are they that the casual visitor may get the idea that everyone is in uniform.

The formalities on joining a club are simple. The prospective member signs a form which indemnifies the club in the case of injury, and certifies that he suffers from no illness or disorder which might endanger his aircraft. If he is under 21 the signed consent of a parent or guardian will be required also. He then pays the entrance fee (about 2 guineas to 10 guineas), and subscription (about 5 guineas to 8 guineas) for the period for which he is joining – usually one year – and, providing that the club has no waiting list, can start flying straight away. By law, however, he is not allowed to buy drinks in the club bar for forty-eight hours.

One thing the prospective member or his relations will want to know about is safety. This is understandably prudent. What are the chances of a glider pilot being involved in an accident, and how serious is it when he is. Obviously, any sensible person realizes that no sport is absolutely safe: even in croquet it is possible to receive a nasty crack on the ankle. Where does gliding lie between, say, croquet and international motor racing? There are two questions which need an answer. What is the risk of injury or death to the pilot or others, and how much risk is there of damaging the glider?

To take the second one first. Gliders are easily damaged on the ground or if coming heavily in contact with anything solid. They are also expensive pieces of equipment. All this is known and the first thing that is taught is how the aircraft should be cared for on the ground. It must be parked so that it does not blow over, and bystanders must be prevented from treading on it. In this respect gliding is at a

disadvantage compared to many other sports. Only a little paint is lost if sailing dinghies jostle each other at their moorings, skis can be stacked together, or dropped, a boat can run aground and a car can go on driving with a crumpled wing, but a damaged glider is not safe to fly until it has been repaired. If a glider pilot does a bad landing or carelessly hits a bush on the approach to land, or lands too near parked aircraft and runs into them, it is almost certain that the glider will receive some damage, even if only very slight, and it will then be out of service. Gliders are naturally insured against this sort of activity, but it is nevertheless true to say that for accidents in which the equipment is damaged gliding is at a disadvantage compared to other sports in which the equipment is much more robust, and where penalties for using it in a slightly damaged state are virtually non-existent.

But what about the risk to the pilot? What are the statistics? The figures for the U.K. show that at the present time one person manages to get himself killed for every 200,000 flights made, and that this figure steadily improves over the years. Additionally, a few people collect some injury, about ten a year only. The cause of these accidents is invariably due to pilot error, often overconfidence, and not to circumstances beyond his control, but the surprising thing about glider accidents is how rarely the pilot gets hurt, even though the aircraft has been thoroughly smashed. Gliding is the safest of all airborne sports, and there is no reason why the careful and sensible pilot should ever have an accident at all. No one, however, of any initiative wishes to spend his life wrapped in cotton-wool, particularly if common sense and competence are all that are required for safety.

The main thing that a pilot loses if involved in an

accident is his self-respect. A few years ago a pilot hit a tree when landing in a field, and cartwheeled upside down into the ground. When the noise of splintering wood and the dust had settled, the pilot, unhurt, crawled out from under the wreckage to find a tall fierce old countryman staring down at him. It was difficult to feel dignified in such a situation, but the pilot at least tried to explain what happened only to be cut short by the old man sadly shaking his head, but not with sympathy. 'Young man,' he said, 'if God had meant you to fly, he would have given you wings, and then you might have been some good.'

3 *About the Gliders*

THE modern high performance glider is the result of forty years of gradual evolution, and although there are considerable variations in their details, all the best designs are similar in basic outline.

The performance of a vehicle which is power driven is normally stated in terms of its speed, its acceleration, its range, or its weight-carrying capacity; with gliders different criteria apply, the two most important characteristics being the sinking speed and the angle of glide. The sinking speed, which is usually given in feet per minute, is the height which a glider loses in each minute. For the best of modern gliders this is about 100 ft. The gliding angle is the flattest angle at which a glider can come down, and is given as a ratio in the same way as gradients of hills are expressed. While claims of 1:40 have been made for some experimental aircraft, it is probably true to say that no production glider has a flatter angle of glide than about 1:35. This means that the aircraft will come down 1 ft. in flying 35 ft. horizontally. These figures are slightly, but not much, better than those of soaring birds, of which the albatross is one of the most distinguished examples. A slow sinking speed can be achieved by having large wings, and a low weight, or in aeronautical parlance, a low wing loading. This is the weight carried by each square foot of the wings. It is usually between 4–6 pounds per square foot for a modern glider, 1 pound per square foot for a seagull, 8 for

an old-fashioned aeroplane like a Tiger Moth, and 80 for a jet airliner.

If a low sinking speed was the only important characteristic required, it would pay to have very large wings. However, in order to be able to convert the height gained into the greatest possible distance a good angle of glide is even more important. This demands a smooth streamlined shape and slender wings. The slenderness of the wings is called the aspect ratio, which is defined as the span (distance from tip to tip), divided by the chord (distance from the front to the back of the wing). Typical figures for a glider are a span of 60 ft. and a mean chord of 4 ft., giving an aspect ratio of 15. Some gliders have been built with aspect ratios as high as 30, in contrast to a buzzard, where the figure is about 4 or a modern airliner where it is about 10.

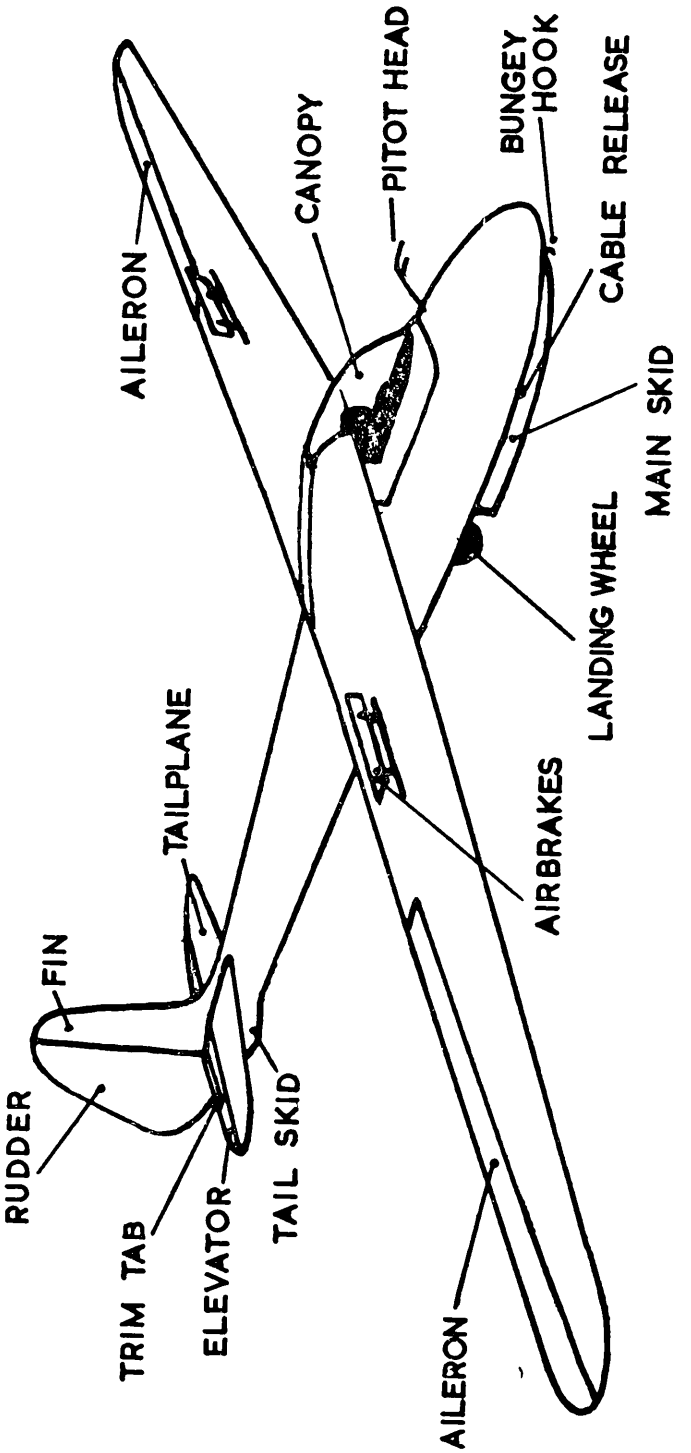
When circling in an upcurrent it would be best to have a glider which would sink down through the air at a low rate when it was being flown very slowly, as this would enable the pilot to fly in small diameter circles. However, such an aircraft, which is technically possible, would have to be very large and would not be much good for cross-country flying where it is advantageous to be able to fly fast at a good angle of glide. Most gliders have a minimum flying speed (stalling speed) of between 30–40 knots (33–43 m.p.h.), and cruise between upcurrents from 45–80 knots.

Because of the clean shape, a glider diving vertically earthwards would be able, theoretically, to reach something like 300 knots. If it were built to withstand this in practice it would have to be made exceptionally rigid and it would be very heavy. As there is no advantage in going at these speeds most gliders are designed for top speeds of from 120–150 knots. As these speeds can be achieved in a

comparatively flat dive after a loss of height of only a few hundred feet, it is important that the pilot is aware of, and abides by, the limitations (which are placarded in the cockpit). As a safeguard, gliders are fitted with airbrakes on the wings which limit the speed to a safe value even in a vertical dive. These brakes are used also to adjust the angle of glide when coming into land.

The achievement of a good performance in terms of sinking speed and gliding angle can be obtained only by very skilful aerodynamic design combined with clever structural techniques. There are no short cuts, and since there is no engine the motor-car method of increasing the horse-power does not apply; improvements in performance can be obtained only with better wing sections, cleaner design, or lighter structures. Experience over many years has shown what loads a glider is subjected to in the air, and the aim of the designer is to make the aircraft just strong enough for the lightest possible weight. To those who are not familiar with engineering practice this may seem rather peculiar, but the same principle applies to all aircraft, and for that matter to bridges, electricity pylons and things like that.

The achievement of a really light design is always an expensive process, and new gliders have much thought put into them. The design, in terms of aerodynamic and strength calculations, and the drafting of the numerous drawings which are required, takes a team of three men something like a year to do. In order to obtain the lightest possible weight first-class materials have to be used, and at the present time there is little to choose between wood, steel, and aluminium alloy. Glass fibre reinforced plastics have been used to a limited extent, and it seems likely that the use of this material will increase in the next ten years.



3. Glider details.

In England, virtually all gliders are made of wood, spruce being used for the main members, with plywood of either birch or gaboon, a light mahogany type wood, for the skin. The weight of a 60-ft. span single-seater is about 600 lbs. The largest members are the main beams (spars) in the wings, which have top and bottom booms of about 2 ins. by 3 ins. in cross section in the middle. However, most of the parts are very much smaller, and the pieces of the ribs, for example, are smaller than a pencil.

The plywood which is used to cover the fuselage and the non-fabric-covered parts of the wings is quite thin, never more than one-eighth of an inch and sometimes only one-sixteenth. All the wooden parts are held together with glue, without any nails or screws. This glue is normally the urea type (Aerolite) and is the same as that used for building dinghies.

There are comparatively few metal parts in a typical wood glider; the fittings where the wings join to each other and to the fuselage, the hinges of the control surfaces, and the controls themselves. These parts are normally of steel, although sometimes light alloy is used. The connexions between the stick or rudder pedals and the control surfaces are made with flexible steel cable about one-eighth of an inch diameter.

Although simple when compared to a modern aeroplane, the construction of a glider is fairly sophisticated when compared to a boat. Because its reserve strength is less, and also because the result of structural failure might be lethal, it is essential that the parts do not become disconnected, fail or jam. For this reason making a glider is not a matter to be undertaken lightly by an amateur, and it is a waste of time to consider designing one without several years of aircraft design experience. Construction

to an established design is possible, but it must be realized that working to a set of drawings will take some 2,000 hours of labour. However, kits of parts of a number of aircraft are available, and construction from a kit is much easier.

Gliders are not allowed to be flown from club sites unless the design and construction have been approved, and they have a certificate of Airworthiness. This is issued only after extensive prototype test flying.

Because of the importance of saving weight and drag, gliders are fitted with a very simple undercarriage, usually consisting of a long skid under the nose, a single pneumatic wheel, and a small tailskid. Because there is nothing to keep the glider level laterally, on the ground it leans over on one wing tip. This apparently crude arrangement is always a source of surprise to those not used to it. People ask 'Why doesn't the wingtip get broken when you land?' 'Why don't you fit a more conventional undercarriage?' This could quite easily be done, but it is not necessary. It is no great hardship for someone to hold the wings level for take-off, and on landing the aircraft can always be balanced with the ailerons until it comes to rest, when it flops over gently on to one wingtip. Slight damage may occur if there happens to be a sharp stone or a stake underneath, but this is a rare occurrence.

In order to achieve as good a performance as possible all soaring gliders have a carefully streamlined fuselage in which the pilot sits, usually in a fairly recumbent attitude, in a cockpit enclosed by a canopy made of a perspex moulding about one-tenth of an inch thick. Between the pilot's knees is a stick connected to the elevator and ailerons, and his feet have two pedals connected to the rudder. On his left are the auxiliary controls such as the

cable release and the airbrakes. Usually the last part of the backward movement of this airbrake lever works a brake on the landing wheel. The instruments are grouped on a panel in front of him. While some aircraft have a beautifully pointed nose and a canopy at a very flat angle, it is generally accepted that the importance of a good view is so great that a slightly blunter shaped perspex cover is to be preferred. Although the cockpit should be draught-free, it can be cold when flying high up; on the other hand, it may be almost too hot sitting in the sunshine low down on a summer day. Most gliders have little windows in their canopy, and a ventilator to stop it misting up.

There are about 10,000 gliders flying in the whole world at the present time, of which about 500 are in this country. The cost, depending on purpose and performance, is between about £1,000 and £2,000 new, and from £400 second-hand complete with a certificate of airworthiness.

4 *How Gliders are Launched*

A GLIDER stays up by means of the air currents alone. This is fine once it is in the air, and suitable lift is present. But it is the present-day glider's disadvantage that it cannot launch itself. Many people have thought a lot about personalized rockets, but these are at present too expensive and complicated. The glider is therefore launched by an outside source of power. In winter, and in some sorts of weather, there are no upcurrents, and having got the glider airborne, usually to at least six hundred feet, it will then merely glide back to earth again. This is particularly the case with training flights, and so the means of launching has to be both cheap and efficient in order that it can provide repeated launches without delay.

There are four methods of launching in use: car towing, winch launching, aero towing, and bungey launching. They are all valuable in their particular way.

Car Towing

This is a simple and relatively cheap method. It will get the glider up to about a thousand feet, the actual height depending on the ground run available, something like three-quarters of a mile being needed. The principle is as follows. The glider is towed faster than its minimum flying speed by a long wire attached to the tow car. Once in the air, the pilot brings the glider into a climbing attitude, and while still attached to the wire it rises steeply, rather like a

kite. In due course he releases the wire from the glider and flies away.

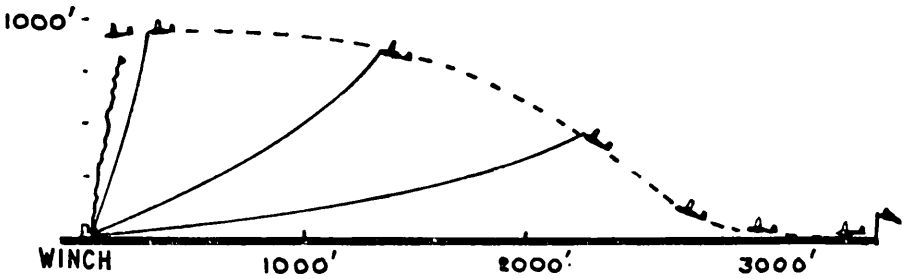
The vehicle itself needs to have an engine of about 100 horse-power and preferably fluid drive with an automatic gear change. This is not so necessary if the driver is good, but it is easier with the automatic change to give smoother launches. The car should have a good rearward view, and be fitted with a standard glider-type automatic override release hook, attached somewhere near the car's centre. The launching wire is usually heavy gauge piano wire, which has standard rings to fit the car release. At the glider end of the wire there is a weak link, which is less strong than the glider itself, a small parachute to keep the wire straight after it is dropped, and about eighteen feet of rope to keep the parachute clear of the glider. The standard rings which fit into glider releases are spliced into the end of this.

In order to launch, the wire is laid straight out between the car and the glider and attached at both ends. The signaller gives the order 'take up slack' to the tow car driver to tauten the wire, and then the car is driven away fast down the runway. The actual speed of driving will depend on the wind strength, take-off always being made into wind. If there is little or no wind, the car will have to be driven at 45 to 50 miles an hour to give the glider enough speed, but if the wind is strong the car driver will subtract his estimate of its strength and drive at a suitably reduced speed. For example, if the wind is 20 miles an hour the driver will need to accelerate to only about 25–30 miles an hour, and then as the glider climbs into the stronger wind higher up, he will be able to reduce his driving speed still more.

At the end of the launch, the tow car driver will drop his

end of the wire, turn round, pick up the glider end and take it to the next waiting aircraft. In this way one car can launch gliders about ten times in an hour.

Car launching is suitable only if there is a smooth enough runway on which the vehicle can drive fast.



4. Winch launch.

Winch Launching

The principle is the same as for car towing but the wire or cable is wound in on to a drum, which is rotated at speed by a powerful stationary engine, instead of being towed along. It is a rather more complicated method of achieving the same result, but has to be used if there is no runway available. Flexible stranded steel cable of about one ton or twenty-five hundredweight breaking strain is used instead of piano wire.

First of all the cable has to be towed out from the winch to the waiting glider by a tractor or retrieve winch. If this is done too fast or jerkily there is a risk of the cable over-running the drum and tangling. In order to save time two or more winch lines are often run side by side, using either a winch with two drums, or more than one single-drum winch, and the cables are pulled out together. The winch driver then launches a glider on each cable in quick succession, after which the tractor again pulls the cables

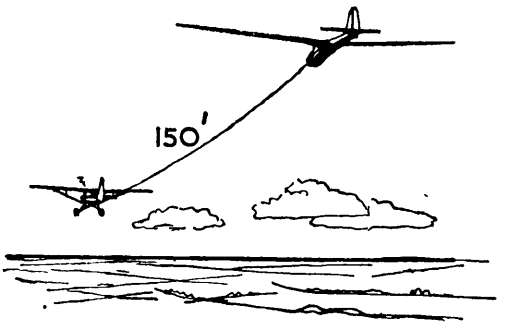
back simultaneously to the launch point. About twelve launches an hour can be done with a two-drum winch in this way.

Winch launching can be carried out over rough country, and even across valleys and streams if necessary. If the wind is very strong, it is possible for the glider to climb to several thousand feet on the cable in exactly the same way as a kite will gain height if the string is let out gradually.

Both winch driving and car towing can be done well by any sensible car driver who has reached the stage of flying solo.

Aero towing

Whereas a winch or tow car can launch the glider only to a point almost above them, and to a limited height, the aeroplane can tow it to a required place and to any reasonable height. If several aeroplanes are used, a very high rate of launching is possible – up to sixty an hour is practicable from a single launch point, and for this reason aero towing is used to launch gliders in competitions. It is possible to tow two or even more gliders at the same time with one aeroplane, but this is not practical for ordinary club flying. The standard aero tow takes the glider to 2,000 ft. and leaves it a short distance upwind of the field, and if possible in lift. The procedure is simple. A short rope is attached to the glider's normal release hook and to a similar release hook at the tail of the aeroplane. This rope is usually made of nylon, of about 1,000 lbs. breaking strain, with linked rings to fit the releases at each end. If a stronger rope is used, it must contain a weak link at the tug end of a strength not exceeding 1,000 lbs. Occasionally tow ropes are made of hemp or sisal, but nylon is preferred because



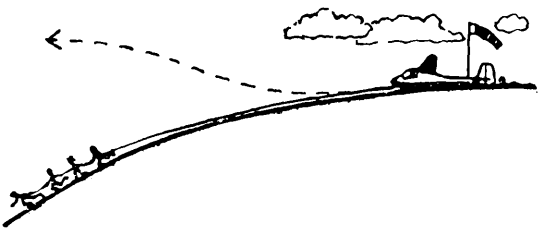
5. Aero tow.

it gives a much smoother tow. They are normally 150–200 ft. long, although it is possible to tow on ropes as short as 15 feet. When the rope is attached, the tug pilot is signalled to take up the slack and when it is taut, to take off. The glider normally gets off the ground first, and when the tug becomes airborne, they both climb away together. When the glider pilot wishes to release, he lets go of the rope at his end, and the tug dives away and lands back on the airfield. Sometimes the tow rope will be dropped before landing, but if there are no obstructions, it will be left attached.

Aero towing can be used to retrieve gliders from cross-country flights, and is a simple way of doing this provided that the glider has landed in a big enough field, or at an airfield. Aero towing is easy and safe and although rather more expensive per launch than winching, need not be so in terms of glider flying time, since an aero tow takes the glider higher, and can give it the best chance of finding lift.

The requirements of the tug aeroplane are that it shall be able to fly slowly enough to tow the glider safely, and that it shall have enough power to have a reasonably good rate of climb with the glider on the back. It should also have an adequate rearward view from the cockpit so that

the pilot can see the glider he is towing. Light aeroplanes such as Tiger Moths, Austers, Chipmunks, etc., which have an engine of 120 h.p. or over, and can fly at 50–55 knots are normally used. It is possible to tow with a helicopter, but very little of this has been done.



6. Bungey launch.

Bungey Launching

This is a simple method of launching a glider off hills or mountainsides where it would not be possible or practical to use a winch, car, or aeroplane. All that is required in such situations is to get the glider airborne, because it will then have its height above the valley to soar or to fly as the pilot wishes. Bungey launching is of no value from flat ground. The energy required to get the glider airborne is supplied by a crew of six or eight men who run down the hill stretching out a V-shaped rubber rope whose end is attached to the glider by a short rope link. When their energy has been transferred to the bungey, literally, because getting gliders airborne this way is exhausting – the person holding the glider back by the tail lets go, and it is catapulted into the air, with enough speed to go on flying.

This method of launching is great fun. It is still used occasionally on some hill sites, but not so often as it used to be mainly because of the increased weight of present-day gliders.

Ever since gliding began, people have thought about

putting a little engine into the glider to enable it to get off the ground under its own power. Such a motor glider has never really been successful, since having got into the air it is forced to carry the weight of the motor around. If this is not retractable, its drag also will spoil the performance. This added burden makes the glider a less efficient soaring device. In due course a small rocket launcher will be invented which can be attached to the glider for the take-off, and the containers then discarded, but at present there are several problems to be solved, among them cost, weight, safety, noise, and even the bureaucratic one of whether the glider would still be a glider within the meaning of the act or not.

Nevertheless, a cheap practical rocket would be a good thing.

5 *Introduction to Learning*

WE MUST now assume that the reader has discovered a bit of what gliding is about, decided which club is for him, and is ready to get down to the actual business of beginning.

This is where the problem of spare time arises. If a week can be devoted to starting with a concentrated elementary course, this will shorten the rather lengthy spell during which the pupil is making his uncertain way through all the various pre-solo exercises. Many people are unable to give up a week's holiday and they must do all their learning at weekends, but, if it is at all possible, by far the best way to begin is with a week of regular flying. For most people there is so much that is new and different when learning to fly, that it is difficult to take very much in at a time in the early stages. If the sessions are separated out too much, then some of the new impressions and lessons will be forgotten, and on the next visit the beginner literally may have to begin again almost where he started last time. If there is as much as a fortnight between flights most pupils will find their progress slow indeed, and may not go solo for months. If at all possible, then, a start should be made with a week's course.

Most clubs run courses for beginners without any obligation to join their club afterwards, although if the course member then does so, there is often some reduction in the entry fee or subscription. Some clubs run starting courses specially for their own new members. It is usually

best to join a course at the club where it is intended to continue afterwards, in order to avoid possible differences in the aircraft or training methods. It is also helpful if the learner and instructor get to know each other as soon as possible, but it is not essential, and there may be other reasons for starting at a different club. One such reason might be if the budding enthusiast had an unenthusiastic or reluctant family. At this stage even the prospective pilot may not be certain that he will like gliding and it may be practical as well as politic to do the initial course at a club where there are suitable facilities for other members of the family, or holiday interests in the locality, instead of at the nearest one. For example, Perranporth offers both gliding and an excellent beach with fine swimming. Camping on the top of the Long Mynd would be delightful for a family who normally lived in a city, and Dunstable is next to Whipsnade Zoo.

The actual time in terms of the number of launches to go solo varies between about 30 and 100, depending on the frequency of the flights, aptitude, age, the weather, and the complexity of the site itself. It is not possible to give a closer answer than this. Points which tend to reduce the dual training period, other than the obvious ones such as sheer natural talent plus the luck of superb weather, are experience in related activities such as sailing or skiing, and youth. Both sailing and skiing teach co-ordination between mind and body, as well as the ability to deal with movement in more than one direction at the same time. Dinghy sailing, in particular, is useful and is an excellent introduction to gliding, especially for the very keen teenager who, the parents may feel, is too young to be let loose in the air just yet. Points which tend to prolong the training period are irregularity in flying, an absolutely non-

technical or sedentary background, and age. This last, uncontrollable factor is only a disadvantage in starting; once a pilot has reached a reasonable stage of proficiency in his flying, he can continue safely and enjoyably as long as he remains fit and can see properly with suitable glasses.

Lessons are usually composed of three consecutive flights and a pupil may get one or two lessons a day depending on the number of people wanting to fly. To make sure of as much flying as possible it is advisable to arrive early and spend the day out at the launch point; turning up at lunchtime on a Sunday risks getting no flying at all, or possibly only the odd trip just before flying finishes for the night. Time spent out on the field is not wasted as a great deal can be learnt from watching the efforts of others. This is quite apart from getting involved in the actual jobs of learning to drive the winch or tow car, pushing the gliders back to the launch point once more and, above all, learning to handle gliders on the ground. In case it should be thought that there is a great deal of involvement on the ground for very little flying, it should be pointed out that it is just this involvement which makes gliding more fun than flying little aeroplanes, where there is rarely anything to do between flights except sit around.

The Two-seater

All training in the U.K. is done in two-seater gliders, with an instructor aboard. The gliders used are the Slingsby T21b and T31 for almost all the elementary training, and the Slingsby Eagle for more advanced teaching. A new all-through trainer (elementary and advanced), the T49 Capstan, is expected increasingly to replace the T21b and T31.

Slingsby T21b. This is a fairly big glider, of 54 ft. span,

weighing 600 lb. It has an open cockpit and side-by-side seating, and is the most widely used trainer of all. It has become a favourite because of its strength and toughness in withstanding early and none too gentle attempts at landing, and because of its tolerance of mishandling in the air. It is a thoroughly good aircraft, and one which will climb well in thermals, although it has no high-speed performance. It flies normally at about 35 knots, and stalls at 30 knots. It is normally launched by winch or tow car, but is slowly becoming obsolescent as it is rather too heavy and ponderous on the controls when used for the higher flying speeds of aero towing. For ease of landing it has lift spoilers, which are less effective than the powerful airbrakes of higher performance aircraft, but which are perfectly practicable for elementary training from the club field. Club T21s will often be found to have affectionate names such as Daisy, Bluebell or Fanny, which is indicative of the regard in which they are held.

Slingsby T31. This is smaller and lighter than the T21, and has tandem seating, the instructor sitting in a separate open cockpit behind that of the pupil. It has not such a good performance, nor is it such a useful all-round elementary trainer, although some pupils prefer it because they are sitting in a cockpit of their own, and feel more independent than when they can see the instructor alongside. It is a cheaper aircraft, and is used by mainly small or new clubs, or as a supplementary two-seater for circuit and landing practice in clubs which also have T21s. It is possible to aero-tow T31s, but they are usually launched by winch or car tow, because their low performance would not justify the regular use of the more expensive aero tow.

Slingsby Eagle. This is rarely used as a basic trainer, because it is an expensive, fast and rather heavy aircraft,

much more suited to cross-country and cloud-flying training. In some clubs it is used to supplement the elementary training in such respects as extra teaching in stalls and spin recovery, and the use of air brakes, etc. The Eagle has tandem seating, but both cockpits are enclosed with a perspex canopy. The span is 58 ft., empty weight 850 lbs., stalling speed 33 knots and normal flying speed 40 knots.

The Eagle is often aero towed into the air, as it is a little on the heavy side for most club winches or tow cars. It has an excellent soaring performance, with a gliding angle of about 1 in 28, and is best used for longer flights, as the continuous ground handling needed for the shorter winch-launched training flights is too tiring.

Slingsby T49 Capstan. This new glider shows great promise as an all-round trainer. It has an enclosed cabin, side-by-side seating, a good soaring performance, and suitable handling characteristics for elementary training. It has the same span as the T21b, 55 ft., weights 750 lbs., and is equally suitable for all methods of launching. It also has adjustable seats so that small pilots will no longer have to fly cosily packed forward with cushions.

Training Methods

The learner continues flying dual with the instructor in the two-seater until he is able to fly the aircraft safely and steadily, and judge his approaches sufficiently well so that the glider lands reasonably near where it was intended to. He must also be able to cope with the sort of things which might go wrong when he is flying alone, such as failure of the winch engine, or breaking of the launching cable. When the instructor thinks that the pupil is ready, and if the weather is calm and clear, he will send him off on his first solo.

In some clubs this is done in the two-seater, with a ballast weight instead of the instructor, but in others, the pupil is transferred to a single-seater of fairly similar performance and character. Both methods are satisfactory in practice, although the nervous pupil, or one who is slow to adapt to new things is a little better off going solo in the glider with which he is familiar. The early solo flights consist of straightforward circuits of the field, and are interspersed with fairly frequent dual check flights in the early stages to see that no careless or bad flying develops.

Instructors

In most clubs the instructors are members doing the job in their spare time, without pay and because they like it. Even in the bigger clubs where there may be full-time professional staff, a great deal of the instructing is still done by the amateurs. It is a system which works well, and it is fortunate that it does because if all the instructors had to be paid, the cost of learning to fly would be very much higher. Gliding is, after all, a sport, and it would be a pity if the enthusiast could not do it simply because it was too expensive. Costs are kept down only because members do much of the work of running the club, and this spirit of co-operation contributes greatly to the friendly atmosphere to be found in gliding.

All Chief Instructors, training course instructors and professionals of Clubs belonging to the British Gliding Association are required to be qualified. Their assistants need not hold categories (although some do) provided that they are approved by the Chief Instructor.

Proficiency Standards

There are no pilots licences in the U.K. for glider pilots,

instead pilots obtain Proficiency certificates. These range from the elementary standard of first being able to go solo, up to those which can be gained only by highly experienced and skilled soaring pilots.

The higher certificate requirements are to International standards, and the design of the badge with its white birds on a blue ground is common to all countries where gliding takes place. This means that glider pilots all over the world are able to recognize each other, and many new friendships have been made by glider pilots travelling abroad, and spotting someone perhaps in a train wearing the same badge.

The requirements for each of the badges is as follows:

A & B. 3 solo flights, showing ability to turn in both directions and followed by normal landings (these used to be two separate certificates and are now for all practical purposes issued together).

C. A solo soaring flight of at least 5 minutes spent at a height greater than that of the launch; and a written test paper on air law, and aerodrome signs and signals, etc.

Silver C. This is the first badge to comply with international as against national requirements and for it the pilot has to make (*a*) a cross-country flight of at least 32 miles (50 km.), (*b*) climb up in lift so that he gains at least 3,300 ft. (1,000 metres), and (*c*) stay up for a flight of not less than five hours duration. Not more than two tests may be gained in any one flight.

Gold C. (*a*) A distance flight of at least 186 miles (300 km.) which may be straight, or include not more than 2 turning points at least 50 miles apart. (*b*) A climb of 10,000 ft. (3,000 metres).

Diamonds. There are three Diamonds which can be added to the Gold badge. The goal diamond requires a

flight of 300 km. to a pre-declared destination; the distance diamond, a flight of 500 km.; and the height diamond, a climb of 5,000 metres.

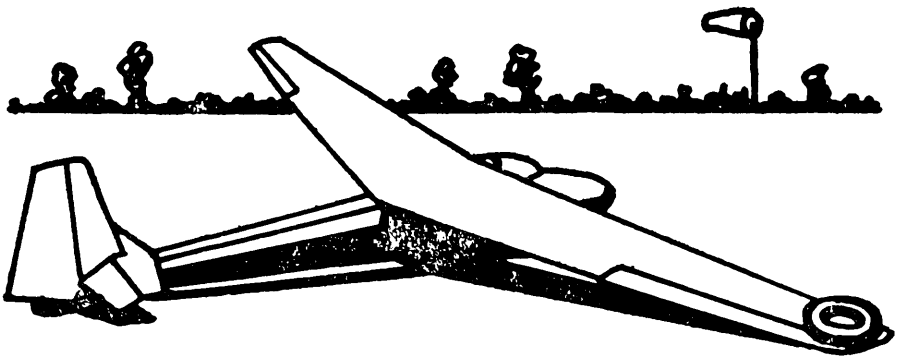
There are 305 pilots in the world with all three Diamonds, of which eight are British. The low number is largely due to the fact that weather and the smallness of the U.K. only rarely allow conditions suitable for such flights.

Before the learner can even think of the fun and excitement the prospect of cross-country soaring may conjure up, he will have a great deal to learn and the first thing he will have to know is how to handle aircraft out on the field. This is extremely important because although gliders are designed to be very strong in the air, they are easily blown over by the wind on the ground.

Ground Handling

A glider should never be left facing into the wind unless the pilot is in the cockpit, nor should it be parked tail to the wind. If it is not going to be flown for a while it should be turned across wind with the windward wing down and a suitable weight – old car tyres are used – put on the wingtip. The tail should also be prevented from swinging round by placing another tyre, or something similar against the lee, or downwind side, of the tail skid. When moving a glider on the ground it should be held at the windward wingtip to keep it level, and handled at the tail only by the proper lifting handles. It can be moved by pushing on the leading edge of the wing and the nose, but never by the thin trailing edge or the control surfaces. If it has wing struts it can be pulled by the top or bottom of these, but it is undesirable to lean on or pull struts in the middle.

If when moving gliders about at the launch point, one glider should hit another, however gently, the matter



7. Parking a glider.

should be reported at once to the duty instructor, even though no damage is apparent. He will then be able to check that it is all right before anyone else flies it.

Signalling

One of the ground jobs that the new member will have to learn is how to give the appropriate signals for the glider to be launched. These may be given with a signalling lamp, or bats. If lights are used the signals are as follows:

Take up the slack in the launching wire or cable – *Slow flashes.*

All out, the wire being taut. Pull in the wire fast enough to get the glider into the air – *Quick flashes.*

Stop, Something is wrong, someone – anyone – has shouted stop, there is another aircraft coming too close, etc., etc. – *Continuous light.*

There are two systems using bats, in the first of which only one is used, and in the second two bats are employed. The first is simpler, but the second may be useful if only the top half of the signaller is visible from the winch, due to the shape of the ground.

One Bat Method.

Take up slack – *the bat waved to and fro across legs.*

All out – *the bat waved to and fro above the head.*
Stop – *the bat held up high and stationary.*

Two Bat Method.
Take up slack – *one bat waved up and down.*
All out – *both bats (one in each hand) waved up and down.*
Stop – *both bats held up stationary.*

No substitute signal methods should ever be used, even though the bat has been lost, owing to the impossibility of giving adequate stop signals with handkerchiefs, etc. Car headlights operated properly can, however, be used as a safe substitute for a signalling lamp.

Logbooks

Finally and before actually starting to fly, the new member should get himself a Pilot's Log Book. These can usually be bought at the club for a few shillings. The log-book should always be taken to the launch point, and given to the instructor before flying, who may wish also to add comments at the end of the lesson. It is likely that the pupil will have a number of different instructors before he goes solo, and a well-kept logbook is helpful to everyone in getting him on as quickly as possible, quite apart from becoming, with time, quite an interesting document!

6 *Learning to Fly (1)*

HANDLING THE GLIDER

ON HIS first trial flight in a glider, the learner probably noticed that his pilot did a certain amount of knob twiddling and control moving before take-off. This was not so much an incantation to the gods as a commonsense procedure to ensure that the aircraft was fit for the flight, and that the instruments had been properly adjusted. The cockpit check is the first lesson in flying and the learner will get plenty of practice since it will be carried out before every flight. The pilot will be taught a drill to help him remember each item.

Controls

The first job is to check the controls to see that they are working in the correct sense, and that there is full movement. This is not so much to ensure that the controls have not suddenly gone wrong, which is extremely unlikely, but much more to check that something, a camera, gloves, or believe it or not, a cat, has not got into a position where the controls might be partly jammed.

The main controls are the stick, and the rudder bar, or pedals. The stick works the elevators and the ailerons.

The *elevators* are the control surfaces on the tail plane which control the pitch – the diving or climbing – of the glider. The control stick is moved backwards and forwards to move the elevators.

When the stick is pushed forward, the elevator surface at the tail is moved down; the airflow pushing against this raises the tail, which causes the glider to be put into a dive, when it will, of course, increase speed.

When the stick is moved backwards, the elevator surface at the tail goes up. This will cause the nose of the glider to be raised, and the aircraft will lose speed.

The *ailerons* are the control surfaces on the trailing edge of both wings. They are linked together. They control the lateral position, or banking, of the aircraft. The control stick is moved sideways to move the ailerons.

When the stick is moved to the left, the aileron on the left wing moves up and that on the right wing down. This will cause the glider to bank over to the left. When the stick is moved to the right, the right aileron moves up, the left down, and the glider will bank to the right. The ailerons are the primary control for turning.

The *rudder* is the vertical surface at the tail, which controls the sideways yaw of the glider. It is needed to assist the ailerons in order to produce accurate turns, to correct drift on landing, and for sideslips and aerobatics. The rudder bar is moved with the feet to operate the rudder. If the left foot is moved forward the rudder surface moves to the left; the airflow over this pushes the tail to the right causing the nose of the glider to yaw to the left. If the right foot is moved forward, the opposite occurs.

The movement of these primary controls, then, must be checked before take-off, as also must the auxiliary controls.

Airbrakes

These are the surfaces normally hidden in, or flush with, the wing, which when extended spoil the clean lines, and therefore the performance, of the glider. They enable it

to glide down at a much steeper angle without at the same time getting faster and faster. They are normally used during the approach in order to help the pilot land accurately where he wants to. If the type of airbrakes fitted are called 'spoilers', this is their only function. If, however, they are the 'dive brakes' which are fitted to all high performance gliders, they will also prevent the glider flying faster than the maximum speed for which it was designed, should it, for instance, get out of control when soaring in a thunderstorm. The airbrakes are controlled by a lever, normally on the left-hand side of the cockpit. The pre-flight check is to ensure that they open properly, and, above all, that they are fully closed and locked home before take-off so that they do not come open by mistake in flight.

The Tail Trimmer

Not all training gliders are fitted with a trimmer. Its object is to adjust the loads on the stick for pilots of different weight. A light pilot would need the trimmer forward of neutral, and a heavy pilot back. Sometimes the trimmer is worked by a spring-loaded device in the elevator control circuit, but much more usually it is operated by a tab (like a tiny extra elevator) on the trailing edge of the elevator itself. The movement of this tab should be checked before take-off. When the trimmer lever is moved forward the trim tab should go up and when the lever is moved back, it should go down.

The Release

This is the mechanism which releases the launching wire or rope from the glider. It has an over-ride mechanism which automatically drops the wire, should the pilot forget to do so, directly the glider overflies the winch or tow car.

The control is invariably a yellow knob on the left-hand side of the pilot.

Before the first flight of the day the release should be checked for both forward and automatic back release operation. It is not necessary to check it on each subsequent launch, other than by operating it to attach the cable for the launch itself.

Instruments

In the early stages only simple instruments such as the altimeter, airspeed indicator, and perhaps a variometer (for indicating whether the glider is in rising or sinking air) are used. The pre-flight check consists of seeing that the needles are reading zero and have not got stuck somewhere round the dial, or perhaps fallen off! In addition the altimeter should be set so that it is reading either zero, or the height of the take-off point above sea level. For training flights it is customary to set it at zero.

Harness

Having got comfortable in the cockpit, the instructor will demonstrate how to do up the safety harness. This consists of four straps which fasten together in front of the body either by a special pin or by latching into a quick release box. The object of the harness is to keep the pilot secure and comfortable in his seat when flying in turbulent air, or doing aerobatics, and as protection in the event of a crash.

Ballast

Before taking off the permitted weight range of the aircraft must be checked, from the cockpit placard, to ensure that the pilot(s) are neither too heavy nor too light. If necessary, extra ballast must be carried.

The effect of controls

The first lesson will be to discover what effect movement of the controls has on the glider in the air, to learn the amount of movement necessary and to co-ordinate the three controls together.

It will be assumed that the glider will be launched by winch, as this is the method most widely used. The instructor will fly the glider during the take-off and climb, and will not begin his demonstration until after it has been released from the wire. The newcomer will be able to keep his hands and feet lightly on the controls all the time, so that he can feel what is happening. At take-off the instructor will check with the signaller that there are no other aircraft coming near enough to be in the way, and if the air is clear call for the signaller to 'Take up slack'. As the cable comes up taut he will call for 'All out', and the wire will be pulled fast enough for the glider to obtain flying speed to take off, and climb.

After releasing at the top of the launch the instructor will show that the aircraft is stable by taking his hands and feet off the controls, letting the glider go on flying quite happily by itself. He will explain that flying is not like tight-rope walking, but merely guiding a stable device in the desired direction. He will show that if the stick is moved forward gently, and only gentle movements are required at all times, the nose of the glider will go down and the speed increase. It will be noticed that much more can be seen over the nose of the glider, and that the increase of speed has brought with it an increase in noise. The instructor will then bring the glider back to its normal flying attitude and then move the stick smoothly and gently backwards. As he does so, it will be noticed that less and less can be seen ahead as the nose comes up, and

that the airflow noise reduces as the speed dies away. If the stick is held back long enough the speed would get so slow that it would become less than the minimum necessary to support the glider's weight in the air. The glider would then stall, falling nose down until it had gathered enough speed to fly once more. Although a glider stalls very gently, the instructor will not let it do so in this demonstration or until the pupil has become confident and used to being in the air.

Once more the instructor will return the aircraft to the normal gliding attitude, with the nose correctly positioned on the horizon to give the desired flying speed. Then he will let the pupil have the controls himself, and try to repeat back the demonstration. The controls should be held lightly and moved smoothly and gently. Strength is not required.

After this the instructor will demonstrate the ailerons by moving the stick over to one side, so that a wing goes down, and the glider banks. When the pupil attempts this himself he will find three things; that the ailerons feel slower and more ponderous than the elevators, that the wing will continue to go on going down unless checked, and that if the wing is allowed to stay down, the glider will start to turn in that direction, even without the use of rudder. The pupil will then try out the ailerons himself.

For the rest of this flight, the instructor will probably let him hold the stick, try to keep the glider at the proper altitude and speed, and use the ailerons as directed until it is necessary to take over control for the landing.

The instructor will next demonstrate the rudder in the air and how it causes the nose of the glider to yaw or slide across the horizon, and it will be noticed that the rudder is

not used as a control on its own, but only in conjunction with the ailerons. Again the pupil will be given practice in trying to fly at the right speed and attitude, and in co-ordinating the controls, until he can do this well enough to go on to learn how to turn.

Turns

Good turns are of the greatest importance in glider flying, as well as being excellent training in smooth use and proper understanding of the controls. In any case, until he can learn to turn at least reasonably well, the pupil cannot really progress further. In addition to actually controlling the glider, the importance of keeping a good look out for other aircraft before and during all turns has to be learnt. It is difficult for a beginner to do this when he knows that everyone else in the air is a better pilot than him, but it is a habit which must be learnt at the start and never forgotten.

An aircraft has to be banked in order to turn so that an inward force is created to counteract the centrifugal force, or outward pull. The turn is therefore made and maintained almost entirely with the banking control – the ailerons.

To do a gentle turn, a good look round must be made to see that the air is clear of other aircraft, as well as a check that the glider is flying at the right speed. It should be banked over about 30 degrees. At the same time some rudder should be applied in the same direction to help the glider go smoothly into the turn. The angle of the bank is maintained by using the ailerons as necessary; if it tends to increase, this should be prevented from happening by reducing the amount of aileron, if the bank tends to get less more aileron should be applied. Once the turn has commenced, the amount of rudder should be reduced, and all

the effort should be concentrated on maintaining the bank at a constant angle.

During the turn a check should be made that the speed is still correct. This is best done by getting to know the position of the nose or windscreen in a turn and using this to judge the right speed. A good look out should still be kept.

Gentle turns of this sort should be practised until the pupil can go into, stay in, and come out of them without getting in a muddle, and is able to criticize his own efforts. When this stage is reached, he will appreciate that if the amount of rudder used for a given angle of bank is excessive, the glider skids outwards like a car on an icy corner, and the airflow will come from the side – the outside of the turn – instead of from straight ahead of the nose. If, on the other hand, insufficient rudder is used for the angle of bank, the glider will tend to slip inwards towards the centre of the turn, and the draught will come at the pilot from the inside of the turn. He should then practise co-ordinating the bank and rudder until his turns are accurate.

At the same time as turns are being practised, other things will be learnt as well, such as how to fly straight, take off and land, so although the lessons are separated out in this book, in practice progressively more of them will be done in each flight until the pupil can carry out the complete circuit himself.

The Launch

The take-off and climb in a glider, unlike that in an aeroplane, is under divided control, that of the pilot and that of the man driving the launching mechanism, whether it be winch, tow car or tug aeroplane. It must be realized,

therefore, that not only is the launch a team effort, but that it is necessary for the glider to be flown in such a way that any failure on the part of the launching mechanism, or error of its driver, will not endanger the aircraft.

Take-off

After the 'All Out' signal is given the glider starts to move with the wings held level by a runner at one of the tips. As it accelerates it will outstrip the runner and the wings must be held level by use of the ailerons. If the acceleration is abnormally slow, the pilot will have to use his controls much more coarsely than he would in the air, owing to their poor rate of response at very low speeds.

At the same time, while rolling along on the ground, the glider must be kept directionally straight by means of the rudder, but it will be difficult to do this unless the wings are kept level. While accelerating, the glider should be allowed to run along on its main wheel only, and when flying speed has been reached it will gently lift itself into the air. If it runs along too nose down the main skid will be heard grating on the ground, and the nose should be gently raised until the noise stops. If it is running along with the tail skid on the ground, the nose is too high and it should be gently lowered until the glider is again running on the main wheel only. It should never be allowed to go into the air in a nose-up attitude.

When the glider becomes airborne it should be allowed to climb only gently until it is about 100 ft. up. If it is climbed steeply at less than this height, and the launching cable breaks, the glider would have insufficient height to recover to its normal flying attitude and speed, without considerable risk of hitting the ground first. Above this

height the climb can be gently and smoothly steepened until the glider is climbing at an angle of about 45 degrees. This angle can be assessed by looking out sideways along the wing and comparing the angle of the undersurface of the wing to the horizon.

If the glider is tending to wallow about sideways, a check should be made to ensure that the wings are level. Near the top of the launch the glider may start porpoising up and down if the climb is too steep; a slight lowering of the nose will stop this pitching.

As the top of the launch is reached the more downward pull from the launching wire will tend to reduce the climb angle, but before releasing the cable, the nose should be lowered still more until the glider is in the normal flying attitude; the release knob should then be pulled hard – twice to make sure.

After release the speed should be checked and a good look round made before starting to turn.

A good winch or tow car driver will pull the glider up at an airspeed of somewhere between 40–50 knots, having made allowance for the wind strength. If the glider is launched at too slow a speed, the pilot should not pull up at all steeply until the speed has been increased. He can signal that he has insufficient speed by rocking the wings laterally, using the ailerons slowly and coarsely.

If the glider is being launched too fast, the pilot should signal that his speed is excessive by yawing the glider from side to side with the rudder.

If the take-off and climb cannot be done directly into wind, the windward wing should be held slightly down during the take-off and climb. This helps to counteract the leeward drift of the glider, by causing it to slip slightly in the direction of the lowered wing. If the drift is not

corrected the launching wire may well be dropped over parked gliders, fences, or people, instead of along the take-off line.

Approach and Landing

The only object of the approach is to prepare for the landing, and a good landing is invariably the result of a good approach.

At this stage the instructor will say when and where the turns which will position the glider are to be made, so that the pupil will be able to concentrate all his attention on the handling of the glider.

In the air the glider will have been flown at quite a slow speed, only a few knots above the stall, but this is not enough for the approach, particularly if the wind is strong or the air turbulent. And so, when down to about 300 ft. and beginning the approach, the speed should be increased by about 5 knots if the air is calm, and as much more as seems necessary if the air is rough and the wind strong – perhaps even by 20 knots. A good look round must be made to see if the air is clear, and the pilot should put his hand ready by the airbrake lever. The glider should be turned so that it is lined up accurately on the proposed landing path, which must obviously be clear of obstructions, and the pilot should look well ahead – about the same sort of distance as when driving a car at 50 miles an hour.

As the ground gets closer, the pilot must go on looking ahead, and gently reduce the angle at which he is approaching the ground, by very gently and progressively raising the nose. This also reduces the speed. As the glider gets close to the ground he should go on trying to hold it off the ground by continuing to move the stick further and further

back, until the glider settles of its own accord on main wheel and tail skid. In landing the pilot is not trying to *put* the glider on to the ground, so much as to bring it to a point at which it ceases to have flying speed at a height of a few inches above the ground. It sounds difficult, but few pilots have any great problems over landing.

When the glider touches down it quickly slows, and the controls become ineffective, so efforts must be made to keep it running straight after landing by coarse use of ailerons and rudder. On coming to rest one wing will go down of its own accord and rest on the ground.

If the air is turbulent on the approach or the wind strong, plenty of speed will be needed. On such days the wind near the ground will be slowed up by ground obstructions and interference, and may be appreciably less than the wind at, say, 100 ft. up. As the glider comes into land it will pass from the region of strong wind to the comparatively light wind near the ground. If the pilot has not got an adequate reserve of speed at this transitional moment, which is quite sudden, the glider may have insufficient airspeed, and sink heavily to the ground, or even possibly stall.

Use of the Airbreaks

So far the pilot has learnt how to make a steady approach and landing. He can probably put the glider on the ground without bouncing it, and he can control the speed of the approach. The vital thing which is still missing, however, is the ability to put the glider down accurately at the intended point. This requires two things. Judgement in how to choose the path through the air which will bring the glider into position for the final approach, and learning how to use the air-brakes to make the approach both easier and more accurate.

The airbrakes are controlled by a lever on the left-hand side of the pilot, and must be kept locked shut when not in use.

When they are opened in the air they produce a great deal of resistance or drag, and cause the glider to slow down. To prevent the airspeed getting less the nose must be put further down. This results in a steep rate of descent without excessive speed. The airbrakes do not, for all practical purposes, affect the stalling speed, but on some gliders produce a change of trim, or attitude, when they are opened. On the T21 two-seater they tend to make the nose go down slightly on being opened.

It should be remembered that the airbrakes are not an 'on-off' control like a tap, but an infinitely variable control, capable of allowing very fine adjustments, like the accelerator of a car.

When using them for the first time, however, the instructor will probably tell the pilot to open them, and hold them quite still. This is so that he will have time to assess the effect that their use has on the approach path and on the feel of the glider.

The airbrakes can, of course, be used at any stage on the approach but it is a waste of height to use them merely as a means for getting back to earth as quickly as possible. Each launch should be used to obtain the maximum amount of flying time, and the airbrakes used only to assist a well-judged approach. They should not be regarded as an end in themselves. When first practising using the airbrakes, the pilot should come in rather higher than usual and when facing into wind open the brakes about half-way, and then try to make the glider fly a steady flight path, or slope, into the field. If he feels that the glider is remaining higher than intended, and is likely to

overshoot the proposed landing spot, then the brakes should be opened more. If, on the other hand, the glider is getting lower and lower or there is any possibility of undershooting the landing-place, then the amount of brake should be reduced, or they should be closed entirely.

Throughout the final hold-off and landing the airbrakes should be held quite still, and the amount not varied until the pilot has enough experience to understand their feel and use.

If the pre-flight cockpit check has not been carried out properly, there is a risk that the airbrakes will not have been locked in the closed position, in which case they will open during the launch. It is surprising how often this is not noticed, even though the performance of the glider is seriously affected. If ever the pilot feels that there is something not quite right about the launch he should look to see if his airbrakes are open.

The pilots logbook will now record some 10 to 20 flights.

7 *Learning to Fly (2)*

PREPARING FOR SOLO

Planning the circuit

NOW THAT the pilot is able to take the glider off, fly around and get it back on the ground again, he will be ready to learn some of the other things which are needed to make a safe solo pilot. The first of these is how to plan the circuit of the airfield, so that the landing is made at the intended place. It is useless being able to land a glider superbly, if the bit of ground it arrives on is the local rubbish dump or the club car park. It is essential that the pilot shall learn to place himself in the air so that at all times he knows that he can reach a suitable and selected landing-place. To do this involves flying round and round the club field often enough to obtain experience in thinking out and judging the circuit and the approach, and to understand the effect on it of the wind and down-draughts, etc. In its simplest form the problem is to fly the glider from a suitable point about 600 ft. up and near the landing-field on such a path as will eventually bring it in contact with the ground facing into the wind at the selected point on the landing area. The approach starting position, at about 600 ft., is not critical, but it needs to be upwind and to one side of the landing-place. See fig. 8.

Considerations which affect the flight path are (*a*) that the pilot must never allow the glider to get appreciably

downwind of the field, particularly in strong winds, as he may be then unable to return to it; (*b*) the last turn into wind must not be made too low – not less than 150 ft. minimum – or otherwise there is a risk of hitting a wing or making a heavy landing; (*c*) the final turn-in point must be so placed that the pilot has enough space and time ahead for a straight glide into wind during which time he can concentrate on the landing and (*d*) finally, the landing area must be clear, or if it is not, an alternative place must be selected in time, and the approach path checked to ensure that no other gliders are coming in to the same place at the same time.

Now to do this in practice:

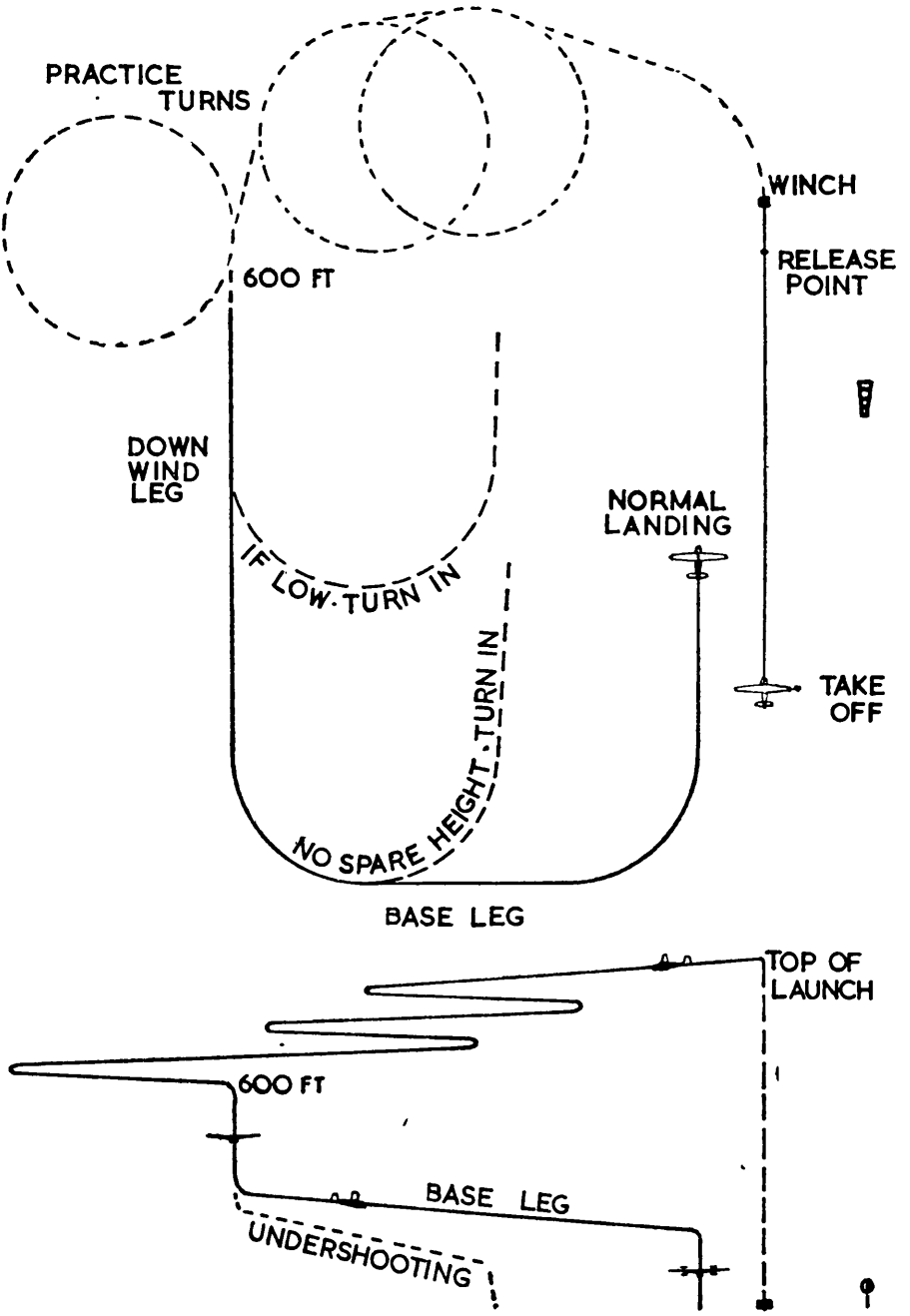
If the release height from the launch is higher than about 600 ft., the pilot should practice turns, or some other exercise, and not waste all his height in merely doing a circuit. He should, however, remain in a suitable area – upwind and to one side of the landing-place. When down to about 600 ft. he should start to make his approach circuit. This should consist of three parts, (*a*) the downwind leg, which takes the glider to the leeward end of the field, although not much beyond it if the wind is strong, but still out to one side of the landing-place; (*b*) the cross wind leg, sometimes called the base leg, which will bring the glider along the lee boundary until it is opposite the selected landing line, and then (*c*) the into wind or final approach leg, terminating in the land.

On the first, or downwind leg, the pilot should observe the wind sock, to see that there has been no change of direction, and have a good look at the landing area to see how clear it is, and to decide on what part of it he wishes to land. He should then try to visualise the location of the three legs of his flight path which will get him there. If he

thinks he is, or will be, too high he should edge the glider away from the field. If he feels that he is low, then he should edge in towards the field, but not so much that there will not be enough space in which to do his later turns into wind.

If the broad assessment of the downwind leg has been correct, the pilot will be able to turn cross wind, and fly along parallel to the rear boundary of the field with enough time to enable him to judge when to make his final turn into wind, and to look out for other gliders, etc. It is on this base leg that the broad assessments of the downwind path are remade to a finer degree of accuracy. If the glider is high it again should be edged out from the field, or if it is low the final turn into wind should be made without delay. If the glider is really excessively high, either because the approach has been badly judged, or because a strong, but inconveniently placed upcurrent has been encountered, there are two things to be done. The airbrakes can be used earlier and fully and the intended approach path maintained, or the glider can be flown straight on across wind past the turn-in point, turned back and approached from the other side. In the early stages it is better just to use the brakes, and keep the approach simple, even if it means landing quite far up the field.

Deciding when to turn in for the final approach is difficult. It is not really a matter of flying across wind and waiting for a particular moment at which to turn in, so much as thinking all the time 'Where would I get to if I turned in now?' and mentally swinging the nose round in trying to assess at what point the glider would reach the ground. This mental process is continued until it is thought that a turn at this moment would bring the glider to more or less the desired point. The turn is then commenced.



8. Landing approaches in plan and in section.

If the approach has been misjudged and the glider is in danger of under-shooting, the speed should never be allowed to decrease in an attempt to stay in the air as long as possible; the nose should be put down and the speed deliberately increased so that the glider is able to penetrate the strong wind, or the downcurrent, flying through it as quickly as possible.

Stalls and Spins

Practice in stalls and spins will continue to be given throughout training. The purpose is not so much to demonstrate how to do them, but how to recognize their approach and how to recover from them should the pilot mistakenly fly too slowly. A glider can fly only if its speed is sufficient to enable the wings to support its weight. If it is flown, or carelessly allowed to fly, at less than the minimum speed for the particular type, the glider will stall, falling nose downward, and cease to be under the control of the pilot until it has gathered enough speed to fly once more. If it stalls when turning, or with rudder on, it may spin, in which case more height will be lost before control is regained. The danger in stalling or spinning inadvertently lies in doing this near the ground, when there may be insufficient height to recover. High up there is no danger.

The instructor will first demonstrate a mild stall quite early on in training because, high up, they are not even frightening. Having looked round to see that the air is clear, he will raise the nose slightly, so that the glider gradually gets slower and slower, pointing out how the outlook ahead is less than for normal flight, how the noise of the airflow is dying away, and how the controls feel sloppy and unpositive. These are the signs that must be quickly recognized, in case the glider gets too slow while

the pilot is day-dreaming or concentrating on something else. If the nose of the glider is not lowered at this stage, the glider will stall and drop its own nose. At this moment no amount of further backward movement of the stick will raise it, and the pilot can do nothing. Very quickly, however, the glider will regain speed. Obviously the stick should not continue to be held back, and as soon as speed is regained the glider's attitude should be corrected so that it is flying at the desired speed.

More spectacular stalls can be done by raising the nose abruptly so that the speed falls off rapidly. As the stall occurs the nose will drop sharply and steeply. This looks quite impressive from the ground, and is sometimes included in aerobatic displays, but teaches little or nothing about recognizing the symptoms of, or avoiding, the stalled condition.

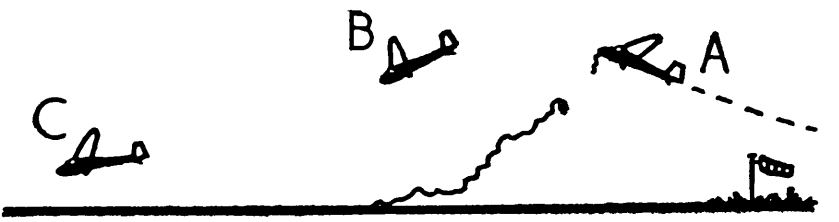
The teaching of spins is usually left until later in the training programme, when the pupil has become more familiar with being in the air and controlling his glider. The important thing about spinning is that it is an artificial condition of flight, and that the control corrections that have come to be regarded as natural will not stop the aircraft spinning. Some gliders are reluctant to spin, or even if they start to do so, recovery is automatic and almost immediate, but others, with a more pronounced spin, can be stopped only by the proper drill, and they may be disinclined to come out unless this is used. The drill is: *full opposite rudder, slight pause, then stick steadily forward until the spinning stops.* If the glider is inadvertently stalled in a turn and starts to fall away uncontrollably, the rudder should immediately be applied opposite to the direction of turn – a pause – and then the stick should be moved steadily forward. If the spin stops at once, there is no need

to go on moving the stick forward as it will merely allow the glider to gain excessive speed in its recovery dive. If, on the other hand, the spin develops, then the stick must be put and held forward until it stops.

As soon as the glider ceases to spin corrective action should be discontinued and the glider recovered to the normal flying attitude.

Cable breaks

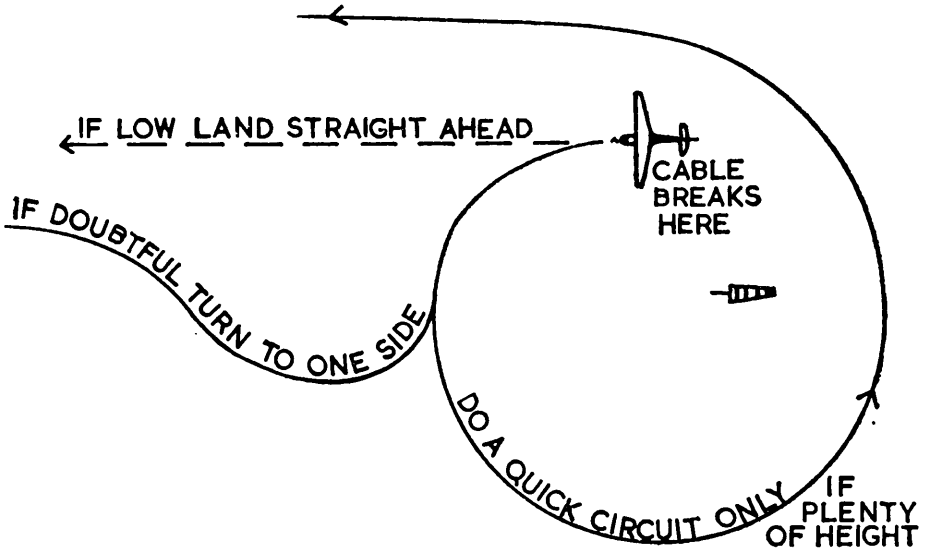
One of the things that a pilot may have to cope with at any time on the launch is the wire breaking, or for that matter, its failure for any reason. If the wire does break, it usually goes suddenly. The pilot feels a jerk, and the glider is left in a nose up attitude (A), with the speed falling off rapidly. Immediately he should get the nose down (B), well down, particularly if the steeper part of the climb has been started, until the glider is flying at normal approach speed; the release knob should be pulled to get rid of any cable which may still be attached.



9. Cable breaks (1).

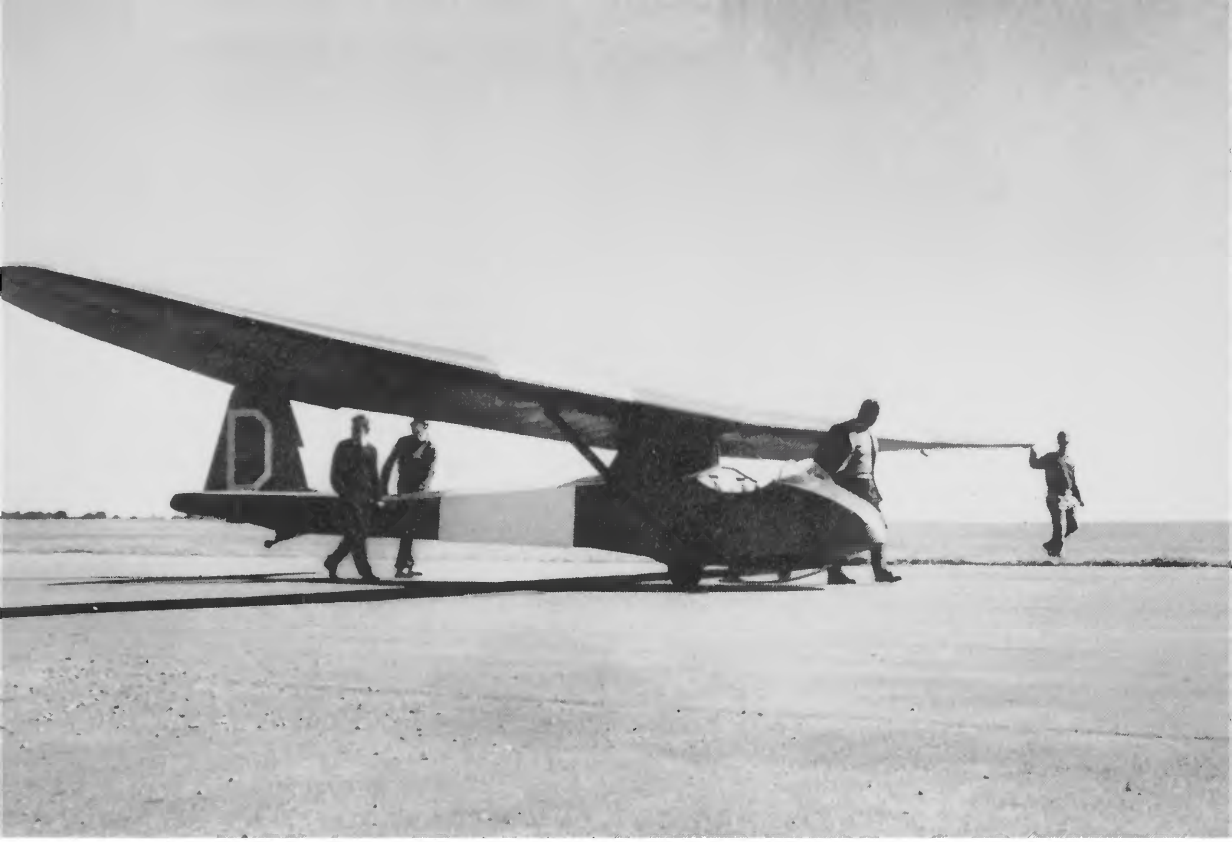
If the glider has not yet gained any appreciable height it should be landed straight ahead (C). Airbrakes should be used only after the pilot has considered whether they are necessary to prevent him running into the far hedge, and whether he is high enough off the ground to use them safely. In any case they should be used gently. If the glider is only a few feet up, for instance, and the pilot, without

thinking yanks open his brakes, the glider will sit down hard on the ground, with considerable risk of damage.



10. Cable breaks (2).

If the glider is too high to land straight ahead in the field, but probably not high enough to do a quick circuit of it, then it should be turned to one side as soon as approach speed has been gained, and the release pulled. The pilot can then assess the situation. If he can get into the field by turning away to the side, and then back again, and continuing straight into wind again, in other words to fly a sort of ⅁, he should do this, using the air-brakes as necessary. If, however, he is convinced that he has too much height to land in the field unless he does a quick circuit, he should continue on round with the turn. By the time he is pointing downwind he will be able to see what height he has. If the glider is very low the turn should be continued so that it describes a circle, rather than a circuit, to face into wind. If there is enough height to spare, then a more normal circuit should be made. On no account should the pilot be misled into trying to get back



Above: Taking a T 21 2-seater to the launch point.

Below: Taking off on a training flight.

Above: Skylark II flying over Nympsfield.

Below: T49 Capstan two-seater over Lasham.

to land in the usual landing place, unless he has really adequate height. It is much safer to complete the circuit, turning into wind early, and land well up the field, rather than arrive at ground level before the turn has been completed. Again airbrakes should be used with discretion.

Occasionally the launch fails not because the wire suddenly breaks, but because the winch engine dies slowly away. The pilot starts by thinking that the launch is merely too slow, and signals for more speed. Nothing happens. Meanwhile the glider is flying steadily across the field, but not gaining any height. If this state of affairs is allowed to continue, the glider will arrive at the far end of the field with nowhere to land ahead, and too little height to make a circuit. This unnecessary emergency can be avoided by deciding to abandon the launch while there is still room to land ahead in the field. The nose should be lowered, the cable released, the brakes used as necessary and the glider landed ahead.

Instruments

During the pre-solo training some instruments will be used, although it is important that the pilot should be able to fly without reference to any of them. Instruments can go wrong, but a glider is not such a complicated mechanism that it cannot be flown safely, and, in fact, extremely accurately by means of the senses alone. However, instruments are a useful guide, and will become more necessary when the pilot progresses on to soaring, and so he should have some understanding of their function.

The Altimeter gives readings of height. The pressure of the air reduces steadily with altitude, and the instrument indicates this reduction of pressure on a dial graduated in feet (or, if convenient, metres). Since, however, the pressure

of the air at any given place or time varies slightly, it is necessary to reset the altimeter each day.

It should be remembered that in the air the altimeter gives readings only above sea level, or above the height at which it was set to zero on the ground. It does not indicate the height of the ground over which the aircraft may subsequently pass, or therefore, the gap, if any, between the bottom of the aircraft and the top of the mountain.

It will also give inaccurate readings if the weather (i.e. air pressure) changes appreciably during the day and the altimeter is not reset, or if the glider is flown a long way to an area where a different weather system prevails. This inaccuracy takes the form of an over-reading on the instrument if the air pressure is reduced. For example, if the glider was launched from sea level in Sussex, and landed at sea level in Cornwall where owing to an approaching depression the air pressure was lower, the instrument would still show the glider to be airborne, even when it had landed on the sands. The reason for dealing with altimeters at some length, is to emphasize the need to learn to be able to judge approaches and heights by eye and not by reliance on the instrument. When the pilot sets off to fly across country in his glider, the altimeter will be useless to him when he comes to land in a strange field, because neither he nor his altimeter will know its height; and therefore the height of the glider above it. The safe landing must be made by practised judgement alone.

The Air Speed Indicator. This may be calibrated in knots or m.p.h. or kilometres. The instrument itself is simply a pressure gauge which measures the pressure of the air in a forward-facing tube. As the speed of the glider increases so does the pressure and the instrument shows a higher reading. The A.S.I. therefore shows the speed of the

aircraft through the air. Unless there is an absolute calm, which is unlikely, it does not show the speed of the aircraft over the ground, as this is affected by the wind. Wind is merely the effect of a vast mass of air moving over the earth and any aircraft, butterflies, clouds or pieces of old newspaper, move along in it and at its speed. If a balloon is released in a 60 m.p.h. gale, in one hour it will be over a point 60 miles away. Gliders and aeroplanes, however, must have an air speed of their own in order to fly at all, and to obtain the speed over the ground this speed must be subtracted from or added to the wind speed, depending on whether the aircraft is flying into or with it. For example, if the wind speed is 20 m.p.h. and an aircraft is flying along in the same direction at 100 m.p.h. through the air, its speed over the ground will be 120 m.p.h. If the wind is 40 m.p.h. and a glider is approaching into wind to land, at an airspeed of 40 m.p.h. it will have no movement over the ground, and clearly will never reach the field. Its only possibility to avoid sinking irrevocably on to the ground short of the airfield will be to increase air speed so that headway against the wind can be made.

The Variometer. This is the most important instrument of the soaring pilot, since it helps him to use upcurrents by indicating whether the glider is going up or down, that is, when it is in rising or sinking air. It, too, is worked by air pressure, this time by the changing pressure between a container of air in the glider and the free outside air. The glider rises, the air pressure surrounding it gets less, because air pressure reduces with height. The air in the container, now of higher pressure than the outside air, moves out in an attempt to equalize the pressure, as nature desires. To do this the air must pass through the instrument, which registers the changing flow and indicates, in this case, that

the glider is going up. The rate at which the air moves from the container to outside air, indicates the rate or speed of the rise. When the glider flies into sinking air, the outside pressure is increasing and is greater than that in the container As the air passes through the system to equalize the air pressure in the container, the instrument will indicate sink.

Some variometers have a needle on a dial, and some have green (rise) and red (sink) balls that move in tubes. Some variometers are electrical, but these are not normally used on school gliders.

Total Energy Variometer. An ordinary variometer is affected by the climbs or dives of the glider caused by the use of the controls. For example, if the pilot pulls the stick back the glider will go up, and this will quite rightly show on the vario, but the pilot is not interested in this method of climbing, only that which is caused by genuine up-currents. In the ordinary vario, therefore, he will have to decide if his lift is genuine, or whether he is affecting it by his handling of the glider. In this case it will mean nothing since if the glider gains height in this way it can only do so with some loss of speed and energy which can be regained only by coming down again. Some variometers are fitted with a device to eliminate indication of climb or descent caused solely by changes in speed. These are called Total Energy Variometers, because the instrument indicates the rate at which the glider is gaining or losing energy.

Other Instruments

Most gliders are fitted with a compass, and a turn and slip indicator for flying in clouds: the latter is usually battery driven. High performance gliders usually carry a

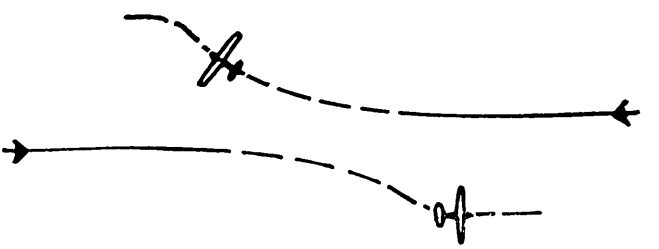
galaxy of exotic instruments including an artificial horizon, also for cloud flying, but easier to use than the turn-and-slip; a Cook compass, which is especially suitable for coming out of cloud with great directional accuracy; and valuable gadgets such as a speed-to-fly ring on the variometer, and a final glide calculator. These will be dealt with in a later chapter.

Rules of the Air

Before a pilot gets loose in the air on his own, he must learn the rules of the air, in order to know what action to take to avoid collision with other aircraft.

The law states that aeroplanes must give way to gliders, but any glider pilot that flies along on his dignity until hit by an aeroplane is a fool. The view from most aeroplanes is worse than from a glider, the aeroplane pilot may be reading his map or playing with his radio, and, anyway, the glider is likely to come off worse, being lighter, and maybe smaller. Apart from this an aeroplane can often be heard from a glider, whereas the glider certainly will not be heard from an aeroplane.

Greater risk of collision, however, exists between gliders; not, surprisingly, when they are circling together in the same thermal, but when they are just flying vaguely about, or soaring together on a hill. Collision, in fact, is rare, but this does not absolve any pilot from knowing



11. Avoiding collision – each alters course to right.

properly what action to take when faced with a possible hazard. The basic rules are:

Head on: When two gliders are approaching each other head on, or nearly so, each must alter course to its right. (This is the same as with boats, and cars on the continent).

Converging: When two gliders are on converging courses, the one that has the other on its right must give way.

Overtaking: The overtaking glider has the responsibility for avoiding the one being overtaken, and may overtake on either side (aeroplanes may overtake on the right only). The reason for this is that when gliders are soaring together on a hill, all overtaking shall be done between the overtaken glider and the hill. At the end of each beat along the ridge the glider must turn in order to beat back along it. This turn must be made outwards from the hill into the wind, so that the glider will avoid being blown into the down draught behind the hill while turning, but it could not do so if other gliders overtook on the windward side. When thermal circling together, the overtaking glider must pass on the outside of the circle, and not cut in through the middle.

The other important rule of the air is a commonsense one. It is that the glider which is nearer the ground when coming in to land has right of way over those higher up. If two gliders are at the same height on the approach, the glider known to have the lower performance shall be allowed to land first.

First Solo

When the instructor considers that the pupil can fly reasonably well and safely, he will send him off for his first solo flight. This may be done in the two-seater, or in a

similar sort of single-seater, in which case the instructor will explain any differences between the two types. Although the instructor may appear quite casual in sending off the solo, he will not have taken the decision without a lot of thought and care in his preparation. He will have checked that his charge can control his speed well, so that there is no risk of flying too slowly, that he can judge his approaches with reasonable accuracy, and above all that he will be able to cope with any emergencies, such as cable breaks, on the launch. The flight would not be made in rough weather, into the glare of a setting sun, or when the light is beginning to fade. Statistically, the first solo flights are some of the safest that a pilot is likely to make, and quite rightly they are regarded as merely a stage in the training and not as an end in themselves. Nevertheless, it would be surprising if a pilot did not feel that he had really achieved something with a well-flown first solo.

When three solo flights have been completed, and these will normally be done straight off one after the other if they are just circuits of the field, the pilot will be eligible for his B. certificate and badge. The requirements are that, during the flights, he should have demonstrated his ability to do both left and right turns, and that each flight shall end with a normal landing. Having got this far, the new pilot will be the first to realize how much there is still to learn, but he is unlikely to find this a chore, for the next stage leads him on to soaring, which is where the fun really starts.

8 *Post Solo Flying*

FOR some time after he has been solo the pilot will start each day's flying with a check flight in the two-seater. This will be for the purpose of ensuring that he is not developing any careless or bad habits, and is capable of coping with different types of weather, changes in take-off direction, and to teach him some more advanced exercise. If it is just a check on flying, then probably only one dual circuit will be made, and the pilot will then make two or three flights – perhaps more – on his own.

Even if the pilot is flying merely to consolidate his experience and not to tackle something new, he should never go up just to 'do a circuit'. Those who get on best and quickest use every moment they can get in the air to advantage. It would be wrong if sheer pleasure were not included in this category, but some pilots at this stage allow themselves to droop into the habit of just going up, round and down, neither getting any real fun, nor endeavouring to fly better. Before take-off, the pilot should get into the habit of assessing the weather, and the affect it will have on his flight, and deciding what particular exercise he is going to practise. For instance, if the wind is strong, he will have to plan his circuit and approach with extra care so that he does not get drifted out of reach of the field, and the exercise could be practice in accurate turns, improved speed control, a search for thermals, or even straight stalls. To begin with, the instructor will suggest

to the pilot what should be done, but after this it is up to him to be critical of his own flying.

The pilot will be expected to do some 50 to 100 flights solo at this stage, during which time he will convert on to more advanced aircraft and learn about controlling his glider in different and more difficult circumstances.

Conversion to different gliders

If the pilot has soloed on the two-seater, his first conversion will come after relatively few solo flights, in some clubs only about three or four, and in others about a dozen. The new glider will be a single-seater, of either equal or better performance than the two-seater. One aircraft which is becoming fairly widely used at this stage is the Slingsby Swallow. This has a span of 43¼ ft., weight 450 lbs., and is fitted with an enclosed canopy for the pilot, and fairly powerful airbrakes. It flies in the air at about 35 knots and needs 40 to 50 knots for the approach. The controls are crisper and lighter than those of the two-seater, and as a result it gives a feeling of confidence and assurance to the pilot, who must not be misled into thinking that his flying has suddenly become superb! The perspex canopy is large and the view good, but the lack of fresh air on the face, as a means of judging speed and slip, etc., will not prove a difficulty. There are always noise changes with changes of speed, and by now the pilot should be able to feel, with greater sensitivity, any inaccuracy in his turns. The airbrakes are powerful and if used fully will give a steep approach and a short landing. For the first few landings, however, the brakes should not be held more than half open, otherwise the pilot may well find himself on the ground, while still thinking about beginning the landing.

Another glider which is often used at this stage is the Eon Olympia. This is an older type, but one which has a fine reputation. It is slightly larger than the Swallow, having a span of 50 ft. It also has a canopy and good airbrakes. It is a very gentle glider, which is delightful to fly, but must not be landed very heavily, since it has a rather weak bottom! The Olympia flies at about 37 knots and approaches at 45 knots. The seating position is not so upright as in the two-seater, and care has to be taken that the pilot is not misled by this on the launch and as a result does not climb steeply enough. One or other of these gliders will probably be used during the whole of the post solo training stage, and in a small club, probably longer.

The performance of both these aircraft is quite good, and from the Olympia, particularly, somewhat longer circuits will be obtained from the ordinary winch launch. Both gliders are capable of being used for cross-country flying, and for a long time an Olympia held the record for the longest distance flight made in this country, 245 miles.

Two new exercises that the pilot will learn at about this stage are how to land across wind, and how to make his turns much steeper.

Cross Wind Landings

Although it is desirable to land into wind, since this gives the shortest landing, it is not always possible. The landing area may be obstructed, or the pilot fail to reach his intended point, or when landing in a field at the end of a cross-country flight, it may not have been possible to make a correct assessment of the wind until the glider has been committed to a certain approach direction. In any case, the pilot is faced with landing out of wind to a greater or lesser extent. If the cross wind landing is not done

properly, the glider will arrive on the ground drifting sideways. The landing wheel and skid are not designed to cope with more than a fairly small degree of drift (to make them capable of this would involve an excessive penalty of extra weight and cost). Somehow, therefore, the sideways drift over the ground must be removed during the actual moment of touch down.

The simplest method of doing this is by slipping the glider into the wind, thus counteracting the drift to leeward. This method, however, will only deal with small amounts of drift, and further action must be taken if the cross-wind component is larger. While still under supervision, the pupil is not likely to find himself flying in difficult or strong wind conditions, but he will quite often have to deal with small amounts of drift, when only fairly simple action is needed.

Often, while he was flying dual, there would be some slight drift from one side, and the instructor would have told him to take off with the into-wind wing slightly down, and to hold it down during the winch climb, so that the launching wire was dropped straight. When coming into land the wing has to be held down in the same way, and rudder used to maintain the chosen landing path.

The glider will then land with little or no drift. The pilot must obviously ensure that he does not hold the wing so low that there is any risk of hitting the ground with it, and this, of course, is the limiting factor to this means of counteracting drift. If, however, when the wing is held down as far as is safe, the glider is still drifting sideways over the ground, then something further must be done.

The necessary action, to be successful, requires that the landing can be made without bouncing, and this is the reason why it is not usually taught in the early stages.

If the amount of cross wind is appreciable, the pilot should make the approach along his intended landing path in the usual way, holding the into-wind wing down, and keeping straight with the rudder. Then, just at the moment of touch-down, the nose of the glider should be swung further *downwind* by applying downwind rudder, the into-wind wing still being held down. This action, if done properly, causes the actual contact with the ground to be made without drift, since the aircraft is now flying in the same direction as it is moving over the ground. The aircraft should be landed and held firmly on the ground, since if it bounces it would immediately drift even worse, and there then might be insufficient control over the glider to land it properly.

Care should be taken with the landing run, so that the wind is prevented from lifting the windward wing, and because, owing to the effect of the wind on the side of the fuselage, the glider will want to 'weathercock' into the wind. This is because the side area of the tail and rudder is much greater than the side area of the nose. For further clarification on this point, the local town weathercock should be studied.

Steep Turns

Up to this stage the pilot will only have done, or intended to do, gentle or medium turns of 30°–40° angle of bank. If he has inadvertently done an appreciably steeper turn than this, he may have felt that he was not managing it very well, and so returned hastily to his more familiar medium turns. Steep turns are merely steeper ordinary turns, but more understanding of them is needed before they can be done accurately.

In any turn the stalling speed of the glider increases. This

is because the 'weight' of the glider is increased by the centrifugal force of a turn, and enough lift must be provided to cope with this plus the ordinary weight of the aircraft. This lift is provided by increased speed. If the speed is not increased the margin between the speed at which the glider is flown and the stalling speed is reduced. If the turn is steep enough, it may disappear all together and the glider will stall, and almost certainly spin.

The increase in the stalling speed for gentle or medium turns is so small that it is not necessary to fly faster than normal flying speed, but with steeper turns it is necessary to have more speed, as the stall speed rises at an increasing rate as the turn gets steeper. So much so that if the glider is being turned as steeply as it can be turned – probably about 75° to 80° of bank, the stall speed is in fact doubled. If the glider normally stalls in straight flight at 35 knots, then the stall speed in a really steep turn may be as high as 70 knots. The other thing to be remembered about steep turns is that although the controls always have the same effect on the glider, for instance putting on left rudder will always swing the nose in the direction of the left wingtip when the glider is in quite a different attitude in relation to the ground, these same control movements may not produce the result the pilot expects. For example, if the glider is on its side, the same left rudder which normally makes the nose swing round the horizon would make the aircraft go down towards the ground. The effect of control movements on the aircraft is the same, but the whole aircraft is in a different relationship to the ground.

However, the pilot is unlikely to find any real difficulty if he properly understands the primary effect each control has on his glider – and he should by now – and relates it

to the attitude of the whole aircraft in relation to the ground.

To do a steep turn. First of all a good look round should be made for other aircraft. Then the speed should be increased by about 5 knots, if the turn is not to be very steep, or more if it is.

The turn should be entered smoothly in the normal way but with more bank than usual, and this steadied at the desired amount. It will be found that in order to make the aircraft go steadily round the horizon an appreciable amount of backward pressure is needed on the stick. This is because the glider is partially over on its side.

A check on the speed should be made and any adjustment made by raising or lowering the nose in relation to the horizon. If the speed is steadily increasing rudder should be reduced in the direction of the turn. If the speed goes on increasing the bank should be taken off and the glider straightened up, and a new start made with a turn which is not quite so steep. No glider can make true vertical turns, and so if the turn cannot be made accurately it is probably because the pilot is attempting one which is steeper than is possible.

It is quite difficult to make a really tight turn well, and it is much better to work up to this by degrees, by first of all practising turns which are not much steeper than normal, and getting them right. When doing very steep turns centrifugal force will cause the pilot to feel the effects of increased gravity. He may feel pressed down into his seat, have difficulty in lifting his arms, and get a drawn feeling in his face. This is quite normal, but if the pilot does not like it he has no need to do such steep turns. Continuous steep turns should not be done low down or anywhere near the approach path. Well done, they are

pretty to watch, and they provide excellent practice in accurate flying.

If the pilot follows his instructions and takes off bank if he finds the turn is getting somewhat uncontrolled, and the speed is increasing rapidly, he will not get into trouble. If, however, he allows the speed to build up excessively the turn will become a spiral dive. In this case, he must take off bank at once, and correct to normal flight.

It is important to realize that this can happen, because an inexperienced pilot might well confuse a spiral dive with a spin, as in both cases the aircraft is going continuously round in a nose down attitude. The difference is actually great since in a spin the aircraft is stalled, and the airspeed remains fairly constant and low, whereas in a spiral dive the speed is increasing rapidly. As was mentioned earlier, some gliders do not like to remain in a spin, and if a pilot is trying to carry out a developed spin of several turns, he may well find that although the aircraft is still going round, it has, in fact, unstalled itself and the spin has become a spiral dive with the speed increasing.

If the pilot knows he is spiralling he should take off bank and correct so that he is flying normally, but if there is any chance that he is spinning, then he must apply the proper spin recovery action at once.

If at any time the speed of the glider should build up so that it is diving or spiralling at over 65–70 knots, the airbrakes should be opened to prevent a further increase in speed, at the same time as taking corrective action. When back to normal flying, the brakes must be shut and locked again.

During this further training stage some flying will be given on an advanced two-seater, such as the Eagle, if the club possesses one. On this it will be possible to practise

more continuous turns, and if aero towing is available some more spin recoveries. The pilot will probably find the bigger, faster two-seater rather heavier to fly than the single seaters, but the Eagle, particularly, has performance and characteristics representative of the modern soaring single-seater, and any training that can be obtained in this way will be very valuable; particularly if the pilot can fly in soaring conditions with an instructor to help him find and learn to use upcurrents.

Aero towing

It is not necessary to have dual instruction for being towed up behind an aeroplane, but if the club has a suitable two-seater such as a T49 or Eagle, it is helpful, since it will not then be necessary to wait for very easy conditions in which to do the first tow. Aero towing is a pleasant way of getting into the air, and if the tug pilot knows how to find an upcurrent in which to leave the glider, this makes it even more worthwhile. Club towing is invariably done in the high tow position; that is, with the glider above the slipstream of the tug. To do an aero tow, the glider is connected to the aeroplane by means of the tow rope, heading into wind, and with about 800 yards of clear run ahead.

When ready, the signaller will tell the tug pilot to taxi forward until the rope is taut, and the aeroplane will then proceed to take off in the normal way. The glider pilot, having done his cockpit check, with special reference to the locking of his airbrakes, will allow the glider to be accelerated along the ground, while keeping his wings level. The take-off run will be longer than with a winch launch since the aeroplane cannot accelerate quickly, and so the glider pilot must not try to hurry his aircraft off the

Above: Portmoak, home of the Scottish Gliding Union, with Bishophill in the background.

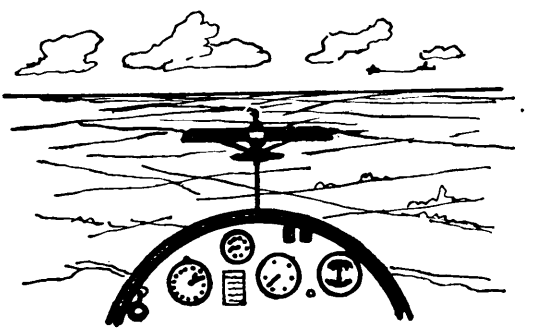
Below: Bristol Club, Nympsfield, Glos., from the air.

Above: Cockpit of a Foka glider.

Below: Instrument panel of a modern glider.

ground before it is ready. Since its minimum flying speed will almost certainly be less than that of the tug, he will take off first, and the glider should be allowed to go up to about 10 ft., and then held at this height, until the tug takes off. Once the tug is free of the ground it will accelerate faster, will convert its extra speed into height, and start to climb away. The glider pilot must watch for this, and not allow himself to get left behind, lower than the tug. He should endeavour to gain height with it.

In the air, station should be maintained behind the tug by flying in such a way that the whole of the aeroplane is a little below the horizon. A good check is to keep the space between the horizon and the top of the tug the same as half the span of the aeroplane. The glider pilot should keep behind the tug directionally so that he always sees a symmetrical back view of it. When the aeroplane banks to



12. Flying behind a tug.

turn, the glider pilot should follow suit, and still try to keep the symmetrical rear view. In other words, the tow rope should always be a straight continuation of the aeroplane fuselage. If the glider should get out of position so that the tow rope goes slack, the pilot should not worry too much about this, but concentrate on gently but firmly returning the glider to the correct station.

At the agreed height for release, the gilder pilot should disconnect himself from the tow rope, and turn away to one side. If at any time the tug pilot wishes the glider pilot to release, he will rock his wings laterally. This is an order and it must be obeyed instantly, however inconvenient or even hazardous the situation. If such a signal should be given shortly after take-off, for instance, the chances are that the aeroplane engine may be failing. If the glider pilot hangs on he may be endangering the pilot's life, who will do the only thing left to him, which is to release the rope from his end, and leave it with the glider. If this happens the rope will back-release from the glider and probably be lost altogether, unless the glider is out of position, when the rope may go back over it and damage it or get caught in the controls. The glider pilot is always better off than the aeroplane pilot when it comes to a forced landing, and it is up to him to obey this signal promptly.

On early tows the glider pilot will probably be told that the tug pilot will signal him off at the agreed height. This is done in case the inexperienced glider pilot has lost his bearings on the way up. The tug pilot will usually wave him off when they are pointing towards the club field.

There is another signal which the glider pilot ought to know. Should he find that he is unable to release the cable, he must fly out to the left of the aeroplane, and waggle his wings. The tug pilot will then fly back to the field at a safe height and release his end of the cable. The glider pilot should approach in to land high enough to avoid the rope getting caught up in the hedge, and with the release held open. So far this emergency has not arisen on British gliders with back releasing hooks, but the signal should be known just in case.

It is the aeroplane pilot's responsibility to ensure that

the glider has released before diving away to go into land.

After a few tows in calm weather, the glider pilot will find that he can keep in position quite easily even in the more turbulent air of windy or thermally days. Once used to aero towing most pilots prefer it to winch launching.

9 *Soaring*

METHODS AND WEATHER

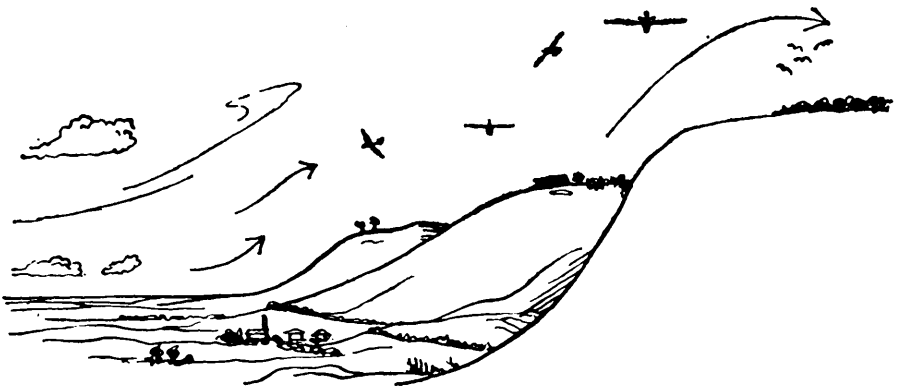
ONCE the pilot has learnt to fly he can learn to soar. He may well have had some soaring flights with his instructor, but until he can control the glider accurately himself it is a waste of time trying to learn to keep it up.

There are two basic methods of soaring, that associated with convection in the atmosphere, and that associated with orographic influences. This sounds extremely complicated and although the finer meteorological points of both *are* complicated, their practical application is not. If, for convection, read upcurrents caused by hot air rising, and for orographic influences, read wind blowing over hills and mountains, nearly all the difficulties disappear. Many people feel that meteorology is beyond their understanding – except that met. men are often wrong – and think that they will never be able to soar because they know no meteorology. Obviously to the record breaker comprehensive knowledge is valuable, in the same way that knowledge of the inside of his car is necessary to the top racing driver, but to begin with no more technical knowledge is required than is needed to start driving.

Soaring on Hill and Mountain Lift

The limitations of this type of soaring is that it is confined to hilly regions. In its simplest form it provides Slope

Soaring, but in some conditions a more complex and far-reaching system develops in which wave lift exists. Slope soaring can be carried out whenever the wind blows



13. Hill soaring.

against the face of a ridge of hills. Since the air cannot go through the hill it lifts up over the top. If a glider is flown back and forth along and just out ahead of the crest of the ridge, so that it is in the rising air, it will remain airborne until either the wind drops or the pilot gets fed up.

The height which can be obtained from hill lift depends to some extent on the actual slope, but is very generally two and a half times the height of the ridge above the valley, in a fresh wind of roughly 20 knots. Individual ridges vary in the minimum wind speed at which they become soarable; some ridges of about 200 ft. high will just keep a glider up when the wind is blowing at only 5 or 10 knots. Other ridges, and often the bigger ones, need about 10–15 knots minimum. The lift over the ridge is invariably smoother and more consistent if the valley out in front is large and flat. If there are other ridges ahead of the one being soared the lift may be more turbulent, or there may be a cut-off, or region of dead, or calm, air low down, where the soaring ridge is sheltered by the windward one.

Once the air has risen over the ridge it will go down again on the far side and if a glider gets too far to the lee of the ridge it will be forced down in this downcurrent. Gliders can be soared continuously but at only a very low height if the wind is weak, and any temporary lull may be enough to force a hurried landing in a field at the bottom. For this reason inexperienced pilots are given a minimum safe soaring height, and as soon as they sink down to this level, they must leave the hill and come in to land.

Hill soaring was once the only practical form of soaring known, and many of the clubs whose sites possess a ridge were formed in the early days of the 1930s. It is a valuable way of piling up the flying hours, and also as a means of waiting in the air for a good thermal from which to go off across country. When the wind is blowing down the hill, however, no soaring is possible on it, and some clubs whose sites are at the bottom of a ridge may find their flying restricted in these circumstances.

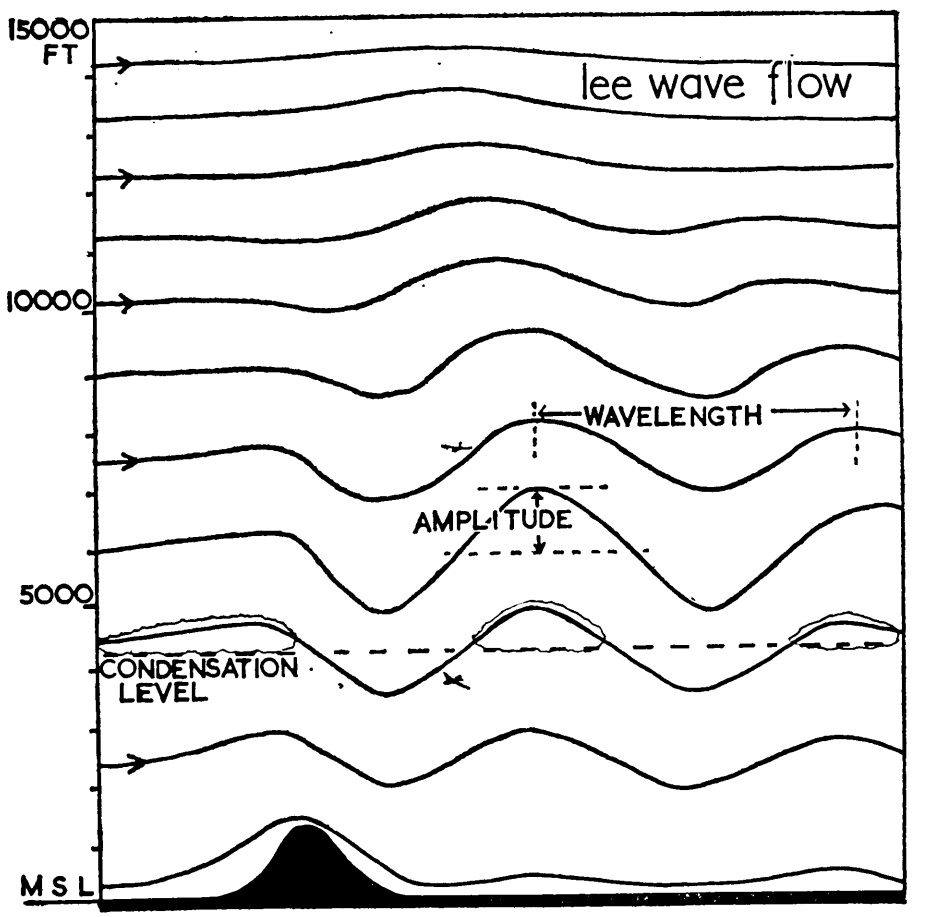
Wave Soaring

In any fluid, and air is a fluid, it is possible to get a wave system set up as a result of disturbances to the smooth flow. Such waves can sometimes be seen in rivers downstream of a rock or bridge pier. In such systems the wave runs through the fluid: it is not a matter of each individual particle going from the bottom to the top of each wave and then down again, but of each particle pushing the one ahead of it and so on, in the appropriate direction.

What happens in the case of atmospheric waves is this: the air flowing towards ranges of hills or mountains must rise up over the top. Having curled up and over the crest it then flows down the other side. Under certain conditions the air, instead of flowing smoothly parallel to the ground,

will form a series of waves downstream of the hill. The position of these waves may stay substantially constant in relation to the ground, although, of course, the air is going through them at the speed of the wind.

Sometimes the waves are marked by a particular type of cloud, called lenticular, from its lens-like shape, which will be seen as stationary. This forms in the up-going part of the wave, where the air condenses on reaching a certain level. As the air descends on the down-going slope of the wave, the cloud evaporates.



14. Atmospheric waves. Their existence can often be seen by the lenticular clouds which form at the crest of each wave.

Frequently only one or two waves will form to the lee of the hill, although the number may sometimes be greater. The distance between the crests may vary between 2 and 20 miles.

The useful thing for the glider pilot about waves is that they can go to great heights, much higher than is possible with hill soaring, even though triggered off by the same size ridge initially. The giant wave systems of the world come from big masses of mountains, such as the Sierra Nevadas in California. Heights above the ground of 44,000 ft. have been reached in this wave – the world record.

Pilots flying in these huge systems have to be prepared to encounter the extreme cold, reduced air pressure, and lack of oxygen at high altitudes, as well as the severe turbulence which may be found in some part of the wave. Whereas the primary benefit of wave soaring is the height gained; this height can, of course, be turned into speed and distance. The present Goal-and-Return record was achieved by working the N.W. Arch wave in New Zealand to great heights, flying on to the turning point and then searching out and using similar waves for the return flight. The average height of this flight of over 400 miles was about 20,000 ft. or nearly 4 miles up, and it took $8\frac{1}{2}$ hours. The pilot was extremely cold, the coffee in his thermos flask froze and his sandwiches became triangles of frozen rock.

It is often impossible to reach these big waves except from an aero tow, and sometimes a high one, as the system develops well above the valley floor when created by high mountains; and near the ground there is only dead or turbulent air, or upcurrents too weak to be used.

In this country, although we have no really big mountain ranges, there are several wave systems known. There

are those which develop from the regions of the Pennines and the Lake District. Quite a lot of flying has now been done in these waves, and heights of over 20,000 ft. have been reached. There are other systems in association with the Cairngorms, but these have not yet been explored. Smaller wave systems sometimes develop in the region of the hill clubs such as the Long Mynd and Camphill, which may go to heights of 10,000–15,000 ft. These have been explored a great deal, because they can nearly always be reached without the need for a high aero tow. Sometimes, however, it is possible for the wave to be out of phase with the soaring ridge and actually spoil the hill lift. In general waves develop better in steady air, and air which is turbulent with warm upcurrents, or in which thunderstorms exist, is not so conducive to their formation. This is largely why the best wave soaring can often be found in the winter months.

Soaring on Thermals

These are warm air upcurrents and soaring on them can be carried out whenever the meteorological conditions are suitable. The pilot is not confined to any particular geographical region, as he is with hill soaring.

Nearly all the distance and speed records have been made using thermals, which can exist in a usable form anywhere in the world in warm weather. Little research has been carried out into thermals over the sea; these do not exist for all practical purposes over cool water areas, or near land; they may well, however, be of a workable size and strength over the middle of the warm oceans, but no one has yet been prepared to experiment!

Thermals are formed as a result of the sun warming the ground. This does not heat uniformly as different surfaces

absorb or reflect heat at different rates, therefore some areas warm up to a greater extent, and more rapidly, than others. Areas such as villages, towns, sheltered sunny valleys, and airfields with tarmac runways do not take long, whereas woods, lakes or marshland are slower to warm up. The air immediately above the warmed area of ground is warmed in turn and is warmed more quickly than that over surrounding cooler areas. The more quickly warmed areas or patches of air become increasingly unstable. They want to obey the natural law which everyone learnt at school, which states that hot air rises. When they have become sufficiently warmer than the surrounding air – for a usable thermal about 2°F or more – they will break away from the surface and start to rise, at the same time drifting away on the wind. No one knows the exact shape of a thermal, but there is increasing evidence that it represents a doughnut or vortex ring, with an internal circulation of its own in which the air rises strongly in the centre and down at the perimeter.

The rising air of the thermal will be replaced by air flowing inwards from all around, and sometimes on the ground these local winds or gusts can be felt on an otherwise calm summer day. As the patch, or bubble, of air rises, it expands into the reducing air pressure of altitude, and as it expands it cools. It will go on rising as long as its temperature is greater than that of the surrounding air. It cannot continue to go up for ever, though, because it is losing heat at a slightly greater rate than the surrounding air, due to mixing, as well as to its natural rate of cooling. Simple thermals in England rise to a maximum of about 7,000 ft., although for various reasons explained later, the height is often less than this. In hot dry countries thermals may rise to 12,000 ft. or more.

The expansion of the thermal with height is of value to the glider pilot, as it means that it becomes both easier to find and to use as it gets higher. The air between thermals sinks to compensate for them. The English summer thermal may well vary in size between 100 yards and a mile across. Thermals with a diameter of less than 250 yards, however, require tight circling and are difficult or impossible to stay in.

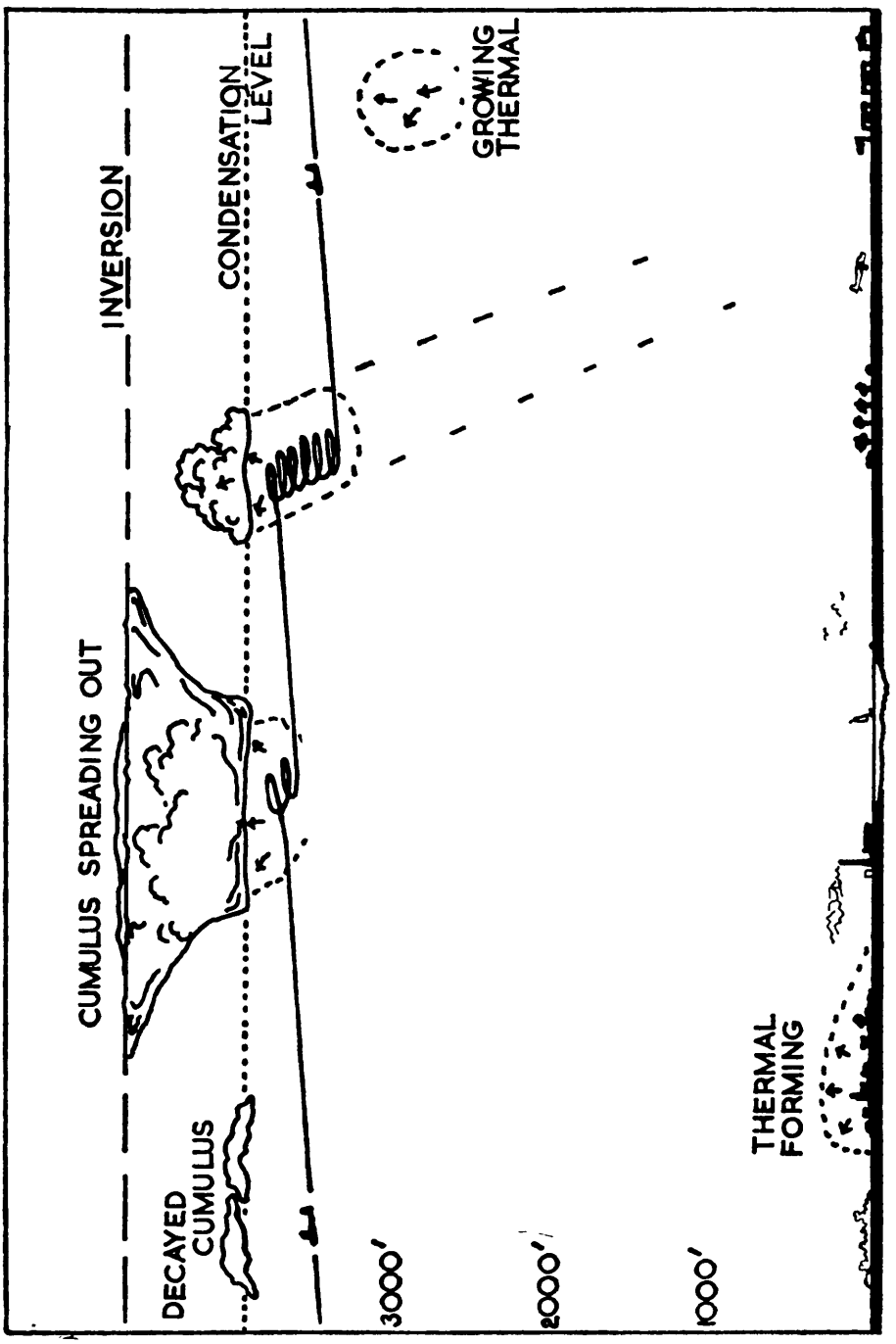
Thermals are distributed fairly evenly over the countryside, but the distance that they will be found apart depends to a large extent on the size of the individual thermals. Small narrow thermals will be found closer together, and large thermals, particularly those that have developed into thunderstorms will be further separated. The distance may vary between a half and several miles.

If the air is very dry the thermal will rise a few thousand feet and then die away in the blue sky. If, however, the air is damp, and this is much more often the case in the U.K., then a cumulus cloud will form in each thermal. What happens is this. All air contains some moisture, and this varies according to where the whole mass of air has come from; for instance, air which has travelled over the sea will be damper than air which has moved thousands of miles over land. At any particular temperature, air can carry only a certain amount of moisture invisibly. Hot air can carry more than cold air. As air is cooled it becomes progressively less able to carry this moisture. When it cools below the temperature at which it is able to carry the amount of moisture it contains – the dewpoint – some of this must be given up. It condenses out in the form of water droplets. The mass of water droplets is a cloud, the name of the cloud formed in this way from thermals is cumulus. As the cumulus forms, heat is given out due to

the physical transformation of the vapour into droplets – the latent heat of condensation. This heat is available to the glider pilot in the form of stronger lift in the cloud, and increased altitude, before the thermal reaches equilibrium.

A thermal does not last very long, therefore the cumulus that it creates does not normally have a long life either. The delightful little white puff balls of a summer day live for about twenty minutes, although the sky seen as a whole gives an appearance of the same clouds drifting continuously along. First of all, as the thermal reaches condensation level – and the height at which cumulus form is constant throughout the whole air mass at a given time – the little wisps of a new-born cloud can be seen swirling overhead. The wisps coalesce together and grow into the crisp and beautiful cumulus. As the thermal which produced it dies away so the cloud starts to decay. It becomes flatter and, losing its white sparkling look, slightly discoloured. Steadily the disintegration continues until the cloud has completely subsided and disappeared.

If the air is very unstable and the thermals strong, the cumulus on formation may set up such a powerful circulation, that by sucking more and more air into its base, it can continue growing. Sometimes big but still simple cumulus will form, having a life of half an hour or more, but if conditions are right the growing process will continue, and as the circulation within the cloud becomes stronger, the process will accelerate, and the cloud grow to an immense size. If this happens lightning may appear and its noise will be heard as thunder. These clouds may go very high and will almost certainly reach above the height at which the temperature is lower than freezing. This means that some of the top of the cloud will be formed of ice



15. Thermals and cumulus.

crystals instead of water droplets, and that snow or hail or both will be found within the cloud. A glider flying in such clouds will have ice form on its wings, tail and cockpit cover, etc., and may well encounter severe turbulence, and if not properly protected, lightning strikes and even electric shocks for the pilot. Inexperienced pilots should keep absolutely clear of big clouds, especially on a day on which there is any sign of them developing rapidly. The upcurrents may be so powerful that the inquisitive one may be sucked smartly in, and be unable to extricate himself.

On a day when thunderstorms develop cross-country flying will be difficult, if not impossible, for the pilot who has not learnt to blind fly properly, or who does not wish to enter such clouds, as upcurrents will only exist under, and in the storms, and these may be perhaps 20 miles apart. Thermals will be unlikely to form in the air between, partly because it is generally sinking to compensate for the masses of rising air in the storms themselves, and partly because the spread of cloud of the thunderhead will keep large areas of the ground in shadow, and prevent the formation of new thermals. From cloud base the distance to the next likely upcurrent may be greater than it is possible to glide straight without arriving on the ground first.

In some circumstances thermals are prevented from reaching the height at which they would naturally fade out because the surrounding air does not continue, as it should, to cool. Instead it remains at a constant temperature or gets warmer, and the thermal ceases to have an excess of temperature over the surrounding air, is no longer unstable, and so ceases to rise. This *inversion* of temperature occurs for various reasons, sometimes because

a layer or mass of warmer air is moving over the existing air, as happens when the warm front of a depression approaches, or when an anticyclone or high pressure area covers the country. To the glider pilot, the increase of air temperature with height due to the subsiding air of an anticyclone can be more frustrating than any other form of inversion. This is because spring and summer anticyclones produce the sunny and warm weather which is excellent for the formation of thermals. If, however, the anticyclone is strong, the inversion may be too low, literally putting the lid on soaring. When the inversion occurs at, say, 5,000 ft. there are excellent opportunities for cross-country soaring, but if it is only 500–1,000 ft. above the ground even local soaring is not really practical, and the only thing to do is to sunbathe.

Occasionally the inversion level occurs below condensation level, and the sky will remain blue and clear of clouds although the thermal may be strong right up to the inversion itself. Sometimes, however, cumulus are just able to form as the powerful thermal 'makes a dent' in the bottom of the inversion. Such cumulus are small, have a flat plate-like appearance, and a life of only a few minutes. They are characteristic of anticyclonic conditions.

If an anticyclone in the summer has been stationary for some days, the weather may get hotter and hotter with a heavy sultriness and a clear but increasingly hazy sky. This is due to dust rising and remaining suspended in the air below the anticyclone lid. Often these conditions terminate abruptly when the overheated air imprisoned below the inversion finally bursts through and surges upwards creating the huge thunderstorms which so often seem to come after some days of very hot weather.

A further effect of anticyclonic inversion on soaring is

that the visibility is often poor in the hazy air. This may make navigation difficult.

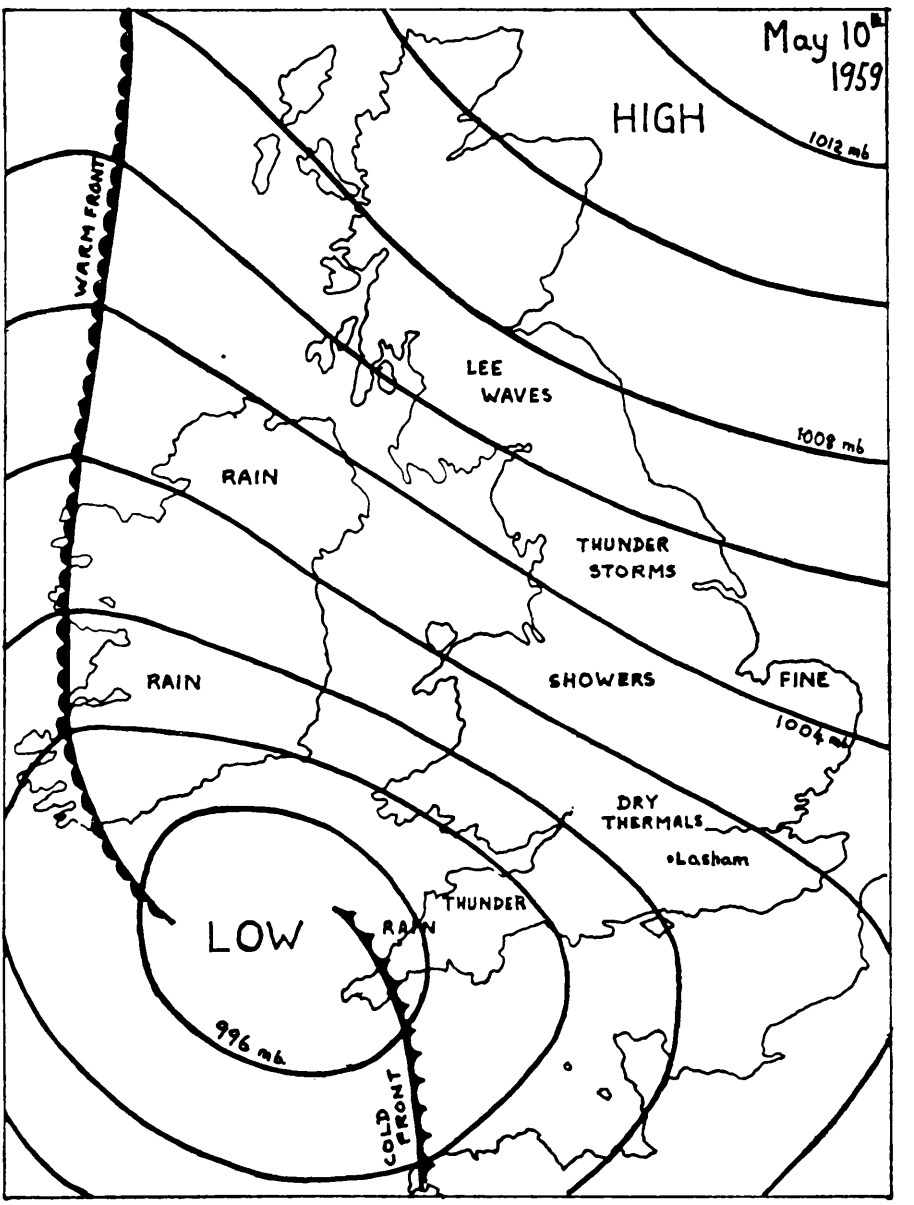
In a small country like ours surrounded by sea, there occur on good thermal days local winds which blow from the sea to the land. These are called sea breezes and their effect is to cool the ground over which they blow and prevent thermal formation. They blow because the air over the land is hotter than over the sea, and much of this air is rising in the form of thermals. More air is required to move in from somewhere to take the place of the rising air and it is 'sucked' in from over the cool sea. The penetration inland of the sea breeze depends on the time of day, the strength of the thermals, the instability, and the direction of the wind. Usually the sea breeze starts during the morning and penetrates slowly and steadily inland until the thermals begin to weaken in the late afternoon or early evening, when it too dies away. On a day of strong lift it may penetrate up to 25 to 30 miles by about 5 p.m. If the main wind is blowing in the same direction as the sea breeze – from the sea towards the land – then the sea breeze will penetrate further than if the main wind is blowing against the sea breeze. In other words, the sea breeze on the South coast of England will not be able to penetrate so far if the whole country is covered by a Northerly air stream, as it would if the wind blew from the South. Sometimes lift occurs along the sea breeze 'front' and pilots have been able to soar along it for many miles.

Synoptic Charts

Although the glider pilot can learn to soar perfectly well without ever having seen a synoptic chart, the ability to read and understand them is a valuable aid to interpreting weather forecasts for his own purpose, and enables him to

assess in advance the probability of a good soaring day.

Synoptic charts appear every day in newspapers and on the television, and show isobars, which are lines connecting



16. Synoptic chart. A total of 5,400 miles was flown by gliders on this day from Lasham.

places of equal pressure, and the warm and cold fronts associated with depression. By comparing succeeding charts, the rate of movement and change of the air masses can be interpreted.

The newspaper charts which try to simplify interpretation by using suns, umbrellas, and other picturesque and arbitrary symbols are useless.

In England the thermal soaring season begins in late March and continues into September, although it is possible to have occasional days on which short cross-country flights are possible near the end of February and in October, or even early November, although these are rare. The best months are April, May, June and July.

10 *Using Thermals, and Local Soaring*

TO SEE the ease with which the expert finds and circles up in a thermal is often depressing to the pilot who is convinced that they deliberately slip out of his grasp whenever he even blunders into their path. Thermal hunting is not, however, a particularly difficult pastime provided that the pilot can fly reasonably accurately and knows what he is trying to do, and if suitable conditions for thermals exist at the time. However, the first ones that a pilot uses are less likely to be thermals that he has searched for, so much as those that he has flown into by chance. As soon as he realizes that the glider is in lift, he should circle round and round to stay in it.

Centring in a Thermal

The first sign that there is a thermal somewhere nearby is that the feel of the air changes. The pilot may be flying along in fairly smooth air, with a variometer reading of, say, 100 feet per minute sink. If the air suddenly becomes more turbulent in a 'twitchy' sort of way, and even if the variometer shows an increase in the sink rate of the glider, it is possible that it is somewhere on the fringe of a thermal. Since it is not known, at this moment, whether the up-current is straight ahead or partly towards the left or right, the glider should be flown straight and a careful watch kept on the variometer. Sometimes, if the thermal is strong, the sink rate will increase sharply on the periphery

of the thermal, but the pilot should not be discouraged by this.

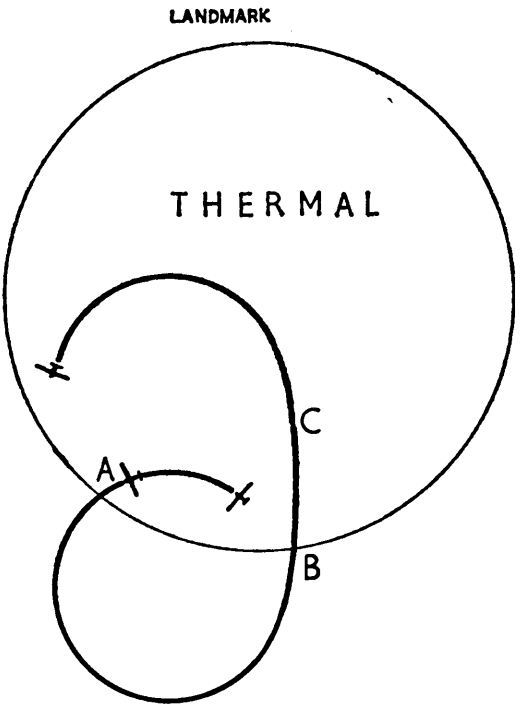
After a few seconds, but it often seems longer, the variometer reading may steady, and even possibly show impulses towards 'rise'. Still nothing should be done, for to circle now would be to turn back straight out of the thermal. Some indication may be obtained at this stage as to the direction from the glider of the thermal centre, by the behaviour of the wings. If one wing is pushed up, it is quite likely that the centre of the thermal lies on that side, and this will probably determine whether a left or right turn is made to get into it.

At about this moment the glider may start to surge upwards, and this will be accompanied, although possibly with a few seconds' delay owing to instrument lag, by indicated rise in the variometer. The pilot should wait until the rise is well established on the variometer, but not so long that the indication begins to subside again. Then he should start to circle in the selected direction. If he has no idea of where the centre is he should circle in the direction in which he finds that he flies best. If he is joining another glider in the thermal he must circle in the same direction as it. He should endeavour to do good medium turns, remembering to look round first. Unless the thermal is huge, the pilot will invariably discover that he has started to circle at the wrong moment or in the wrong direction and that he and his glider have been firmly deposited back in the sink.

He should not be discouraged, but continue circling steadily while he thinks out what has gone wrong. If he immediately starts to alter the circles in hope or desperation, he may be lucky and hit the centre of the thermal, but he is much more likely to arrive at a situation in which he

has absolutely no idea in which direction the wretched thing now lies. It is better to go on circling either half in and half out of the thermal, or even more or less outside it, while remembering the direction of flight on first encountering lift, because there is then a good chance of working back into it again.

To do this he should circle round and note the direction in which he is flying when the variometer indicates that the lift is strongest. In this direction, less an amount equivalent to the lag in the variometer, is the centre of the thermal. At the moment when the variometer shows maximum rise, he should look out and note some point on the ground



17. Centring in a thermal.

rather nearer the outer wingtip of the turn than the nose. The turn should then be continued (A) and the

glider straightened up (B) on this point. It should now be flying straight towards the centre. As he is already partially in the thermal, he should not delay before starting to circle again in the same direction as before, only long enough to obtain an established reading of lift.

If this improves the situation, but lift is still not being obtained all the way round the circle, then the manoeuvre should be repeated until the pilot is in the centre of the thermal and going up steadily in the smoother and stronger lift of the core. The important thing is to be prepared to waste circles and a little time while thinking things out, in the early stages, rather than risk losing the thermal entirely as a result of too hasty changes of turn.

Once in the thermal, smooth steady turns should be continued, and the variometer watched for variations in lift strength. If it is found that the lift is weaker on one part of the circle, and that this weakness becomes more marked with succeeding circles, the glider is edging steadily out of the thermal. An adjustment should be made as described above, but with the glider flying straight towards the true direction of strongest lift for only a few seconds before recommencing circling.

At the top of the thermal, the lift will weaken and die away, and it is probably not worth making centring adjustments to obtain the last remnants, but to set off and look elsewhere for another thermal. If there is a rapidly developing cumulus overhead in the thermal, circling should be broken off at least 200 ft. before reaching cloud, otherwise there may be some risk of becoming enveloped.

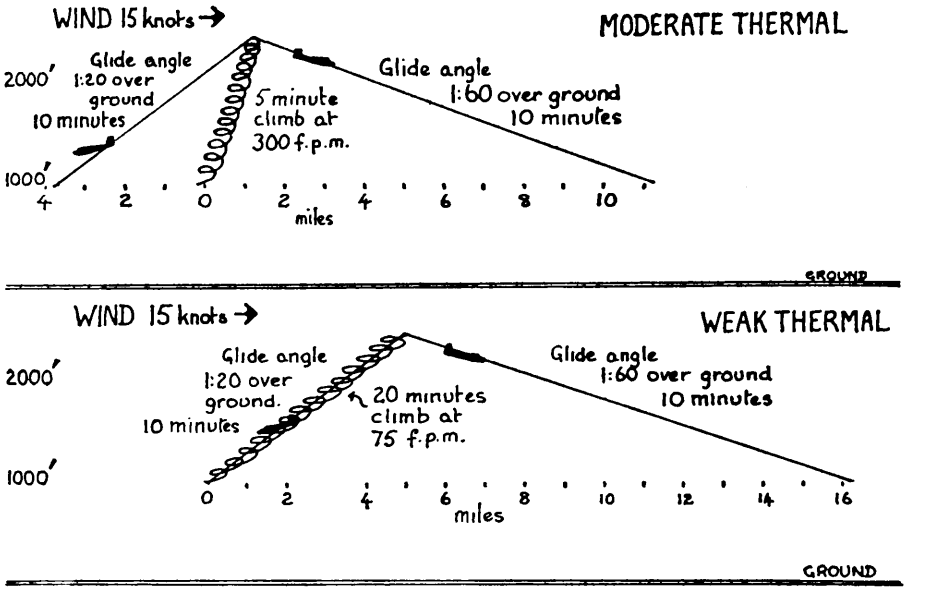
There are other methods of centring in a thermal, and many pilots have developed their own private systems which are often a mixture of intellectual deduction and animal instinct. Some of the best pilots simply cannot give

an explanation of their methods and success, they just 'know' when, and in which direction to turn. The essential thing is to gain experience using a simple system such as described above, and after a while a feel for the thing will be developed and it will be possible to explore rather than grope a way into lift.

Local Soaring

Having found a thermal, and gone up in it, what then? The glider is at 3,000 ft. and the pilot admiring the superb view, with nothing in the world to worry about. This might be true if there was no wind blowing, but whenever it is, the circling and rising glider will be being drifted along over the ground as well. If it is allowed to get too far from the landing field, it will not be able to get back to it again against the wind, and will, unless another good thermal is found, have to be landed out in a strange field. The pilot may not have enough experience to do this safely, and in any case time will be wasted in retrieving it. It is essential, therefore, that when learning about thermal soaring, the glider is not ever allowed to get into such a position that the landing field cannot be easily reached in a straight glide. 'Easily' is the operative word. Unexpected downcurrents may be met on the way, and in any case the pilot may wish to change his direction to explore a new cloud, or have height to investigate the thermal that another glider seems to have found, during the glide back.

When a glider is circling up in a thermal it will be both climbing and drifting. If the upcurrent is weak the glider will take longer to reach the top than if it is strong. It will therefore drift further while climbing to the same height in a weak thermal than in a strong one. It may be necessary, therefore, to break away from the thermal and



18. The effect of the wind on the glider's position over the ground.

return home long before the top has been reached. It will be followed from this that the stronger the thermal, and the faster that height can be gained in it, the stronger the wind that can be soared in, with the glider always remaining within easy reach of the field.

The technique of local soaring is to work upwind of the field, and to make every effort to stay upwind. If a thermal is found from a winch launch, circling will be started at about 700 ft. in the vicinity of the field. If the thermal is a good one, and the wind is only moderate, say 12–15 knots, the glider will have climbed some 3,000 ft. reaching the top in about 10 minutes. During this time the glider will have drifted, while circling, some 3–4 miles downwind away from the field. The pilot should then glide straight back towards either the landing field or to any good cumulus in its vicinity. If he flies into a thermal while still more than a mile from the airfield centre, he should ignore it unless it is large and strong. If he flies straight back he will arrive

over the field with about 2,000–2,500 ft. in hand and should continue flying into wind over or to one side of the field, while studying the sky and deciding which are the best-looking clouds ahead. On making up his mind, he should fly towards the chosen cloud endeavouring to approach it from dead downwind, as this will provide the best chance of locating the thermal. He may well fly into another thermal on the way, and should, of course, use it. At its top the glider should again be headed off into the wind, with the pilot aiming to locate and use thermals about 1–2 miles upwind of the field. From this situation the top of the thermals will be reached more or less above the landing field. This is, of course, an excellent location for obtaining the maximum freedom to search for further lift, because being virtually above the landing area, all available height can be used for locating thermals. If, on the other hand, the pilot gets himself into a situation well downwind of the airfield, even at a good height, much of this will have to be used up merely in order to get back, and there will be very little or none to spare for thermal hunting. Late in the day, when the lift is beginning to weaken, and the climbing rate slows down it will be more difficult to stay upwind, but even more important to try to do so, so that the last feeble thermals of the day can be effectively used. Once the glider gets downwind it will become increasingly difficult, if not impossible, to use the dying thermals without risking an out-landing. If, however, the glider has been kept working well upwind, even the last thermal of the day can be used, as the glider will drift back with it over the field, and be in a good position for landing.

If the glider is launched by aero tow, the tug pilot will take it a few miles upwind so that, after release, it will be in a suitable situation to start thermal hunting.

The speed, – airspeed, – at which the glider should be flown back against the wind between thermals is tied up with the strength of the lift, and will be dealt with later. At this first stage of thermal soaring, it is much more important to concentrate on using thermals effectively and not bother about the precise best speed to fly between them. It will, however, always pay when local circling, to increase speed a bit when beating back upwind. If the glider is flown too fast, not only will its performance decline due to the extra drag, but it may be flown right through, say, the side of a thermal without the pilot realizing it, and he may not be able to find it again. If it is flown too slowly it will take a long time to cover the ground against the wind, and this will unnecessarily waste precious height getting back. In moderate winds speed should be increased to about 50 knots when flying straight into it, and reduced to normal on entering the lift. Should the pilot be foolish enough to find himself rather farther than intended downwind, particularly if the wind is stronger than anticipated, then the speed should be increased even up to 60 knots to try to return to the landing field as quickly as possible. If it is thought that the glider is unlikely to reach it, the pilot should not just sit there hopefully until coming to rest on the fence, but firmly decide to land out, making this decision early while there is still height to manoeuvre and choose a field.

At this stage of the pilot's experience he should select a big flat field as nearly ahead (i.e., into wind) as he can, and within very easy reach. He should aim for it, maintain plenty of speed, and use the airbrakes to lower himself into it, remembering that if he is going to make a muck of it, he will do far less damage running into the far hedge than undershooting into the near one at flying speed. Above all,

he should not dither and change his mind at the last moment, or go in for any fancy turns near the ground. On landing he should wait in the glider until someone turns up to help him. The insults which will be heaped upon his head, if, having given the club the work of retrieving him, he then lets the glider get blown over by the wind, would have to be heard to be believed.

The first time that the pilot finds a thermal on his own, soars up in it, and peers down upon the less fortunate or less able club members like minute pygmies at the launch point several thousand feet below, will be an exciting day. If he can soar the glider higher than the launch release height for at least five minutes he will have qualified for the flying part of his C. certificate. This soaring test can, of course, be carried out on hill or wave lifts as well as on thermals. The C certificate carries with it a further test – a written paper on air law – so that when eventually he flies across country, he will not hazard other users of the air, or land at London Airport by mistake.

Air Law

Although the glider pilot does not have to hold a licence in the U.K. there are still plenty of laws that he must know about and learn. The Rules of the Air, so that aircraft can avoid colliding with each other, have already been mentioned. The other rules fall roughly into three groups: (*a*) those which affect gliders only, (*b*) what to do when arriving in a glider at someone else's airfield and (*c*) the rules concerning air-traffic-controlled airspace, which is that part of the sky where airliners have priority.

As an indication of what is required, included in the first group are:

The minimum age for flying gliders is 16.

Nothing may be dropped from a glider except sand and water, except (in an emergency) articles for saving life.

The pilot may not be drunk in charge, or carry a drunken passenger—and

Formation flying is not permitted without prior agreement between the pilots.

In the second group (other people's airfields) it is necessary to know such things as:

The lights and signals which may be flashed at the glider pilot from the control tower and what they mean.

The ground signs displayed in the signal square and what they mean.

That aircraft (including gliders) should always be landed to the right of those already down, etc., etc.

In the air traffic group questions will be asked on:

What is an airway, a control zone and a control area.

What does V.F.R. and I.M.C. mean, and when are they applied.

What is an airfield traffic zone.

When is an aircraft deemed to be flying too low, etc., etc.

This is not as complicated as it seems and is all contained in a 2/6 booklet obtainable from the British Gliding Association.

11 *Preparation for Cross-Country Flying (1)*

HAVING got his C certificate safely behind him, the pilot can at last look forward to being able to leave the site and fly cross-country. He will in all probability have seen others fly off into the distance from the same thermal that he has been in, and from which he has had to return back to base. Now the time is approaching when his skill and experience will be sufficient for him to try for himself the delights and excitements of irrevocably leaving home, and setting off into the unknown. Flying locally he already will have started using better performance gliders, and the equipment that goes with them. These will include:

Parachutes

These are worn in all gliders used for soaring, the seat back of the aircraft being built to the right shape for pilot and parachute. Parachutes have been worn when soaring ever since the early experimental days when it was not known what sort of weather would be met, or even if the gliders would be strong enough to cope with it. Today gliders are extremely strong, but the habit of wearing parachutes continues and provides security against the possibilities of collision, or imprudent invasion of the real tough thunderhead – the cumulo-nimbus – in which damage to the glider is possible if it is not controlled properly.

Since the parachute exists it is only sensible to wear it properly and understand its operation. The moment of

need is not the time to stop thinking of the parachute merely as a cushion, and to find out how it works.

Glider parachutes are invariably the back and not the seat type, and weigh about 20 lbs. The canopy itself is 28 ft. in diameter and is normally made of nylon. The harness straps click together in a quick release box on the stomach. The rip cord handle is on the left side, so that it can be pulled by the right hand across the chest.

On some parachutes the harness must be adjusted to fit before it is put on, but many now have straps which can be tightened when the parachute is being worn.

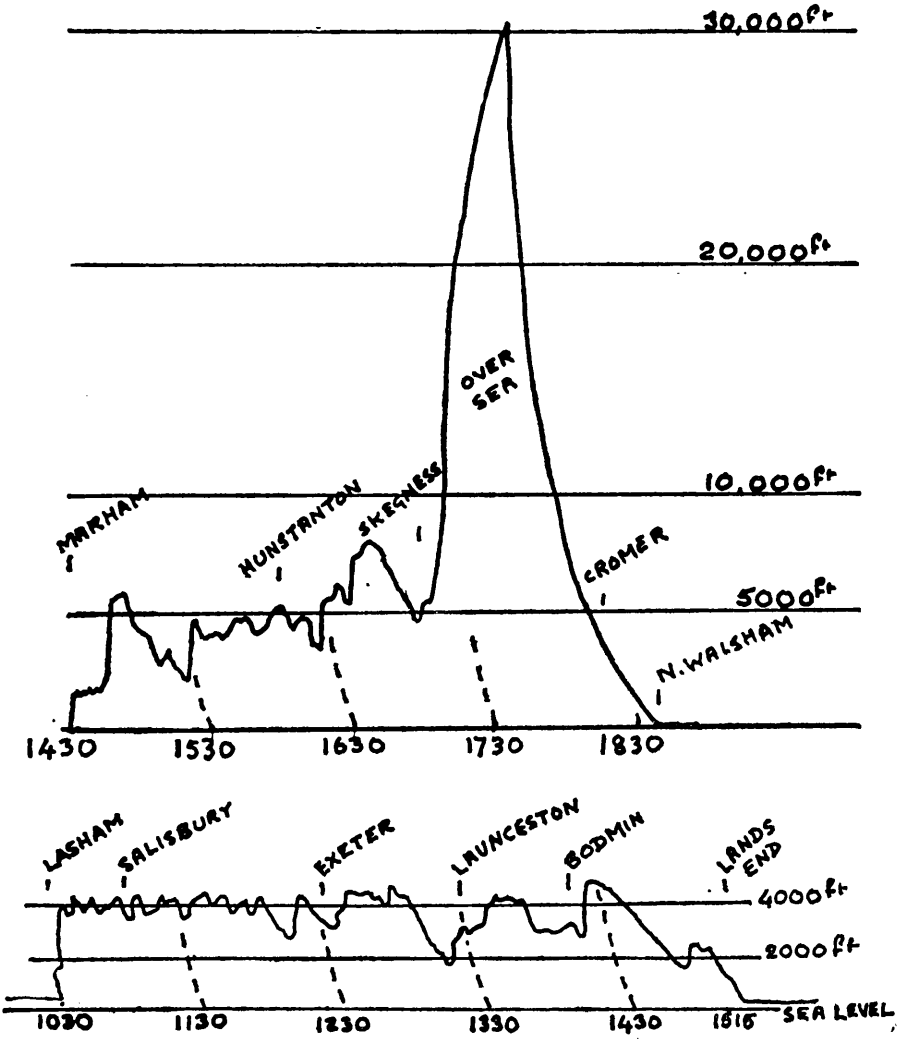
The parachute should be put on before getting into the glider, and the harness tightened enough to make it difficult to stand absolutely upright. Whatever happens, the harness should not be so loose that it can slip off the shoulders. At the end of the flight the pilot should get out with the parachute still on, take it off, and put it carefully into its bag. It should be kept in a warm dry place and not allowed to get damp, and it should be repacked regularly – about three times a year.

Should the pilot ever find it necessary to jump, he should jettison the cockpit canopy, undo his cockpit harness, pull himself forward and up so that the parachute pack on his back will not get hitched up, and go out of the aircraft head first. He should count three slowly and then pull the rip-cord. If he has height to spare, he should delay the pulling of the rip cord for a few more seconds to ensure that he is really clear of the glider. This is more necessary than with an aeroplane, because it is the weight of the pilot that determines the position of the centre of gravity, not, as in the case of a light aeroplane, the engine. When the glider pilot bales out the balance of the glider is wildly upset and it may do all manner of evolutions, seeming to pursue its

pilot, and so the further that he can get away from it before opening his parachute the better.

Barograph

This is simply a recording altimeter, which is carried in the glider, usually in the fuselage somewhere behind the pilot. It consists of a drum on which a trace is made by a



19. Two barograph traces showing flights of G. Rondel who reached 30,000 ft. on 18.6.60, and A. J. Deane-Drummond on a distance flight to Lands End. The former shows a thunderstorm climb.

pen or tracer connected to a pressure capsule. As the glider climbs so the line indicates increased height, etc. The drum rotates at a fixed rate and so it is possible to relate time with the height, and a study of the trace afterwards will enable the pilot to see, for instance, at what stage of the flight he was getting his greatest heights, and to work out his rates of climb, etc. The reason that barographs are carried, in addition to providing a record of the flight, is that their use is mandatory for all certificate and record flights for which they must be sealed beforehand. The barograph is a pretty useless instrument if the pilot forgets to wind it up, or switch it on before he takes off, and these actions should become part of the soaring pilots pre-flight drill. Barographs cost about £30 each.

Maps

Quite apart from the fact that a pilot may not fly cross-country without maps on which controlled air space has been clearly and accurately marked, the pilot needs them to avoid getting lost. Glider navigation is largely a matter of map-reading, and so good maps, and a thorough knowledge of how to read them, are an essential part of his equipment. Air maps, which are published by the Ordnance Survey, come in two scales, $\frac{1}{4}$ million, or approximately 4 miles to the inch, and $\frac{1}{2}$ million – 8 miles to the inch. The $\frac{1}{4}$ million maps have a large amount of detail on them, and are excellent for practice in map-reading while flying locally. Features seen from the air can be located on the map, and indications on the map can be related to the real objects on the ground. In this way valuable practice can be obtained before ever flying over strange country. Many pilots, however, find that the $\frac{1}{4}$ million maps contain too much detail and are of too large a scale to be ideal for

cross-country flying, and they prefer the ½ million maps, which give only important features, completely leaving out villages and minor roads. A further disadvantage of the large-scale map is that several sheets have to be carried on a long flight and sorting out and changing maps is inconvenient in a small cockpit.

The ½ million maps cover England, Scotland, and Wales in three sheets (South England, North England and Scotland), each covering an area of roughly 200 by 200 miles, plenty for most glider pilots.

The Compass

Most gliders are fitted with either a small goldfish-bowl type compass or a Cook compass, or both. The Cook compass is intended primarily for coming out of cloud accurately on a predetermined heading, but is, of course, valuable for all ordinary purposes.

The ordinary compass gives bearings in figures on a band which swims round inside the glass. It is not nearly so dead beat as the Cook, and takes a little while to settle down when the pilot stops circling. For navigation in a glider the compass is not so valuable as the ability to map-read well, so long as the visibility is good. It should, of course, be used in conjunction with the map, and as a check on direction.

Navigation

The first stage in learning to navigate is, as suggested above, learning to recognize, to be able to 'read' the ground as well as the map, and relate the two together, accurately. This is best done while local soaring. The pilot should look around him and spot some feature on the ground, preferably several miles away, or even near the

horizon – say a wood, upland, or a patch of water, or town. He should then find it on his map. When he has done this, or thinks he has, he should check it, by looking at the map and seeing what features exist, say, on either side, or somewhere near it. He should then look out again, and see if he can identify these map features on the ground. Having done this he can continue to relate other features with the first. For example, away to the North the pilot can see a town. He looks at his map and decides that it is Westingstoke. If his theory is correct, then, according to the map there should be a military airfield about 8 miles to the East of the town, and a main road running from the town towards the glider. The pilot should look out and check that this is so. If it is, he can be reasonably certain that the town is Westingstoke. Now, Westingstoke has a main railway running out of it to the West, which after some miles curves around to the South. He had not noticed this at first, but it must be there, and so the ground should be examined where the railway line ought to be, even though it may be several miles away, and the pilot should see if he can locate it. Continuous practice in using maps in this way will teach four things.

1. The appearance of distant features such as railways or roads, and even when the actual thing cannot be seen, by its relationships and effect on the surrounding features; e.g. a long gentle winding line of trees is probably the road.
2. How to recognize the actual relationships between features in terms of angles and visual distances.
3. The need for avoiding self-deception. It is surprisingly easy to convince oneself that a particular group of buildings is a particular town. If it is not then the pilot will be lost, and he may take a long time in finding

himself again. If he practises checking each feature that he proposed to use, by the means described above, he should not have any trouble in this respect.

4. Finally, he will learn how to arrange and fold his map in the air so that it does not end up merely as a crumpled heap of interference with the controls.

The second stage of learning to navigate can be done to a large extent in the so-called long winter evenings, and consists of planning mythical flights. From any club there are certain directions which are more suitable for cross-country flying than others. Perhaps it is because the country is better for field landings, or because it avoids controlled air space, or for some other reason. The hopeful pilot should find out which way early cross-country flights are made from his club, and draw lines on his map radiating out in the appropriate directions. He should then draw circles on the map, either in kilometres or nautical miles, whichever he prefers, at suitable distances from the site – say every 50 kilometres, or every 25 nautical miles – in order to give him an indication of flight distances. On studying the land over which the flight line takes him, the pilot will notice it is criss-crossed with lines, railway lines, trunk roads, even lines of hills, rivers or canals, and that these link up with others, to the extent that a country like England is covered by irregular squares or shapes.

The flight line will therefore be over a series of 'boxes', and when the pilot eventually sets course he will be able to use these boxes to aid him, because as long as he knows that he has not crossed the railway or whatever it is that confines the 'box', he must be in it, and cannot therefore be lost.

On this pre-flight study the pilot should try to visualise the country as it would look ahead from the glider. It is no

good searching for a town as a landmark, when a study of the map would show that it is surrounded by higher land, to such an extent that it could not be properly seen from a distance unless the pilot was really high up.

The third stage of learning to navigate is to actually go across country and do it. When circling up in a thermal over the site, the pilot will be able to see further the higher he gets, but he must have decided in which direction he is going to go before he arrives at the top of his thermal at, say, 3,000 ft. On the way up he should check the direction in which he has been told to go, and study the land in this direction. He is not in the least concerned with the next village down the road, but big general features several miles away. He should not study what is below him, but the direction in which he is going to fly. At this stage he should not have any difficulty in identifying some suitable landmark, since he should have located them all while soaring locally. This landmark should be somewhere near, or on, his line. At the top of the thermal, the pilot should set off using the relationship of the landmark with his line in order to give him the direction to fly. In other words, if a town lies two miles to the left of his line several miles ahead, he should set off so that he will pass to the right of the town by the necessary amount.

At this stage he should check up on as many of the lines that he can see which outline the 'box' that he is in. Such lines that he can locate at this moment should be observed to check also that they are lying at the appropriate angles to him. In other words, a straight railway line which is 6 miles away on his right at the start of the flight and crosses the flight line 10 miles ahead, should converge on his path at only a very flat angle. If the pilot should see it nearly at right angles ahead of him, then he will be flying in the

wrong direction and must alter course. Simple map-reading of this sort is, of course, utterly confused by the pilot having to look for, and concentrate on using lift. He may have to fly off away from his flight line to visit a cloud, then he may get very low and be unable to see much more than the immediate local countryside beneath. Then later he manages to climb up again, has to concentrate on not losing his thermal, and at the same time he drifts with the wind. By the time he is up to 3,000 or 4,000 ft. again, and has time to think, he finds that he is over new country and does not recognize anything at all. This situation can be avoided by working on the box system and watching carefully for the line (rail or road) which has to be crossed before the glider can leave one box and move into the next. It is likely that on crossing the line identification is possible of the exact place. Perhaps a river crosses the road, or a triangular-shaped wood lying across the railway line, at that point. But if precise identification of the point cannot be made it does not matter. The pilot knows that he has crossed a known line, between two known points or junctions and should note the time on his watch. As he gets higher he should look out for landmarks ahead and well ahead which his map tells him he ought to be able to see from somewhere along this line. As soon as he has positive identification, he can work out better where it was that he crossed the line out of his last 'box'. He can then check how far he is off his flight line, and what he is going to do about it. Although this flight line is the shortest distance between two points it has no magic significance. If the thermals are consistently better 10 miles to one side of the flight line, then the pilot obviously uses the thermals and flies along on a parallel track. If, however, thermals are uniformly distributed, but the pilot consistently finds

that he is off course to the same side, then it is almost certain that he is being affected by the wind blowing at an angle to or across his flight line. If the flight line has been drawn to a particular destination or to give a long distance far enough inland to be clear of sea breezes then the pilot must do all he can to work steadily back to his flight line as he progresses, and if possible continue across it to the windward side. This will give him something in hand in case he will have to spend a long time in a feeble thermal drifting downwind.

If the pilot, in spite of being fairly high up, and in good visibility, is lost, he must not waste any time in trying to convince himself that the town he is rapidly drifting away from is the same as one marked on his map. He should decide that he is heading in the intended direction, by looking at the sun's position, or his compass, or cloud shadow movement on the ground, and then see what can be seen both ahead and away out to each side. If he can identify anything, even the far coast, he is not lost, and with little difficulty can re-locate himself.

Let us assume that all he can see is the sea, some 25 miles away near the left horizon. Then the first thing to do is to see if any point along the coast can be identified – a huge inlet or estuary, or an island. If it is thought that some point on the coast may be known, the map should be studied to find out what ought to be seen out on the opposite side. If the map shows high land away to the right, a search should be made for evidence. It may now be possible to decide, for instance, that the glider is between the sea, about 25 miles away on the left and hills, say, 10 miles away on the right. The map should be studied again to see what other landmarks exist which could be seen from this general position, perhaps a large town

ahead and fairly near the hills. Can either the town or its smoke haze be seen? In this way, by steadily adding to the evidence of position, the pilot will be 'found'. But the search for evidence should be started from distant and progress to more local features, and not from landmarks drifting by below, unless of course they are unique and give immediate knowledge of position such as, for example, the big loop in the Severn Estuary.

If the visibility is hazy and poor, it is easy to get lost, and much more difficult to rediscover the position again. If there is any risk of the glider being flown inadvertently into controlled air space, the pilot should land as soon as possible.

When the pilot initially sets off straight towards his first landmark at the beginning of the flight, he should take a compass reading, remember the figure and note the position of the sun. When flying straight between thermals, he should continue to check up on the compass reading. When he is sure that it includes a fairly accurate allowance for wind, he can thereafter straighten up on this bearing, but should still check up with his landmarks visually so as not to get caught out by wind changes. In poor visibility, the compass comes into its own, and accurate use of this and a watch, plus the ability to do some mental arithmetic while struggling to stay in a difficult thermal, is a necessary skill for the pilot who wants to get to the top. But first of all he should learn to use a map.

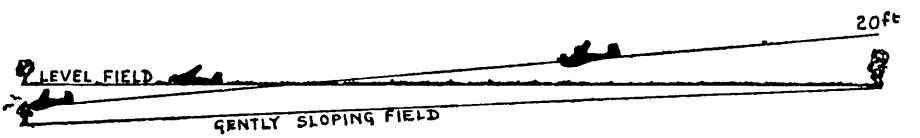
12 *Preparation for Cross-Country Flying (2)*

SINCE any cross-country flight in a glider may end in a strange field, the pilot must obviously learn the best way of doing this safely before he sets off. The problem of landing in fields is twofold. Selecting the field and landing in it.

Field Selection

A glider can be landed by a very experienced pilot in a flat field with good approaches of only 100 yards length. At the other extreme any inexperienced cross-country pilot should be able to land in a similar field 400 yards long.

The effective size of the field will be reduced if the pilot has to come over high trees, or other obstructions on the approach, or if the ground is made slippery either by surface water, snow or frost, or smooth short dry grass. Worse still, the landing run of the glider will be increased if the field slopes even very slightly downhill, or the pilot lands downwind. The first essential then is that the proposed field shall be one of the largest available. It should be at least 250 yards long for early landings. It is, of course, possible to land in quite a narrow field provided that it is



20. The glider should never be landed in a field which slopes downhill.

long enough, but this presupposes accuracy in both knowledge of wind direction, and making the approach, so in the early stages the pilot should aim for simple bigness. As a guide telegraph poles are normally 60 yards apart.

The second essential – slope – is that the field shall not run downhill in the direction proposed for landing. From the air, the countryside always looks flatter than it actually is, and so if any slope at all can be detected when examining a field, it should be discarded and another chosen. If the pilot has got himself into such a situation that the only available field slopes, then he will be better off landing downwind and uphill. Gliders, even with brakes out, fly at a flat angle, and so a very gentle slope will lengthen the landing run, and to come in over any steeper slope may prevent the glider even being put on the ground before the far hedge is reached. If, however, the field slopes gently uphill into wind, it is acceptable.

Even if a field cannot be seen to slope, this should be expected when the field is adjacent to a stream or river, since water lies at the lowest local point. It is always safer to approach over a stream into a field on the far side, rather than land in a field running down to a river. Even if no water is present the darker green grass usually indicates a damper, and therefore lower area.

The third essential is – Surface. The field must, of course, be smooth or covered with something short, and the crop should be one which will not be damaged by the landing. Stubble fields are usually excellent, fulfilling all requirements. Grass fields are good unless they are very old pastures, when they may be riddled with rabbit holes, rough or boggy patches, and even have rocks hidden under the grass. Grass pasture fields may be divided by electric fences. These will not be visible until almost too late on the

approach to easily modify it, but often the field on either side of such fences is of a different shade, according to the stage it is at of being eaten down by livestock, and the existence of electric fences may be deduced.

Crops of all kinds may be landed in when the plants are very small, and by landing between the rows with care little or no damage will be done. Nevertheless, fields with crops should not be used unless the safety of the aircraft is at stake. If a crop field is landed in the pilot should do everything in his power to keep sightseers away – a horde of children will do more damage in three minutes than the glider itself would do in twenty landings. If the crop is long it should be avoided absolutely. There is not only a risk of breaking the glider, particularly its tailplane, but the crop will be damaged. Tall corn is especially vulnerable, because even if the glider flattens only a small patch, this lodged corn may well cause much of the rest of the field to flatten in the next wind. Some root crops are grown in ridges and these may be hidden by foliage, and if the ground is heavy and hard, the bottom of the glider will be damaged. On the whole, fields with crops should be avoided except in a real emergency. Ploughed fields have an obvious disadvantage, but if there is no alternative, the landing should be made along the furrows, although a landing in heavy wet clay will quickly make the glider pilot appreciate some of the farmer's problems! The field should be without livestock if possible. Most animals, except horses, keep still during the landing, but may be a nuisance afterwards.

As soon as the pilot has satisfied himself that he has found a large flat field, with a suitable surface, he should check on the wind direction to decide his precise landing line into it, and study the approaches, and the undershoot

area. If there are trees on the boundary of the field, the pilot should look around at other hedges or houses nearby to try to get an estimate of their height. If there is a road over which the glider must fly, telegraph poles should be assumed, until or unless the pilot is quite satisfied as a result of a careful search for poles that they do not exist. At this stage the pilot should look around the district for electricity pylons, and if he sees any, he should trace the line of the cables to see if they pass near his field. If there are cables anywhere near the approach end of the field, then the field should be given up, and no efforts be made to nip in under or over them. If, however, they are over the far end of the field, it does not matter at all, since the glider will by then be on the ground.

If there is a valley running along the undershoot area before the field, and the wind is strong, downcurrents or at least turbulence must be expected in this region.

These then are the qualities of the field and its approaches which the pilot should consider, particularly for his first cross-country flights. Now let them be put into practice.

At any stage of the flight the pilot may find no further lift, and have to select a field for landing. This does not mean that he has to search for fields all the time, regardless of his height. When he is high up, 3,000 ft. or so, he does not really even have to consider the matter.

Gliders, such as the Olympia or Swallow, have a gliding angle of about 1:25. This means that they can glide 25 ft. for every 1 ft. of height lost. In more realistic words, from 1 mile up – 5,280 ft. – such an aircraft can glide 25 miles. These are theoretical figures, because obviously some height must be kept in reserve for planning and executing the approach and landing, and in addition, they include

no margin for flying through large areas of sink. A reasonable figure to work on, then, is 4 miles per 1,000 ft., and nothing for the last thousand.

This means that when a glider is down to 2,000 ft. it can still fly to any point on the perimeter of a circle 4 miles away if the air is calm. If there is a wind, this circle must be moved downwind, so that although the glider will not be able to reach a point 4 miles upwind, it will be able to travel more than 4 miles downwind, and at this stage, this is likely to be the direction that its pilot wants to go. It will be seen therefore that even when the glider is down to 2,000 ft. it can still fly another 4 or 5 miles absolutely safely, so there is no need to start studying the details of fields below. There is need, however, to keep the glider over or within reach of landable country which contains good fields, and not wander off over large forests, marshes or rough moorland.

At 2,000 ft. then, the glider should be kept in reach of good fields. If no further lift is found the pilot should begin to consider seriously the possibility of landing, so that by the time he has sunk to 1,500 ft. above the ground, as near as he can guess, he should have selected one or more actual fields. Although he can and should continue his search for lift, the glider must be kept within reach of the chosen field until an alternative has been examined, and accepted as suitable. In this way the glider may be kept airborne drifting along in weak lift for many miles, and this is perfectly safe provided that it is always kept within reach of a really suitable field.

If no further lift is found, and the glider sinks lower, there will come a time at which it is impractical to try to soar any longer without hazard. Very experienced pilots may be prepared, in certain circumstances to leave this

break-off to the last possible moment when they are only 150–200 ft. above the ground, but the less experienced pilot should forget all about soaring at 1,000 ft. above the ground, and concentrate entirely on making a safe and sensible approach into the chosen field.

In the selection of the field, and for the approach into it, the pilot will want to know the wind direction, and its strength. Occasionally there is a large conveniently situated factory chimney streaming out smoke, but often there seems to be no reliable indicator at all. The careful pilot will have kept track of wind direction throughout the flight, and when the landing becomes imminent, will merely want confirmation of something he already knows; but if the pilot is lost, or is flying near the coast or in hilly country, he may get badly caught out and land down or across wind, unless he is able to determine the direction. The first way in which the pilot can help himself in this matter occurs before take-off, and is very simple. The glider must take off and land into wind, and the position of the sun in relation to the glider can be seen at take-off, and, provided that the wind does not change, can be assessed in advance for the landing. For example, if at take-off when the glider is facing into wind, the sun is just to the right of the glider's nose, then a landing about two hours later should be made to that the sun is to the right of the nose, but nearer the right wingtip. This method may be quite effective on its own for early cross-country flights, since on such a flight the pilot would be sent off only if the conditions were unlikely to change and over flat and open country.

During the flight reliable indications can be obtained from smoke and heath fires and tall chimneys, or dust raised by harrows, tractors, etc., on open farm lands – but

not, for instance, from a cottage chimney in the middle of a wood, or in a deep valley.

Movement of the shadows of cumulus clouds will give the direction of the wind at cloud height, but this is not necessarily the same as the surface wind. More usually there is a slight veer – clockwise movement – of the wind with height. This cloud shadow movement should be observed in any case for navigational purposes.

In high summer, when the hay or corn is tall and it ripples in the wind the direction can be clearly seen; in the same way as with ripples on the surface of large sheets of water.

Unless the glider is very high, any appreciable wind can be assessed from the direction of drift of the circling aircraft over the ground. The pilot should note the point over which he started circling, pinpoint some landmark on the line he hopes to make good, while still circling and near the top of the thermal, compare his actual path and position with the intended line. The difference will be the drift effect of the wind.

Unreliable wind indicators include washing on the line, or any indicators which are sheltered or obstructed by something much larger. Landing tees on big airfields may well be set out of wind, in order to suit a particular runway. Near the coast on a summer afternoon, the pilot should expect the wind to be blowing in from the sea.

Landing in the chosen field

The pilot will find landing in a strange field easier if he can follow a similar approach pattern to his normal landings on the home site. He should therefore position himself as though he has had a winch launch out of the field – upwind and little to one side of it – and then remind

himself that the field is much smaller than an airfield. Having committed himself to the field, and got into a good position, he should have a really good look at the field and try to visualize his actual approach path into it, so that he will touch the ground at about a third of the way across it.

There is plenty of time, and the temptation should be resisted to rush the glider on to the ground. When about 500 ft. above the ground and to one side of the upwind end of the field, the pilot should start on his downwind leg, keeping well out sideways from the field. The speed should be increased at this point as suitable for the approach conditions. As he flies along this leg, he should again try to picture the crosswind leg, and the point at which he wishes to turn into wind for the final glide in to land. This Turn-in-Point is the key to a good field landing, and it should be sufficiently far back to allow a steep but straight final glide with enough time to concentrate properly on the landing. The glider must be turned into wind at this Point with just enough height to make the turn safely plus a small margin for error, including a possible wrong assessment for hedge height, slope, or undershooting – say 200 ft.

The turn from the downwind leg on to the cross wind leg should be made, ideally, with the glider several hundred yards out from the boundary of the intended field, although if the glider is now lower than expected, the pilot should keep closer, or even turn straight into the field without delay. Usually, however, field landings fail to be successful because the pilot, in his efforts to make sure of getting into the field, has got far too much on top of it, leaving himself no room to turn, or manoeuvre.

The crosswind leg should be used to lower the glider to the Turn-in-Point so that it is reached at a suitable height. The airbrakes should be used, fully if necessary, to achieve

this. On reaching the intended Point, the glider should be turned into wind, with the airbrakes used as necessary, and flown straight into the field for landing. Since the pilot will not know everything about his field or the conditions near the ground, he may continually have to modify the rather arbitrary approach pattern indicated above. If his judgment is good, such modifications as become necessary will be made in time; for instance, if the glider is far too high on the downwind or crosswind legs, this surplus height can be got rid of by using the brakes straight away and not waiting to do this until the final approach. If he finds the wind gusty near the ground speed should be further increased. If the field slopes up more steeply than expected, plenty of speed should be maintained right down close to the ground, so that the glider will arrive at the nose high landing attitude that the shape of the ground requires, without losing speed and stalling it.

What the pilot should avoid doing, if he finds that he is not quite in the desired position, is to abandon the method of approach he is using, and try to improvise, particularly if this requires fancy turns near the ground. If there are serious doubts about reaching the chosen field, the brakes should be opened and with the minimum of turns, the landing made on the ground short of the field even if it is not ideal, and even if there is a slight risk of finishing the landing run in the hedge. On the other hand if he has really overshot, or too late finds that the field slopes down slightly and he may run into the far boundary, he should not try to make more than the gentlest modification to his direction, but put the glider firmly, but gently, down on its wheel, and hold it on the ground so that the main skid rubs along as well. It is possible to ground loop the glider to avoid running into the hedge by putting one wingtip on the

ground following the landing, when the glider will swing round. There is a risk of damaging the glider doing this so it should be resorted to only when absolutely necessary.

Although the pilot should be prepared for unexpected problems when landing in a strange field, it is not an intrinsically difficult thing to do, and if care is taken, and some dummy runs are made on selected parts of the home field first, there is no reason why it should not be successful. The essentials for a safe field landing lie in selecting the field in time, and forgetting all ideas of soaring with 1,000 ft. still in hand, so that full concentration can be given to planning and carrying out the approach. The decision must not be left until it is too late, and if a thermal is encountered during the approach this must be absolutely disregarded; even a single circle 'just to see if it was a good one' may be enough to put the glider irretrievably out of position.

After landing the Club has to be informed of the landing and the glider must be looked after. Before getting out the pilot should gauge the wind strength. If this is strong, he must stay in the glider until help comes, but if it is only light he should get out, turn the glider across wind by lifting the tail round so that the down wingtip slides gently forward over the grass, and put his parachute, in its bag, on the into-wind wingtip. He should make a note of the landing time, and replace the cockpit cover. By now he is likely to be surrounded by people or cows, and as cows eat gliders they must be gently but firmly persuaded away, but not chased.

Sightseers are unlikely to damage the glider if they can be prevented from taking photographs of their children standing on the tailplane, etc., but they may wreck any possibility of cordial relations with the farmer, and they

should be kept out of the field if there is any risk at all of damage to its surface. It is the pilot's responsibility to see that gates have been shut. He should ascertain also whether or not he has landed in an infected area and if so avoid wandering in and out of the fields looking for a telephone.

When he feels that the situation is under control, and not before, the pilot should go and call up his club. If he has not got the appropriate coins on him, this merely shows lack of planning ability. He should remember when landing in a field, that he is a visitor with no invitation and no rights. It is therefore up to him to make contact with the owner of the land without delay and explain the position.

Farmers are invariably generous and helpful, and are much more likely to provide a handsome tea than complain, but this sort of kindness does not absolve the pilot from every effort to compensate for his unheralded arrival. If the farmer or his family are interested they should be shown over the glider, and given an explanation of how it works. A note of thanks afterwards or later a Christmas card is little enough return for what amounts to the use of a private airfield.

13 *First Cross-Country Flight*

EVENTUALLY the day will come for the first cross-country flight. The weather will be such that there are good thermals, good visibility, and only a moderate wind. The object of the flight will be to try to fly the glider to a predetermined landing point some 40 or 50 miles away more or less downwind, which if successful would qualify for part of the Silver C certificate. Already dummy field landings will have been practised, the map will have a track line drawn on it, and the barograph will be ticking away in its locker.

During the morning the thermals and the cumulus will develop, and then when they are strong enough the glider will be launched, if possible, by aero tow, and left at 2,000 ft. a little upwind of the field. It is now up to the pilot. The instructor will have told him to work a couple of thermals locally, so as to get a measure of the day, and to climb to at least 3,000 ft. before setting off and irretrievably leaving the familiar and comfortable field behind.

When soaring locally, the pilot had little to do except concentrate on circling in order to get the best out of the thermal, and to look out for other gliders. On arriving at the top he could wander about within reach of the airfield, until he either found another thermal, or landed. Now, at the same time as climbing up in the thermal, he must make his navigational preparations, and consider where the next lift is to be found. It is no good leaving these decisions until

the glider has arrived at the top of the thermal, because not only will height be wasted while he is hanging about making up his mind, but if his thermal has produced a cumulus, he will find that when close up beneath it, his view of other clouds is severely restricted by the wisps and fringes of his own.

The first thing then is to determine the direction in which it is desired to go and note one or two landmarks, both near and far away, on this line. It is useless to try to obtain a compass bearing while circling.

Having done this, the cumulus clouds should be studied in the appropriate direction. Since he is circling, the pilot will have to make his inspection each time round. If there are other gliders in the same thermal he will have to watch these too.

The pilot should study cumulus which he reckons to be within reach; it is a common fault to go after fine-looking clouds which cannot be used when finally reached because the glider has now sunk too low. The distance of the cloud can be assessed from the size of any gliders circling underneath it, or by locating its shadow on the ground and roughly measuring the distance on the map. Preferably, the cloud should be not more than 3 miles away. If it is as much as 5 miles away, the glider will have sunk a good thousand feet lower and it will be more difficult to locate the thermal under the cloud. The pilot should try to keep as high as possible, because thermals are stronger and easier to find with height, and there is greater room to manoeuvre.

If there is a cumulus in a suitable position it should be studied to find out whether it is still growing, or whether it is decaying, in which case, although it may still look superficially good, there will be no lift underneath it. While

still circling up in a thermal, the best next cumulus would be one which is still in the early wispy stages of its formation, because by the time the glider arrives, it will be still developing strongly with good lift underneath. If there are no prospects downwind at all, the pilot should abandon the idea of leaving base, find another thermal upwind and wait for a while until the sky improves.

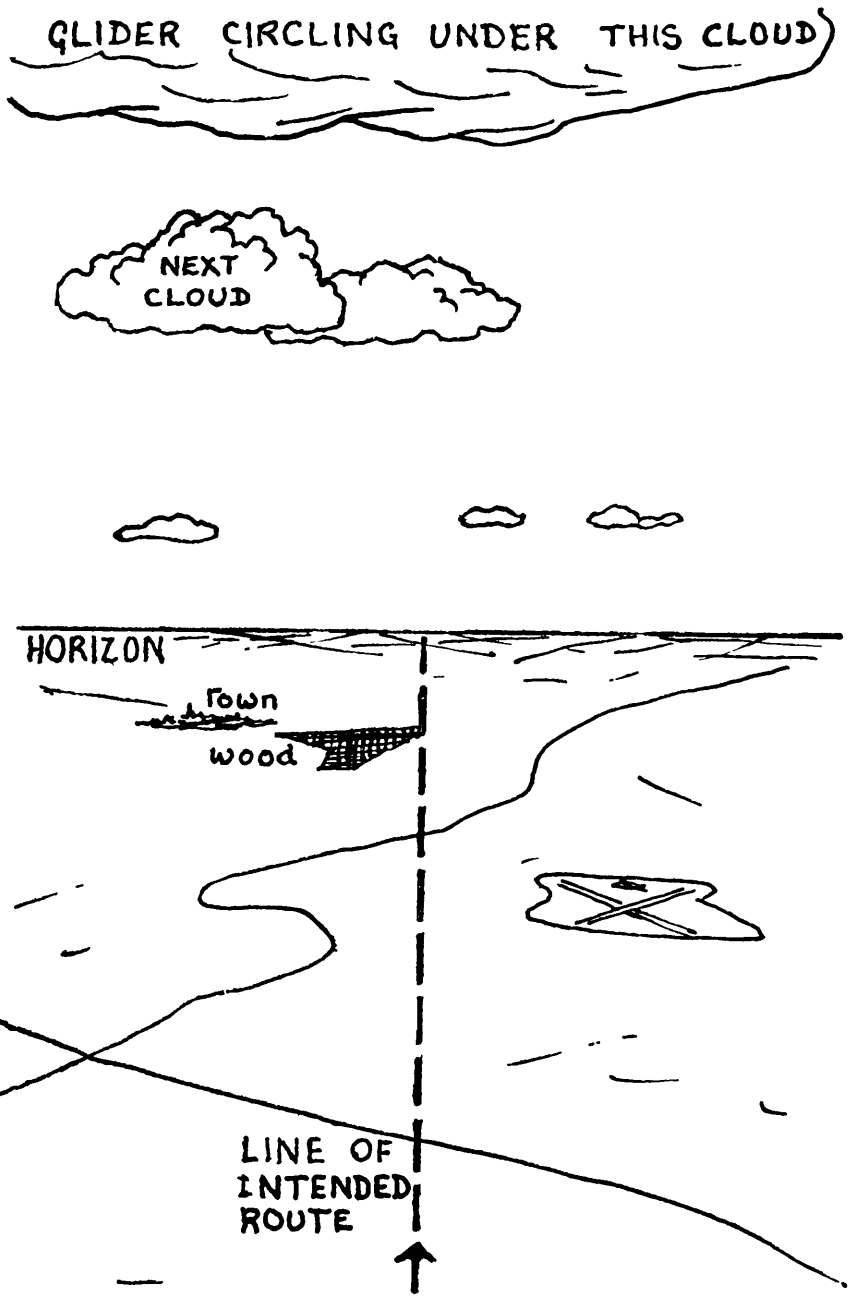
As soon as the decision as to the next cumulus has been made, the sky beyond it should be looked at to see what it has to offer, and where it looks best. If there is a choice of two nearer cumuli and both look equally good, the one with the better clouds beyond it should be selected.

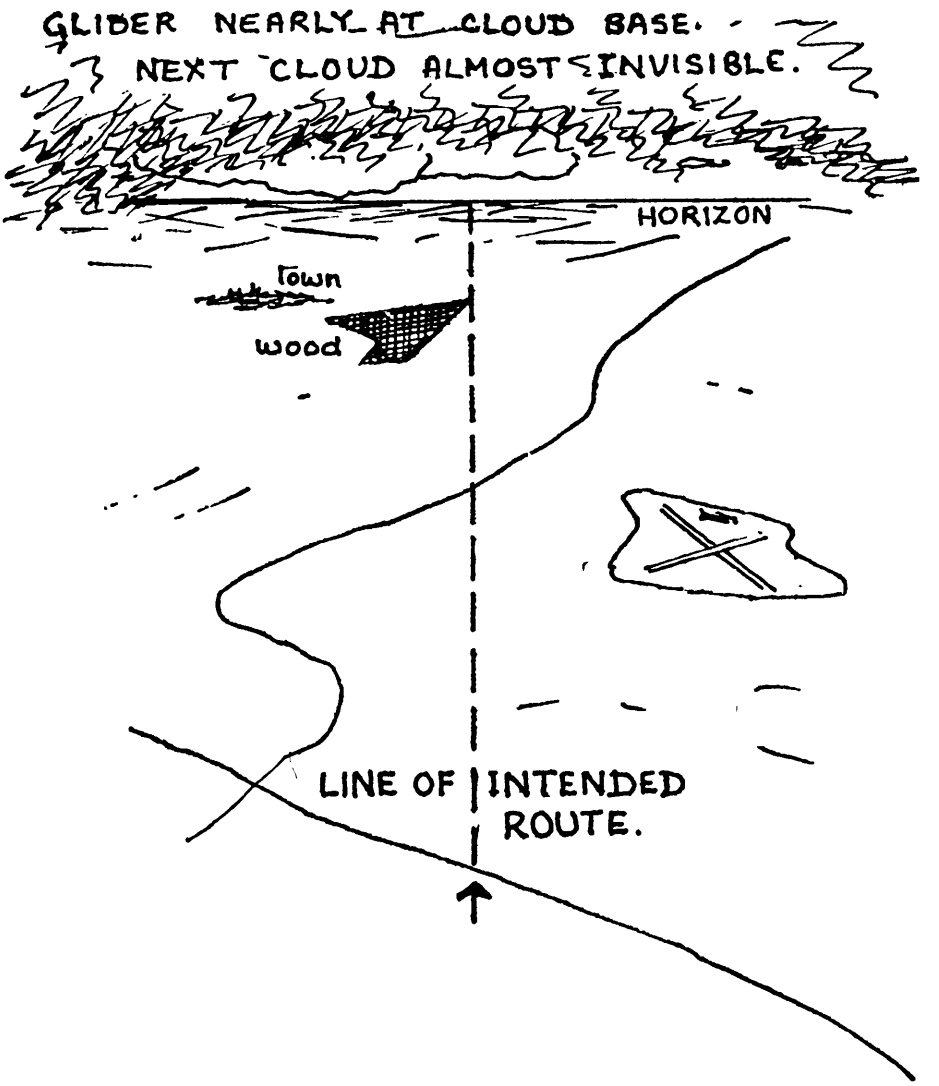
By this time, if the pilot has not lost his thermal through thinking about what to do next, he will be near its top, and finding the spread of the cumulus above him beginning to restrict his view. Before it does so completely he must note a suitable landmark, not too far away, as a pointer to his next cloud. At the same time, a check should be made on the position of the cloud in relation to his intended direction. (Diagram 21)

As the glider rises up near the base of the cloud, but before it is sucked into it, the pilot should straighten up on the landmark which is the pointer to his next chosen cloud, which he probably cannot now see, and go.

As the glider clears the area of the cloud, the pilot will be able to see his selected cumulus once again, and should fly straight towards it, increasing speed a little, about 5–10 knots, to get there quickly.

While flying straight he should check on the navigational landmarks and see if he can add one or two pinpoints, which will in due course enable him to locate more easily features which he cannot yet see. This is the moment to take a compass reading, and remember it.


GLIDER CIRCLING UNDER THIS CLOUD
NEXT CLOUD
HORIZON
Town
wood
LINE OF INTENDED ROUTE



21. Next cloud should be marked by suitable landmark, wood, not too far away, before it disappears.

If the selected cumulus is slightly across wind the glider should not be flown diagonally towards a point underneath the cloud itself, as the thermal is likely to trail because the wind is usually stronger with height. Instead it should be got across wind the necessary amount early on, and the invisible thermal attacked from the rear. About 1,000–1,500 ft. below the cloud, the thermal may be as much as a few hundred yards behind the cumulus, although if the glider arrives almost at cloud base, it should be flown straight under the centre, or the darkest part of the cloud. Sometimes the strongest lift will be found on the sunny edge of the cloud, and sometimes at the upwind edge; fortunately on any one day the lift is usually in the same part of all the clouds, so that when it has been found for one cloud, the chances are that it will not need too much searching out thereafter.

When the air begins to tremble, and the variometer is flickering, indicating the nearness of lift, the glider should be slowed down to its normal flying speed, and the pilot use all the skill that he has so far acquired to find and centre in the thermal. Once circling, and again gaining height, the pilot can permit himself a look back at his home field, now almost certainly out of reach, and anonymous in the distant countryside. But there is no time to spare to admire the view, or regret the departure, because once again the next cumulus must be chosen and located by a landmark before the glider nears cloud. It should be straightened up on course, a check made on the compass reading, and flown straight on to the next cloud. The navigational situation must be kept in hand, and some further distant landmarks selected which are on or near the flight line.

So far, so good, but inevitably there are variations on

the theme. Sometimes the pilot, alone in his thermal, finds that he is set on by hordes of other gliders which have not found anything for themselves. If this worries him, he is better off trying to find another less congested thermal. Perhaps the pilot, while flying straight and conscientiously interesting himself in navigation, will fly slap into a thermal he did not even think might be there. He should, of course, use it. Sometimes, however, the chosen cumulus will fail to produce any lift, or the pilot fail to locate it, or, even more infuriating, he may lose a perfectly good thermal long before getting to the top, and be unable to find it again. This is the moment when it is very easy to dither, and fly about aimlessly hoping that something will turn up, and this is the moment when it is easy to get lost. If the pilot loses the lift and doesn't quite know what to do next, he should immediately fix on his mind some landmark more or less on course, and 5 or 10 miles ahead, and fly straight on at ordinary cruising speed, and think out what to do next.

It may be that he is unlucky and cannot find the thermals, or they may simply no longer exist, due to nearness of the sea, the lateness of the day, or because the lift has been killed by excessive cumulus production, or by spreading high cloud cover, blotting out the sun. If there is no obvious reason for the absence of thermals where expected, then there are three things that may be done: (*a*) decide on, and make for, another cumulus, even if it seems too far away, (*b*) if there are no cumulus anywhere in the sky, fly straight on, on course, or (*c*) diverge from the intended flight line to pass over country which looks as though it might be good as a thermal producer; for instance, a ridge of low hills facing the sun, or dry chalk downs.

If the pilot is at 4,000 ft. then he can glide at least 12 miles

before having to land, and has over twenty minutes left in the air, so that the chances of finding something are good. If, however, he is at only 2,000 ft. there is a 4–5 miles range, and about eight minutes free time, with a certain restriction on direction, since the glider must now be kept within easy reach of a good field area. Being lower, any thermal picked up is likely to be smaller and perhaps weak, and so extra care will be needed to centre in it. It is in this sort of situation that the inexperienced pilot often finds that his flight soon comes to an end. He finds some scrappy lift at about 1,700 ft. but is also concentrating on seeing what fields are available. He climbs a few hundred feet, loses the thermal again, finds nothing else, flies over to an area of big-looking fields, runs into some more lift, circles, realizes that if he uses it there is a risk of drifting too near a built-up area, or over a large wood, goes back to the big fields, selects one, sees another which looks better, looks at it, and then can't decide which to use, goes back to the first, runs into more lift, controls his impulse to circle, and since he is now only 1,000 ft. up sensibly decides to go and land.

If, however, he has been lucky or clever, or both, he may well, if it is a good day, get up again, and with an altimeter reading of 4,000 or 5,000 ft. spare a moment just to enjoy the exhilaration of having defeated gravity. By the time three or four thermals have been successfully used, the glider will probably have covered some thirty miles, probably more if the wind is strong, and may well be in reach of its intended destination. This will probably be an airfield without much traffic, or another gliding club, and the pilot should first of all ensure that it is, in fact, the correct field by checking it with other ground features well in advance of arriving there, and he should join the circuit with as much height as he can so that he has time to study

the layout of the field, and keep clear of other traffic. Even if he feels on top of the world at having succeeded in reaching his goal, he should refrain from demonstrating this by flashy flying, and wait until he can nonchalantly announce his success over the telephone to his own chief instructor.

Retrieving

If the glider has been landed on an airfield, it may be towed back to the home airfield by air, but more usually a car and trailer will come after it. To go in the trailer, it has to be de-rigged, or taken to pieces. This does not require technical skill, so much as care and common sense, and any cross-country glider pilot should be able to rig, and de-rig his glider.

Having landed, secured the glider, and then telephoned the club to give his whereabouts, and these should include the full postal address of the nearest house where he can be found – the pilot will have some time to wait, and should return to look after his aircraft.

De-rigging a glider consists of first of all removing any fairings and disconnecting the controls, and secondly in dismantling the aircraft itself into its component parts. Since gliders have to be de-rigged quite often the connecting pins and bolts are designed for simplicity and ease of operation. While waiting for the retrieving car to arrive, the pilot should disconnect the controls, in order to save time later, but never attempt to take the actual glider to pieces until the proper crew arrives. Willing but unskilled help can do a great deal of damage in a very few minutes, and, in any case, the component parts of the glider lying on the ground, may much more easily be trodden on and broken.

When the trailer arrives it need only take 5 or 10 minutes to remove the tailplane and the wings – which may be in two or three parts – and put them in their racks inside the trailer. The fuselage is rolled in on its landing wheel, and secured. It is the pilot's responsibility to ensure that nothing is left in the field, as the frustration of arriving back in Cheshire and discovering that the main wing attachment pins have been left in a Southampton field is considerable. The car driver, of course, has his responsibilities as well, and one of them is to ensure that he does not arrive, probably at midnight, and open the trailer doors, only to find it already full of another glider, because he failed to ensure that it was empty before starting!

On arriving back at the club, the glider will have to be re-rigged again, and have another D.I. (Daily Inspection) before it is flown. These two jobs should be kept separate, and if possible be done by two different people. First of all the glider should be fully rigged, and checked that nothing has been forgotten, and then it should be inspected to see that it is airworthy, and hasn't been damaged during the field landing, or while it was waiting to be collected, and that nothing is wearing out, etc. One part of a glider that is highly susceptible to damage on an away landing is the airspeed indicator which is frequently wrecked by small boys blowing down the pitot head. This is the tube in which the pressure of the air is fed to the instrument. A good puff down it by an over-enthusiastic child will provide a reading on the dial equal to an airspeed of several hundred miles an hour, which is far in excess of what the delicate low-reading instrument is designed to withstand.

Pages could easily be written about retrieving, because it is a skilled art in itself, as will be seen in the chapter on competitions. Enough to say here that it can be enormous

fun, and any pilot hoping to fly across country should take every opportunity to go on a few retrieves before flying away himself. There are probably more funny retrieving stories in existence than for any other aspect of gliding.

14 *Speed Flying*

SO FAR the pilot has gently ambled across the sky circling up in thermals, and gliding peacefully on in between. If, however, he wants to break records, win his gold C, or merely get the satisfaction of obtaining all that it is possible from the day's weather, then he must learn to fly fast.

The problem is this. There is only a limited period of thermal activity on any day. On an excellent day in June this can last from about 9.30 in the morning until about 7 o'clock in the evening – $9\frac{1}{2}$ hours. More usually the maximum period is nearer 7 hours. Often, however, for various reasons thermals will last for only a few hours in the day. This period may not be long enough to enable the pilot to get to his destination unless he can fly fast. Put in another way, the pilot who is able to increase his cross-country speed will be able to go further.

The average air-speed is that which can be achieved by circling up, gliding on, and circling up again, etc., in calm air, without any help from the wind. This speed is dependent on the skill of the pilot, the strength of the thermals and the performance of the glider. If we assume two identical gliders being flown on the same day, the better soaring pilot will achieve the faster cross-country speed. This difference may be as much as 10–15 knots. A first-class pilot in a good glider with strong thermals can achieve average air-speed of 35 knots, perhaps more, whereas a mediocre or inexperienced pilot in a similar glider would achieve only about 20–25 knots.

If there is a wind blowing, its speed must be added to the average air-speed if the glider is going down wind, and substracted if it is working against the wind. It will be seen that whereas the difference in cross-country speeds of the two pilots when going downwind may not be very important, the ability to fly fast is most necessary to success when flying against the wind.

Consider the following examples of flights of 50 nautical miles:

Average air speed	*Wind speed*	*Cross country speed*	*Time*
Fast pilot – 35 knots	15 knot tailwind	50 knots	1 hr.
Slow pilot – 25 knots	15 knot tailwind	40 knots	1¼ hr.
Fast pilot – 35 knots	15 knot headwind	20 knots	2½hr.
Slow pilot – 25 knots	15 knot headwind	10 knots	5 hr.

It will be seen that when flying downwind the slow pilot takes only a little longer than the faster man, whereas when flying into wind he takes twice as long. On a day of five hours' thermal activity the fast pilot could make the into-wind flight without difficulty; but if the slow pilot had a minor delay in his launch time, got slightly lost or had one particularly weak thermal, he would almost certainly not reach his goal.

There are three main directions in which a higher average cross-country speed can be achieved. These are by an improvement in the pilot's technique, by flying at the correct speed for the conditions between thermals, and by an understanding of the problems of the final glide.

Technique. In his search for, and use of thermals, the pilot in a hurry can save time, and therefore fly more efficiently in a number of ways.

1. By locating the next good thermal without delay.
2. By finding the strongest area of lift in the thermal and centring in it quickly.

3. By deciding to leave a weakening thermal at the right time, and not hanging about to see if it improves.
4. By knowing when to discard poor thermals, and flying straight on to the next prospective lift area.
5. By navigating accurately.
6. By assessing the general conditions and time of day with sufficient accuracy to know when it is safe to fly on really fast, or when it is prudent to try to stay high by using any lift that can be found.

To elaborate, at any given moment the fastest speed will be obtained if the glider can be flown at the levels where the thermals are strongest. This usually means remaining within about two thousand feet of cloud base unless the clouds are to be used. As long as the glider can be kept within the appropriate height band the pilot can afford to use only the strongest thermals. Should it sink below the lower limit chosen – say 3,000 ft. – then weaker thermals may have to be accepted. If nothing is found and the glider sinks to, say, 2,000 ft., any lift, however feeble, will have to be used in order to keep the glider airborne. By anticipating the varying strength of the conditions throughout the day and altering his operating height to suit, the pilot should be able to obtain the fastest possible speed from the weather prevailing.

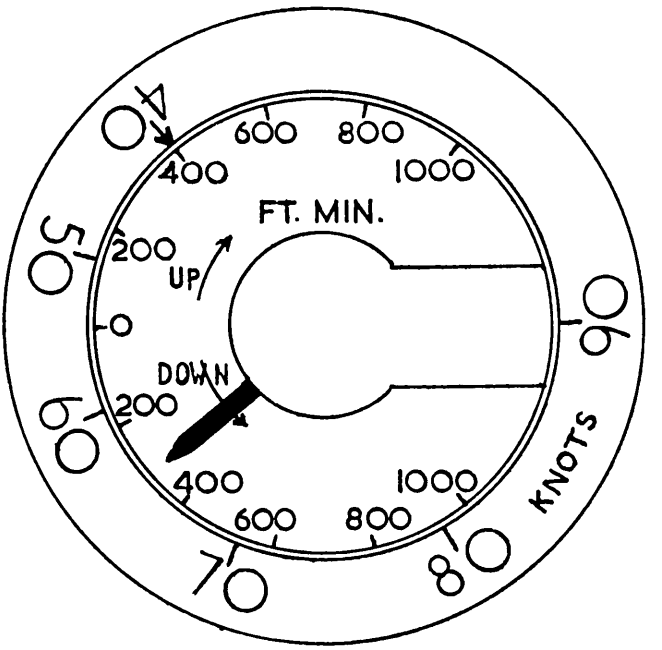
The Best Speed to Fly. The speed at which a pilot flies when circling will, to all intents and purposes, be the same regardless of whether the thermals are strong or weak. Since the whole object is to gain height as rapidly as possible the air-speed at which the glider is flown will be that appropriate to the minimum sinking speed when circling – normally about 40 knots. The rate of climb achieved will be the rate at which the thermal is going up less that at which the glider is sinking through it. If the

thermal is weak it will pay to convert the height gained into the maximum distance by flying at the speed corresponding to the best gliding angle of the aircraft, which is usually about 45 knots. In these conditions the average cross-country air-speed which the glider will achieve will depend on the proportion of time in which it is flying straight, compared to the total time. For example, if half the flight is spent circling and half flying straight at 45 knots, the average cross-country speed will be 22½ knots.

However, if the thermals are strong the performance characteristics of a glider are such that it will often pay to fly faster than the best angle of glide speed; more height will be lost, which means that more time will be spent in climbing up again, but despite this the average speed will be greater. An additional factor affecting this simple analysis is the presence of downdraughts. It is axiomatic that if there are upcurrents there must also be downcurrents. Usually, although not always, these are spread over a larger area than the upcurrents, and consequently are less strong. When flying through downcurrents, less height will be lost by flying faster, since although the glider itself is coming down more quickly in relation to the air it will spend a shorter time in passing through the downcurrent.

The best speeds to fly when cruising between thermals of different strengths can be simply worked out if the performance of the glider is known, and most high performance gliders are equipped with either a table of speeds, or a speed scale ring fitted on the variometer, so that the pilot can see easily by how much he should increase his speed when flying through downcurrents.

The speed at which a glider should be flown between thermals, and the consequent average cross-country



22. Use of variometer speed ring.
If the rate of climb in the previous thermal was 400 ft. per minute, the outer ring is twisted by hand to bring the arrow opposite the 400 mark. The glider is then flown at the speed shown opposite the variometer needle. In this case 65 knots. If a downcurrent is encountered the needle will show greater sink and indicate that the speed should be increased.

air-speed depends then, for a particular type of glider, solely on the thermal strength, and is not affected in any way by the speed of the wind. The problem is to go the furthest possible distance through the air in any one hour, and assuming isolated thermals, this will obviously be the same whether the glider is flown into, cross, or downwind. The actual distance covered over the ground will, as mentioned earlier, be the average cross-country air-speed with the wind vector added.

This simplified description of cross-country flying, when the glider is considered as first circling to gain height, and

then gliding off in a straight line before climbing up again, may give the incorrect impression that all cross-country flights are done in this way. In practice it is often possible to fly appreciable distances in a more or less straight line in weak thermals when, though height may not be gained, little is lost. Using thermals in this way can make a very significant change in the average speed obtained if, on a day when the thermals tend to be in lines inclined at an angle to the route to be followed, the glider is circled up in a strong thermal, flown through weaker ones along the thermal line, and then cut across to the next line following a zig-zag route, rather than being flown directly along the correct track.

In countries where strong thermals are usual, the best performance can be achieved by gliders having a heavy wing loading, since although their sinking speeds are higher, and consequently they take longer to climb up in thermals, they come down less quickly when flying really fast. However, when the thermals are weaker, gliders with lower wing loadings are better, and this, of course, implies in the limiting case that a large light glider can stay up, while the heavier loaded glider will be forced to land. While the performances put up by heavy aircraft on really good days are spectacular, it is noticeable that gliders of this type do not always do really well in competitions because these usually include several days of poor weather when their performance is less suitable.

Final Glide. The pilot circles in thermals in order to gain enough height to enable him to search for more lift in the desired direction, and then to reach his destination. To arrive at his goal, however, he will need only enough height in order to land, and none for finding further lift. Since he will be able to cover the ground fastest while flying straight

he does not want to continue circling once it becomes possible to reach his goal in a straight glide. Since he is out for the highest possible speed, this glide wants to be made at as high a speed as the particular glider will allow. Modern high performance aircraft have a glide ratio of about 30:1 and in some cases more. This means that if the glider is at 6,080 ft. it can reach a point 30 nautical miles away in a calm or, looking at it another way, if at 30 miles from the goal, the pilot can climb to 6,080 ft. and then go straight, he will theoretically arrive. Various factors, however, affect this performance.

1. The pilot does not want to fly his glider at the rate for best sink which is fairly slow, but as fast as possible, even though this will reduce its actual performance. It is no good, however, spending a long time climbing up in a weak thermal merely to save half that time in flying fast during the final glide. The best speed for the final glide, therefore, as with the speed to fly between thermals, is bound up with the thermal strengths. If the pilot can gain height very rapidly in his last thermal, he can afford to climb the extra bit which he will need to compensate for the increased rate of descent caused by flying really fast.

2. The pilot wants a little height in hand to allow for unexpected downdraughts, and for the approach and landing, but this need not be much since he is racing to a goal which is a landing field, where he is expected. Further, if he sees as he approaches, that he is lower than he should be, he can slow down and thus improve the angle of glide, or if he finds that he has more height than is necessary he can speed up.

3. The wind. Obviously the whole of the final glide calculations are affected by the wind. When flying downwind less height will be needed to cover a certain distance than

would be the case when flying against the wind. For example, if a glider has a best gliding angle of 1:30 when flying at 45 knots, then when flying down a 15-knot wind its ground-speed will be 60 knots, giving it a gliding angle over the ground of 1:40. Conversely, flying into a wind of the same strength, the ground-speed will be reduced to 30 knots, resulting in a gliding angle over the ground of 1:20. This is, in fact, an oversimplification of the problem as slightly better results can be achieved by flying at a slightly slower air-speed when going downwind and at a considerably faster speed when going into the wind; but it does illustrate the marked effect of the wind on the gliding angle.

One of the problems of racing to a goal down a strong wind is that the glider can reach its destination in a straight flight from so far away that the goal may still be invisible when the pilot commits himself to the final glide and sets off. From 6,000 ft. in a 20-knot following wind a high performance glider can go 50 miles and it will be necessary for the pilot's navigation to be very good if he wishes to arrive at the right field only 100 ft. up.

Unless the pilot is endeavouring to obtain the maximum cross-country speed in a race, or for record purposes or practice, it is not necessary for him to go all out for the fastest final glide on an ordinary cross-country flight. If he is trying for maximum distance, he will obviously need to try to obtain the maximum cross-country speed for as long as thermals last. But once they have died away in the early evening, and there is no chance of finding further lift, it is not necessary any longer to fly fast, particularly if there is a following wind, since there is now nothing to be gained by hurry. The pilot can sit back and enjoy himself, while floating along at ordinary flying speed, either to his goal, or for as far as possible. If he is trying to reach a certain

goal and speed is not involved, he might just as well arrive with height in hand so that he can fly around before landing and perhaps take photographs. As with the best speed to fly, final glide information is calculated in advance for the particular glider, and displayed on a chart carried in the cockpit. This chart will tell the pilot the height that he needs for a given distance from the goal in different wind conditions.

To summarise: if the pilot wants to obtain the maximum from a day's thermals in terms of either speed or distance, then he must learn to fly fast. This is a combination of pilot skill, finding and using thermals, flying between thermals at the correct speed for the conditions, getting the final glide right and finally, but not by any means least, by the ability to assess the day and use it to the best advantage. This is important, as it is a waste to attempt a flight which is unsuitable for the available weather, when a different choice would have been more satisfying and enjoyable.

15 *What to do with a Day*

THERMALS exist only when the air is unstable, and thermals usable by gliders are produced only when the sun is strong enough to allow sufficient temperature difference to build up between the varying surfaces. Cross-country flying is not possible if the prevailing weather does not allow adequate convection to take place, and it is a waste of time trying to plan and carry out a flight in such conditions.

If, however, the forecast indicates that conditions suitable for thermal production will exist, then the pilot can get out his maps and work out how to best use the weather.

The choice will range from flying vaguely around the district to soaring as great a distance as possible, probably directly downwind, or flying to a declared destination, or around a predetermined course, and returning to base. The intention may vary from a social visit to an attempt on a record. If thunderstorms or big cumulus are about the pilot may wish to use them to fly high.

The information that must be obtained before any selection can be made concerns the wind strength and direction, the likely strength of the thermals, the manner in which the cumulus clouds are expected to develop, and the probable period of thermal activity.

Wind strength. This will determine whether a flight with any into-wind, or even cross-wind component is possible, or whether it will be practical to go only downwind. As mentioned earlier the strength of the wind against which

it is possible to make effective headway varies with the skill of the pilot, the performance of the glider, and the strength of the thermals. A good pilot in a good glider with strong thermals may be able to work satisfactorily against a wind of 15–20 knots, whereas a lesser combination of skill and performance will only be able to manage to any effect in a wind of 10 knots or less. It will be seen that since the speed over the ground will be low when flying against the wind, a great deal of time can be spent in going a short distance.

Another aspect of flying in strong winds is that they will affect the production and growth of thermals. It will be more difficult for them to start, because of the slowing-up of ground heating due to the wind blowing over it. The new thermal will tend also to get torn away too early, and be broken up by the turbulent air of the lower levels, and thus be difficult to use. Sometimes, however, in strong winds the thermals tend to lie in lines along the wind, and the cumulus above them mark this tendency by their 'street' formation. If there are well-formed cloud streets, it is possible to achieve fast speeds even against the wind by flying along in the lift underneath them, sometimes without even having to circle.

Wind Direction. This is important only in the geographical sense that there needs to be enough suitable country in the appropriate direction, and that the proposed flight can be kept clear of sea breezes, airways and control zones.

Thermal Strength. If the thermals are very strong there will not be much problem in deciding what flight to make, as the choice is wide. Great distances downwind may be possible and flights which have windward components, such as a triangle, will be possible even in a fairly fresh wind. If, however, thermals are weak, the direction of flight will be determined much more by the wind strength. If it is strong

downwind flights only will be practical, and triangular flights only if it is very light.

The difficulty when flying against the wind is that every time that the glider circles up in a thermal it ceases to go in the desired direction, but drifts back on its tracks. If the thermal is strong the glider will climb quickly and not lose much ground, but if it is weak it will drift back as far as it had been able to glide forward after the previous thermal, and so will not gain any distance at all.

Period of thermal activity. This is determined by the time of year – the period will be shorter in April or September than it will be in June – and by the type of air mass prevailing, its characteristics and its movement. In addition it will be affected by the way in which the cumulus clouds develop. Briefly, thermal activity will be prolonged and good in anticyclonic weather, provided that the inversion is not too low, in the cold (polar) air following the cold front of a depression, and in ridges of high pressure. It will be non-existent in or near the warm front of a depression, deteriorating as the warm front approaches, and it will be poor, weak or erratic in the warm sector air between the warm and cold fronts, and in small low pressure troughs. When planning a flight, therefore, the wider picture of the weather should be taken into account, and the likely period of thermal activity deduced. It should be remembered that the glider does not stay stationary, but is able to move either into an area of improving conditions or stay with a patch of good weather. Let us assume, then, that there is a day of fairly uniform anticyclonic weather, with an inversion at 4,000 ft., and an East wind of 15 knots on the ground, increasing to 20 knots higher up. The month is May, but owing to the fact that the sea breeze is likely to reach the area by 4 p.m. only six hours of

thermals can be expected. Lift along the sea breeze front is not anticipated. Thermals are expected to give rates of climb of 500–600 ft. per minute.

What can be done with this day? Obviously a Distance flight, either as far as possible, or to a downwind goal 150 miles away would be quite possible. But unless Distance is favoured for any reason, such as an attempt on the 300 km. for the Gold C, it would be better to save the long retrieve and make a flight which gives just as much flying, but does not take the glider so expensively far from home. The alternative possibilities are an Out-and-Return or a flight round a triangular course of about 120 miles. Of these the Out-and-Return flight is more likely to be successful in a fresh wind simply because it need not have any leg with as large a headwind component as a triangle, by its very shape, would have. Out-and-Return flights can be done across wind, so that there is no leg straight into the wind, or into and downwind if there is a chance of cloud streets developing. If a triangular course is preferred, one leg will always have a headwind component, but it can be laid out and flown in a direction so that the headwind leg is done during the part of the day when the thermals are strongest. If the triangle is a big one it should be attempted only if the conditions are good, since to do it at all the start will have to be made early in the day before the thermals are properly developed. The direction of flight should be such that the easy downwind leg should be flown at the beginning. When considering his triangle the pilot should not forget the effect of sea breezes, and unless there is a chance of lift on the sea breeze front line, he should fly any leg which approaches the coastal regions early in the day, rather than late.

Although to achieve really good flights the ambitious

pilot should be able to calculate the probable length of time of the proposed flight, and should certainly be able to discover beforehand whether the flight he hopes to do is even possible in the time available, he should never for one moment think that gliding is something which is even reasonably predictable. To do so will be an almost surefire guarantee that he will be sitting in a field only 10 miles out on the best day of the year, while to his disgust other gliders sail past overhead. It is one of the charms of gliding that when the pilot gets into the air, conditions will almost certainly be different from what he expected, and he will have to improvise, and modify his plan, or divert off course because of a patch of poor weather, or hang about just keeping airborne until conditions ahead improve. Nevertheless, careful assessment of the conditions before take-off, combined with a calculated plan, will enable him to extract the maximum good soaring out of the day. Soaring is to an enormous extent a series of decisions, and the successful pilot is one who makes the fewest wrong ones.

Because the pilot never really knows when the alliance of weather and his ability are going to combine sufficiently strongly to beat a record – even if only a minor one, he should always pre-declare his turning points and goals, carry a barograph, and practise using a camera in the air. Even if he is not interested in records, it is much more satisfying to decide to do something and then attempt to achieve it – to have an object – rather than just wander aimlessly about in the air. The object may be simply trying to fly upwind to see how far it is possible to get in two hours, or to visit, say, a lake 10 or 15 miles away to see if the dinghies are racing and then return home via a friend's house and peer down unknown from 3,000 ft. on to their tennis party. But it should exist.

The declaration of turning points and goals is a statement written and signed by the pilot, giving the place name and date, which has been handed to an Official Observer or a responsible person, such as an instructor, before take-off. A signed certificate of landing place is also required if the goal is reached.

Evidence of Turning Points. The evidence of turning points can be either observations from the ground or photographic. If the pilot wishes to use the latter method, he must take a photograph before take-off of a known responsible person, preferably an Observer with a board on which is the Declaration information. This must appear on the same negative. The pilot then takes photographs during the flight of his turning points (and anything else he wishes) and on return to base takes another photograph of the same person or an Official Observer who will certify to the landing. If a record is to be claimed, the film which must be uncut, and still in the roll, is submitted as evidence combined with a certificate that the aerial photographs are in fact those of the place claimed.

16 *Cloud Flying and Aerobatics*

WHILE learning to soar the pilot should not enter cloud, except in the two-seater with an instructor, because of the risk of coming out in the wrong direction, failing to find an airfield and then having to land in a field without knowing how to do it properly. Even on early cross-country flights it is not really desirable to go into cloud owing to the increased risk of getting lost.

Once genuine field landings have been carried out, however, it is practical to learn to fly by instruments alone.

Ideally, instruction should be obtained in a two-seater, but it is by no means impossible for a pilot to teach himself solo in actual clouds, provided that he is cautious and aims to progress slowly. He should understand how to use his instruments, know any regulations governing where and how he can fly in clouds, and understand enough about practical meteorology to select suitable clouds and avoid icing conditions.

Instruments

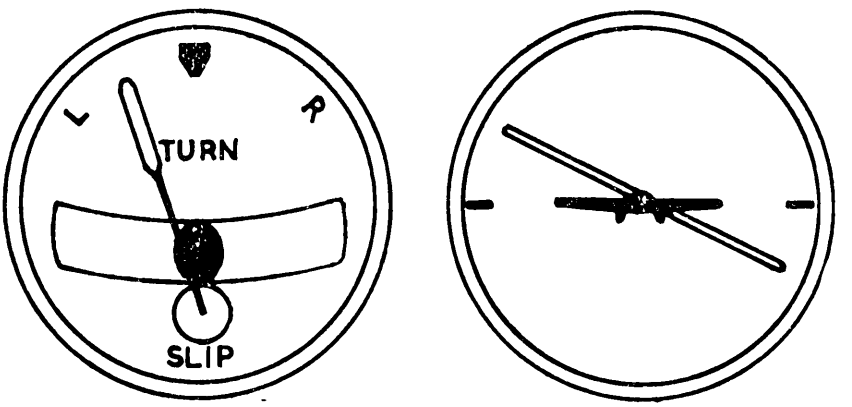
Nearly all soaring gliders are equipped with a turn and slip indicator, which is a simple gyroscopic instrument driven, in a glider, by dry batteries. The instrument has two indicators, a needle worked by the gyroscope, and a ball in a curved tube on its face. The ball shows when the glider is slipping or skidding, and the needle indicates whether the glider is turning or flying straight.

When the pilot is flying straight the needle and the ball will both be in the centre. When wishing to turn he should apply aileron and rudder to bring the needle to the first mark (rate 1 turn). The aircraft should be kept turning steadily with the needle on this mark. If the turn is done correctly the ball will stay in the middle; if the ball is on the inside of the turn, this shows a slip which should be corrected by applying more rudder. If the ball is on the outside of the turn, it shows that the aircraft is skidding, which is corrected by taking off rudder. The correction of slip and skid is of much less importance than achieving a steady rate of turn.

To straighten up, ailerons and rudder should be applied in the opposite direction to the turn.

The correct speed is maintained in cloud by reference to the air-speed indicator, although some assessment of this can and should be developed from the air noise alone, since in more ambitious clouds it may be necessary to have to manage without an air-speed indicator at all because it has iced up.

The use of the turn and slip indicator needs practice, and



23. Turn and Slip indicator and Artificial Horizon, both showing a turn to the left.

it is more difficult to use than the artificial horizon, which unfortunately is much more expensive.

The artificial horizon is also a gyroscopic instrument, but needs more powerful batteries to operate it. The instrument gives a representation of an aircraft fixed in the centre of the dial, and positioned so that it seems to be going straight ahead of the pilot. A line – the horizon – floats behind the image. The relationship between the line and the image indicates the actual state of affairs to the pilot. For example, if the horizon line runs diagonally across the dial from top left to bottom right and is above the centre point of the aircraft (centre of dial) it will tell the pilot that he is doing a diving turn to the left. The aircraft can be flown entirely by the artificial horizon, and the air-speed indicator is not absolutely necessary, other than for precise information on actual speed. It is a much easier instrument to learn to use than the turn and slip indicator.

Cloud-flying rules and regulations

When he took his C certificate the pilot will have learnt the airspace rules governing flying in cloud and poor visibility. Now, the regulation covering cloud-flying near gliding clubs must be learnt, because its sole purpose is to prevent collision between gliders in the same cloud.

The purpose of entering cloud is to gain height by circling up in the lift. When enough height has been gained, or the top of the thermal has been reached, the glider is straightened up and flown out. It will be seen therefore that the risk of collision in the cloud is small provided that all gliders entering the cloud do so from the bottom, and at intervals. By the time the next aircraft enters, the earlier one will have circled up a couple of

hundred feet. The risk, however, would be enormously increased if gliders flew into the cloud from the side. There would no longer be any natural spacing, and the new arrival might go into the cloud at the exact height at which someone else is circling. There is a regulation, therefore, to cover this point. It states that within 5 miles of a gliding site, no glider shall enter cloud except from a position not less than 200 ft. directly below. This creates an opportunity for other pilots to see the circling glider before it enters cloud, and therefore allow it an opportunity to get well up into the cloud before they too follow it in from the bottom.

Meteorological Considerations

When learning to fly in clouds difficult and large ones should be avoided. It is therefore wise to learn what causes clouds to develop extremely rapidly into huge turbulent monsters, and at what height icing up of the glider can be expected. When flying in cloud for more than a few minutes, the pilot may well be surprised when he comes out to find how far he has drifted. He should therefore understand about wind changes with height, and be able to make simple calculations in his head, so as to avoid getting out of reach of the landing field inadvertently.

When the weather looks suitable for a first attempt, permission must be first obtained from the Instructor so that he can restrict the numbers of gliders following the learner into his cloud. A check should be made that the batteries are adequate for at least twice the amount of cloud flying that is contemplated.

When airborne and while circling up in a thermal a further check should be made that the clouds are remaining reasonable in size. The glider should then be worked to a position a couple of miles upwind and a little to one side

of the airfield, so that it will not drift back right over it. Then, when circling up in a thermal with a nice little cumulus on top, the instruments should be switched on. This should be done in plenty of time in order to see that they are behaving properly and to get a picture of what certain indications mean in terms of what the glider is doing. The circling should be done exactly as usual, but at a very slightly increased speed. Nearing cloud, a really good look all round should be made for other aircraft, and then entire concentration devoted to the exclusion of looking out at all. There is unlikely to be any noticeable turbulence or change in conditions on entering a small cloud, except that the noise of the glider may take on a slightly more muffled quality. Circling should be continued with the instrument readings kept as steady as possible, and without worry over fluctuation of the speed of 3 to 5 knots on either side of the intended speed. In due course, the surrounding greyness may lighten, and the glider come out of the side of the cloud somewhere near the top.

This has not been difficult, and the pilot will have the beginnings of some useful basic experience. It is, however, only the beginning, and he should get as much practice as possible in little clouds before tackling anything more ambitious. Further practice in circling should include modifying the circle in order to shift the glider into the strongest lift, and this should be followed by practice in straightening up and coming out of the cloud on a predetermined compass heading. Straight stalls, and then spins, should be done outside cloud with the recovery carried out only by reference to the instruments.

This continual practice in small clouds is valuable not only for co-ordinating the instrument readings with the

actual behaviour of the aircraft, but in overcoming the contrary feeling of the senses when changing from one manoeuvre to another. For instance, when the glider is straightened up after circling, the pilot may get the feeling, quite strongly, that it has started to turn in the opposite direction. This is because while flying blind he is deprived of his normal reference points. The pilot must learn to disregard these feelings of what he *thinks* the glider is doing, and believe the evidence of his instruments.

If when cloud flying, the pilot should get in a muddle, and sooner or later he probably will, he should endeavour to straighten up and come out of the cloud. If in his efforts to do so he feels that there is any risk of flying too fast, or he is confused as to what exactly is happening, the air-brakes should be opened before the speed exceeds 65–70 knots, and earlier than this if the air is rough. Once the brakes are out, the pilot should concentrate on getting the glider going more or less straight, by correcting with the ailerons to try to get the needle in the centre. Then efforts can be made to correct the speed. By this time the glider will probably have come out of the cloud.

Only when about two or three hours have been flown in small cumulus, controlling the aircraft adequately, should an attempt be made in the rougher, tougher clouds. When doing this the risk of icing must be accepted. Ice forms along the leading edges of the wing and tail surfaces, on the nose and canopy, and may be thick. It will add to the weight of the glider, and the drag will increase the rate of sink. Icing may prevent the airspeed indicator from working, and in extreme cases freeze up the controls. If the airbrakes have been used in cloud, they may freeze out, or even in, after they have been closed again. This results in a glider which is less effective and less controllable so

long as the ice remains. After coming out of cloud, the ice will steadily melt away, the glider sink less fast, and the canopy again become clear. This, however, takes time, and the sensible pilot will not go flying in clouds above freezing level when this is at only a few thousand feet. In the spring there is quite a chance of getting a combination of fast-growing cumulus and low icing level, and unless the possibility of an out landing is accepted, the glider should be kept within very easy gliding reach of the airfield.

Cloud flying is valuable when cross-country soaring if the cumulus are large and spaced many miles apart. By climbing up inside a cloud the pilot will have enough height to be able to reach the lift area of the next cloud. Without cloud flying he may be too low to do so. If the clouds are small and the thermals more closely spaced, the disadvantages of losing sight of the ground, the sky ahead, and the position of other gliders nearby, may well outweigh the benefit of a little extra height.

After any spell of cloud flying, the pilot should remember to switch off the instruments, in order to save the batteries.

Aerobatics

Some people like doing aerobatics and some do not. Soaring gliders are designed primarily for soaring, and although strong enough to do limited or even unlimited aerobatics according to the particular type, no real concessions are made in the design to suit them for aerobatic flight. Nevertheless, there is some benefit to any pilot in being able to carry out simple aerobatics safely. Even if he is not interested in doing them for their own sake, the experience and understanding obtained by controlling the aircraft in unusual speeds or attitudes is valuable,

particularly if the aim is to indulge in cloud flying, or to become an instructor.

Although gliders are very strong, there are obviously limits to the strength, otherwise they would be excessively heavy or expensive. These limitations affect both speed, and gravity loading – the effects of increased gravity due to centrifugal force. The limiting speeds above which the glider may not be flown are placarded in the cockpit.

These speeds must never be exceeded. If there is any danger of doing so – and gliders accelerate when diving very rapidly indeed – the airbrakes should be opened at once.

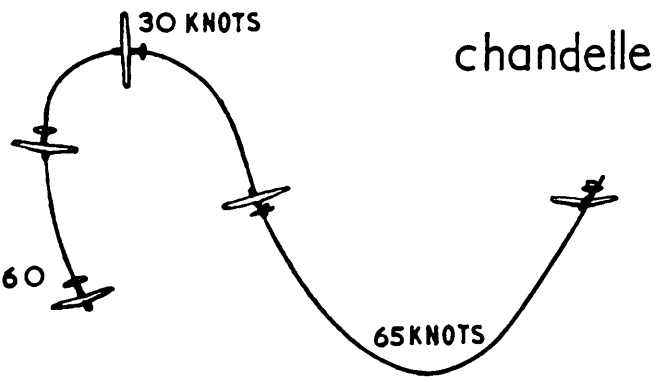
The gravity loadings can be kept down by gentle handling of the controls, particularly at higher speeds. At these speeds they will feel heavier, and this should be regarded as a warning, and force should not be used to obtain rapid movements of the controls. The effects of gravity will be felt on the pilot pulling out of a dive or doing a loop, etc. He will feel pressed down into his seat. This is reasonable and to be expected, but if the discomfort is considerable, or there is any tendency to grey out, owing to the blood being withdrawn from the head, then the pilot is overdoing things and must use the controls much more gently. Most modern gliders are stressed for loads up to 5 g, in the normal sense, that is when flying the right way up.

Some gliders may be flown inverted, but upside down flying should *never* be attempted without proper training. Not only are gliders less strong inverted, but since they can gain speed diving so very fast, the pilot may not be able to make the appropriate corrections in time in the unfamiliar situation of being the wrong way up, and may pull the glider apart in the air. Inverted, gliders are stressed for only minus $2\frac{1}{2}$ g.

Sometimes the pilot can experience some negative g when flying the right way up, either in excessive turbulence, or by the pushing of the stick forward too abruptly. The effect of this will be to lift him off his seat and up into his harness. If this is not tight enough, he may well hit the roof. If the pilot thinks he is about to stall, as he might, for instance, if he has a cable break on the launch, and pushes the stick forward rather too hard, the effects of the negative g that he induces may be enough to give him the feeling of weightlessness, and make him feel that he has stalled, and encourage him to push the stick even further forward. This is of course undesirable, since once the nose is down a reasonable amount, the glider will gather speed and must become unstalled. There is no need to go on pushing the stick forward since this will only result in excessive speed, and risk of hitting the ground if the glider is low.

Practice aerobatics should be done only when there is enough height to recover in case of errors of judgment; above all there must be no other gliders in the vicinity that might be hazarded. Practice aerobatics should not be done under 2,000 ft.

Chandelle. This is the most suitable manoeuvre to start with. The glider is flying the right way up all the time – that

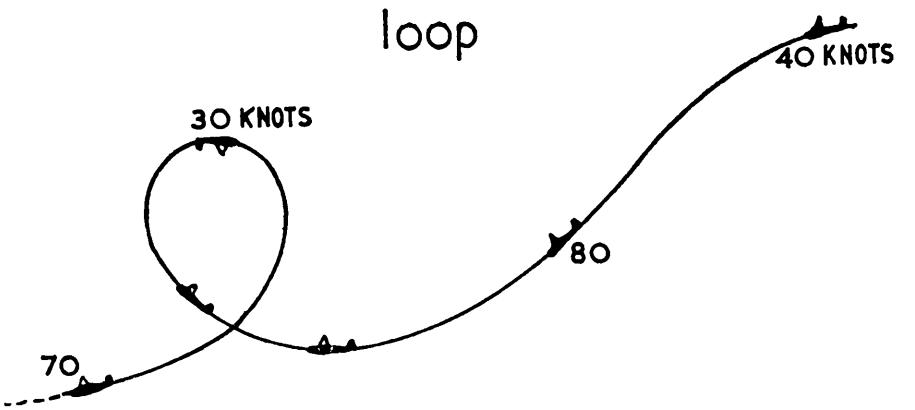


24. Chandelle.

is with the pilot being kept in his seat, with no negative g. It is very much like the stalled turn done by aeroplanes, but which should not be done on gliders owing to the risk of doing an inadvertent tail slide, and damaging the controls. The chandelle is a pretty manoeuvre, and several can be done one after the other very easily.

The glider should be dived firmly but not too steeply until it is flying at about 65 knots (depending on the type). The nose should then be brought up well above the horizon, and the glider at the same time, rolled and turned with plenty of aileron and rudder. The glider will appear to swing over about the inner wingtip and dive back in the opposite direction. As it does this the pilot should adjust the controls in order to straighten the glider with precision, and to prepare for his next manoeuvre.

Loop. More speed is needed for this. The glider should be dived to about 80 knots or $2\frac{1}{2}$ times the stalling speed ($2\frac{1}{2}$ vs) with the wings quite level. At the appropriate speed the stick should be eased back gently, but progressively more and more as the load comes off the stick as the glider gets slower, until when it is somewhere near the top of the loop, the stick should be hard back. As the nose



25. Loop.

comes up the pilot should look straight up over the top of his head. He will then see the horizon which was behind him appear. He should use this as a check that his wings are level. The stick should still be kept back as the earth passes the pilot's head-back view, but as soon as the original horizon reappears, he should ease forward on the stick so that by the time the nose has come up to this normal horizon, the glider is again flying level.

The usual fault in a loop is misuse of the stick at the beginning of the climb. If it is brought back too fast initially the pilot will be subject to a lot of g, and the loop will be tight, and apply an appreciable load on the glider. If, however, the stick is brought back too slowly, or eventually not enough, then the glider will not fly over the top of the loop, but stall. In doing this it may simply flop over nose down, but there is also a slight risk that it may tailslide first. Loops are also pretty to watch, and can be done consecutively after a little practice. Loops look better from the ground if done into or downwind. If done across wind the drift makes them appear crooked. It will be helpful to the pilot to do his loops towards a visible distant point, as an aid to straightness.

Rolls. It is not proposed to go into the inverted flight aerobatics in this book, as they can be done on a few gliders only, and require specialist tuition.

17 *Expeditions, Competitions and Records*

ALTHOUGH gliding is a solitary way of flying, or perhaps because it is, glider pilots enjoy getting together with their aircraft, and flying in company with each other. This is one of the reasons why expeditions and competitions are popular.

Expeditions

These invariably have some sort of exploratory purpose unless they are purely training events to get new pilots used to flying on different sites. The purpose of the expedition may be anything from trying to soar over Snowdon, to exploring waves over the Scottish mountains, or even merely to visit a distant club which has some special attraction such as cliff soaring combined with good surf riding and an attractive pub or two. It is not necessary, however, to visit either a club or an airfield to have an expedition. In the hands of competent pilots gliders can be operated from almost any patch of ground – they can be bungey launched off mountain tops or even sides, they can land on glaciers or beaches, and due to their manoeuvrability and relative slowness they can be flown in close proximity to hills or in mountainous country. Anyone going on an expedition should, however, not for one moment get the idea that they will have a rest cure. The newcomer will soon find that an exploratory expedition involves rock-climbing, swimming, picketing gliders in gales, cooking, searching the countryside for the other half of the

expedition, operating radios, and having his ingenuity put to the test in the most unexpected ways.

Even an expedition to explore newly discovered wave systems and starting from an airfield with aero towing laid on, will find that it gets involved in some sort of pioneering, even if this is merely trying to do a retrieve from some fell or other bit of country unsuitable for anything except gliders or mules.

Competitions

Interest in this aspect of gliding is increasing. There are World Championships, usually every two years, and in the U.K. National Championships, Regional Competitions and Rallies. The purpose of all of them is the same, and that is to discover who is the best pilot at the end of a series of daily contests, the minimum of which is three. On each day a task is set involving speed or distance. The best flight is awarded the maximum points available for the day with the rest of the field marked in proportion. The pilot with the highest total of points at the end of the competitions is the winner. The daily task flights are selected from Free Distance, Distance along a line fixed by the organizers with scoring penalties for divergence from that line, Race to a goal, Race to a fixed Point and Return to base, and Race round a Triangular Course. There are no tasks for height or duration. The selection of the task for the day is made early each morning by the person in charge of task setting in close collaboration with the met. man, using the latest and most detailed information available. This is then given to the pilots at Briefing, together with information about airfield layout and starting conditions, etc.

The British National Championships are about the biggest in the world, and the entry has been as high as

92 aircraft. In a country like England where the weather is somewhat erratic there may be difficulty in launching very large numbers of gliders quickly enough to enable them all to have a fair chance of using a poor or relatively short spell of soaring weather. For this reason the number has been reduced to about eighty. Entry into the Nationals is so popular that it now has to be controlled by the position of pilots on a National Rating list, otherwise there are far more entries than places. A pilot obtains a rating by flying in Qualifying competitions.

The National Championships entry is composed of those pilots who are the highest on the Rating list. A pilot can then work himself further up the Rating list by flying in Nationals which have a higher grading, and in other qualifying competitions.

The Rating system works by taking the best six competition days that a pilot has achieved, and adding the total points together. A day's marks are the points gained by a pilot expressed as a percentage of the winner's marks. Each year the value of a pilot's rating is reduced by some 10% and so in order to maintain his position on the list a pilot must fly in current events, and is unable to rest successfully on his laurels.

The organization required in running a big competition is considerable, and in common with almost all gliding activities it is done by enthusiasts in their spare time, nearly eighty people giving up their summer holiday to run the Nationals.

For the serious contender in such competitions there is both expense and considerable preparation, but in return, and weather permitting, as much flying as any pilot could want. To fly in Nationals, the pilot, or pilots if a glider is being shared, need in addition to the aircraft, trailer, car

and possibly radio, a ground crew of one or two friends. The job of the crew is to look after the glider when it is on the ground, rig it, and see that the barograph is wound up, and that the bottle of drinking water is full, etc., see that the trailer and the car are serviceable, and – the real object of the exercise – chase after the glider, find its landing field, and get back to base without delay. This part of the job can be both entertaining and exacting, and there is little doubt that the possession of a good crew is an active assistance in obtaining higher marks.

If there is radio communication between pilot and crew, it is sometimes possible for them to reach the landing field that the pilot has selected before he does. It is then only a matter of minutes before the glider is de-rigged, secured in the trailer, and on its way back to base. If there is no radio, the crew has to develop a cross between a Sherlock Holmes deduction and telepathy, and it is surprising the extent to which this is done by some crews. The problem lies in trying to assess the speed of the invisible glider, and above all its direction which may, if the weather is different from forecast, differ from any prearranged plan. If, for example, the flight is for pure Distance and the pilot is starting from, say, Bristol in a S.W. wind, he will be able to achieve a good, but known, distance by flying into East Anglia, but a much longer distance would be possible by working North of the Wash and attempting to get up towards Newcastle. The crew will start off early if the day looks good, even before the glider has been launched if possible, and telephone back every hour, because the car cannot travel as fast as a glider going downwind. If there is no information it will be quite safe to press on until the Huntingdon–Cambridge area has been reached, when the crew will have to try to assess what the pilot would have done. If the sky

looks only moderately good, and the crew think that the pilot would not have reached the area until, say, 3 p.m., then the chances are that he will have gone on downwind into East Anglia, and the crew will drive South of the Wash. If, on the other hand, the sky looks excellent, and/or the wind is less strong, or has become more Southerly, or the wind is the same but the weather looks better to the North, then the crew may decide to alter direction and drive N.W. of the Wash. If they make the wrong decision, there is no short cut back and they will have to return all round the Wash to get back to the glider, which is both tedious and expensive. Sometimes it may pay to wait at a 'parting of the ways' until more evidence becomes available – perhaps in the form of landing reports of other gliders in a certain area – but delay will mean a much later return to base than is involved with a correct decision, and on a long retrieve may well make the difference between seven and two hours in bed! But the wrong decision? One flight starting in Hampshire ended with the glider near Dover and the trailer at Coventry!

On a triangular race, it often pays to situate the trailer at a convenient junction somewhere in the centre of the course, or if the triangle is very large to make a smaller tour well within its perimeter. As soon as the crew have discovered, by telephone, where their pilot has landed they can dart out from their junction or lesser orbit, pick up the glider, and return to base with the least delay, in order that the pilot can have a further attempt. If the pilot is successful and gets round fast the first time, then the crew is not so very far away, and can come quickly home.

Crewing in World Championships is one of the best ways of getting to know a country. Far from the tourist tracks, battling with unfamiliar languages, competing

with strange telephone systems in a hurry, and reversing the trailer into the mud of some far-flung farm will give the enterprising crew an excellent opportunity to see how the other half of the world lives.

In competitions the pilot's day starts with Briefing, and then working out a plan with his crew, and selecting his take-off time – on a Distance day it pays to get going as early as possible, whereas on a small Triangle the fastest times round the course will be possible during the early afternoon when the thermals are stronger; and then getting into the air. Aero towing will almost certainly be used for launching, and the gliders will be dropped in a selected area at about one minute intervals, perhaps less. It will be obvious from this that each thermal, particularly near base, may contain a considerable number of gliders, even as many as twenty or more milling around together. This means that a really excellent look-out must be kept while searching for lift, as other gliders will almost certainly be very close. Against this, there will be some advantage in the existence of other gliders as their circling will mark the whereabouts of thermals. Circling together is safe only so long as the rule of circling in the same direction as the first gliders to arrive is obeyed. Trying to get out of the stream suddenly, and without consideration of the whereabouts of others, must be avoided. It is obviously undesirable for a number of gliders to go into cloud at much the same height and anyone entering cloud should be allowed a few minutes' grace by those wanting to follow. Unless use of the cloud is essential in order to obtain enough height to reach the next lift area, it will be far better to avoid it and fly straight on to another thermal.

If the task is a race to a goal, the final glide may well be made in company with other aircraft, and the pilot when

diving over the finishing line should realize that there may well be someone just behind him, and avoid pulling up too abruptly, or doing aerobatics.

World Championships

These are held, normally, every two years and are entered by between twenty-five and thirty countries from all over the world. The World Championships since the war have been in Switzerland (1948), Sweden (1950), Spain (1952), England (1954), France (1956), Poland (1958), Germany (1960) and Argentina (1963).

A National entry may be composed of up to three or four pilots each with their own glider. The gliders are divided into two classes and it is usually left fairly free as to whether a country shall enter one or both. There is the Open Class, for gliders however exotic, of any performance, size, or cost, and Standard Class, for gliders limited to 15-metre span. The winner is the pilot, not the team, of each class who amasses the highest total of points, the credit going both to him and his country. There is therefore a world champion in both Open and Standard Class.

Pilots selected for World Championship teams may be amateur or professional, male or female, and all fly together on equal terms. There is a fine record of friendliness in these competitions, due partly to the nature of the sport itself and partly to the absence of arguments over such things as amateur versus professional status, which is such a problem in the Olympics.

The daily tasks in World Championships are similar to those in Nationals, and the standard of flying is really exceptionally high. The championships last for two weeks, preceded by several days' practice so that the visitors can get used to the locality.

Records

There are World Records, and National records which can be won for a Country by a National of that country, and in addition, there are U.K. records for flights which have started in the United Kingdom, but which may be held by a pilot of any nationality. There are also Women's records in all classifications. Two-seater records still exist, but will probably soon disappear. World records have to be approved by the Federation Aeronautique Internationale in Paris, but National and local records may be approved by the National Aero-club.

Within the British Isles it is now difficult to achieve a high enough performance to beat a world speed record. Thunderstorms and waves do not go high enough for altitude records. Also it is almost impossible now to fly from this country and continue across the continent, because virtually all of the 'jumping off' part of S.E. England is now controlled air space, and reserved for airliners, etc. As a result any World record to be held by a Britisher is likely to have to be made abroad, and since the opportunities to do such flying in other countries are limited, invariably by a pilot's lack of cash and time, it is more difficult for this country to figure prominently on the World list. This on no account means that British pilots are not capable of such performances, as is shown by our good position in World Championships. On the other hand, the possibility of beating a U.K. record still lies within the capabilities of any competent soaring pilot on any good day, and without big outlays of time and money. For instance, the 100 km. triangle record now standing at 52 m.p.h. could be improved on in a flight from almost any club in the space of an afternoon. There is still, too, the challenge of the 500 km. triangular flight, which is waiting

to be done in this country for the first time by somebody.

Records have to be beaten by a certain margin. For distance records this is 10 kilometres and for speed records 2 k.p.h.

The future is full of possibilities. Height records even now require pressurised oxygen, or cabins, and electrically heated clothing, etc., and it is known that wave lift extends even higher than the 44,000 ft. above the ground that has now been reached. The Distance record now stands at 535 miles. That is an average speed of 60 m.p.h. If a pilot could fly faster or for longer, what distance could be achieved? Average speeds are now in the sixties for the triangular flights, and downwind at high altitude pilots have exceeded 100 m.p.h. over the ground. There are wave systems, for instance over the Andes, that have not yet been explored, and in this part of the world it might be possible to increase the world distance record to 1,000 miles by using this vast chain of mountains, so that in addition to thermals and wave systems in association with it, there would be a chance of staying airborne all night in hill lift, and then going on again the next day.

There are possibilities too in the use of lift, of which we know little or nothing at present, especially at very high altitudes. One thing is certain, however, that world records will steadily climb out of the reach of the part-time enthusiast however able he is, because of the greater need for expensive scientific equipment, and very specialist knowledge and even co-operation of scientific or supporting bodies that will be necessary for some attempts. This is in some ways a pity, but the time is not here yet, and world records are still within the range of ordinary pilots who still today are dipping only their toes in the deep end of soaring.

18 *On Becoming a Private Owner*

BY NOW our pilot will have become so deeply involved in gliding that he will find it difficult to extricate himself. If he has a leaning towards teaching his Chief Instructor will help him in this direction, first of all by giving him a good spell of carrying passengers and then teaching him to instruct, so that, in due course, he will be helping the club, in the same way as the people who originally taught him. If he is not so interested in instructing, but just wants to do a lot of soaring, then there are two courses open to him; to continue to take his turn on club gliders as often as he can, or to become a private owner.

It is, of course, possible for one person to buy one glider and have it all to himself, but this is not very practical unless the prospective owner has a wife or family willing and able to be his crew, and retrieve him from wherever he lands. The more normal practice is for a small group of pilots to buy and share a glider between them. This number usually varies between two and six, although any number over four sometimes seems a bit of a crowd.

Private syndicates exist in most clubs and from time to time opportunities occur for new members to join them.

It is a mistake to become a private owner too soon. If a pilot is not experienced enough to have reached the stage where he will soon be able to land in a field then he should think very carefully before joining a group where all the other members vanish across country every weekend. He

may well find that he is discouraged from flying away in case he damages the precious glider, but at the same time is expected to drive miles collecting the others. If, in a small club, a group of inexperienced pilots decide to band together and get their own aircraft, because the club facilities are insufficient, they should discuss the matter fully with their C.F.I. and agree to stay on local flying for at least one soaring season, or some suitable period, and accept instruction, or criticism like any ordinary club pilot.

The cost of becoming a private owner varies enormously, depending on the glider selected and the additional equipment, the amount of work the syndicate members are prepared to do themselves, and the number of pilots in the group.

Gliders

A new Slingsby Skylark 4 costs £1600, and a T49 Capstan, £1800. These are the best performance gliders in their class. For the less experienced pilot the Swallow costs £1100, and the Eon 460 £1100.

Most of these gliders are available in kit form, and can be built more cheaply than the commercially finished product, provided that workshop space and adequate skill is available. Second-hand values vary a great deal according to type. The Skylark 4 is likely to cost more second-hand than new, but an Eagle can be bought for £1,200. A Swallow will be priced high and the Olympia 2, which is the older type, will be quite cheap at £400.

These prices naturally fluctuate, but they will do as a guide. In addition to the aircraft, a sum ranging between £25–£100 must be added for instruments, £20 for a parachute and £15 for a barograph.

This will provide the syndicate with a serviceable glider,

but if they are going to fly across country it must have a trailer, and at least one of the syndicate members must have a suitable car fitted for towing with a 2-in. ball hitch. New trailers cost £250 approximately. All this adds up to a lot of money, and private ownership can be expensive. For example, two pilots sharing a new Skylark 4, a commercially built trailer, full instruments, all maintained professionally, and comprehensively insured, must be prepared to lay down £2,000 (£1,000 each) on capital items, plus between £150 to £200 (£75 to £100 each) a year before-they-even start to get launched into the air, or pay their club membership fees. Fortunately it is possible to become a private owner on much less than this. For example, four pilots can buy and share a second-hand Olympia 2 with basic instruments and parachutes for £400, and they can build their own trailer for £100 (an open trailer can be made for appreciably less, but in damp countries this is no economy). They can insure the glider but maintain it themselves, buying only materials. This will work out at £125 each down, and about £20 each a year, excluding launching, etc. For the enthusiast this is by far the better way to start on private ownership. It will be possible to get in plenty of hours flying fairly cheaply, and at the same time to learn a great deal about the aircraft and how to look after it.

Instruments

The instrument panel on a glider usually includes the following:

A sensitive and accurate *A.S.I.* These cost about £25 new, and they are difficult to get second-hand.

An altimeter. These can be bought for about 35/– in disposal stores.

Two variometers. This is not necessarily mere duplication, since one may be a no-lag electrical one, and the other a standby of a type which is less likely to suffer from the defects of flat batteries, etc. or one may be a 'total energy' vario, and the other not. Variometers cost from about £8 up to £25 for the electric variety.

Compasses, two of these also for preference, an ordinary course-keeping goldfish bowl like an E2, and a Cook for accurately turning on to course when cloud flying and even thermal soaring.

For cloud flying a *turn-and-slip indicator* can be bought from disposal stores for about £5. It runs on dry batteries.

If possible an *artificial horizon*, difficult to get and expensive (£40) but necessary for the serious pilot determined to involve himself in big clouds. Artificial horizons run on small accumulators.

If a pilot wants to make do with the cheapest available which at the same time will be perfectly adequate for his needs, at any rate to start with, he can reduce the formidable list above and have:

1 airspeed indicator.
1 altimeter.
1 variometer (P.Z.L. or Horn).
1 compass, any small goldfish bowl or a Cook.
1 Turn and slip indicator.

Oxygen

Again, necessary for the ambitious and really serious. There are several suitable and light weight varieties on the market, costing from £18 to £35. A more elaborate set costs about £70.

Parachutes

The second-hand ones which have been completely over-

hauled by the makers, and which sell for under £20 are excellent value.

Barographs

These, as well as parachutes, are essential equipment for any private owner. There are very few available on the second-hand market and the cost now is £38.

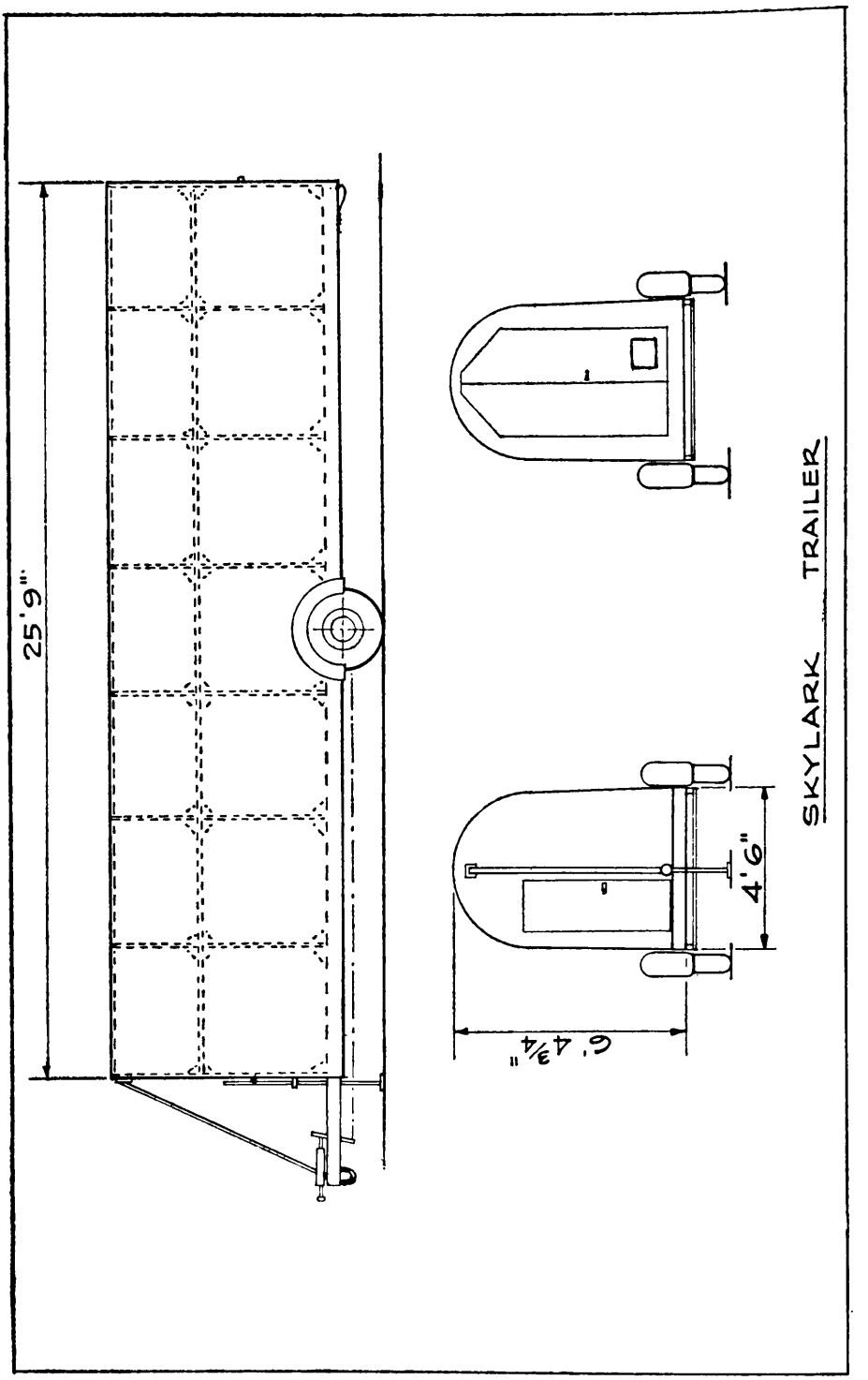
Radio

If a radio is desired, this can, of course, add anything up to £250 because the car must have a set as well as the glider.

Trailer

The best way of cheapening the whole business of private ownership is for the syndicate to do as much as possible of their own work and the best way to start this is by building a trailer. Very many private owners do this job themselves and it is not difficult for anyone able to use ordinary tools, who is prepared to be reasonably accurate and painstaking in his work. The one pitfall to avoid, however, is to design a trailer without having studied other people's good ideas, and above all their mistakes, first. There are many monuments to the 'make first and think afterwards' school in existence, and all of them a source of constant trouble to their owners. A drawing of a proved simple form of trailer appears on page 198.

It will be seen that the body work is simply plywood glued, not nailed or screwed, to a simple wood framework of hoops. This body is fixed firmly to the floor platform, and provides strength and stiffness to the whole. A commercially built axle is bolted on under the centre of the body and this must be done accurately, otherwise the



26. Trailer Plans.

trailer will not run true. A tubular tow bar can be made up by any local welder and bolted on the front.

Racks are constructed inside to fit the glider, and the whole is then painted.

Having coped with the trailer, the do-it-yourself syndicate can start work on the glider, but here enthusiasm must be combined with really skilled knowledge. No one should attempt to modify or alter his aircraft in any way unless he has the qualifications and technical knowledge to do so. However, this certainly does not mean that he can do nothing. Work on the glider falls into three categories. Daily inspection, annual inspection and certificate of airworthiness, and repairs and improvements.

Daily Inspection

Certainly any private owner should know how to inspect his own glider. The C.F.I. or ground engineer of his club will show him how, if he has not already learnt how to do this on club gliders. It is not difficult, requiring care and a conscience, the latter coming into use when something, a crack perhaps, is found which is not understood, when the conscientious and honest person will admit his lack of knowledge and ask someone more qualified for advice.

Certificate of Airworthiness – Annual Inspection and Overhaul

The private owner syndicate, if they built themselves a good trailer and are competent at carrying out daily inspections can well do this too. The first essential is to find a suitable workshop where at least one wing or the fuselage can be worked on easily and left under cover. Then it must be examined by an approved Inspector, who

will give the syndicate a list of the work that has to be done, and tell them at what stage he wishes to make further inspections as the work proceeds. When everything is carried out, he will give the aircraft a final examination, and if it is satisfactory sign the certificate that the C. of A. can be renewed. Most syndicates do this work in the winter, at weekends or in the evenings.

Minor repairs such as mending tears in the fabric, or replacing a skid sheath, are soon learnt.

Improvements

For most pilots this merely means improvements in the cockpit, the seat cushioning, arrangements of the instruments or the making of a complete new instrument panel, or to the surface finish of the glider. If they feel their knowledge inadequate, they can always ask for advice from any more experienced private owner, but no alterations to the structure or the aerodynamic qualities should be done without agreement with a Senior Inspector of the British Gliding Association or the Air Registration Board.

Operation of the Glider

This will normally take place from a club site using the club's launching facilities. The members pay the Private Owner subscription, which is normally less than that for a full flying member.

Before buying, the syndicate will be well advised to have decided on a policy as regards the number of pilots to be included, the conditions covering changes in the membership, the sharing of costs, etc., and to have made a written agreement between themselves.

Now, before starting flying, a programme must be made

of how this can be shared to everyone's benefit. It is possible to put the members in an order, and go through the list changing the pilot on every launch, or it is possible to consider that a turn consists of the right to have up to two or three consecutive launches, or to say that a turn will be a complete day, or as much of it as the pilot desires. If the syndicate is composed of inexperienced pilots who want to get in as much local flying as possible, then there is a lot to be said for variations on the first or second themes, but if the pilots are more experienced, and the object is cross-country flying, then it is much better for each pilot to have the glider for a day, and to be able to know in advance which day this will be. He can then make all his preparations so that if the weather is good, he can take full advantage of it, without having to rush round finding maps and chocolate, and putting petrol in his car and cancelling special engagements at the last minute. If the weather is useless, he then hands the glider back and anyone can fly who wishes. In addition to day-to-day flying, the syndicate members will probably want to concentrate on the different aspects of gliding which interest them most; one pilot may be desperate to fly in the National Championships with the glider all to himself, another may want to take the glider to a hill site for a week's holiday, and a third may badly want to get his gold or diamond height qualifications. Such inequalities of use can be sorted out quite easily if they are thought of in advance, and everyone agreed on how the glider shall be shared. It is obviously wise, before starting a syndicate, to join up with people who have the same ideas, and who think that they can get along together. Nevertheless, the best friendships will be better safeguarded by care in working out a proper scheme for the operation of the glider, so that everyone feels that

they are getting and paying their fair share. In the same context, the use of a car, or cars, belonging to syndicate members should be considered, and the car owner paid either something like 6d. or 7d. a mile for his vehicle on retrieves, or he should be paid only petrol and perhaps be given some other benefit or let off some chore. What it is is immaterial provided that it has been agreed in advance.

Nearly all private owner syndicates work remarkably well, perhaps because, unlike boats, when the part owner who is left behind has nothing to do, the part owner of a glider is extremely interested in going off and quickly retrieving the aircraft, because it is his turn next. In glider syndicates, members are necessary to each other as part of a team, in order for each to obtain the maximum amount of enjoyable flying.

APPENDIX

Member Clubs of the British Gliding Association

BRISTOL GLIDING CLUB

The Bristol Club operates from 80 acres of land near Nympsfield in Gloucestershire, at the top of a N.N.W.-facing escarpment 400 ft. high. This deflects Northerly winds upwards and enables gliders to make prolonged hill-soaring flights. There is also a more Westerly-facing slope within reach. This ridge, known as Frocester Hill, forms part of the Western edge of the Cotswolds and is a popular beauty spot, famed for its view of the Malvern Hills, the Severn Valley, and the Black Mountains.

The Club is managed by a committee of ten, elected annually by the members. There is a full-time instructor for the Summer courses and a part-time catering staff to prepare meals at weekends, but most of the Club's operation depends on the voluntary efforts of the members themselves. Flying instruction is given by a dozen instructors who hold the B.G.A. Category. These take charge of all flying, under the direction of the Chief Instructor. No additional charge is made for instruction.

Maintenance and repair of aircraft is undertaken by members under the supervision of those who are B.G.A. approved Inspectors. In addition to gliders there are trailers and cars for retrieving from cross-country flights, and it is hoped to acquire more high performance aircraft. When they become proficient, however, many members form groups and buy their own gliders.

Due to the shape of the field the only practicable methods of launching are by winch and aeroplane. The Club has its own Tiger Moth, flown by qualified club pilots, and this has

greatly increased the opportunities of soaring, but the bulk of training launches are made by winch.

A programme of winch construction is in hand, and will continue until the Club is really well equipped in this respect. Extension and improvement of Club buildings is also expected to continue steadily.

To extend facilities to those wishing to start gliding in their summer holidays, the Club runs a series of weekday courses during the summer months. These courses are intended primarily for people who have no previous experience of the sport and live too far away to come regularly at weekends. The all-in fee covers membership, flying, meals and accommodation at a comfortable country hotel near the site.

Site: Nympsfield, near Stonehouse, Glos. 3 miles S.W. of Stroud.

Membership: Flying 236, associate 41.

Fleet: 2 two-seaters, 5 single-seaters. 7 privately owned.

Operates: Weekends and summer weekdays.

Charges: Entrance, £6 6 0; Subscription, £7 7 0, launch, 5/-, 18/- per hour.

CAMBRIDGE UNIVERSITY GLIDING CLUB

In 1935 a group of undergraduates and research students founded the Cambridge University Gliding Club. One of the founders (now Professor J. W. S. Pringle, M.B.E., Sc.D., F.R.S. and British Silver C No. 45) has been active ever since, and is still President of the Club. From its earliest days the Club was noted for technical originality and innovation. When most other clubs were established on hills, C.U.G.C. was winching on a flat site, and developed for the first time the technique of catching thermals from winch launches. After the war Club members pioneered, amongst other things, auto-towing with piano wire, two-drum winches, V.H.F. radio for

gliders and the transistorized electric variometer. In flying, too, new advances were being made. As early as 1937 a Club pilot reached 7,000 ft. in what is now realized to be a standing wave, while in 1949 the first cross-country in multiple waves was flown in the Club Olympia.

Wanderlust has always been traditional in the Cambridge University Gliding Club. Three or four members take an aircraft and a bungey, and go exploring. Before the war most of Southern England was prospected in this way; since the war the Clwyds, the Malverns, the Lake District and many lesser hills have been turned for a few days into Club flying grounds.

What of the Cambridge University Gliding Club in 1963? It flies practically every day from Cambridge Airport, where it has its own hangar, workshop and garage. It has a full-time ground engineer/instructor/philosopher, who was himself Club-trained. A fleet of gliders is available to members, and launching is provided by two two-drum winches and a Tiger Moth. The whole scheme of training is geared to producing soaring pilots; C.U.G.C. has in its history produced more Silver Cs than any other British club. Among the members are not only undergraduates, research students and dons, but many non-members of the University from all over England.

Twice a year the whole Club operations are transferred to the Long Mynd, where the Club has for many years enjoyed the Midland Club's hospitality. Club aircraft compete regularly at competitions and Championships, and occasionally set up British records. The characteristic Cambridge University Gliding Club spirit – best summed up as 'Press on, but not *too* regardless' – still flourishes.

Site: Marshalls aerodrome. 2 miles E. of Cambridge.
Membership: Flying 300, associate 1.
Fleet: 1 two-seater, 5 single-seaters. 1 privately owned.
Operates: Weekends, most weekdays.
Charges: No entrance fee; Subscription £7 7 0, launch 5/-, £1 per hour.

THE CORNISH GLIDING (AND FLYING) CLUB

The Cornish Gliding Club with its unique site – a three-runway airfield on the edge of the Atlantic cliffs—was formed in 1957. Since that date progress has been energetically pursued and accompanied by all-round advancement, safe flying and improvements to both the Club's fleet and facilities for members.

The airfield is so placed that in any moderate wind from N. to W. members can soar almost immediately after casting off the launching wire. This was soon to be recognized by other glider pilots and many visitors come to the club with this primarily in mind.

Cliff soaring, often reinforced with thermals, is truly an exhilarating experience and is not confined to qualified pilots only; it is often offered to the wives and friends of visiting pilots in one of the Club two-seaters. Heights of about 1,500–2,000 ft. are common, and the view is magnificent. The coast can be seen as far as St. Ives and sometimes to the extreme tip of Cornwall at Lands End, with Godrevy Lighthouse standing out brilliantly white in the blue sea. In the other direction, Perranporth beach with its great length of sand is almost below, and farther North, Newquay, and Trevose lighthouse. Perhaps the biggest surprise of all is that on looking inland, the sea of the South coast at Falmouth and the river winding up to Truro are visible.

Each summer the Club arranges courses for visitors which are in charge of full-time experienced instructors who make sure that each individual is given the best instruction. Accommodation is usually arranged at a guest house near the airfield boundary, or a nearby holiday camp. At Perranporth, only three-quarters of a mile, is a wonderful sandy beach for children, and many pilots arrange accommodation in the 'Porth' for their families.

A live part of the Club is the new clubhouse. This is a warm

and comfortable Cornish-stone house, run by members who serve coffee and light meals at almost any time when flying is in progress. There is a bar. It is a haven when the weather is bad, and from it emanates the spirit of friendliness that the club has always tried to foster, and without which any club is the poorer.

The Club has the use of another airfield about 35 miles further North, Davidstow, and a field for away landings at Newlyn.

Site: Perranporth airfield. 7 miles N.W. of Truro.
Membership: Flying 103, associate 30.
Fleet: 2 two-seaters, 4 single-seaters. 4 privately owned.
Operates: Weekends and summer weekdays.
Charges: Entrance; £2 2 0, Subscription, £6 6 0, launch, 5/-, 15/- per hour.

COVENTRY GLIDING CLUB

The Coventry Club was founded in 1952 by a small band of enthusiasts in the area. Flying has taken place at the Coventry Civic aerodrome at Baginton but the Club is at last being able to develop its own site on part of the war-time airfield of Husbands Bosworth, which it now owns. Flying takes place every weekend and visitors are very welcome.

The present fleet consists of one T21b two-seater trainer, one advanced two-seater, and four single-seaters. Members are encouraged to progress with their flying by a check system. After going solo a pilot may take a check every 60 launches. These consist of flying tests and oral examination. Each check entitles the pilot to some benefit. For example, check 1 entitles the pilot to do solo aero towing behind the Club's tug. Check 2 to fly Olympias, Check 3 to attempt Silver C duration, and Check 4 to fly the Skylark, and attempt Silver C cross-country. After Check 4 a pilot may be invited to carry passengers.

Subscription to the Club is about the average at 6 guineas a year with an entrance fee of 4 guineas. The future is full of

possibilities and will include development of clubhouse and bar facilities, as well as the continued modernization of their fleet.
Fleet: 2 two-seaters, 4 solo gliders.
Flying takes place every weekend and some weekdays.
Charges: Entrance, £4 4 0; Subscriptions, £6 6 0, launch, 2/6, 18/- per hour.

DERBYSHIRE AND LANCASHIRE GLIDING CLUB

The Club, which was formed in 1935, is at Camphill, near Tideswell. The old address was Camphill Farm, and as the Club is approached over the edge of the hill from Gt. Hucklow, it would still be possible to mistake it, were it not for the hangar in the background, and perhaps the gliders overhead.

Camphill itself is 1,300 ft. up and stands at the Southern end of Bradwell Edge; to the South lies the high plateau round Tideswell, and to the North the hills leading up to Kinder Scout, the highest point in the Peak District. Bradwell Edge provides excellent hill soaring in W. and N.W. winds. To the South the ridge turns East towards Eyam, and is soarable in Southerly winds. When the wind is E. or N.E. gliders fly to the bowl of hills round the Castleton valley, bounded at the Western end by the sheer face of Mam Tor.

The main attraction of winter is that in this season the best wave soaring conditions are found. To fly in them, above clouds rolling in great undulations below, and with a sun of unshielded brilliance above, is an unforgettable experience.

Camphill is not a difficult site, but it is one where care is needed. People who learn to glide there may take longer to go solo than at some clubs, but they are usually glad that they have had their training there. Instruction is carried out on the T31 two-seater, and after going solo a member will fly Tutors, Prefects, Olympias and Skylarks.

The Club is a place where most members come to spend the weekend, sleeping in individual bedrooms, the bunkroom, or in a caravan. There is a full-time Steward and his wife does the cooking for the weekend meals. The mess room is in what was formerly the old cattle byre, where the walls have been white-washed and the original roof timbers preserved. Other parts of the old farm have been converted into a clubroom and bar.

In 1954 the World Championships were held at the Club, and in 1961 the first Northern Gliding Competitions were held. It is planned to continue these in future years.

The Derbyshire and Lancashire Club is one of the oldest in the country. It has a long tradition of gliding and particular experience of flying in the Pennine wave. With this is combined a warm and friendly atmosphere.

Site: Camphill. 8 miles N.E. of Buxton.
Membership: 193 flying, 109 associate.
Fleet: 3 two-seaters, 10 single-seaters. 7 privately owned.
Operates: Weekends, some weekdays.
Charges: Entrance, £10; Subscriptions, £10, launch 3/-, 18/- per hour.

THE KENT GLIDING CLUB

Recently moved to a new site at Charing, which is being actively developed.
Membership: 100.
Fleet: 2 two-seaters, 3 single-seaters.
Operates: weekends.
Charges: Entrance £4 4 0; Subscriptions £8 8 0, launch 5/-, 15/- per hour.

LASHAM

Lasham is a centre rather than a club. The Lasham Gliding Society Ltd. operates the airfield, provides all domestic and

launching facilities, and runs a school which carries out elementary training for clubs based on the airfield. The centre is run by a permanent staff, including three instructors, which enables flying to be carried on every day throughout the year. The staff is assisted, particularly at weekends, by volunteer tug pilots, instructors, and winch drivers, etc.

In late 1960 the Lasham Gliding Society obtained security of tenure on the airfield, which had been built in the war, and is now able to go in for a programme of improvements. The hangar has been recovered, and as soon as enough money can be found the old wartime huts will be replaced by a civilized clubhouse.

More flying goes on at Lasham than at any other single site. In 1961 over 25,000 flights were made, and the biggest championships in the world took place, with nearly 100 gliders competing.

In association with the society are six soaring clubs, some twenty-five private owners, the Air Scouts, and a test flight group. From time to time other activities such as man-powered flying, parachute kites and other experimental devices may be seen.

Many Club members stay at Lasham in their own caravans for which there is a permanent site near the clubhouse. Meals are provided every day, and there is a licensed bar.

The main clubs at Lasham are the Army, Crown Agents, Imperial College, Polish Air Force Association, and the Surrey Club, which has unrestricted membership, and which is described on page 218.

Site: Lasham Airfield, half-way between Alton and Basingstoke, Hants.

Operates: Every day.

THE LONDON GLIDING CLUB

The West-facing ridge that stretches from Whipsnade Zoo to

the Dunstable 'Bowl' has been soared by London Club gliders since 1931. In early pre-war days when the bungey was the main method of launching, clubs were necessarily hill-bound. As launching methods and soaring skills improved, however, the chalky soil of the Downs proved excellent thermal country and became the starting point for many fine pioneering flights, such as those made by Philip Wills.

Today the ridge is more of a natural grandstand for spectators who can watch the activity on the field 250 ft. below, where two tugs and two winches launch the 13 club and 25 privately-owned gliders into the air. In the summer cross-country flying is possible in all directions except South – the centre of London is only 35 miles away. In the winter hill and wave soaring keep the gliders in the air; there is no hibernation at Dunstable.

There is variety at the Club, not only in the flying, but in all the ways that individuals choose to enjoy gliding Club life, each suiting his own temperament and pocket. Some members potter quietly in the workshop with an old glider, keeping it in beautiful condition but only airing it on occasions; others put in long thoughtful hours floating above the ridge spectating the spectators and the Whipsnade animals; others are fierce competition pundits, eager for speed and distance, but everyone comes to Dunstable for fun, and everyone's idea of fun is different.

The Club has resident staff and flies every day throughout the year. There are catering and residential facilities for members in the famous clubhouse, and many members come and live at the club for their holidays.

Membership: 300.

Fleet: 3 two-seaters, 10 solo gliders.

Flying takes place every day.

Charges: Entrance £7 7 0; Subscriptions £10 10 0, launch 5/-, 18/- per hour.

THE MIDLAND GLIDING CLUB

The headquarters of the Midland Gliding Club are situated on the Long Mynd, a hill approximately 1,500 ft. above sea level, ten miles south of Shrewsbury in Shropshire. The site has been used for soaring for the past thirty years and in the early years it was the fact that the hill had a splendid West-facing slope some five miles long which made it such an attractive proposition for hill soaring in the prevailing westerly winds.

The Club's early progress owes everything to the efforts of the late Espin Hardwick, a true enthusiast if ever there was one. Before the Second World War the standing wave phenomenon was discovered but not understood. In the post-war years the fact that the Mynd was one of the most versatile gliding sites in the United Kingdom, offering not only superb hill and wave soaring, but excellent thermal soaring opportunities as well, became more apparent. That pilots have climbed in wave lift to heights of between ten and twenty thousand feet, together with numerous gold C distance flights accomplished, illustrate these facts well. With the advent of regular aero towing facilities, it is expected that our knowledge of wave flying will be greatly enhanced.

The Midland Club is a happy one with a fine clubhouse and excellent catering facilities. Good launching equipment and gliders well maintained are valuable assets of the Club. In addition, private owners keep their high performance gliders on the site. Each Easter the Club runs a task flying rally which is a popular event in the gliding year. Well patronized instruction courses are run each year from March to September. A happy blend of experience and youth is the strength of the Club.

Membership: 140 flying, 56 social.

Fleet: 3 two-seaters, 9 solo gliders.

Flying takes place every day.

Charges: Entrance £3, Subscriptions £9, launch 3/-, 12/- per hour.

NEWCASTLE GLIDING CLUB

The Newcastle Gliding Club, after a long history of operating from temporary flying fields, finally settled at Carlton Moor in July 1960.

Situated on the North-west edge of the Cleveland Hills at a height of 1,300 ft. above sea level, hill lift is produced in winds ranging from due West through North to due East. In North winds it is possible to soar over a distance of nearly 15 miles.

Standing waves have been contacted in all wind directions and heights of 12.000 ft. have been reached. Excellent thermal conditions ensure a good start to cross-country flights. Gliders are launched to heights in excess of 1,000 ft. in all wind directions.

The site consists of undulating moorland with a variable covering of peat and heather over sandstone. A vast programme of site levelling to be followed by seeding with grass should enable aero towing to be done by 1963. The club hangar is 75 ft. long by 60 ft. wide and it is hoped to replace the temporary club hut by a permanent building within the next few years.

The Club owns one T21, one Olympia and a Tutor. Additions to the Club fleet will be made as soon as outstanding loans on site development have been substantially reduced.

With a current membership of eighty flying members, flying instruction up to first cross-country flights is available at weekends, public holidays and during two or three weeks of the summer. With a potential membership of 150–200 the Newcastle Gliding Club should, during the next decade, develop into one of the finest in the country.

Site: Carlton Moors. 12 miles S. of Stockton-on-Tees.
Membership: 63.
Fleet: 1 two-seater, 2 single-seaters. 4 privately owned.
Operates: Weekends, some weekdays.

Charges: Entrance £1 1 0; Subscriptions £6 6 0, launch 5/-, 15/- per hour.

OXFORD GLIDING CLUB

The Oxford Gliding Club is one of Gliding's smaller clubs.

Founded in 1938 by Robert Kronfeld, the Club was reformed in 1951 at Kidlington Airfield and it then moved to Weston-on-the-Green airfield.

The Club operates each weekend from what is an almost ideal 'flat site' and although the absence of runways prohibits auto-towing, winches give launches to over 1,000 ft.

The problem of the small club is to equate finance with frustration, for a large number of members must result in long queues for aircraft, whilst an adequate number of aircraft will raise costs to a level beyond the reach of many who are keenly interested. It is the degree of compromise which determines the character of a club.

The Oxford Club limits itself to less than 100 members and a high proportion remain from year to year. A T21 provides the training vehicle for the few who fill the vacancies which occur and it is in this aircraft that *ab initios* make their first solo flights. A high standard is required from pupils since the first single-seater aircraft they fly is an Olympia. On this aircraft experience is widened and techniques perfected until proficiency entitles a member to fly one of the club's Skylark 2s.

One of these aircraft is always available for local soaring flights of up to 90 minutes, as is the Olympia, but the other Skylark 2 is reserved for 'Task Groups'. All Skylark pilots are formed into such groups and they operate the second Skylark on a rota as if they were a private syndicate.

This arrangement takes much of the frustration and chance out of gliding, for a small group can more easily agree plans and priorities and make the best use of the weather.

For those who aspire to even greater things there are private

syndicates and four privately owned aircraft, operated by some twenty members.
Site: Weston-on-the-Green. 10 miles N.E. Oxford.
Membership: Flying 83, associate 2.
Fleet: 1 two-seater, 4 single-seaters. 4 privately owned.
Charges: Entrance £2; Subscriptions £6, launch 3/6, 12/- per hour.

SCOTTISH GLIDING UNION

The site of the S.G.U. at Portmoak in Kinross-shire lies on the East shore of the trout fisherman's paradise – Loch Leven – and half way between the West and North-facing slopes of Bishop Hill and Benarty.

Twenty-five years of experience of both hill top and low level airfield sites prompted the purchase of this low-lying ground which, strategically situated as it is, provides all the amenities of both hill soaring and thermal flying. As an exciting bonus, wave flying to high altitudes is regularly experienced. Winch launches provide all that is needed to contact waves, although aero towing can be had too. The method generally used if a wave is not contacted at the top of a launch is to slope soar on either Bishop or Benarty and after climbing to 3,000 ft. in hill lift to fly out to the nearest wave and continue on upwards. Heights of nine and ten thousand feet have become commonplace, while climbs to fifteen thousand feet occur at regular intervals.

In July 1961, a course instructor flying a T21 made three successive flights with different pupils to 15,000 ft. all in one morning. Early in 1962 a group of four pilots in solo gliders climbed to Gold C height.

Gliders equipped with oxygen will undoubtedly break the U.K. altitude record here, as members who also fly aeroplanes with the R.A.F. at Leuchars, nearby, have found wave lift over Portmoak at well above 40,000 ft. Distance flights in the

prevailing South-westerly winds take pilots North of the Tay as far as the North Sea at Fraserburgh, 115 miles away, and in Northerly winds landings have been made near Newcastle and Manchester.

Enthusiastic about the potential qualities of their site, S.G.U. members have foregone some of the pleasures of flying in order to provide the labour needed to build an airfield and clubhouse facilities second to none. This accomplished, a visit to the site is now a pleasure in all weathers and no longer like an expedition into Antarctica – a condition so often associated with gliding in exposed places. Mothers and small offspring can enjoy a day at Portmoak, while Dad floats skywards. In the attractive new clubrooms, built to small hotel standards, there are showers, and all bedrooms have hot and cold water. Bedroom accommodation is for twenty-six residents, the non-flying ones being able to make full use of the warm sun lounge, while viewing the airfield activities and the soaring slopes of the nearby hills. Meals are available and in the evenings there are film shows, lectures and dances. Bathing, fishing, golf, tennis and hill climbing can be enjoyed in the neighbourhood.

As well as holiday gliding courses for beginners which are run every year, parties of glider pilots bringing their own gliders visit Portmoak with increasing regularity. The Scottish Wave Fund which provides a trophy and money prizes for the most successful Gold C flights from Scotland into England, done in wave flying, gives an added interest.

Site: Portmoak, S.E. end of Loch Leven.
Membership: Flying 140, Associate 40.
Fleet: 2 two-seaters, 5 single-seaters.
Charges: Entrance £3 3 0; Subscriptions £6 6 0, launch 4/-, 15/- per hour.

SOUTHDOWN GLIDING CLUB

The long line of the South Downs turns at Lewes and runs South-eastwards to meet the sea at Beachy Head. Its highest point, Firle Beacon, about eight miles inland from Newhaven and seven hundred feet above the Cuckmere valley, marks the meeting-place of the North and North-east facing ridge. Behind the Beacon two large fields are used for flying by the Southdown Gliding Club. Like most hill sites the fields are far from flat but the broad whale-backed hills provide landing runs in all directions and the countless ridges and valleys give good hill soaring.

Launching is by winch or by that most exciting of all methods, bungey-launch, when the gliders are catapulted by elastic rope over the hillside to rise like helicopters in the strong upcurrents.

Flying goes on all through the year at weekends with thermal soaring for much of the time. The site has the great advantage of hill soaring during the winter months when the north-easterly winds blow, often for weeks on end, and thermal currents have left the cold land.

The Club's fleet consists of the well-tried dual-control two-seater Slingsby T21b for training, the Slingsby Tutor for early solo flying and two medium high-performance Olympias for more advanced flying. An unusual feature of the Club's organization is its use of one of the Olympias almost entirely for hiring by small groups of pilots. It may be used for week-ends or for a week's holiday or taken to any site the group pleases for cross-country flying competitions. This gives members many of the advantages of a private aircraft for only a small cost.

The Club is one of the oldest in the country and was founded in 1930 only a few years after gliding was first introduced into England. During its life it has flown on many sites on the South Downs but its present fields at Firle are only a few miles

from where the first gliding meeting ever to be held in this country took place. The nature of the site keeps it a club of moderate size with an enthusiastic membership and a characteristically friendly atmosphere.
Membership: 130 flying, 20 social.
Fleet: 1 two-seater, 3 solo gliders.
Flying every weekend.
Charges: Not known.

SURREY GLIDING CLUB

The Surrey Gliding Club was formed in 1938 by the author at Colley Hill, near Reigate, with two gliders, a winch and a hangar, bought for a total of £300. By the time war started almost a year later, it had achieved the second highest total of launches done and pilot certificates gained, combined with the lowest breakage rate, in the country.

After the war it re-formed, and at Redhill made great progress under the C.F.I., Lorne Welch, until 1951 when it moved to Lasham. It was the first club to change over to full dual instruction on two-seaters, and did more cross-country flying for a better safety rate than any other club. In 1948 it associated with the Imperial College Club and remained in happy partnership for many years. After the move to Lasham, because it had outgrown the available space at Redhill, the Surrey Club amalgamated with the Army Club, and ran operations at Lasham on an increasing scale, continuing the reputation that it had built up, and including three big National Championships.

In 1959 the activities had grown so big that the Lasham Gliding Society Ltd. was formed to deal with the administration, run the launch facilities, and cope with the elementary training.

The Surrey Club now operates only soaring gliders, and has a fine fleet composed of a Swallow and Skylark 2s and 3s. Qualified members can use these aircraft for cross-country

soaring, and entering rallies and Championships. In 1961 the Club won the League Two Competition. A good deal of the work of caring for the gliders is done by the members, who have the opportunity to learn about the aircraft, and who have built the club trailers. It is hoped to obtain a T49 two-seater in the near future, in order to give members advanced training in all aspects of soaring, including cross-country flying.

Lasham itself is a large flat airfield set in beautiful and open Hampshire country, and is a wonderful place for the city dweller to spend his weekends.

Site: Lasham airfield, half way between Alton and Basingstoke.
Membership: about 300.
Fleet: 6 soaring gliders.
Operates: Every day.
Charges: Entrance £8 8 0; Subscription £6 6 0, launch 5/6, 16/- per hour.

THE YORKSHIRE GLIDING CLUB

The Club site at Sutton Bank is situated in the Hambleton Hills about six miles due East of Thirsk. The actual flying field, which is owned by the Club, is reclaimed moorland and on the edge of a ridge which can be soared in any wind from North through West to South. In winds near due West the ridge can be soared for distances of more than twelve miles. Good thermal soaring is available round the site and waves from the Pennines up to 10,000 ft. occur regularly.

Launching is by diesel winch or aero tow and flying is available seven days a week throughout the year. The Club employs a resident instructor who holds a B.G.A. category and a second staff instructor is available during the Summer months. Gliding courses for the public are run throughout the summer.

A new two-storey Clubhouse was erected on the site in 1962 which provides a very high standard of accommodation. Bedrooms are available in a separate building which formed

the original Clubhouse. Facilities are available on the site for caravans and camping.

Members from other Clubs and anyone interested in Gliding are always welcome at the Yorkshire Club.

Membership: 140 flying, 37 social.

Fleet: 1 two-seater, 8 solo gliders.

Flying every weekend, some summer weekdays.

Charges: Entrance £1 1 0, Subscriptions £8 8 0, launch 4/-, 18/- per hour.

ASSOCIATE CLUBS

ABERDEEN GLIDING CLUB.
The most northerly civil club in the U.K. Runs beginners courses. Launches by winch.
Site: Dyce airfield, 6 miles N.W. Aberdeen.
Membership: 52.
Fleet: 2 two-seaters, 2 single-seaters, 1 privately owned.
Operates: Weekends, some summer weekdays.
Charges: Entrance £3 3 0, Subscription £6 6 0, launch 4/-, £1 per hour.

BLACKPOOL AND FYLDE GLIDING CLUB.
Largely a social club with a small keen gliding section. Launches by winch.
Site: Squires Gate airfield, 2 miles S. of Blackpool.
Membership: flying 37, associate 200.
Fleet: 1 two-seater, 3 single-seaters.
Operates: Weekends.
Charges: Entrance £3 3 0, Subscription £6 6 0, launch 4/-, 15/- per hour.

DEVON AND SOMERSET GLIDING CLUB.
An active and ambitious club. Runs beginners courses and soaring competitions.
Launches by winch.
Site: Dunkeswell airfield, 5 miles N. of Honiton.
Membership: 120.
Fleet: 2 two-seaters, 4 single-seaters, 3 privately owned.
Charges: Entrance £3, Subscription £5, launch 3/6, 15/- per hour.

DONCASTER AND DISTRICT GLIDING CLUB.
Possess a good club house, and build their own winches, some aero towing.
Site: Doncaster airport, E. outskirts of Doncaster.
Membership: flying 104, associate 46.
Fleet: 1 two-seater, 3 single-seaters, 2 privately owned, 1 under construction.
Operates: Weekends, some weekdays.
Charges: Entrance £2 10, Subscription £8, launch 4/-, 19/6 per hour.

DORSET GLIDING CLUB.
A young club involved in developing a new site at Bovington, Dorset. Launches by winch, some aero towing.
Membership: flying 69, associate 21.
Fleet: 2 two-seaters, 2 single-seaters.
Operates: Weekends.
Charges: Entrance £2 2 0, Subscription £6 6 0, launch 5/-, £1 per hour.

DUMFRIES AND DISTRICT GLIDING CLUB.
Site: Thornhill, 19 miles N. of Dumfries.
Membership: flying 42, associate 32.
Fleet: 1 two-seater, 1 privately owned, 1 under construction.
Operates: Weekends.
Charges: No entrance fee, Subscription £7 7 0, launch 4/-, 12/- per hour.

ESSEX GLIDING CLUB.
Site: North Weald Airport.
Fleet: 1 two-seater, 2 single-seaters.
Operates: Weekends.
Charges: Entrance £3, Subscription £7, launch 5/-, 15/- per hour.

EAST MIDLANDS GLIDING CLUB.
A hard-working young club with progressive ideas. Launches by winch.
Site: Rearsby airfield, near Leicester.
Membership: flying 57, associate 22.
Fleet: 1 two-seater, 1 single-seater.
Operates: Weekends.
Entrance: £3 3 0, Subscription £7 7 0, launch 4/-, 18/- per hour.

GLASGOW AND WEST OF SCOTLAND GLIDING CLUB.
Site: Bankhead Farm, 1 mile S. of Carnworth.
Membership: flying 36.
Fleet: 1 two-seater, 1 single-seater.
Operates: Weekends.
Charges: Entrance £2 2 0, Subscription £7 7 0, launch 5/-, 15/- per hour.

HALIFAX GLIDING CLUB.
An enthusiastic club with a difficult moorland site. Launches by winch.
Site: Ringstone Edge, 5 miles W. of Halifax.
Membership: flying 47, associate 26.
Fleet: 1 two-seater, 1 single-seater, 2 privately owned.
Operates: Weekends.
Charges: Entrance £2 2 0, Subscription £8 8 0, launch 5/-.

LAKES GLIDING CLUB.
An established club with good clubhouse facilities, and interesting soaring. Launches by winch. Beginners courses.
Site: Tebay Gill. 15 miles S. of Penrith, Cumberland.
Membership: flying 46, associate 21.
Fleet: 1 two-seater, 3 single-seaters.
Operates: Weekends, some summer weekdays.
Charges: Entrance £2 2 0, Subscription £6 6 0, launch 5/-, 15/- per hour.

NORFOLK AND NORWICH AERO CLUB (GLIDING SECTION).
A progressive club. Launches by aero tow and some winch launching. Runs soaring competitions.
Site: Swanton Morley airfield, 15 miles W. of Norwich.
Membership: flying 162, associate 39.
Fleet: 1 two-seater, 1 single-seater, 2 privately owned.
Operates: Weekends, some weekdays.
Charges: No entrance fee, Subscription £5 5 0, 15/- per hour.

NORTHAMPTONSHIRE GLIDING CLUB.
Site: Podington airfield, 5 miles S.E. of Wellingborough.
Membership: 85.
Fleet: 1 two-seater, 4 single-seaters.
Operates: Weekends.
Charges: Entrance £3 3 0, Subscription £7 7 0, launch 3/6, 15/- per hour.

OUSE GLIDING CLUB.
A new club just starting up. Launches by winch.
Site: Rufforth airfield, near York.
Membership: 75.
Fleet: 1 two-seater, 1 single-seater.
Operates: Weekends.
Charges: Entrance £2 2 0, Subscription £8 8 0, launch 5/-, 16/- per hour.

SOUTH WALES GLIDING CLUB.
A young club flying from the hills. Interesting soaring possibilities.
Site: Eglwysilian, 1 mile N. of Bedwas.
Membership: 50.
Fleet: 1 two-seater, 2 single-seaters.
Operates: Weekends.
Charges: Not known.

SWANSEA GLIDING CLUB.
A young club. Launches by winch.
Site: Fairwood Airport, near Swansea.
Membership: 50.
Fleet: 1 two-seater, 1 single-seater.
Operates: Weekends.
Charges: Not known.

SWINDON GLIDING CLUB.
Site: South Marston airfield, near Swindon.
Membership: flying 60, associate 12.
Fleet: 1 two-seater, 2 single-seaters.
Operates: Weekends.
Charges: Entrance £2 2 0, Subscription £5 5 0, launch 5/-, 15/- per hour.

GLIDER FLYING

WEST WALES GLIDING CLUB.
A very active club going all out to provide soaring for its members.
Launches by aero tow and car tow.
Site: Withybush airfield, Haverfordwest.
Membership: flying 63, associate 1.
Fleet: 1 two-seater, 3 single-seaters.
Operates: Weekends, summer evenings.
Charges: Entrance £5 5 0, Subscription £5 5 0, launch 5/-, 18/- per hour.

The following clubs are also Associate Members of the B.G.A., but their membership is generally restricted:

AVRO GLIDING CLUB, Woodford airfield, Cheshire.

B.E.A. GLIDING CLUB, Booker airfield, Bucks.

COLLEGE OF AERONAUTICS GLIDING CLUB, Cranfield airfield, Beds.

CROWN AGENTS GLIDING CLUB, Lasham airfield, Hants.

HANDLEY PAGE GLIDING CLUB, Radlett airfield, Herts.

IMPERIAL COLLEGE GLIDING CLUB, Lasham airfield, Hants.

PERKINS SPORTS ASSOCIATION, Westwood airfield, Peterborough.

POLISH AIR FORCE ASSOCIATION, Lasham airfield, Hants.

SHORTS GLIDING CLUB, Newtonards airfield, Co. Down.

THE BRITISH GLIDING ASSOCIATION,
Artillery Mansions,
75 Victoria Street,
London S.W.1.
SULlivan 7548

All details about gliding clubs will be sent on application.
The Association publishes a bi-monthly magazine, *Sailplane and Gliding*, price 3/- per copy.