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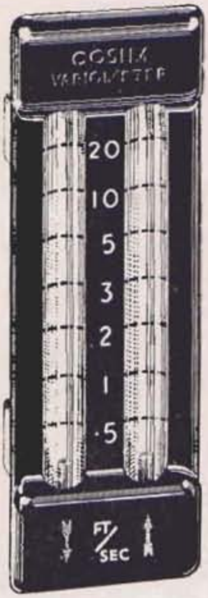

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THE FIRST JOURNAL DEVOTED TO SOARING AND GLIDING

JANUARY 1953 ★ Vol XXI No 1

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Editorial

THE passing year may with justice be described as the most successful that the British Gliding Movement has ever experienced. For the first time a world champion has emerged from our Island, for the first time our team as a whole has been more successful than those of other countries, for the first time British high-performance sailplanes have been acknowledged as the most successful in an international competition, and for the first time the gliding world has been startled by the unprecedented spectacle of seeing that the most highly organised, trained and best-equipped team was British.

We would again like to take this opportunity in congratulating Philip Wills, Slingsby (who designed and built the 'Sky') and all the others who contributed to this success. We look forward to the 1954 internationals because they promise to be more truly an individual's competition than any preceding one as all teams can be expected to be at least as highly organised and equipped as the British team in Madrid.

Meanwhile, the most promising method of raising the standard of our pilot's performances would be to encourage out-and-return or triangular flights. We have witnessed the amazing results produced by a little encouragement and competition (*vide* the Kemsley Winter Soaring Prizes) and the encouragement of goal flights as opposed to simple down-wind dashes. Out-and-return flights have been unpopular in the past due to the difficulties of organising official observation at one's turning point and due to the frustration created when one's observers failed to observe or failed to fire the recognition Verey lights.

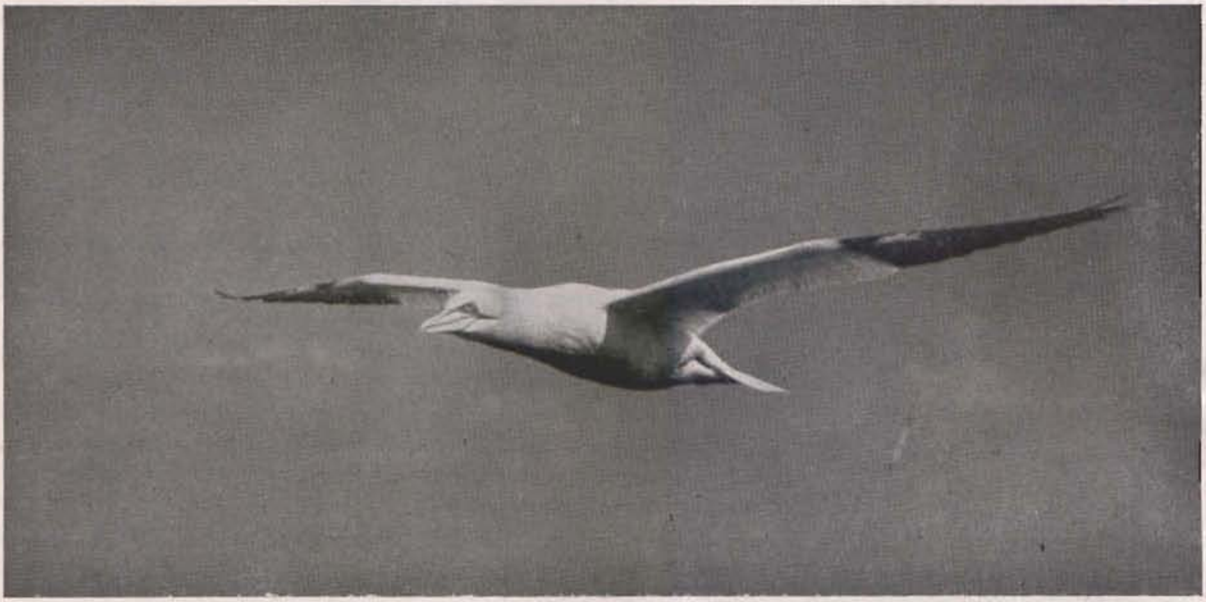
We would therefore like to put forward the proposal that the B.G.A. and Clubs should encourage out-and-return, triangular or polygonal flights by all means at their disposal. Further that it should not be necessary for the pilot to be observed at the turning point, nor that the turning point or points should have to be named before each flight, but that aerial photographs of the turning point or points, if sufficiently clear to be identified by the B.G.A., should be accepted as satisfactory evidence that the turning points have indeed been attained. Obviously the onus is on the pilot to choose an easy landmark to facilitate recognition but even if his first choice should be obscured by 8/8 cloud, a first-class flight need not be invalidated as the pilot would be free to photograph the nearest other visible landmark. Most pilots already possess cameras of their own, those who do not can easily purchase a cheap bakelite box camera which can provide satisfactory results.

So much for raising the quality of our competition flying—now to everyday club flying. Let us strive to get into the air more frequently and to make fuller use of our existing equipment. Most clubs do examine the utilisation figure for each sailplane in their fleet but it would be well to give these figures greater prominence. Let us also examine the number of hours' soaring achieved, divided by the number of flying members. It would be interesting to compare these figures with those achieved in France, the U.S.A., Sweden and Germany. No such comparisons have ever been made but they would give a new picture of the health of each country's gliding movement.

Each individual pilot should be enabled to soar more frequently than ever before and thus delve deeper in the beautiful experience of soaring flight. Cheaper or more efficient sailplanes, total energy variometers, better or cheaper methods of launching, quicker or more thorough methods of training are merely the means to this ideal and not ends in themselves.

BIRD FLIGHT

By John Barlee, F.R.P.S.



BIRD flight presents complex problems to those who are used to dealing with the aerodynamics of ordinary aircraft. All observations must be qualitative not quantitative, for all measurements are variable from bird to bird. The bird adds further difficulties by altering most of its measurements at will to suit different flight conditions. Thus wing-area, aspect-ratio, sweep-back, dihedral and many such factors which we usually regard as fixed are far otherwise in a bird.

We hear a lot about the marvels of modern aircraft, but we tend to forget that except for speed and ceiling birds are superior in all aspects of flight. Let me give a couple of examples : A pair of swallows I found nesting in a loft had to enter through a slit in the wall which was far narrower than their wing-span. Yet all day they flew in and out without apparent difficulty, sometimes meeting in the slit when going in opposite directions.

The goldeneye, a species of diving duck, can fly exceedingly fast, can swim on the surface of the water and can dive and swim below in search of food. Not content with such versatility it nests in holes in trees. Now a duck is a type of bird definitely not designed for tree-climbing or for perching on twigs. The goldeneye gets over this by flying directly into its nesting hole and stopping when it gets inside. How it manages this feat without damage to itself remains a mystery.

Many of the details of design incorporated in modern aircraft have been used by birds for millions of years. Slots, retractable undercarriages, and variable sweep-back are examples. If designers would study birds more carefully they might discover other refinements which they could use.

EVOLUTION OF FLIGHT

Passive or gliding flight has been attained by a number of groups of animals. Such animals as the 'flying-fox' climb to a height in a tree and launching forth, glide for a distance. A fold of skin, widely stretched between the fore-limb and hind-limb on each side, is used as the sustaining surface. Such animals glide only and do not flap. In true flight power is applied during flight, and long sustained flights can be made. This type of flight has been achieved by pterodactyls, bats and birds, but before we consider these let us look at the flying fish.

The special interest of the flying fish is that the wings are not the means of propulsion, and here we have the nearest approach in nature to flight on the principles used by man. Although vibration of the wings has been observed there is no true flapping, and the flight is no more than a prolonged glide of up to a hundred yards, the fish sometimes reaching a height sufficient to land it on the deck of a ship. The sustaining surfaces are the specially large pectoral fins which have a curved aerofoil section. The wing-loading is greater than in any bird.

The fish takes off in the following manner—it emerges from the water at its swimming speed, estimated at 15-20 m.p.h., the pectoral fins are at once extended and the fish then taxies along with all except its rapidly-vibrating tail above the surface. During the next second the fish accelerates to about 40 m.p.h. and takes off on its glide. During the taxying the rapid vibration of the tail may set up a quivering of the 'wings' and this quivering is what has so often been described as flapping. Speed begins to drop once the fish is airborne and after a few seconds it falls back into the water, though by dropping its tail below the surface it can taxi up to take-off speed again, and so embark upon a second glide.

The sustaining surface of the bat resembles that of the prehistoric pterodactyl and is composed of skin held out by the elongated finger bones and attached also to the hind legs. The use of the hind limb in stretching the wing leads to undercarriage difficulties and the creature is unable to rise from a flat surface. Unlike the pterodactyl, however, temperature control in the bat is fairly well developed although it is abandoned when the animal is hibernating. Lack of heat conservation was a disadvantage in the pterodactyl, for a cold-blooded animal cannot produce such sustained power as a warm-blooded one, and falls far behind it in intelligence.

Still we must not sneer at the bat for it is able to land head-downwards clinging by its hind-legs to a crevice in the roof of a completely dark cave. This feat is achieved by the use of an echo-sounding system, for the eyes are not well developed. As the bat flies it emits through its nose a succession of short pulses of ultra-sonic sound of a frequency of 50,000 cycles/sec. Echoes are received by the bat's highly developed ears, and enable the bat to locate obstacles accurately. The bat's habit of getting tangled in ladies' hair may be due to the poor echo-giving qualities of the latter !

BIRDS

It is considered likely that birds evolved from reptiles which ran rapidly on their hind-legs, waving their fore-legs to aid balance. Large scales, developed along the trailing edge of the fore-limb, may eventually have evolved into feathers, though it is equally possible that feathers were evolved first as an aid to heat conservation, and were later put into use as an aid to flight. Which came first, feathers or flight ?—this question is still unanswered. The presence of a flattened fore-limb enabled the ancestral bird first to glide from branches or to taxi with occasional jumps and short glides, and later to develop true flight. Flight was certainly evolved as a means of escape from enemies, and where birds have found themselves without enemies they have in many cases lost the power of flight.

The development of temperature-control by feathers put birds far ahead of the lower animals. The high rate of metabolism thus achieved gives birds a high power-weight ratio, and is shown by the birds' high temperature, up to 111°F. in the swift, the large

(1)


(2)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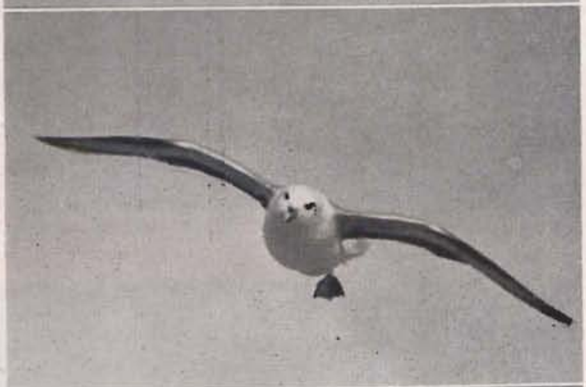


(4)


(1) *Razorbill flying flat out down wind with a probable ground speed of over 60 m.p.h. An evolutionary reduction in the razorbill's wing area demands fast flight to achieve the necessary lift*

(2) *Razorbill in a fast glide using tail and webbed feet as extra control surfaces. The small size of the wing is particularly apparent in this photograph*

(3) *The fulmar, a high-aspect-ratio fast glider, using one foot to steer its flight*

(4) *Gannet completely stalled while landing with vigorous back-pedalling action of the wings. Note the lifting of the feathers below the leading edges of the wing*

amount of food they have to eat every day, and the rate at which they digest and assimilate it, and the amazing quickness of their reactions.

The blood system which distributes food and oxygen to the muscles is extremely efficient. The heart may be as much as 10% of the total weight of the bird, the heart-beat is extremely rapid, and the blood contains a very high percentage of haemoglobin. The lungs which absorb the oxygen have seven accessory air-sacs leading from them. These sacs expand and contract and help to sweep out air, so preventing dead pockets from being formed in the lungs. At rest the rate of breathing of a pigeon is 29 per minute, walking it is 180 per minute and flying 450 per minute.

Feathers have other advantages :

1. They enable the wing to be quite independent of the legs and so have allowed the latter to evolve separately. Thus the feet can act as paddles for swimming, or as weapons for attack, as well as an efficient undercarriage.

2. Feathers are fully replaceable, and are in fact replaced every year.

3. The feathered wing is easy to fold.

THE WING

The centre section, which moves least during flapping, has a good aerofoil section and provides most lift. The wing-tips are more flexible and during the wing beat they twist and so drive air downwards and backwards, giving some lift and all the forward thrust.

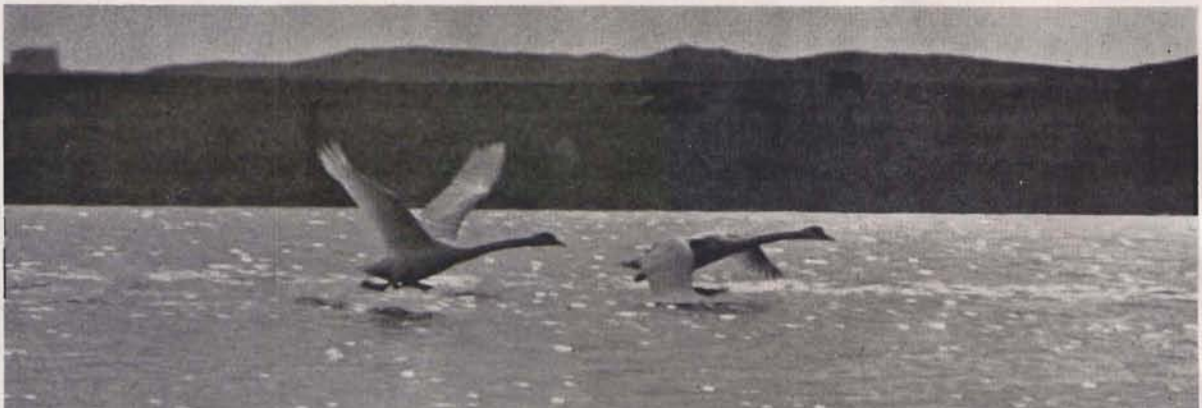
The birds' wing is a normal vertebrate fore-limb, much modified. The bones are the same as in the human arm—an upper arm bone, the humerus ; two fore-arm bones, the radius and ulna ; and a carpo-metacarpus formed from the wrist and hand bones, many of which have disappeared in the bird, most of those which remain having fused together. The long bones of the wing are very light in weight but are immensely strong, being tubular in construction.

A typical example of this is the series of cross-sections of the gannet's humerus illustrated on page 7. It can be seen that in the central region the section is roughly circular while towards the end where the section is no longer circular struts are developed. The Chief Designer of Short Brothers and Harland has written to the author, ' The bones you sent me are really amazing and most interesting, particularly the way in which the internal struts and cellular construction only occur where the cross section has had to depart from the circle. It is a beautiful piece of structural design and I only wish we could do half as well.'

The bird has the advantage in that the bone is laid down by the bone-forming tissue only where the latter is in a state of strain. Thus every strain is counteracted by an increase of strength exactly where it is needed.

The strength of the apparently fragile bones of a bird is emphasized by the test carried out with the wing bone of a gannet similar to the sectioned specimen referred to above. This humerus or upper arm bone was nine inches long and just under half-an-inch in diameter at the centre. It weighed just over two-thirds of an ounce. It was supported on two wooden blocks and a weight-carrier (2 lb.) was hung by a cord from the middle. 10 lb. weights were added till the bone was supporting 1 cwt. (112 lb.), when this photograph was taken. The weight was then increased to 127 lb. but shortly afterwards the bone suddenly collapsed before a photograph could be taken.

The feathers can be divided into large flight feathers and small contour feathers. The latter overlap each other and fill in the spaces which otherwise might appear between the quills of the flight feathers ;



Swans taxying for take-off. The swan, which is the heaviest bird to achieve flight, runs a long distance across the surface of the water before becoming airborne.

they also form a smooth surface for the leading edge of the wing and for the body of the bird. The tail feathers also are overlapped by contour feathers in the same way. The main flight feathers are anchored to the wing bones but are free to twist and move a certain amount.

Wing-flapping is produced by the breast muscles which are fixed at one end to the keel of the breast bone and at the other to the humerus. The main muscle pulls the wing down, and a smaller one, used chiefly during take-off, raises the wing. The latter muscle lies under the main breast muscle and is paler in appearance, being not so richly supplied with blood. The breast muscles may form as much as 25% of the total weight of the bird. The keel on the breast bone is not found in birds, such as penguins, which have lost the power of flight. Many other muscles in the wing itself are used for spreading and folding, for holding the wing rigid, to rotate the humerus and to alter the relative positions of the various parts of the wing during flight.

When the wing is fully spread it can be seen that the flight feathers are divided into three groups. These can be seen particularly well in the photograph of the gannet on page 6. The black primaries form the wing-tip, and spring from the carpo-metacarpus; the secondaries, which arise from the radius and ulna, form most of the rest of the wing; the tertiaries, which spring from the humerus, are near the body.

In addition to these the thumb of the 'hand,' which is separate from the rest of the carpo-metacarpus, bears a small tuft of feathers known as the alula or 'bastard-plume.' This can be seen very easily on the leading edge of the wing, just about halfway along. The alula is sucked up when the wing is stalled and forms a leading edge slot. It is doing so in this photograph; the lifting of the contour feathers just under the leading edge of the right wing shows that stalling is taking place.

When the primary feathers are fully spread wing-tip slots may appear between them, as illustrated on page 6. These slots are poorly developed in high-aspect-ratio gliding birds such as the fulmar, but are extremely well developed in low-aspect-ratio soaring birds such as the vulture and the raven. The slots form a most efficient anti-stalling device, and so help the wing to give enough lift at low speeds.

As a bird flies faster the wing tips are swept back, closing the wing-tip slots which are now not needed, decreasing the wing area and so reducing drag. When the bird wishes to turn or land the wing tips are swept forward again, and at the same time the tail feathers can be spread fully to give extra supporting area. The action of the tail as a control surface is considerable and large tails are usually found on woodland birds which must manoeuvre sharply when flying through trees, e.g. sparrow hawk, pheasant and pigeon. When manoeuvring the tail can be shut, spread, depressed, elevated, tilted or curved.

The silhouettes of a wood pigeon reproduced on page 8, which were obtained by laying out a limp, freshly shot bird lying on its back, and drawing round it, were chosen to show as nearly as possible the attitude in fast level flight, and the fully stretched attitude adopted when landing or turning, where full use is made of the tail feathers. The photographs show how the sweep-back can be varied within wide limits, how the wing-tip slots open as the bird stretches its wings forward, and how the wing and tail areas can be greatly increased when necessary.

Fulmar in a turn showing the unequal action of the wings

Steering is carried out by the joint action of wings and tail sometimes assisted by the lowering of a foot. A turning bird can often be seen with one wing more fully extended than the other, as in the photograph above, or at a greater angle of attack than the other.

Birds use a variety of methods to gain air-speed when taking off. The simplest is the dive from a tree or cliff; large wading birds such as herons do a shallow dive from the height of their long legs. Small birds can often manage with a jump and a vigorous flap. Water birds vary greatly in their ability to take off; broadly speaking, those which are able to escape from their enemies by diving and swimming under water have not so great a need for a quick and efficient take-off as those which cannot dive. Thus the diving ducks such as the tufted duck have to taxi along the surface, while the mallard and other surface-feeding ducks can spring almost vertically

into the air and climb steeply. Most sea-birds must taxi for a distance, as do swans, and it is on record that gannets have been found incapable of taking off due to the combination of a flat calm and no wind.

When landing a bird reduces speed as much as possible, either by vigorous flaps against the direction of motion or by gliding upwards. Finally it stalls on to the landing place, taking off the remaining speed by means of a couple of flaps. When the wings are turned so that the angle of attack is about 90° they act almost like a parachute. Birds with a high wing-loading, such as razorbills, shown on page 3, find great difficulty in landing on to ledges of cliffs, though they find little difficulty in planing down on to water.

GLIDING

All birds glide to a certain extent, but some glide more than others. The advanced gliders are sharply divided into long-winged fast gliders and short-winged slow gliders. The slow gliders which typically have a low-aspect-ratio square-tipped wing with many deep wing-tip slots, usually make use of ascending air-currents such as thermals, in which they soar.

Fast gliders make use of the differences in wind speed found near the surface of the ocean, caused by the friction of the air with the water. These birds have long narrow wings devoid of slots. The albatross, with a wing span of up to eleven feet, is the supreme exponent of this method. Gliding at high speed across or down wind it plunges from the upper faster layer of air into the lower slower layer. This causes the bird's air speed to increase by the difference between the speeds of the two layers. Turning head to wind and zooming up into the upper layer the bird gets a big lift from the momentary increase of air speed which it gets as it does so. Having achieved this height it turns and starts its long glide down wind again.

The photograph of the gannet in a slow glide (above) shows the arrangement of the wing feathers. Black primaries form the wing tips, secondaries form the main wing and tertiaries appear near the body. The alula or 'bastard plume' can be seen halfway along the leading edge

Of course, the air is not sharply divided into two layers, but is really an infinite number of layers, each being slowed down by the layer beneath, but the principle holds good all the same. This method can be used only by fast *heavy* gliders, and only in the layers of air within about 50 feet of the surface of the ocean. If it were not for the slowing down of the lower layers this method would be impossible. In still air the albatross has to flap like other birds.

Some gliders, especially the shearwater, are helped by air being deflected upwards or being suddenly pushed upwards by ocean waves. Gulls which have a lower aspect-ratio than the albatross use up-currents caused by wind being deflected by cliffs or buildings, as well as those created at the sterns of ships.

Most normal flight can be fitted into one of the following categories :

1. *Direct continuous flapping*. This is found in all sizes of birds from the swan down to the wren. The bird's path is horizontal. The rate of flapping depends on the wing-loading, being slow in such birds as the heron and fast in the duck.

2. *Undulating flight*. This is flapping interrupted by a regular momentary closure of the wings. During the flapping phase the bird recovers the height lost during the closure of its wings. The great majority of small perching birds use this method. It is hard to see what advantage is gained for any rest during the closed phase would be more than cancelled by the increased effort needed during the flapping phase.

3. *Regular flapping interrupted by glides*. This method is found in many birds of prey and in the gannet, fulmar, shearwater and game birds. There

is wide variation here for no one can say that a gannet and a grouse fly in the same way. Basically, however, the action is the same.

4. *Long glides interrupted by an occasional flap, prolonged gliding and soaring.* Included here are the two types exemplified by the albatross and the vulture—high-aspect-ratio fast gliders and low-aspect-ratio soarers.

5. *Other types, including the following*—(*a*) Jerky, flitting and zigzagging flight (warbler, chat, robin, redstart, nightjar). (*b*) Jerky and dashing (swallow, martin, swift, falcon). (*c*) Hovering (kestrel, kingfisher, tern, humming-bird). (*d*) Headlong diving (kingfisher, gannet, tern).

SPEED

Accurate measurements of speed are hard to obtain. Near the end of the last century a famous ornithologist claimed that migrating birds flew at great heights, and at speeds of 200 m.p.h. and over. Now that these claims have been shown to be grossly inaccurate there is a tendency to minimize the speeds and to claim for birds only the most moderate performances. Not long ago a scientist who should have known better claimed that the sparrow had a speed greater than the sparrow-hawk! The following speeds may be taken as approximately accurate:

Small perching birds, e.g. sparrows	10-20 m.p.h.
Swallow, martin	20-30 m.p.h.
Gull	20-35 m.p.h.
Gannet	45-50 m.p.h.
Pigeon	c. 50 m.p.h.
Razorbill	40-50 m.p.h.
Swift	50-80 m.p.h.
Peregrine swooping	more than 100 m.p.h.

Estimates of speed are confused by the fact that a small bird flapping its wings rapidly looks much faster than a large bird flapping its wings slowly.

ENDURANCE

Several land birds have been proved to cross up to 2,000 miles of ocean on their migrations to remote oceanic islands. In these cases their powers of accurate navigation are more astonishing than their endurance.

The Arctic tern nests within 600 miles of the North Pole, and in the northern hemisphere winter is found as far south as the edge of the pack ice around the South Pole, a round journey of over 20,000 miles each year. A shearwater taken from its nest in the British Isles was recently released near Boston, U.S.A. It returned, covering 3,200 miles in just under 13 days.

A swift probably averages about 50 m.p.h. as it flies around catching insects for its young, and usually is in the air for nearly all the daylight hours. It must cover a very great distance each day—probably more than 200,000 miles per annum.

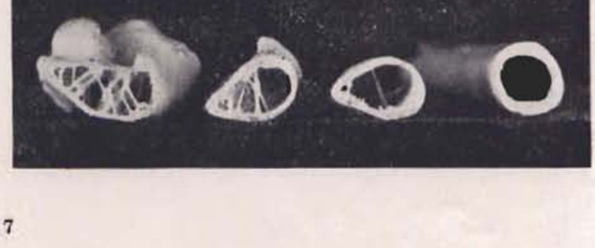
Not long ago a flock of lapwings took off one winter evening from the north of England and headed for Ireland. Since there was an easterly wind of about 55 m.p.h. and the birds' speed was about 45 m.p.h., they overshot their mark and a large number of them arrived in Newfoundland next day.

CEILING AND PAYLOAD

It is unusual for birds to be seen flying over 2,000 ft., and any accurate records of birds over this would be most welcome. There are a number of such records, many of which show that birds often cross high mountain passes on migration. A much quoted record is of a flock of geese photographed through a telescope while a photograph of the sun was being taken. Measurements are said to have shown that these geese were at a height of 5 miles. The condor, soaring over the Andes, must sometimes approach this.

Birds do not have any very great weight-lifting

The photograph on the right shows the gannet's upper arm bone undergoing a strength test. The 9 in. long humerus, weighing just over ⅝ oz., is seen supporting eleven 10 lb. weights; the bone finally broke at 127lb. A cross-section of a similar bone is shown below. Formation of internal struts and cellular construction appear where the section departs from the circular. Diameter at the circular central section is about half-an-inch



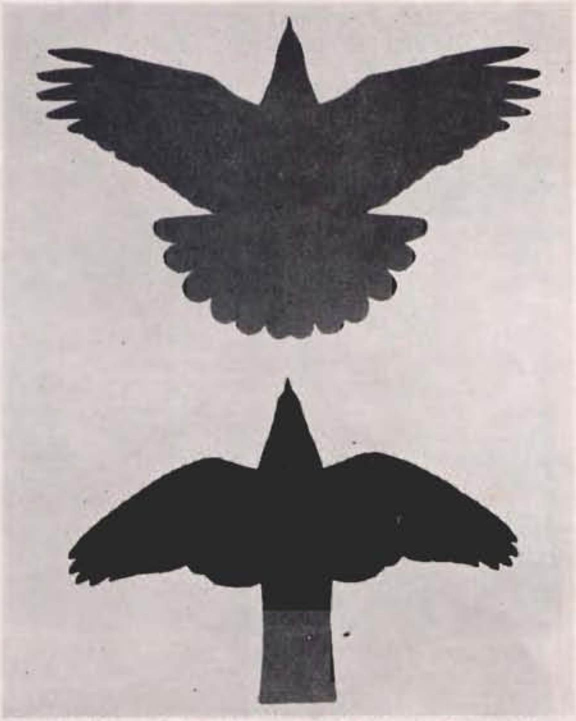
ability. Stories of eagles carrying away young children are almost certainly exaggerated. It is doubtful if an eagle could lift anything heavier than a sickly lamb. Gannets and cormorants when frightened often vomit up their last meal before taking off.

LOSS OF FLIGHT

When birds inhabit remote places where there are no natural enemies, it may be to their advantage not to be able to fly. Once a bird becomes flightless there is no need for there to be a limit to its size, and so such birds as the ostrich reach a very large size, and the extinct moa was much bigger still. The heaviest bird capable of flight is the swan, and it has great difficulty in hoisting itself into the air, having to run a long distance across the surface of the water before taking off like a heavily loaded bomber.

Birds which use their wings to swim under water have an evolutionary pressure on them towards a reduction in wing area. Water as a medium is so much denser than air that the propelling surface need not be large, and the buoyancy of the water holds up the bird without the need for supporting surfaces. Thus we find that the extinct great auk, the penguin and several fossil birds have greatly reduced wings or no wings at all. A close relative of the great auk, the razorbill, is gradually following in the same direction. Its wings are reduced slightly already, and so it has to fly very fast in order to get enough lift from the reduced wing-area. To fly fast it has to beat its wings very rapidly, and this requires very powerful and heavy breast muscles. Thus a reduction in wing-area has led to an increase in weight, and if this process of ' development ' goes on much longer the razorbill will be grounded permanently.

Several interesting species are much nearer flightlessness than the razorbill. The Laysan teal can fly only about 100 yards before becoming exhausted, while the steamer duck of the Falkland Islands exists in two species, one of which can only just fly, while the other heavier one cannot take off. It can, however, move across the surface of the water with great rapidity using its tiny wings like the paddles of a paddle-steamer.



Silhouettes of a wood-pigeon showing attitude in fast level flight (bottom) and in landing or turning (top). The photographs show how sweep back can be varied within wide limits, how wing tip slots open as the wings come forward, and wing and tail areas are increased

All photographs in ' Bird Flight ' were by John Barlee. Acknowledgments to ' Shell Aviation News.'

CLUB NEWS

YORKSHIRE CLUB

SINCE our last Club News, there has been a lot of hard work and many hours of flying at Sutton Bank. Enthusiastic members from Hull have set off at 5 a.m. to get an early start on the roof, which is now quite waterproof, and the Clubhouse is almost completely creosoted and painted.

The Middleton St. George R.A.F. Gliding Group have joined us for hill soaring, and during a week's camp at the end of October, they put in 65 hours flying. P. A. de C. Swaffer and D. Ellis got their 'C's' and M. Bishop, J. Ellis and W. J. Pearce gained ' Silver C ' duration legs. In the nex tflight after his ' C,' Swaffer contacted a thermal at 150 ft. which took him up to cloud base at 2,800 ft. From there, he travelled 25 miles to a point 7 miles beyond Malton. Then, since he had neither maps, barograph nor retrieving team laid on, he decided to return, which he did, as far as Cawton, 8 miles from Sutton Bank.

In spite of wintry weather, training continues during most week-ends. We have at the moment 16 ab-initios and expect many more in the Spring.

Since the summer, Peter Lockwood and Jack Sanders have gained ' C's.' (Sanders came to us from the Midland Gliding Club, where he did most of his training.)

Next year, we hope to have a resident instructor/ground engineer, and have arranged to hold :

TWO LONG WEEK-END RALLIES

1. At Whitsuntide.
2. From August 21st—24th inclusive.

Competitions will be arranged in three classes : (*a*) for ' Silver C ' pilots ; (*b*) for ' C ' pilots ; and (*c*) Open Events. Prizes will be awarded for the best performances.

There will also be : FOUR TRAINING CAMPS

1. During Easter Week. April 4th—12th inclusive.
2. Immediately after the Whitsuntide Rally, from Tues. May 26th—June 2nd (Coronation holiday.)
3. From Sat. June 27th—Sun. July 12th inclusive.
4. From Sept. 5th—13th inclusive.

Further details will be given later. Those interested in the above, write to the Hon. Sec. Y.G.C., Miss S. Parke, ' Norlands,' Middlecave Rd., Malton, Yorks.

FUN WITH THE 'HUMMINGBIRD'

(See May, 1952 Issue of *Sailplane*)

By TED NELSON

I HAVE had a great deal of pleasure out of sitting down with friends and relating experiences and pleasant events I have had since developing the auxiliary powered 'Hummingbird' sailplane. It occurred to me that some of the readers of *Soaring* may also enjoy them.

The first test hops of any ship are always exciting and thrilling and this one was no exception and will be long remembered by the entire crew at the plant. We arranged to go to a local airport in the afternoon and had all the employees knock off work to come out and see the test. Practically all had their cameras and everyone still talks of the various pictures taken. The tests that day consisted of a number of ground runs, short hops and a low run around the airport pattern and a landing. The tests were all successful and most gratifying and that certainly makes it more significant in my memory.

We then undertook the slow and tedious job of running our airflight tests to determine the stability characteristics and gliding performance. We flew over 50 hours of various flights to check the sinking speed at all airspeeds and to make sure the ship would meet all the C.A.A. requirements for stability and control response. These flights were very interesting to me because I would do the precision flying and Harry Perl (designer and engineer of the project) would direct me as to what was necessary and he would then record all the data during the flight. We would take off over San Francisco Bay and climb to approximately 10,000 f.a.s. before retracting the engine. The rate of climb would be recorded all the way up and other data would be accumulated during the glide back down. When within 1,000 feet of the ground, quite often we would again fire up the engine and reclimb to our previous altitude for additional tests. We are most fortunate here in that the air over the Bay is very stable and the temps are such that 'standard air' prevails very often, thus making it possible to obtain very accurate flight data. The self-contained power plant made the flight work much simpler and impressed me with another one of the many advantages of the powered sailplane.

I received quite a thrill out of the first soaring flights which were made at the Shafter Meet last year in June. We attended only 2 days and soared approximately 4 hours the first day. The second day we took off at noon and planned to fly to Oakland and expected to use power and thermal. We arrived at Fresno (100 miles) after using power about half way, whereupon we abandoned the hope of flying to Oakland because of heavy headwinds. Our car and trailer arrived shortly after landing and we proceeded home by ground.

Several weeks later, we again returned to Bakersfield for some more thermal flying. We left Oakland early in the morning and arrived at a small airport approximately 30 miles from Shafter Field where we assembled the 'Hummingbird.' Harry and I took off and after using the engine less than 3 minutes, we retracted it and soared to Shafter and remained in the air for approximately 3 hours and landed at the field for supper. The following day we flew in the forenoon and then loaded the ship on to the trailer and drove over to Bishop for several days of enjoyable flying with Bob Symons. Bob and I took off before noon and climbed to approximately 10,000 f.a.s. and proceeded over the White Mts. where we encountered lift caused by the wind going over the mountains. The engine was then retracted and we proceeded to ridge soar to over 16,000 f.a.s. for over 1½ hours and

Ted Nelson and Harry Perl in the 'Hummingbird' over Warm Springs, Calif. The photo on page 10, taken a few seconds after this one, shows the engine retracted went up the valley for over 30 miles. This flight was most interesting and pleasant because it was the highest I have piloted a glider and it was an opportunity to check myself under conditions where oxygen was scarce and at the same time have one of the swell guys of soaring along with me to check me out under those conditions. The following day was spent thermal soaring about the Bishop Airport and later in the afternoon, we went up to explore the upper air at about 13,000 f.a.s. for a wave condition. We were unsuccessful at finding lift for the ship but did receive the 'Bishop Wave' when Bob finally flew up alongside of us in his 'Belanca' aeroplane at 13,500 f.a.s. whereupon he opened his window, put out his hand and waved to us—thus the 'Bishop Wave.' We have had many laughs about this ever since.

I enjoyed especially the flights that we made at the 17th National Contest. Most of all the contest flights in the 'Hummingbird' were made by Harry Perl and Les Arnold and I drove the car and trailer. We had entered the contest as a team and even though most of my time was spent driving, I will never forget the contacts that we made every few minutes by radio. Our equipment consisted of V.H.F. radio with a mobile unit in the car. This year was the first time a powered glider was ever entered into actual competition at a National Contest and we feel that the points accumulated prove that the design is rather remarkable. The pilots were also experiencing their first National competition and lacked experience in flying over the Texas terrain. These two facts, and the fact that the 'Hummingbird' abided by all the rules governing regular sailplanes, makes the score very gratifying.

It is interesting to note that the ship was not dismantled during the entire meet and yet accumulated 641 points. This is explained by the fact that in the first 3 days of flying, the ship was landed in suitable spots where it could be filled with gas and then take-off to fly back to Grand Prairie under its own power. Other contest flights were goal-and-return. The following are the accomplishments of the 'Hummingbird' at the meet :

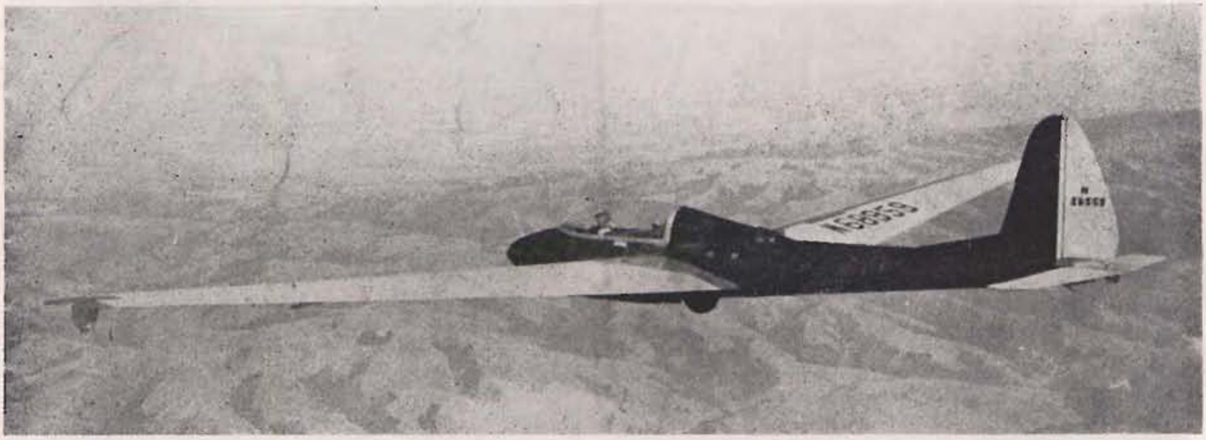
Total Flight Miles	*Pts.*	
Aug. 4 28 miles	28	Flight to Denton, Texas
Aug. 7 50 miles	50	Flights to Anna, Texas.
Aug. 8 58 miles	58	Flight to Van Alstyne, Texas.
Aug. 10 101 miles	152	Goal and return to Hillsboro, Texas.
Aug. 11 158 miles	237	Goal and return to Waco, Texas.
Aug. 12 77½ miles	116	Triangular course speed event completed in 4th place.
TOTAL	641	9th place in points.

These flights and points gave us the following awards :

1. National Championship Soaring Team—Nelson, Perl, Arnold (Trophy).
2. Best two-place ship performance of meet—(Trophy).
3. National two-place goal and return—(79 miles and return).
4. Michael Stroukoff Award for longest goal and return flight—(1st place—$200.00).
5. Beechcraft speed event around 78-mile triangular course—(4th place—$75.00).

This summer (July and August) found me and my family making several week-end trips up to Bishop, Calif., for more wonderful soaring. This is an ideal place for a family vacation as there is excellent trout fishing, hunting, scenery, and last but not least, a wonderful airport approximately one mile from town. Much of my soaring was done above 10,000 f.a.s. over or near the White Mountains. I found the 'Hummingbird' able to climb quickly over the White Mountains which gave me many extra hours of soaring.

I attended the West Coast Contest at El Mirage Lake for several days this year and placed 6th, flying only the first two days out of five. The longest flight was approximately 155 miles to Gene, Nevada, and the maximum altitude on this flight was 15,000 f.a.s. Unfortunately, I was a little late taking off and was over-run by a violent windstorm that killed all lift in the direction of my proposed course and thus I had to abandon my goal flightt lo Burbank, Nevada (210 miles). The flight was a very interesting experience



See photo on page 9

FREE BALLOONING

FREE ballooning is the senior branch of flying and was inaugurated by Pilatre de Rozier and the Marquis d'Arlandes with the first successful cross-country flight on 21 Nov., 1783, one hundred and sixty-nine years ago. It has always remained a sport although it did see military service in captive form during the French revolutionary wars of the nineties and in every major war since that date either as an observation or barrage balloon. Due to its great cost, however, the balloonists have often tried to find sponsors or charged the public for admission at the take-off point. As can be appreciated this is most difficult as the public can always watch a balloon ascent from outside the special enclosures.

Since the war ballooning as a sport has had a considerable revival in Switzerland but the costs have remained high as gas-filled balloons are still used. To qualify for a balloon pilot's licence a candidate must have completed six ascents and pass examinations in :

(*a*) Air Regulations.
(*b*) Aerostatics and the principles of ballooning.
(*c*) Meteorology.
(*d*) Balloon material and equipment including instruments.
(*e*) Air Navigation and Geography.
(*f*) Emergency procedures.
(*g*) A practical examination consisting of 2 ascents, one dual, of at least two hours, ascending to over 2,000 metres and one solo flight of at least one hour.

The cost of training to a member of the Zurich group comes to :

7 ascents at 200 fr. each ..	1.400 Fr. (£128).
1 ascent with the examiner	200 Fr.
8 Insurance premiums ..	160 Fr.
	1.760 Fr. (£160).

Motor car club members find plenty of fun in ' hunting ' the balloon, a change from paper chases and map exercises, the purpose being, of course, to arrive at the place of landing before the occupants can alight from the gondola.

It is rather surprising that balloonists have not taken advantage of recent progress in the development of ' air heaters ' such as domestic liquid fuel heaters and small jet engines to revert to Montgolfier hot air balloons as it would promise to reduce the costs to one tenth of those incurred with gas-filled balloons.

A hot air balloon for two or three people, producing its own ' thermal ' with the aid of an efficient petrol or paraffin heater should have a consumption of about 4 gallons per hour, be capable of rates of climb and descent of well over 1,000 feet per minute (thus permitting ' out-and-return ' flights to be performed when there is more than a 180° change of wind with altitude) and the total cost of material should be in the region of £100.

It is hoped that gliding clubs would extend a welcoming hand to ' hot air ' balloonists as they will eventually be of great aid to sailplane pilots in the advances they will bring in the study of atmospheric phenomena, some aspects of which can best be studied by an observer motionless (and noiseless) in relation to the surrounding air.

FUN WITH THE 'HUMMINGBIRD'

(continued from previous page)

and I enjoyed it very much. On the first day of the contest I made a flight of some 60 miles to Daggett, landed, filled up the gas tank, dismissed the ground crew which had arrived before I did, and flew back to El Mirage in 35 minutes. A decided advantage over tearing down and trailering.

I have had many pleasant flights at our Warm Springs Airport which is operated by Ralph Salisbury. The winter months have usually given us our best flying conditions and have made it possible to ridge soar along Mission Peak with good south winds or northwest winds. Wave conditions exist with the north winds and some south winds have developed remarkable conditions. Some months ago, a passenger and I rode a wave for approximately 3 hours and were able to obtain 12,500 f.a.s. The amazing thing of it was that we were directly over the airport at all times. Trimmed air speed varied from 45 to 65 m.p.h. The summer months provide us with moderate thermal activity near the airport.

Reviewing these flights impresses and pleases me with the outstanding feature of the ' Hummingbird ' —that two or three people can take the ship anywhere and feel assured that they can fly without the worry of whether a tow plane will be available for launching. This certainly expands the possible flying sites for sailplanes. I have also enjoyed a great deal of pleasure taking friends for a ride and letting them fly the ship. Their reaction is also most gratifying.

I am just completing a 300-hour check on the ' Hummingbird ' and it is interesting to note that the engine time is less than 50 hours ; that is a 6 to 1 ratio. Not bad !—' *Soaring*.'

CORRESPONDENCE

DEAR SIR,

Your contributor on ' Aerotows for Ab-Initios ' produces some most misleading figures. Surely it is more reasonable to compare aero-towing costs against those for *dual* winch-launching. Using this method a pupil will normally spend at least 1½ hours in the air before he goes solo. This amount of flying will cost him about £3. If it was done off aero-tow it would cost him at least £12 according to the figures given.

Unless the winch is being particularly unreasonable there should be no difficulty in practising stalls and incipient spins at the top of the launch.

Finally, the fact that a large proportion of accidents occur during approach and landing, seems to me to be an argument for doing *more* landings during dual training, not less.

P. H. BLANCHARD.
Surrey Gliding Club,
Lasham Aerodrome,
Alton, Hants.

See also page 14

Unsolved—THE PROBLEM OF LEONARDO DA VINCI Human Muscle-Powered Flight

By August Raspet
Engineering Research Station, Mississippi State College

FIVE hundred years ago Leonardo da Vinci was born. Fifty years after his birth he invented a muscle-powered flapping wing flying machine. Four hundred years after this conception, man flew but not under his own power ; he had to use a gasoline engine. Now fifty years after the invention of the aeroplane, we are again beginning to consider the problem posed by Leonardo.

Why should we want to study this apparently trite problem ? The answer outside of historical significance has some unique implications in the world of flight. From the standpoint of the development of the science of flight the achievement of muscle-powered flight would prove a command of aerodynamics and structures of a standard much higher than that exemplified by even our supersonic fighters. For the human-powered flying machine we have a limited power. We cannot increase this power over that developed by a man. Today there are aeroplanes propelled by 100,000 horsepower engines. Man has less than one horse-power to offer.

Obviously the only approach to muscle-powered flight is through the development of aerodynamic and structural technology. We must reduce the losses inherent in the flow of air over the lifting surfaces of the wing and tail and over the fuselage. We must make these surfaces lighter than any structure yet developed for the aeroplane. At the same time they must be strong enough to carry a man acting as power plant and pilot.

Even before considering the aerodynamic and structural problems of a muscle flight machine we must consider the optimum configurations. There are three possible configurations :

a. Fixed wing, propeller-driven similar to the first aeroplane of the Wrights'.

b. Rotating wing or heliocopter.

c. Flapping wing, the ornithopter of nature, and that imitated by Leonardo.

Modern aviation is based entirely on the first two configurations, the heliocopter being the more recent development, although it too was first proposed by Leonardo.

It is an interesting aspect that this early designer of aeroplanes should also have invented the parachute. He no doubt did not trust the structures he proposed. With these prophetic developments, Leonardo proved that he should be as well known for his engineering as for his painting.

The technology of ornithoptic or flapping wing flying machine, although it is nature's original and only configuration for movement through the air, is not yet advanced enough for low-powered flight to be developed. The aerodynamics of a wing in motion in two directions, flapping and forward, is not yet developed even in the theoretical aspects, and thus designers have no guidance to the mechanical realisation of a flying machine of this type. Without knowledge of the lift and drag in the flapping mode, it is not possible to predict power requirements or even the imminence of this mode of flight as a reality.

MAN AS A POWER PLANT

Many measurements have been made of the metabolic factor of animal muscle. However, the mere knowledge that 100 pounds of muscle can do work at the rate of one horsepower for a period of several hours is not enough to permit the design of a muscle-powered machine. What is needed is a knowledge of the power which a man can develop when he is coupled to a power-extracting harness. It has been found (Ref. 1) that man can best furnish power when coupled by means of pedals and an arm driven crank. Seated or prone, he develops nearly the same output power.

Having established the manner of extracting power from man we still need to know the amount of power which he can develop over various periods of time and the speed of cranking that is needed for optimum power output. Ursinus (Ref. 1) found in his monumental work at the Muscle Flight Institute in Germany that man can develop a maximum in power of 1.3 h.p. when pedalling and cranking at a speed of 1.8 revolutions per second. However, this peak can be extracted for only 20 seconds before the muscles are fatigued by oxygen deprivation and poisoned by waste products in the muscle cells.

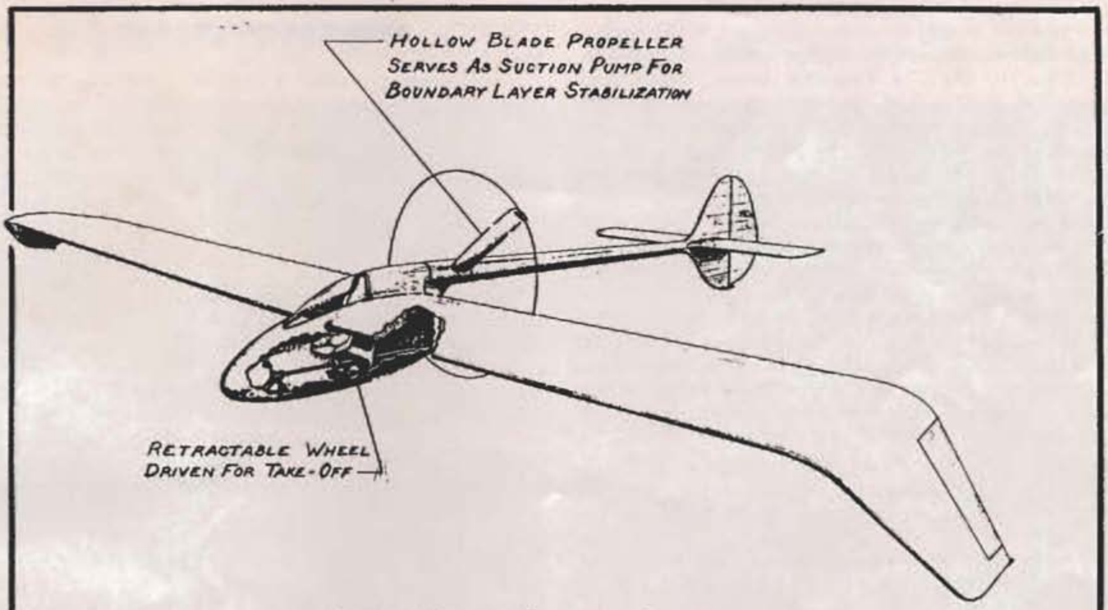
When sustained power is desired the muscle power plant rapidly loses its ability to put out power. Using the arms and legs, a young athlete is able to put out power continuously at a rate of 0.56 h.p.

We now have enough information on the power plant. An aeroplane requiring only 1.3 h.p. for take-off and only 0.56 h.p. for level flight could be powered by a man.

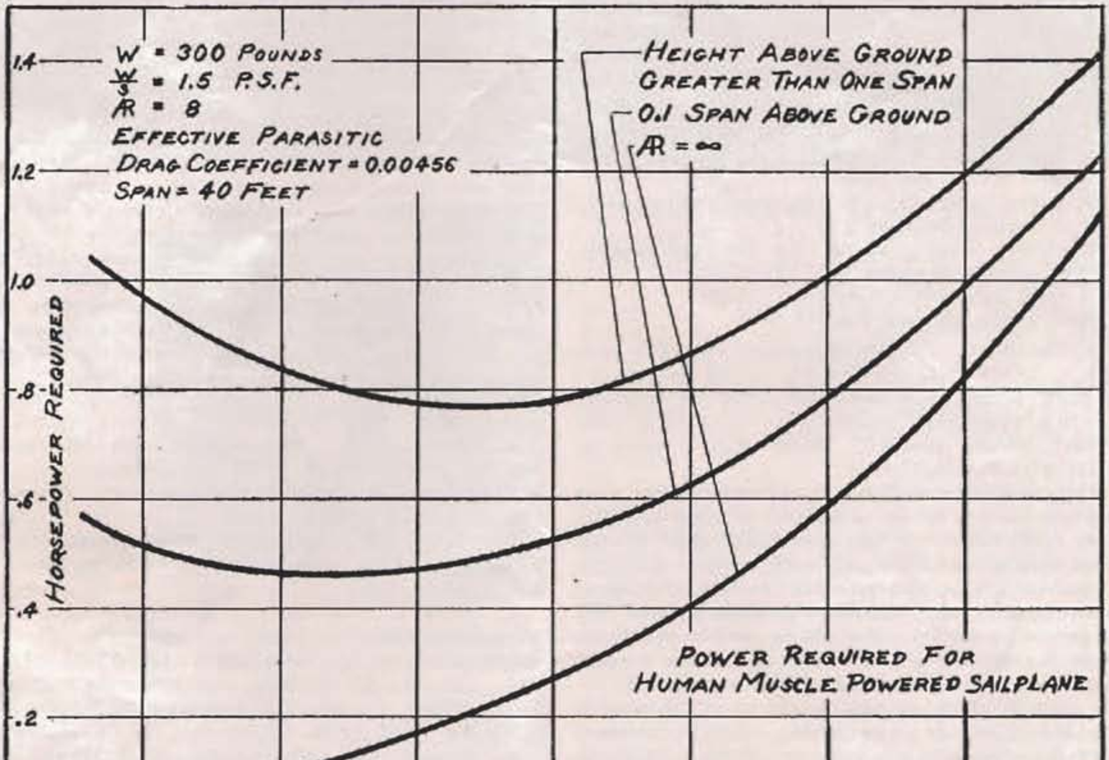
AERODYNAMICS

Let us then consider the aerodynamics of such a machine. If we used a heliocopter in which the man provides the power for rotating the propeller blade or blades, we would require for a man and machine weighing 100 kilograms a power of 1.3 h.p. using a rotor 17 metres in diameter (Ref. 2). Since the man weighs 75 kilograms, we would have only 25 kilograms for the structure, gearing and controls. Even so, if we did attain this low weight, the man would still only be able to lift himself for a period of 20 seconds. Since we cannot call this sustained flight, we must abandon for the present the heliocopter.

The fixed wing aircraft offers the greatest possibility of attaining low energy loss flight. We owe to the perfectionists in soaring the advances made in reducing the drag and power requirements of conventional aeroplanes. There is now flying in America a sailplane, ' RJ-5 ' (Ref. 3) which is capable of cruising at 50 miles per hour with a power requirement of only 2.33 h.p. If the weight of this craft could be reduced from 690 pounds to 250 pounds, the



HUMAN MUSCLE POWERED SAILPLANE
UTILIZING POROUS SUCTION AND GROUND
EFFECT — MINIMUM TAKE-OFF THRUST
HORSE POWER REQUIRED — 0.05



power required would be only 1.18 h.p. With such a craft, of course, only short flights would be possible.

In Italy in 1937, a research team, Bossi and Bonomi (Ref. 4) attacked the problem of muscle flight from basic considerations. They designed a machine driven by two propellers which required a thrust power of only 0.83 h.p. A sustained flight of 800 metres distance was actually flown with it, but it did not take off with muscle power alone. One point which the Italian researchers overlooked was the relatively low propulsive efficiency of the tractor propellers used on this machine. Another serious deterrent to the sustained flight of this machine was the fact that only the legs were used for power, the arms being needed for control. Despite these criticisms, we can consider the work of Bossi and Bonomi, which was methodically executed, as a fine contribution to this field.

One very important concept of aerodynamic theory should permit the reduction of power required. If one flies near the earth's surface, the drag due to the generated lift is reduced considerably. If one flies at one tenth the span above the ground the power required for lift generation is 50% of that at a great height above the ground.

Recently some measurements (Ref. 5) on the aerodynamic properties of soaring birds yielded the interesting fact that birds apparently enjoy a laminar flow over their entire surface. This conclusion was based on the extremely low drag which the bird possesses. If we understood fully the mechanism for such low drag flows, we could design a muscle powered machine capable of flying on 0.78 h.p., not including the ground effect. Such a flying machine would have the following characteristics :

a. span, 40 feet.
b. chord, 5 feet.
c. weight flying, 300 pounds.
d. speed of flight, 18 miles per hour (minimum).
e. maximum glide ratio, 37.
f. minimum sinking speed, 1.4 feet per second, (At one span altitude).
g. wetted area, 600 square feet.
h. drag coefficient, 0.00465.

Near the ground the power required would be only 0.45 h.p. Since man can develop for 20 seconds 1.3 h.p., there would be a sufficient power for take-off. Even if a propulsion efficiency of only 50% were obtained, human powered muscle flight would be possible with this machine.

The technique of maintaining a laminar flow over the entire surface of an aeroplane is now at least defined in direction. It has been found (Ref. 6) that suction through a perforated wing surface stabilises the laminar flow so that the low friction of laminar flow can be achieved. Since this process requires very little power for suction, it would be possible to obtain it from the pedalling of the man in such a muscle-powered machine. See illustrations on page 13.

For this machine an empty weight of 120 pounds is allowed. Even so an extremely efficient structure is needed for the wing and fuselage. There is available a new development called sandwich construction which utilises two layers of fibreglass cloth supported in a very low density porous plastic. In this structure, the two skins are placed so far apart by the plastic that an efficient compression element results. With this construction the fixed wing aircraft powered by man should be possible of attainment.

In summary, this paper reviews the possibilities of achieving human muscle-powered flight in the near future. Recent advances in aerodynamics and structures give definite indication that human muscle-powered flight should be possible within the 500 years of the birth of its inventor, Leonardo da Vinci.

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CORRESPONDENCE

SIR,

Your correspondent J.R.C.W., writing on aerotows for ab-initios, reaches conclusions which are in my view manifestly absurd, his solution to the fact that a high percentage of accidents occur on approaches and landings is to give longer flights to pupils and fewer practice landings !!! This is exactly the same as saying, because a pupil car driver has smashes on corners let us teach him to drive only on straight roads !

The only way to teach pupil glider pilots to fly safely is to build up sound circuit judgment, circuits and landings are the basis of this judgment. It is far better for a pupil to have thirty circuits than ten circuits and two or three hours soaring or aerotowing. I know of no instructor who disagrees with this view, the only time when an aerotow is really justified is to teach spinning, and in any case this can be done by soaring. The ordinary incipient spin can be quite safely demonstrated from a thousand foot winch launch which is easily attained on flat sites.

With regard to the very long time taken to obtain the 'A' and 'B' certificate, I suggest regular attendance at the site is the solution, the type of pupil who comes once a month is the bane of any instructor's life, the regular attender gets off solo quite soon.

I do assure your correspondent that in the present state of development of glider training in this country, winch launched circuits are by far the most economical and satisfactory way of learning to glide, and any attempt to think in terms of pure flying hours during this vital period of his gliding career is a delusion.

Yours faithfully, P. FLETCHER.

Queens Avenue, London, N.10.

See also page 11.

A PYRAMID FLIGHT

By R. SWINN *(C.F.I., Egyptian Gliding School)*

LOOKING at those towering Pyramids, it occurred to me how wonderful it would be to bring together these monuments of ancient splendour with some form of modern progress

An idea formed to fly over the Pyramids in a glider and my next step was to see if it was possible to land near them.

C.F.I. R. Swinn (left) and Pupil

After much effort I found an area near the foot of a large Pyramid on which I thought I could land a glider. I measured up the area, marking out a similar area on our airfield, and practiced landing on it until I felt certain that I could do the actual landing on the corresponding area at the Pyramids.

The difficulty was that there was only one direction of approach, to effect a landing. The area was surrounded by ravines and jagged rocks and allowed for no error.

Having convinced myself I could make the landing I had the more difficult business of convincing other people in order to get permission. I was lucky for although there was much questioning no one asked to see the proposed landing area.

Time and date was set and a large number of members of the School together with police were present to control the crowds and keep the landing area clear.

I was aero-towed by a 'Moth' aircraft from the Royal Egyptian Airforce Aerodrome at Heliopolis some 25 kilometres from the Pyramids, with Lt.-Col. Husseini of the Egyptian Army as second pilot.

We arrived over the Pyramids at 2,000 feet. The air was quite smooth down to 1,000 feet where some turbulence was encountered. Details of the plan were to circle the largest Pyramid, and accordingly we swung round the Pyramid with our inner wing less than 5 metres from the side of the structure.

Each time we came round on the downwind side of the Pyramids the turbulence was so severe that it was difficult to control the machine and maintain a close position to the Pyramid wall.

Two-thirds of the way down I had to get the

Suggestions for Reducing the Cost of Soaring Flight

By Fred Hoinville.

FIRST, what are the costs of soaring? Well, they include such things as learning to soar, buying or building sailplanes, and launching sailplanes, and retrieving.

How do these costs compare with pre-war costs? On the whole, they are about ten times higher. Wages have increased only three times higher.

For instance, when the 'Grunau' was accepted as the best sailplane that money could buy, it cost no more than £150.

There are many claimants for the title of 'best sailplane' today, but they all cost £1,500 or more.

The life of a sailplane is about the same as before. Other components used in soaring have all increased in price very greatly. In Australia, old cars for towing and engines for winches are about ten times more costly.

Cross-country distances have increased so fantastically that few can afford to attempt cross-countries at all, because of the cost of retrieving.

Pre-war, the boy from the corner shop could save his pennies and fly the best with the best. Today, he is restricted to hops and slides. Only the relatively wealthy can fly the best now.

By courtesy of Uncle Joe, atom bombs, retrospective taxes, and one thing and another, pilots are becoming more relative and less wealthy.

Looks like we've got to make a Fresh Approach, or take up dominoes. I don't like dominoes.

How can we reduce training costs? Well, for a start, what kind of training do we want. Solo or Dual? I can't help feeling that the dear old 'five-bar-fence' primary has frightened more people away from gliding than costs have. Horrible looking things, requiring a lot of guts, just at the stage when the pupil most needs reassurance and encouragement. He develops the guts later, with increasing confidence.

Also, primaries train people very slowly, and a huge number of them would be needed to train a reasonable number of pilots in one year. Not good enough.

Two-seaters, then. O.K., just find £1,200 Australian—maybe less in Britain, but still far too much—and we'll start. We have to take an awful lot of pupils to justify that kind of capital outlay, so that means that a lot of people are going to get a little flying and a lot of looking and wishing.

Seems rather pointless to me. That isn't soaring as I think it should be. What then? Well, why not ask each beginner to spend say £20 on suitable dual instruction with an aero club? You can learn more, faster, and better in ten half-hour lessons on a light plane in one month than in 50 five-minute flights in a winch-launched two-seater over six months.

Maybe things are a little better on a good slope site, but they are too few to train hordes of pilots, and slope soaring has many weaknesses inherent in it, besides being the most painfully boring experience I can remember in my fortunately brief trial of it.

There is not one slope in use in Australia today. I'm sorry, but I think that is probably a very good thing in the long run. Australian clubs would use them if they were available, but they are not. If my first taste of gliding had been on a slope, it would have been my last too.

£20 is a very small price to pay to get established in any sport. Even a golfer pays more than that, just to walk miles through wet grass. By doing this, heavy initial capital outlay is avoided, by the club.

Next? Ah, there's the rub. We are not yet ready for next, but we can be. Assuming that our eager hordes of panting pupils are now ready, we—that is, the club—should possess large numbers of extremely cheap, extremely light, extremely easily handled single seaters, on which the pupils could now be given cautious solo flights. The gliders should probably be designed along the lines of the Japanese 1937 'Tondokuro III,' which I am told by Walter Neumark weighs only about 50 lbs. empty, with glide angle of around 20 to 1 at a very low speed.

Weight and cost are usually in proportion. Such a glider should cost about one-sixth the cost of a 'Grunau,' and could be made at home in relatively few man-hours. It could be mass-produced at a very low figure, so cheaply that every pupil could own one in a short time. I have no doubt that if 'Sling' were to bend his efforts in this direction, he would sell staggering numbers.

So much for training. Of course it's only a dream, but a few men with guts, imagination, and a glider factory could turn it into a firm reality in very short time.

So much, too, for buying or building a sailplane. Now we have to worry about launching and retrieving costs and difficulties, which latter are now almost as tough as the costs.

Forget aero-tows. They are not readily available or cheap, in most countries. They are lovely, but let's be practical.

A vast number of soaring pilots would be very happy to own any glider that they can fly to a Silver 'C' or better, launch simply with few helpers, land

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A PYRAMID FLIGHT—*continued from previous page*

machine into position for the final approach to land. A strong eddy drifted the machine temporarily round until it was facing head-on into the corner of the structure.

Literally scraping the corner I was able to fly clear, once more concentrated on the approach.

The machine came down lower and movements of people across the landing area ceased. The Glider behaved beautifully and we touched down at the exact place marked. The machine was immediately surrounded by the large crowds.

Reading in the press later that this was the first time that anyone had succeeded in landing an aircraft at the Pyramids I found myself asking would those ancient Gods of Egypt's Pharaohs smile so favourably on anyone daring again to invade their territory from the sky.

on a table cloth, drag about unaided, carry home on the roof of a light car or a very cheap, simple trailer, and store in a small space.

Such a midget glider *can* be designed and built. Many types with some of the required qualities are already flying. With modern knowledge and improvements we can achieve what we need. If I wasn't so busy writing about it—and doing a little work—I'd try it myself. Maybe I will, anyway, ' next year.'

So to launching. The dear old winch has its points, for a large club. For smaller clubs and individuals, it is a headache. It requires an extra engine, a lot of mechanism to service, a tow car, a lot of people who keep wondering whatinell the other lot of people at the other end of the field are doing, and when they intend to start doing it, a lot of expensive cable, and a skilled operator. Côstly, cumbersome, complex, immobile. You can have it.

Car launching has been used in various forms, and is much simpler and more mobile, but has its drawbacks. The car-pulley-tow, for instance, gives a snappy launch in a small field, but does not offer good heights.

Ordinary car tow needs a smooth runway, gives better height than a winch, but involves much dragging wear on the cable.

Another suggestion from Austria is to use car tow with a drum and drum brake on the car, getting up full speed before braking the drum, thus giving almost a snatch take-off for the glider. If a length of nylon is included in the cable—say twenty feet of ½-inch thick—as was done in Germany at Klippeneck when I flew there, this should be very good, as it worked fine with the German winch, in a form of snatch launch. Very quick, very smooth.

This still leaves the usual faults of cable dragging and slow retrieving, unless the car is reversed all the way back.

My own suggestion, which could be modified by incorporating the Austrian drum brake and snatch launch, is to mount a light drum on the rear of the car, pay out the cable, launch in the ordinary way, but wind in the cable as soon as it is released, by means of an electric starter motor, similar to the car starter and using the car battery. The entire mechanism should be light, fairly cheap, attachable to any car, mobile, give high launches, eliminate cable dragging, reduce operating crew to pilot, driver, and (if necessary) wingtip holder. It would be taken along on retrieves, and sometimes the glider could be launched again instead of being carried home.

The entire outfit, car—drum—cable—glider, could be kept at home for easy servicing, not stored many miles away on an airfield.

The ' Hoinville car-drum ' is likely to be put into immediate use by the Hinkler Soaring Club, which is getting rather fed up with winches, mainly because the club has lost many members lately. Members come and go, but lately more go than come, owing to high costs. So there aren't enough members present to work the winch and its numerous accessories.

To conclude. What *is* soaring, to you and to me? To me it is the joy of fighting up into the sky and the clouds, as often and as long as possible. I want to do my soaring IN THE AIR, not in the hangar or the field. Give me a simple sailplane that I can soar long and often, without needing a Barnum and Bailey circus of contraptions, porters, signallers, runners, cars, wives, and friends, to get me into the air, and a full-scale safari to bring me back if I go cross-country.

In my six years of gliding, using large gliders, I have achieved only 230 flights for 182 hours total gliding and have done only 10 cross-countries. If I had a midget such as I ask for, the totals would have been many times higher. (I learned to fly on power planes, not gliders).

Club flying cannot produce really good pilots. It is only the kindergarten. The pupil must become an owner or group-owner before he can really soar. There must be many potential good pilots yearning on the airfields today, who will never get the chance to prove themselves under present systems.

Big sailplanes will be built, for record breaking, but even there, the trend is in the wrong direction. The bigger machines are designed for a very low minimum sink, which is not needed for records, because records are broken only in strong conditions, when high speed alone counts. This was well demonstrated at the U.S. 19th Nationals, when the small ' RJ-5 ,' three ' Schweizer 1-23's,' and the microscopic ' Tiny Mite ' all walloped the ' Horten IV ' Flying Wing very thoroughly. The ' Horten ' is probably a lot better than most big U.S., British, and European sailplanes, and in very weak thermals, would certainly have turned the tables. *But*, you don't break records in weak thermals, so why bother with big gliders?

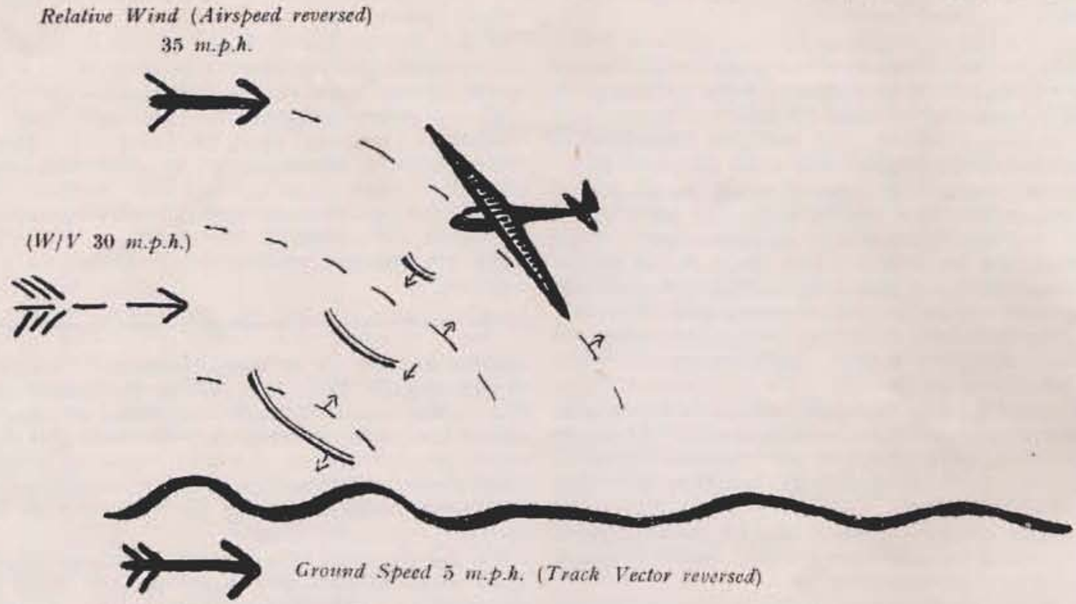
For contest flying, what could be better than a mosquito fleet of standardised midgets? Imagine the joy of Billy Jones and Jimmy Smith, meeting the Champs on even terms at last. That would *really* be a test of skill.

Maybe many of you readers will tear strips off me for some of my statements. Go ahead and good luck, the more you say the better, as long as you do it constructively. Don't just say that I'm wrong. Show me a better way!

WEDNESDAY January 21, 1953, Joint discussion meeting between B.G.A. and Royal Meteorological Society on ' Fair Weather Cumulus ' in the Lecture Theatre Science Museum, S.W.7 at 5.30 p.m.

The meeting will be chaired by Mr. P. Wills, C.B.E., world gliding champion and chairman of the B.G.A., and the following papers will be read: (*a*) ' The Nature of Thermals,' by A. H. Yates; (*b*) ' Fluctuations of the Temperature in the Neighbourhood of Cumulus Clouds,' by D. G. James; and (*c*) ' What gliders find and their potentialities for research,' by L. Welch. They will be followed by a film of time-lapse pictures of cumulus clouds shown by F. H. Ludlam.

UP WIND BEAT



No perceptible Doppler effect on Echoes due to the Insignificant Closing Speed between Sailplane and Reflectors

DOWN WIND BEAT

Echoes here subjected to a Perceptible Doppler effect the Pitch of the Reflected Noise rises
Audible Beat Notes would only occur when Very High Frequency Noise is originated in view of the slow closing speed between the Sailplane and Reflectors

THINGS I HEAR

By Derreck Abbott.

MOST pupils are usually told by their instructors to keep the ' wind in their face ' and to listen to the sound produced by the sailplane when flying at the correct airspeed and to keep these constant.

However, the noise heard by the pilot flying at a constant airspeed does *not* always remain the same and I am not referring here to such obvious changes in noise produced by rain or hail striking the sailplane.

A short time ago while flying the Slingsby ' Prefect ' at Dunstable with stratus at 800 feet and a S.S.W. wind blowing obliquely to the slope, I noticed that the *note* was fairly deep while travelling upwind but rose in *pitch* as much as one sixth of an octave when travelling downwind but remained at the same volume while travelling in either direction. The change occurred during the turn (during which a constant airspeed was very carefully maintained) and then remained constant—deeper into wind, higher downwind. I was soaring between 300-400 feet above the Downs (5-600 feet above the take-off point).

After making quite sure that I was really hearing what I thought I was hearing, I attempted to alter the note by diving and increasing the airspeed. To my surprise the note became much louder but did *not* rise in pitch. Passing 55 kts., the note suddenly jumped up one octave, the original note could then not be heard at all, the vibrations of the new note exactly one octave higher in pitch cancelling out the original note. At about 65-70 kts., the same process was repeated, that is the volume of the note increased steadily with increase in speed but quite suddenly jumped up an octave, the previous note disappearing completely. This last note, the third one heard in the process of this dive, was two octaves above the original note heard when flying at normal airspeed. This phenomenon is of course quite independent of groundspeed although it and the previously described phenomenon can occur simultaneously.

The rise in pitch when travelling downwind can be fairly easily explained by the well known *doppler* effect. I find it helpful to visualise the sailplane as stationary in the centre of my diagram and the air flowing past it at a speed equivalent to the airspeed and the ground surface with any undulations and any changes in surface texture which it might bear also slipping past the sailplane. This is only taking a very ego-centric view of things but it helps in visualising what happens to the waves of sound produced by the sailplane's passage through the air. These are shown as curved arcs in the diagram.

I look forward to hear other people's explanation of the sudden one octave jumps with increase in airspeed.

I might mention that I have had some experience in the discrimination of noise but that these observations are merely a beginning in the study of celestial music. It would be interesting to know whether others have heard these or other noises such as the change in note when entering, circling or leaving thermals.

A Standing Wave at Dunstable

By G. H. Lee and O. W. Neumark.

Introduction.

THE top of the hill above the London Gliding Club site at Dunstable is about 250 ft. above the ground to the north-west, and the average slope is about 1 : 2½. The slope faces about 15° north of west. Launches by winch to over 800 ft. can now be obtained by gliders in easterly winds, whereas previously power cables prevented launches of more than 300 ft. above the site. Only once, until recently, was lift found to the lee of the slope in a south-easterly wind, and then, in 1937, with a wind direction of 160° on the surface veering to 225° at 2,500 ft. Neumark observed a visible standing wave three times in 1947 in easterly winds, before the higher launches could be made; and then, as on the occasion described below, there was a temperature inversion at less than 3,000 ft. Twice there was a bank of fog on top of the ridge which dissolved and reformed again in a line parallel to the ridge, and once there was a haze layer at about 1,500 ft. whose undulations became visible and there was a darkening of the haze over Totternhoe. It is now well known that standing waves occur at Dunstable far more frequently than was once supposed; most often they are marked by clear breaks in an overcast sky.

Flight of September 22, 1951.

The early part of the day was sunny but towards the end of the afternoon a layer of what appeared to be thin medium cloud gradually thickened. No appreciable thermal activity was noticed at all by Lee during the day in several flights with pupils in a ' T.21B ' two-seater glider. The launch was towards the hill and directly in the lee of it, and nothing especially remarkable was noticed until about 1700 G.M.T. when it was observed that a pupil practising turns near the Tring Road lost less height than was expected.

Later, at about 1730, the phenomenon was investigated by another pupil by flying a few beats up and down the Tring Road. In this case reduced sink, corresponding to an upward air velocity of 2 ft./sec., was found (taking the sinking speed of the ' T.21B ' as 3 ft./sec.).

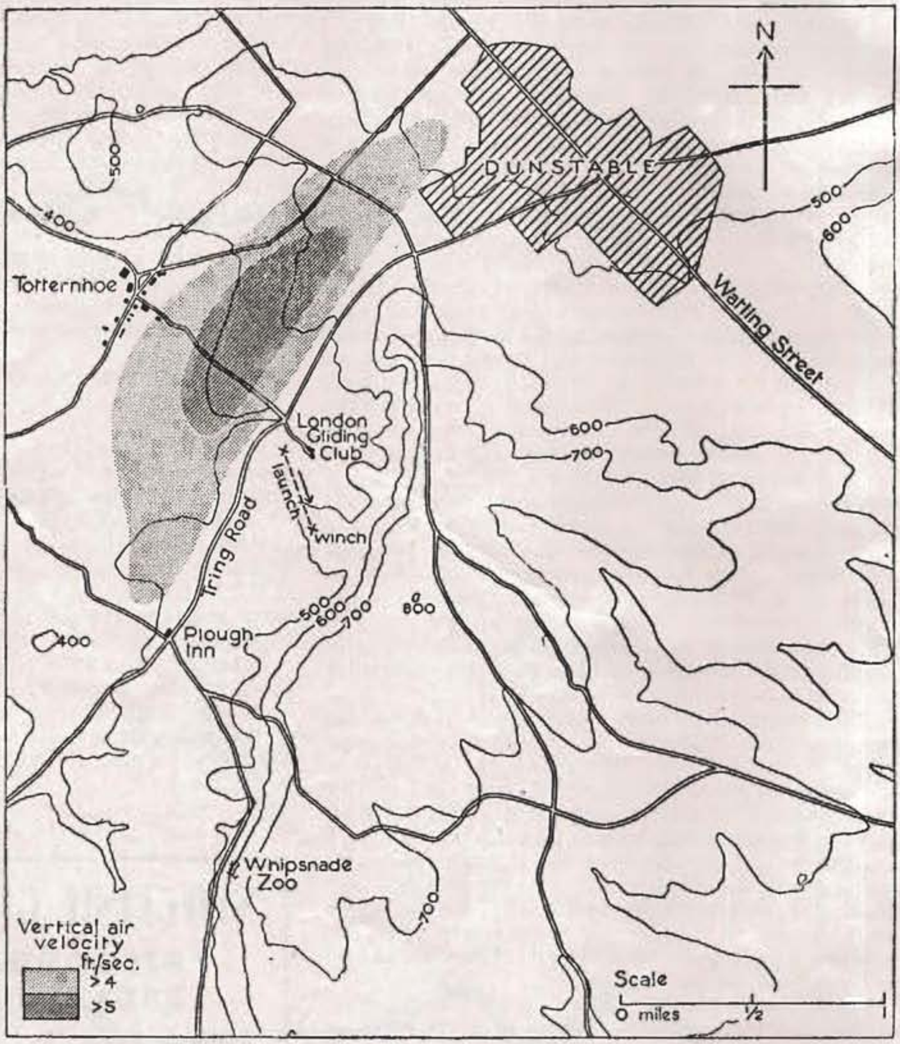
The surface wind at 1800 was about 110°, 10-12 kt., and had increased, and at 1805 Lee and Neumark were launched in J. E. Furlong's 'Dragonfly.' The light was already waning. The cable was released at 900 ft., and it seemed that there was an appreciable strengthening of wind between 700 and 1,000 ft. above the site. At 1,500-2,000 ft. the wind appeared to have veered to about 140-150°, 15-20 kt., but even so all the radio-sonde winds at Downham Market and Larkhill at 1500-2100 G.M.T. showed a much more southerly wind, and it seems cannot be taken as representative of the winds near Dunstable, for the Chilterns appear to deflect the wind from its general direction on many occasions.

After flying directly down wind, lift was found after crossing the Tring Road, and several beats at heights between 1,500 and 2,200 ft. were made up and down to find the extent of the area of lift, which is shown in Fig. 1. The magnitude of the lift was steadily increasing during the flight, and the vertical air velocity reached about 5½ ft./sec. at a height of 2,200 ft. above the launching point, i.e. at about nine times the height of the hill.

A sharply defined haze layer could be seen and was estimated to lie at about 2,500 ft. above the launching point, but no undulation in the haze top could be detected from 2,200 ft. In spite of the continuous lift it was necessary to break off the ascent because of approaching darkness. Descent was made mainly in tight circles in the down-current over the slope, and the landing was assisted by car headlights at 1840.

A 'Tutor' sailplane, flown by A. Doughty, landed one minute later after reaching 1,500 ft. from a later launch.

The following is extracted from an account of the phenomenon by A. Doughty :—



Map showing area of Best Lift on September 22, 1951.
Contour heights are given in feet

'I had never heard of a wave before but had often heard the Club's ground engineer, Mr. Walker, talk about being able to fly right out to Totternhoe at sundown without much loss of height when the katabatic wind begins to blow. On this particular day shortly after 1700 G.M.T., the wind-sock was hanging limply round the mast; about 20 minutes later it started to fill out again as the wind freshened . . . I landed after 28 minutes in the air and found that the wind had freshened to about 20 m.p.h. and two small lenticular clouds had formed above Totternhoe. By 1930 the wind had dropped and the clouds had cleared away.'

[The synoptic charts for Saturday, September 22, 1951, show a depression centred west of Ireland and an anticyclone over Germany with south-east England in a south-easterly air stream.

The observations at Larkhill and Downham Market of the inversion giving the haze layer observed by the authors at about 2,900 ft. above M.S.L. (the height of the gliding club site is 450 ft. above M.S.L.) over the Dunstable area at 1800 G.M.T. are set out in the following table :—

	Time	Pressure	Height above M.S.L.	Temp.
	G.M.T.	mb.	ft.	°F.
Larkhill	1500	862	4,450	58
		922	2,600	52
Downham Market	1500	900	3,300	56
		940	2,140	52
Larkhill	2100	865	4,250	56
		903	3,050	52
Downham Market	2100	878	3,900	57
		933	2,250	55

The air above the inversion was very dry.

In the afternoon the lapse rate was approximately dry adiabatic from the ground to the base of the inversion, but by 2100 an inversion had formed in the layer below as follows :—

		Pressure	Height	Temp.
	G.M T	mb.	ft.	°F.
Larkhill	2100	956	1,510	56
		968	1,150	54
Downham Market	2100	970	870	58
		1006.8 (surface)	120	53

Ed. *M.M.*]

DINNER TO BRITISH TEAM

THE members of the Royal Aero Club entertained to dinner the British Team which won the World Championship, and Philip Wills, the World Champion himself, in the Club Dining Room on November 26th.

For the first remembered time in the history of the Club, Ladies were admitted to the Dining Room, a signal mark of honour, but also indicative of the fact that there are many women Glider Pilots in U.K.

On behalf of the Club, its President, Lord Brabazon of Tara, made his usual 'reaching for the stars' speech, in which he mentioned how much Aviation in general owes to gliding and asked for more recognition. Following on and replying to the toast of the Team and himself, Wills, in a speech full of good sense, remarked that gliding was still too much for the demi-gods. Air-mindedness ought to be so spread that you got your name into the papers if you didn't fly, and not if you did and had to make a forced landing. 'For the cost of one aileron of a modern bomber gliding could be put on its feet for one year in U.K., and for the cost of one wing, a ten year period' could be covered. Fred Slingsby, who was forced on his feet by popular wish, modestly remarked that there is no false modesty about Yorkshire people, and when they set out to win something they expected to be top or thereabouts. They had designed the 'Sky' to win the World Championship and had succeeded. A feature of the evening was the presentation to Wills for the B.G.A., of the tattered Union Jack, belonging to the Bank of London and South America, which had been borrowed for the competitions, blown to ribbons, and then given by the Bank to the B.G.A., at the instigation of Stanley Dickson and Basil Meads It is to fly at the next Competitions at Camphill.

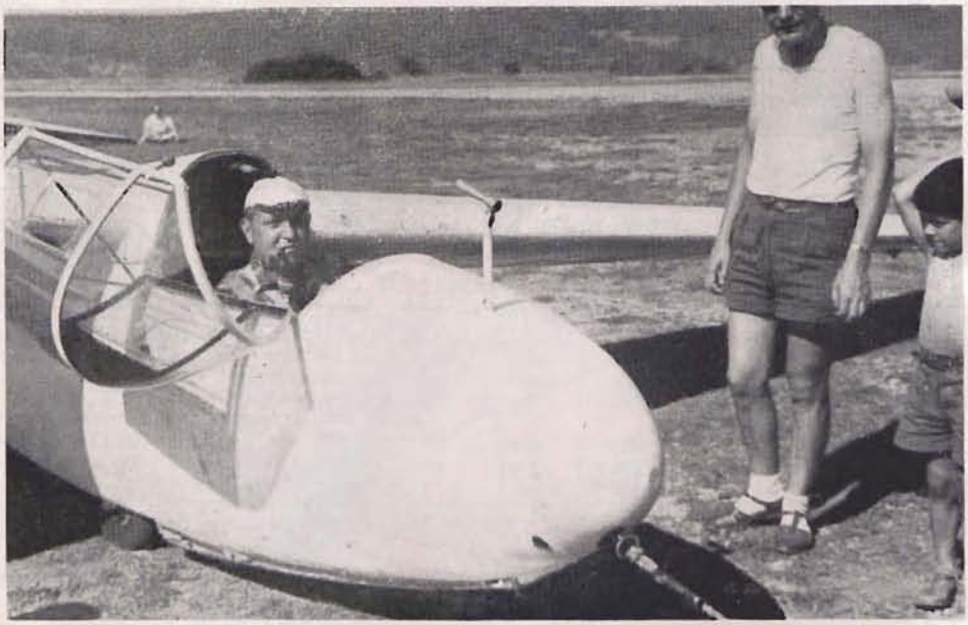
SOARING IN FRANCE (*continued from page* 23)

Of new designs, I hear that Bréguet was designing a new improved version of his '900.' And I have seen on the drawing board, plans of the last idea of Raymond Jarlaud, a high performance sailplane with a laminar airfoil and a wingspan of 16 metres of which the maximum gliding ratio should reach 35. It will be interesting to follow development of these types and to see if they could be able to take the place of the eternal formula of the 'Weihe' of 18 metres.

SOARING IN FRANCE

1952— and a glimpse into THE NEW YEAR

By GUY BORGÉ



An ' Air 100 ' awaiting Aero-tow (*Photo : Borgé*)

1952 has just ended and it appears to have been an excellent year. During Spring, Summer and Autumn, holiday-makers enjoyed the good sun which brought excellent wine and perfect thermals. *Sailplane* is a soaring journal and it seems, is more appropriate to speak from thermals than from bottles, though these could often be appraised at the end of certain gliding days, for instance to inaugurate brand new badge holders. But it's another story.

In no previous year have there been so many long distance flights. Nine pilots exceeded the 400 kilometres mark, and two passed the 500 km. mark. Never have we welcomed, in one year, so ' many ' Diamond ' C ' holders—two, thanks to Eric Nessler and Lebeau. Eric Nessler, our well-known champion, last May accomplished his final leg with a 300 km. goal, in an ' Air 100,' a similar flight to that which he executed in 1950 in a two-seater. And a very young pilot, Jacques Lebeau, puts in his name on the very short list of the Diamond ' C ' finders. France owns with pride three Diamond ' C ' pilots. Pierre, Lebeau and Nessler.

For the other badges, the complete results of 1952 have not yet been announced, but only those concerning the first eight months in the National Centres and the Inter-Club Centres (activity in the Cubs is not included)—

370 legs of Silver ' C ';   112 complete Silver ' C ';
69 legs of Gold ' C ';   19 complete Gold ' C ';
48 legs of Diamond ' C ';

and a big total of 25,252 hours of soaring flight.

Excellent performances recorded at Saint Auban during November and December must increase these figures, because the famous mistral wind blew for many days. A nice result, on November 3, the instructor André Lafargue reached, in a ' Bréguet 900,' an absolute altitude of 9,100 metres (29,848 feet). He would have broken the French absolute and gain records if he had carried with him an official barograph. But Lafargue thinks that these instruments drive away lift and he did not want them in his machine. It is interesting to observe that this gain of 8,400 metres (27,552 feet) is not very far from the present world record. Flight report of Lafargue is extremely short and he has resumed the three hours in a few lines :

" Winch launch at 15 hours local, casting off at 300 metres (990 ft.). Low point on the Mées slope at 200 metres (650 ft.). Very fast climb to 3,000 metres (9,900 ft.), variometer from 1 metre/second to 5 metres (3 to 15 feet/second), decreasing to 5,500 metres (18,000 ft.). A characteristic cloud is forming above Genagobie-Lurs, and I decide its prospection. It is 15.45 hours. I drift in the already used ascending zone and at 130/150 km.-hour ASI (80/90 miles-hour), I sink at 4 metres/second (12 ft./sec.). I find myself at 5,000 metres (16,400 ft.) just vertically above the cloud. But it quickly disaggregates under me. Return towards Les Mées—Montfort, where lift seems to have changed its place. At 5,500 metres (18,000 ft.) wind slows and takes bearing of 290 degrees. In lift of 1,50 m./sec. (5 ft./sec.) in average but dubitious because the variometer is false. Lift decreasing to 8,600 metres above the airfield (28,208 feet). It is 16.50 hours. End of the flight caused by cold and the unusable variometer. Landing at 17.03 hours."

Saint Auban is one of the best European centres for altitude performances ; unhappily its geographical position is not good for purposes of distance flights, like Pont Saint Vincent for instance. But in 1952 the Chavenay Centre, near Paris, proved extreme activity in this field, and I think that several famous days were lost at Pont Saint Vincent, since weather was so fine during a week, that the sailplanes, having landed after 300 or 400 km., could not be retrieved in time to again start. On one day, May 24th, I could appreciate that along more than 600 km. (372 miles), cloud streets were ranging in line from Pont Saint Vincent to the Atlantic Ocean, the wind was blowing at 50 km./hour (31 miles/hour), the clouds had formed at 9 hours local at Pont Saint Vincent, at 10 hours lift under their base at 1,200 metres (3,900 feet), reached an average of 4 metres/second (12 feet/second), their base climbed to 2,500 metres (8,200 feet) above the ground during afternoon, streets decayed at 19 hours. But, like my fellows, I was bringing back my 'Air 100' to Pont Saint Vincent from the Limoges country and we missed a divine day absolutely extraordinary, favourable to the longest travels in France and to unique achievement,—the complete crossing of France from Lorraine to Pyrénees mountains.

However, there were many nice distances, and I resume the nine cross-country flights superior to 400 km. (248 miles).

Pilot	*Distance*	*Plane*	*Start field*	*Wind*
Lebeau	535 km. (331 miles)	'Weihe'	Pont St. Vincent	NE
Thaon	500 ,, (310 ..)	'Air 100'	Chavenay	NE
Labar	480 ,, (297 ..)	'Air 100'	Chavenay	NE
Nessler	460 ,, (285 ..)	'Fauvel'	Chevenay	NE
Borgé	432 ,, (268 ..)	'Air 100'	Pont St. Vincent	NE
Lerat	426 ,, (264 ..)	'Weihe'	Persan	NE
Lambert	420 ,, (260 ..)	'Weihe'	Chavenay	SW
Mrs. Choisnet	406 ,, (251 ..)	'Air 100'	Beynes	NE
Pierre	400 ,, (248 ..)	'CM 8-15'	Pont St. Vincent	NE

What will the New Year bring in French soaring? Firstly, an increase in activity at the National Centres, including Challes les Eaux that will certainly be open to sailplanes. Opening had been announced last year, but this decision was discontinued and the Centre received once more only motor planes.

From March, Challes will become a 'mixed' centre with both categories of flying machines, with and without engine, to prepare new instructors like the Montagne Noire Centre.

Second likely event will be a National Contest at Pont Saint Vincent. In fact, no National Competition has been held in France since 1939 and teams taking part in these contests were always chosen by superior decisions. But results did not appear very successful; apart from the brilliant second place of Pierre at Madrid, the remaining team did not occupy favourable classing in spite of considerable effort in machines and equipment. A national competition should find without arbitrary and consequent discussions, the right team, qualified to enter the international field.

Thirdly, lack of money will stop construction of sailplanes in 1953 and pilots must wait for 1954 or 1955 before flying new machines. This situation will be very acute in the Clubs. As a solution, it had been thought possible to join the greatest possible number of Aero-Clubs on a few airfields with a 'concentration' of machines and equipment using the Inter-Clubs Centres formula. Unhappily in most cases unanimity could not be found; each Club declared itself favourable to that idea but provided that concentration was obtained on its own airfield. Then the SALS decided to give each principal district (there are 14 such districts in France) a certain amount of machines and equipment to share between the District Clubs. In 1952 the standard types chosen in the different types of sailplanes have entered in service:

for school the 'Caudron C.801' two-seaters;
for training, the 'Emouchet S.A.104';
for performance, the 'Castel 311 P';

for high performance, twenty 'Air 101,' derived from the well-known 'Air 100' have been built, but are not yet in service.

It is likely that the 'Fauvel' tailless will be chosen in future production plans to be realized in a small batch. The 'Fauvel' should be worth 800,000 francs when price of a classical performance machine would attain three millions built in the same conditions. Besides the details issued in last number of *Sailplane* about the 'Fauvel A.V. 36,' it is interesting to learn that the prototype again proved its virtues in official tests; on the 13th November it was tested with success at speeds of 180 km/hour (111 miles/hour) and accelerations of + 4 g without any vibration or deformation. It is possible that 'Fauvel' in a next future, draws plans of a two-seater, derived from the 'A.V. 36,' of course, with his successful tailless formula.

(*Continued page* 21)

(*Photo: Borgé.*)
Ford Winch being overhauled at beginning of a Soaring Day

ROYAL AERO CLUB CERTIFICATES

CERTIFICATES - "A"	79	(15716-15794)	(Issued under delegation by the B.G.A.
"B"	75		NOVEMBER, 1952
"C"	18		
Silver "C"	1		
Gold "C"	—		

"B" CERTIFICATES

No.	*Name.*	*A.T.C. School or Gliding Club.*	*Date taken*
11336	G. G. Bomford	No. 123 G.S.	9.11.52
13360	B. H. Mathers	No. 68 G.S.	26.10.52

'B' CERTIFICATES—*continued*

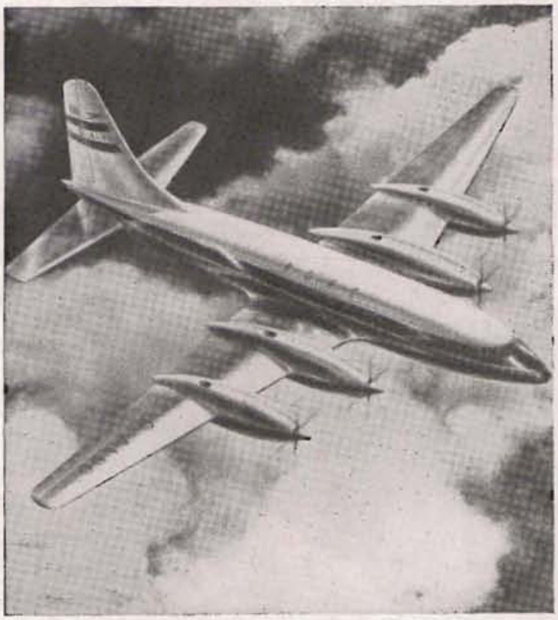
No.	Name.	A.T.C. School or Gliding Club.	Date taken
14026	V. J. Jackson	No. 104 G.S.	25.10.52
14040	D. Richards	Bristol G.C.	4. 9.52
14277	R. Norman	No. 2 G.S.	2.11.52
14536	H. E. Powell	No. 126 G.S.	5.10.52
14727	A. Shucksmith	R.A.F., Halton	2.11.52
14808	N. J. Tarbet	No. 2 G.S.	3. 7.52
15720	F. B. Morley	No. 123 G.S.	15.10.52
15722	R. Faulkner	Moonrakers G.C.	26.10.52
15723	R. C. Mowle	No. 104 G.S.	2.11.52
15724	D. C. Snow	No. 168 G.S.	26.10.52
15727	P. W. D. Ind	R.N.A.S., Culham	27. 8.52
15729	W. L. Barton	No. 168 G.S.	26.10.52
15730	J. C. Bolton	No. 42 G.S.	3. 8.52
15731	D. Houghten	No. 168 G.S.	26.10.52
15732	M. E. House	No. 89 G.S.	5.10.52
15733	R. D. L. Mackie	No. 2 G.S.	2.11.52
15734	H. Lehmann	Midland G.C.	5. 8.52
15735	W. Smith	No. 31 G.S.	2.11.52
15737	G. Stace	Bristol G.C.	5. 9.52
15738	J. M. G. Bennett	No. 203 G.S.	2.11.52
15739	P. J. Clements	No. 89 G.S.	11.10.52
15740	A. Goldman	No. 183 G.S.	17. 8.52
15741	D. B. Hardy	No. 126 G.S.	31. 8.52
15742	P. J. Kemsey	No. 166 G.S.	26.10.52
15743	J. M. Hooper	Surrey G.C.	2. 9.52
15744	G. P. T. Carpenter	Perak F.C.	17. 8.52
15745	J. J. Eatock	Hameln G.C.	16. 3.52
15746	E. B. Sands	London G.C.	31.10.52
15747	T. G. Froggatt	Hereford G.C.	26.10.52
15748	E. J. Rayner	No 166 G.S.	9.11.52
15749	M. Brooks-Smith	No. 126 G.S.	9.11.52
15750	Joan E. Cloke	Southdown G.C.	9.11.52
15751	C. S. W. Harte	Scharfoldendorf G.C.	7. 6.52
15752	A. W. O'Neill	Wahn G.C.	2.11.52
15753	A. G. Peacock	No. 2 G.S.	9.11.52
15754	C. Pearson	No. 31 G.S.	24. 8.52
15755	R. D. Bell	No. 143 G.S.	9.11.52
15756	C. Yarker	No. 23 G.S.	9.11.52
15757	E. Gatley	No. 183 G.S.	26.10.52
15758	W. Kinneax	No. 168 G S	6 7 .52
15759	B G Tibble	No 122 G.S.	9.11.52
15760	B. W. Wilkie	No. 2 G.S.	9.11.52
15761	D. J. Wilson	Surrey G.C.	9.11.52
15763	P. Flucker	No. 2 G.S.	9.11.52
15764	R. Smee	London G.C.	17. 8.52
15765	J. S. Sanders	Yorkshire G.C.	11.10.52
15766	B. J. Huntley	No. 104 G.S.	2.11.52
15767	W. G. Jones	No. 168 G.S.	20. 7.52
15768	J. Kupiewiciez	No. 125 G.S.	9.11.52
15769	E. W. Baker	No. 168 G.S.	16.11.52
15770	R K. Mardell	No. 146 H.G.S.	11. 6.52
15771	D. L. Pay	No. 105 G.S.	9.11.52
15772	J. L. Walford	No. 168 G.S.	16.11.52
15773	R. G. Lang	No. 1 G.S.	29. 6.52
15774	D. M. Carter	No. 23 G.S.	5.10.52
15775	C. N. C. Mitchell	E.T.P.S.	11. 5.52
15776	M. E. Allen	No. 125 G.S.	16.11.52
15777	G. D. Braybrooke	No. 106 G.S.	16.11.52
15778	N. L. Hendren	No. 188 G.S.	8. 6.52
15779	D. E. Horn	No. 168 G.S.	16.11.52
15780	A. H. Oatey	No. 2 G.S.	16.11.52
15781	P. C. Lambert	No. 123 G.S.	17. 9.52
15782	C. L. Hall	No. 166 G.S.	29. 9.52
15783	W. A. Birch	Fassberg G.C.	10. 9.52
15784	E. A. D. Hickman	No. 122 G.S.	9.11.52
15785	J. A. Mathieson	No. 2 G.S.	16.11.52
15786	D. H. Rawlings	No. 48 G.S.	16.11.52
15787	Alison V. Woodburne	Imperial Coll.	8. 6.52
15788	D. A. Bellenini	Wahn G.C.	23.11.52
15789	B. A. Crowdy	No. 141 G.S.	23.11.52
15790	J. R. Lowey	No. 22 G.S.	15. 4.52
15791	R. I. H. McCall	No. 2 G.S.	23.11.52
15794	E. Ingram	No. 2 G.S.	23.11.52

"C" CERTIFICATES

No.	Name.	A.T.C. School or Gliding Club.	Date taken
10820	P. A. Swoffer	No. 7 Area, R.A.F., G.S.A.	26.10.52
11729	J. M. Parkinson	No. 203 G.S.	7.52
12443	G. A. G. Thomas	Deeside G.C.	8.11.52
12796	J. Cox	No. 22 G.S.	21. 5.52
13165	R. Crowe	No. 188 G.S.	26.10.52
14021	V. Biske	Deeside G.C.	3.11.52
14221	B. Parker	No. 23 G.S.	26. 8.52
14266	J. E. Hubble	Derby & Lancs.	25. 8.52
15093	E. Walker	R.A.F., Thornhill	14.11.52
15734	H. Lehmann	Midland G.C.	9.8.52
15744	G. P. T. Carpenter	Perak F.C.	19.9.52
15745	J. J. Eatock	Hameln G.C.	6. 4.52
15746	E. B. Sands	London G.C.	6.11.52
15747	T. G. Froggatt	Hereford G.C.	1.11.52
15751	C. S. W. Harte	Scharfoldendorf	2.11.52
15765	J. S. Sanders	Yorkshire G.C.	28.10.52
15767	W. G. Jones	No. 168 G.S.	29. 9.52
15775	C. N. C. Mitchell	E.T.P.S.	11. 5.52

SILVER "C"

No.	Name.	A.T.C. School or Gliding Club.	Date taken
404	C. N. C. Mitchell	E.T.P.S.	11. 8.52



The aeroplane

The Bristol Britannia airliner.
At present undergoing tests before entering service with B.O.A.C. Four Proteus turbo-prop engines give the airliner a 5,600 mile non-stop range. Span 140′, length 114′.

the pilot

46-year-old "Bill" Pegg has been in aviation ever since he joined the R.A.F. as an air-struck apprentice of 15½. Now he holds a well-earned O.B.E. after 17 years with "Bristol", 5 as chief test pilot. One of his greatest moments was piloting the enormous Brabazon I on her maiden flight. Has now flown over 5,000 hours in 180 different types of aircraft — including the new Britannia. Says he has "always found Shell and BP Service efficient and courteous."

SHELL and BP Aviation Service

Shell and BP Aviation Service is much more than a fuel lorry and a length of hose. It's a service used by everyone who matters in aviation. Manufacturers for their engine tests. World wide airlines. Local charter companies and the chap down the road who goes up on Saturday afternoons. You too can use it at all the major airfields in Britain.

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