Feb. 13, 1931. Vol. 1. No. 23.

THE SAILPLANE AND GLIDER

Price 3d.

AUTO-TOWING.

Mr. Lowe-Wylde demonstrates at Hooton what liberties can be taken on a towed glider. The rope to the left and the aeroplane to the right are nearly invisible.



GAINING SUPPORT AND WASTING TIME.

According to an American contemporary, *The National Power Glider*, 25,000 people attended during the early days of last December the first National Glider Exposition which was held in the ballroom of the Park Central Hotel, New York.

Now this is an idea which ought to have occurred to us before and we bring it very strongly to the notice of *The British Gliding Association*. First as a means of arousing public interest, second as a way of selling gliders and thirdly as means of increasing their own funds, which need is accepted as imperative.

Arousing public interest is a necessary task. There are 5,000 people interested in gliding out of a population of 48 millions, something ought to be done about the odd 47,995,000. The press has drawn, and will continue to draw, attention to the sport but photographs and news must be thrilling or exciting before they receive publicity. Thus our chief object is destroyed.

Motorless flying is exciting, it is a good sport and a fine scientific achievement as well, but it is not sensational, it demands assiduous practice, intelligence and physical fitness. That is to say it requires recruits from the best part of our population, and not merely those who are sick for sensation, who would rather look on anyway than do anything. The sensational news and pictures will not appeal to the people we want. Big gliding demonstrations are valuable but they are too brief and there is little opportunity to explain to those interested the actual way in which difficulties are overcome and flights achieved.

If exhibitions can be held in our big cities you have a chance of focussing attention upon the equipment of the Gliding Clubs. Every type of sailplane and glider in the country that can and has flown can be shown. Members of *The British Gliding Association* and manufacturing firms can be on hand to answer questions.

Some very fine films are available. These should be com-

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bined with a loudspeaker arrangement, as talkies are not yet available, and should be on continuous show to explain the practical side of activities of the Clubs. Thus the Movement can be brought to the very doors of those who as yet have hardly heard of it.

Manufacturers showing their latest types will be able to book orders and those who specialise in auto-towing will obviously be able to stage demonstrations very close to the exhibition.

The gate money should be a very useful contribution to current Association expenses. It would be necessary to advertise; this could be done by drawing attention editorially to the novelty of such an exhibition and also by properly organised display advertisement.

A comparatively small hall would be needed; it might be possible to hire an empty schoolroom; we seem to remember noticing one as we came down Bond Street. The showroom would probably be an excellent idea as it would attract inside the casual passer-by.

Let *The British Gliding Association* start with London and then tour the provinces. Most gliders have trailers and there should be very little difficulty in transport. In the provinces the local Clubs would be able to give valuable assistance and would also be able to augment their membership.

Wasting Time.

Elsewhere we recount the activities of the energetic British Aircraft Company at Hooton. The statement has been made that the gaining of four "A" Certificates in the brief space of an hour on that occasion has not been done before. We do not wish to lessen in any way the achievements of this pioneering firm who have attacked with energy and resource the problems which beset the Gliding Movement.

But why give "A" Certificates to power-pilots? It seems to us like giving a certificate of Matriculation to someone who has just taken a Degree with Honours. If the power-pilot cannot make a straight flight of 30 secs. with a dead engine and a curving flight of 60 secs. in a similar condition, then he ought not to be a power-pilot. People point proudly to our long list of 102 "A" Certificates; half of them mean nothing.

The whole system of F.A.I. Gliding Certificates were designed as part of intensive aviation propaganda in a country which was prevented from training on the usual lines. It was part of a scheme for making a people airminded; Certicates were not intended as insignia to hang upon the coats of full-fledged aviators.

The idea was that you got your pupils. You worked them to death by pulling Zoglings about till they flew in a straight line for 30 secs. When they had achieved this and showed some ability to control a machine in the air you encouraged them by giving a Certificate. When they had progressed a little further you gave them another; and then when all the duds had been weeded out and the pupil really had achieved something you gave him the three seagulls and a "C" Certificate.

Let the Royal Aero Club save its valuable time and merely issue Certificates to power-pilots who can show their ability to soar. The "A" and "B" can be taken for granted. The two first stages are essentials in the development of *ab initios* but a waste of time for power-pilots. You do not give Einstein a school certificate!

TOWED-FLIGHT AT HOOTON.

On Feb. 7 and 8 the B.A. Company, headed by Mr. Lowe Wylde, put up a demonstration at Hooton aerodrome, the headquarters of the Liverpool and District Aero Club. This was most successful.

On Feb. 7, Saturday, the conditions were not at all favourable. The 5 m.p.h. wind was geographically in the worst possible position. Mr. Lowe Wylde on the B.A.C.VI made a number of successful flights and in the evening flights were made by Squadron Leader Williamson, who is Chief Flying Instructor at No. 5 F.T.S., Sealand, by Mr. Davison and Mr. Moulsdale.

The next day it rained in the morning but in the afternoon there was a wind of 20 m.p.h. Several complete circuits of the aerodrome were made by Mr. Lowe Wylde. Later four members qualified for their "A" Certificates, these were Mr. Davison (32 secs.); Mr. Moulsdale (58 4-5 secs.); Sq. Ldr. Williamson (52 4-5 secs.); and Mr. Fresson (45 secs.). These four Certificates were gained in the space of one hour.

One of the features of the B.A.C. machine which came in for very favourable comment was the rapid way in which it was put together. The simplicity of the fittings, and of the whole structure, makes assembly remarkably easy. If later the B.A.C.VI proves able to soar in low winds it will be a very useful machine for Clubs to possess. We suggest that Mr. Lowe Wylde takes a holiday from auto-towing and breaks the British duration record with the B.A.C.VI.

The demonstration aroused a lot of local interest and the formation of a gliding section of the Liverpool and District Aero Club seems imminent with a subscription of three guineas.

These auto-towing demonstrations of Mr. Lowe Wylde and the British Aircraft Company are doing a tremendous lot to introduce a form of motorless flying which is equally applicable to Light Aeroplane Clubs and Gliding Clubs. Under *competent* supervision auto-towing is the cheapest form of instruction available; coupled to this is the fact that the pupil, from the start, has to make a forced landing every time he leaves the ground. He is thus from the start inured to a form of landing which to the ordinary pilot is a contingency to be avoided.

THE I.C. GLIDING CLUB DINNER.

On Wednesday, Feb. 11, the Imperial College Gliding Club held their first Annual Dinner. This was preceded by a lecture before the College Engineering Society by Professor Bairstow. Owing to the fact that the Zditor of The Sailplane did not get back from these notable occasions until after midnight and because our printers cannot be expected to cope with copy so shortly before publishing the paper, the report will have to be held over until next week, when the full importance of the occasion will be explained.

"SAILPLANES" WANTED.

Herr Lippisch is anxious to complete his file of The Sailplane, but as all the early numbers are sold out, we cannot help him from this office. If anyone has early numbers which they are prepared to sell, will they please write the Editor quoting the numbers available and the price required.

A GROUP TO BUY THE BRANT SCUD?

There is a move afoot in and around Manchester to form a group to buy the Brant Scud. This group of advanced pilots would concentrate on intermediate training with this machine.

People who are interested should get into touch with Mr. G. Moore, 10, Crafton Street, Rusholme, Manchester.

HARROGATE ORGANISES A COMPETITION.

The Harrogate Aircraft Club is holding a small informal competition at their Weeton Flying Ground on Sunday, Feb. 22, or, if wet, Sunday, Mar. 1. They are hoping that all the Clubs whom they have invited, and who are situated somewhere near, will turn up. The H.A.C. is presenting a cup to the winning Club—which they are to hold until the next competition.

The competition will be run on the distance method; the Club having the greatest distance flown to their credit, winning. Teams of 6-8 men are necessary. It is hoped to make these local competitions, organised by the H.A.C., a monthly occurrence.

The competition is organised and will be run by Mr. H. S. Crabtree, who is acting as Hon. Sec. for competitions to the H.A.C. Inquiries should be addressed to H. S. Crabtree, Fairmount, Queen's Drive, Ilkley.

A DEMONSTRATION AT BOLTON.

The Bolton Light Aeroplane and Gliding Club are holding a two-day meeting on Mar. 7 and 8. Herr Magersuppe is to give demonstrations throughout the meeting. No information as to the site is yet to hand.

SAILFLYING COURSES AT ROSSITTEN, 1931.

The courses of the Rhön-Rossitten Gesellschaft at the Rossitten Sailplane School have been fixed for 1931 as follows:—

April 1 to 30.—Course for Beginners and Advanced Pupils, and a Lecture Course.

May 1 to 30.—Course for Beginners and Advanced Pupils, and a Lecture Course.

June 1 to 27.—Course for Beginners.

July 1 to 31.—Course for Beginners, Ladies and Advanced Pupils.

Aug. 3 to 29.—Course for Beginners, Ladies and Advanced Pupils.

Sept. 1 to 29.—Course for Beginners and Advanced Pupils, and a Lecture Course.

The last possibility of instruction for Beginners and Advanced Pupils will be in the month of October 1931. Holiday Courses for school children are to be held from March 30 to April 13, and from October 1 to 14.

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THE DEVELOPMENT, DESIGN AND CONSTRUCTION OF GLIDERS AND SAILPLANES.—II.

[*The first part of Herr Lippisch's lecture before the R.Ae.S. was given last week.*—ED.]

Before I go into the details that determine the carrying out of the design of a glider or sailplane, it is necessary to discuss briefly the physical basis of soaring flight, of which there are two possibilities. First, static soaring flight, which depends on the presence of rising air currents. Second, dynamic soaring flight, which depends on the presence of air currents varying in direction and strength.

Horizontal flight in an upwind takes place when the rising speed of the air is equal to the sinking speed of the aircraft. Therefore the best aircraft is the one which has the least sinking speed. This sinking speed may be derived in the following manner. The following conditions must be fulfilled:—

Weight = resultant air force.
Tan wind direction = drag/lift.

or expressed in formulæ:—

$$W = \sqrt{(L^2+D^2)}.$$
$$\tan\epsilon = D/L.$$

that is

$$\sqrt{(L^2+D^2)} = \sqrt{(k_L^2+k_D^2)}S\rho V^2 = k_R S\rho V^2$$
$$V^2 = V^2\sin^2\epsilon = V^2[1+(k_L/k_D)^2] = V^2(k_R/k_D)^2$$

accordingly the sinking speed is

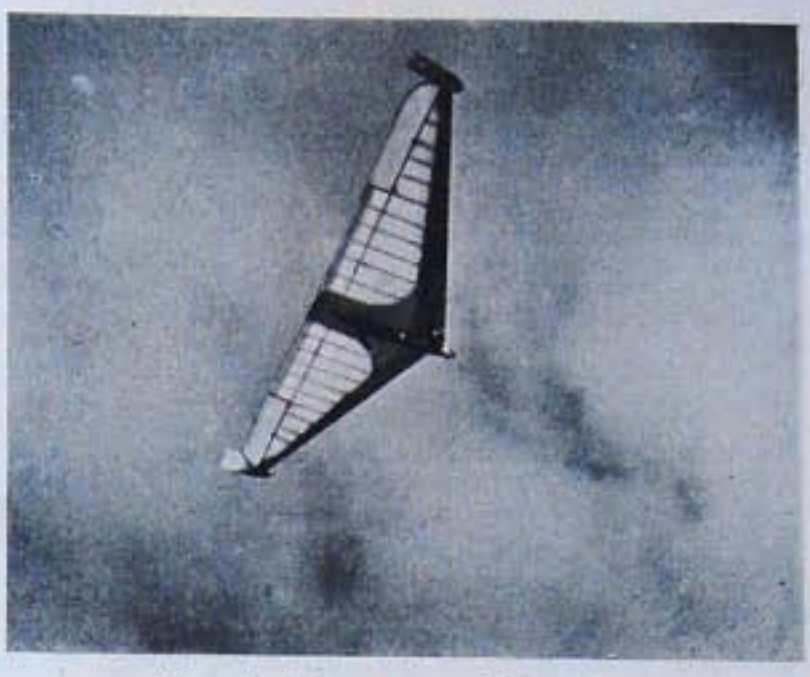
$$V = \sqrt{(W/S\rho)} \cdot k_D/k_R^{1.5}$$

when one considers that the lift coefficient approximates to the total air force coefficient, and when one assumes normal air density and lets $S = 4s^2/A$, one obtains

$$V_z = 10.3\sqrt{(W/s^2)} \cdot k_D/k_L^{1.5} \cdot \sqrt{A} \quad \text{(in ft.-sec. units)}$$

The derivation with W/s^2 and A is better, as one can clearly see the direct effect of the span on the sinking speed. We call this function W/s^2 the span loading. In the second factor $(k_D/k_L^{1.5})\sqrt{A}$ the aerodynamic characteristics of the aircraft concerned are brought together, and we can calculate this factor for one or several wing sections in dependence upon the parasite drag and A. You will see that one can calculate by these means all the necessary facts for a projected design or for checking purposes. It must not, however, be assumed as a result of the above elementary details that a low sinking speed is the only measure of the worth of a sailplane.

Apart from this the gliding angle and the necessary forward speed at the smallest sinking speed is very important. Generally speaking, one tries to achieve a good range of attitudes with low sinking speed, and at the same time good gliding angles. For one thing, the pilot cannot always be flying at the minimum sinking speed, and on the other side the continual variations in the wind direction and strength are always changing the attitude of the aircraft. Thus, for the purpose of attaining the smallest possible deviations from the most suitable attitude, quite a large number of other facts must be considered. The most important ones



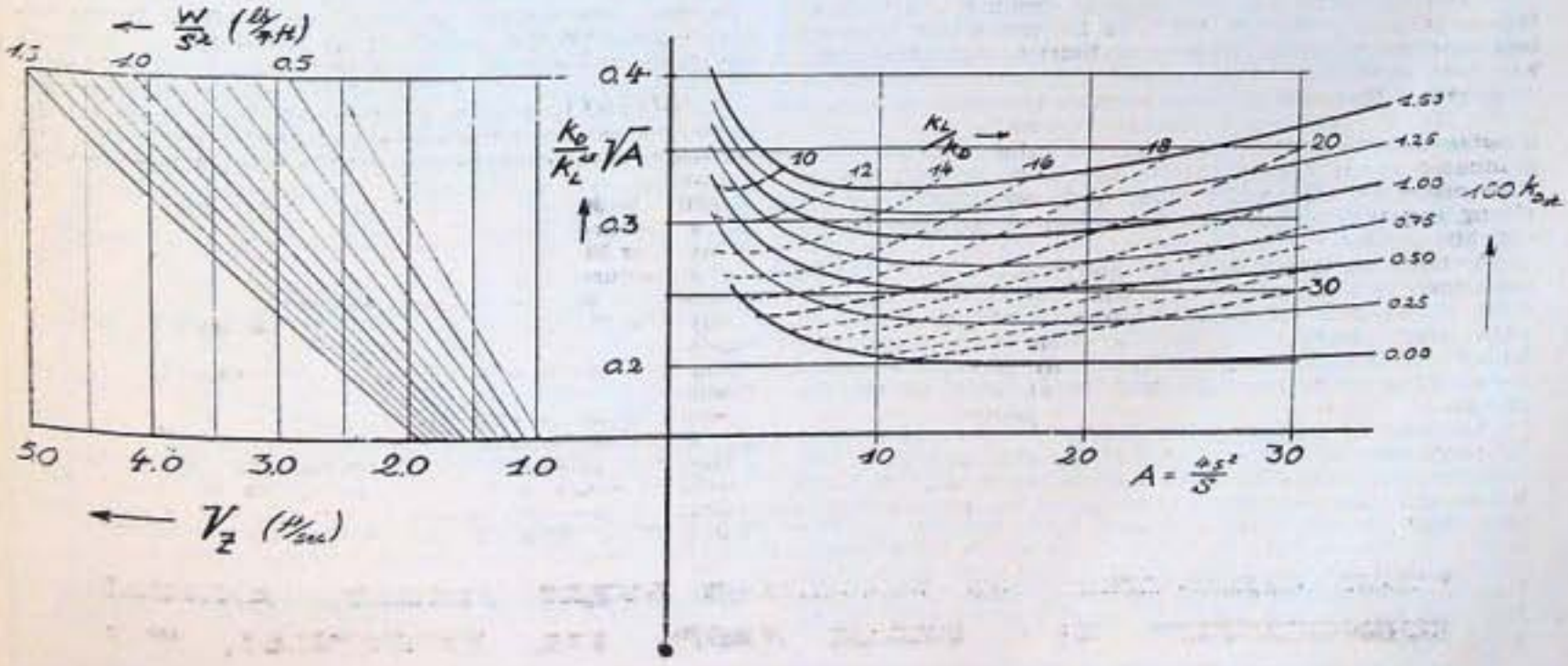
The first stage: a model in flight.

are: Stability, especially longitudinal stability; manœuvrability, even in unusual flight attitudes; and sufficient flying speed. In discussing the aerodynamic basis of sailplane design, I will go into these questions in detail.

Only in the last couple of years in the development of soaring flight has it been possible to make use of the great atmospheric upwind areas. It is thus only too easy to understand that in the times when human soaring flight had not yet been achieved, many phenomena in the natural soaring flight of birds, due to ignorance of these upwind areas, could not be explained as static soaring flight. I would like to make reference here to the extremely interesting explanation of the theory of soaring flight by your countryman F. W. Lanchester in the second part of his Aerodynamics, in which he writes a very thorough discussion of the matter.

For this reason the name of that other type of soaring flight, "Dynamical Soaring Flight," originated from Lanchester. This kind of flight is made possible due to the fact that irregularities in the wind without an average upward movement are present. I will show you, by means of a simple example, how this "dynamic soaring effect" can occur. The bird which flies forward with the help of wing beats receives the necessary forward thrust through the considerable up and down movements of its wings. The horizontal motion implies, then, that the up and down moving parts of the wings follow a path of wave form

Graphs for calculating sinking speed.



relative to the air. If one fixes, as a first approximation, the path of the chief moving wing parts as a sine curve, one can calculate the course and variations of the vertical and horizontal air forces which are caused by such a motion. When the forces are integrated over a period of one complete oscillation, there is a definite forward thrust and lift.

Let us now assume the air to be in such a motion of oscillation due to friction with the earth's surface or to variously moving air masses. By flying through this air in an aircraft with stationary wings the above mentioned vibration effect would occur. As both forward thrust and lift result, it must be clearly possible to soar in such layers without the help of actual upwind. This effect, which is caused by the periodically changing vertical speed of the wind, is called the "Knoller-Betz effect" and played a great rôle in the first years of soaring flight.

If, for the polar of a given wing, one substitutes a parabolic function of about the form

$$k_D = a k^2_L - b k_L + k_{D0}$$

in which $a = S/4s^2 + \text{const.}$, the increase of the induced and profile drags being considered, one finds that the average coefficient of the horizontal air forces is

$$k_X = \tan \phi \, . \, k_L - k_D$$

The curve followed by the wing relative to the air is expressed as

$$Y = m \sin X$$

while the variation of the lift distribution caused by the change in the direction of the air motion along the length of a complete oscillation can be expressed as

$$k_L = k_{Lm} + \Delta k_L \cos X \ (m \text{ denoting mean value}).$$

One could also give the wing a variable angle of incidence to better the effect. As you see, there is no forward thrust if there is no change in lift along an oscillation, or if one keeps the angle of incidence with respect to the air constant. The maximum forward thrust occurs for

$$\Delta k_L = m/2a$$

and then amounts to

$$k_{X\max} = m^2/8a - k_{Dm}$$

This great variation in lift makes it necessary to have the wing polar as straight as possible. Of course the above considerations are only approximate and disregard acceleration forces.

Even although this effect has never yet occurred to any traceable degree, wind channel tests undertaken by the Vienna Aerodynamic Institute check qualitatively with the above considerations

It is obvious that horizontal oscillations of the wind could cause similar effects. Consider for a moment a wing flexibly mounted on a fuselage. A strengthening of the wind would cause an upward movement of the wing, and by means of the energy collected in the sprung connection, a forward thrust could be exerted in the following lull by means of the downward beat of the wing. The motion of the wing is thus caused by the pulsation of the wind, so one can consider the aircraft as "an aircraft driven through wind pulsations by wing beats."

This effect which, as far as I know, was first discussed by W. Birnbaum (Z.F.M., 1924, page 128), reveals a number of matters connected with the performance of cantilever sailplanes of large span in very gusty winds. The superiority of this type over the stiff-winged braced types is very striking. Nevertheless, this effect is very small, and is only of secondary importance as compared to upwinds. In spite of this it is, in my opinion, not wise to ignore this dynamic soaring flight entirely. So long as there exist no incontestable tests carried out with suitable aircraft, it is premature to disregard this kind of soaring flight.

Modern Sailplane Design.

I would now like to consider the aerodynamical and statical bases which determine the design of modern gliders and sailplanes. The glider which is to be used mainly for elementary training is not supposed to have a high performance. This gives one the opportunity to fit the aircraft to the purpose of training, and to give first emphasis to safety. It is basically wrong to wish to design such aircraft with the lowest possible sinking speed or especially good gliding angle. One doesn't learn to ride on racehorses! It is therefore idle to waste many words over the aerodynamic principles underlying the design of elementary gliders.

The choice of a wing section showing a flat curve at high lift coefficients is important so that one can pancake or pull the stick pretty far back in flight (slots are certainly suitable here). It is also important to make all control areas suitably large, through which one must try to combine stability with effective control. Such machines which have insufficient control are unsuitable, for the pupil must know when he has made a false control movement. But I think that last year Mr. Stamer went into these matters with you in great detail.

In the design of a sailplane, as you have already heard, the sinking speed and then the gliding angle are of the foremost importance, and that means that, inside practical limits, we must try to get the best combination of span, empty weight and cost. Of course one starts by trying to find the best possible wing section. When one, after a long search, has actually found a really wonderful wing section, and designed the wing accordingly, one is again in doubt as to which aspect ratio one should choose, and whether or not a change of the wing section would be better in this case, and so on

The more one works himself into the problem, the more new problems crop up, so that one is finally left to one's discretion In time such a wandering about is not very satisfying, so that one begins to look for a method which, on the basis of test results and theoretical considerations, would give a general solution of the problem.

We begin with the wing section. As the characteristics of any one wing section cannot give a general view of the problem, in which the probable inaccuracy of single results is to be especially noted, we try to make a systematic determination of values from a large number of tests. We eliminate the induced drag, and then sketch all the profile drag curves together. Diagrammatically, we get somewhat the following picture: you see that we can substitute a general polar for all the individual polars. The best part of a curve then lies in the neighbourhood of the point of contact with the general polar. Any further calculations we make using the general polar. If by means of this representation we decide on a certain part of the general polar as the most useful in any special case, we choose that section which is tangent at this point of the general polar.

We can now substitute the general polar by a suitably chosen function. If, however, we want to achieve a fairly satisfactory agreement, we must use a function of at least the third order, and then the analytical development is very difficult. Therefore we use a mixed graphical analytical method. We have already shown that the sinking speed can be expressed as

$$V_s = 10.3 \sqrt{(W/s^2)} \, . \, k_D/k_L^{1.5} \, . \, \sqrt{A} \ \text{(ft.-sec.)}.$$

and to determine $(k_D/k_L^{1.5})\sqrt{A}$ generally, the polar of the complete aircraft is replaced by

$$k_{DA} = (1/A\pi) k_L^2 + k_{D\infty} + k_{Dst}$$

in which

$$k_{D+} = \Sigma k_D S'/S, \ k_{D\infty} = f(k_L)$$

then

$$k_{DA}/k_L^{1.5} = (1/A\pi) \, k_L^{0.5} + (k_{L\infty} + k_{Dst}) k_L^{-1.5}$$

By differentiating through k_L we get the desired minimum

$$d(k_{DA}/k_L^{1.5})/dk_L = k_L^2/2A\pi + (dk_{D\infty}/dk_L) k_L - 1.5(k_{D\infty} + k_{Dst}) = 0$$

So that we obtain the equation

$$A_{best} = k_L^2 / \{ \pi (\Phi + 3k_{Dst}) \}$$

and then also

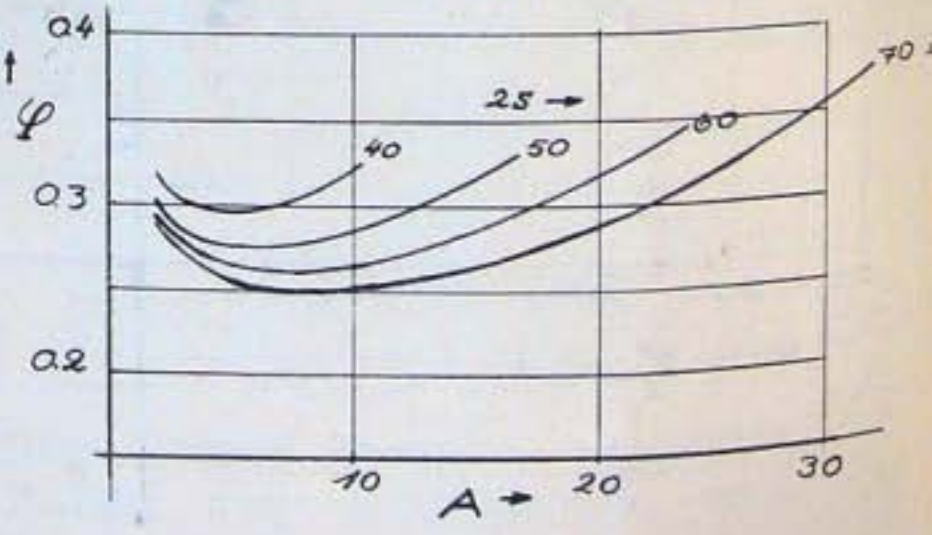
$$(k_{DA}/k_L^{1.5}) \sqrt{A} = (1/\sqrt{k_L \pi}) \{ (\Phi + k_{D\infty} + 4k_{Dst})/\sqrt{\phi} \} = \Phi$$

The expression

$$\Phi = 3 \{ k_{D\infty} - (dk_{D\infty}/dk_L) (k_L/1.5) \}$$

can be determined for the individual points of the general polar and we can get the aerodynamic sinking speed coefficient $(k_D/k_L^{1.5}) \sqrt{A}$ expressed in A and k_{Dst}. In further calculations, for the sake of simplicity, I will designate this expression by ϕ.

In the same manner as for ϕ, one can also fix the lift-drag ratio, and also sketch it on the diagram. Although the use of the general polar is in this case not quite exact (the actual values of the individual sections would be somewhat smaller) it is quite good enough for a check calculation. The shape of the curve $\phi = f(Ak_{D0})$ shows first that the coefficient ϕ changes only a little when A has a greater value than ten and secondly, the minima of ϕ lie between





The second stage: the full-size two-seat glider.

$A=10$ and $A=20$. Aspect ratios over 20 are then unfavourable when considering the least possible sinking speed. Merely the improvement of the gliding angle requires a large aspect ratio. And now to be able to judge the conditions for some definite design, we must either decide on the wing area or the span. Then it is still necessary to evaluate the parasite resistance. The existing results in this connection from experiments show much smaller values than those actually shown in flight tests. When one, for example, knows the sinking speed of a sailplane by calculating the same from barographs or test flights, and has further measured the gross flying weight and the span, then φ is determined as

$$\varphi = V_z / 10.3 \sqrt{(W/s^2)}$$

If one sets the values found in the diagram over the A concerned, one can determine the value of k_{∞} and also, of course, the so-called "reduced drag area," or $\Sigma K_D S'$, where k_D is the drag coefficient of the part concerned and S' the area of same normal to the wind direction. I have placed these points for three well-known high performance sailplanes on the diagram, and found as a result that the average value for the reduced drag area is

$$\Sigma K_D S' \text{ (average)} = 4.6 \text{ sq. ft.}$$

Even although these values seem very great, and one might assume that the machines concerned were not flown to the best advantage, it would be well to use these values in working out projects, as most aircraft are considerably better on paper than in the air

To make use of this diagram further. If, for example, we want to build a sailplane with a span of 50 feet, we

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calculate the necessary wing area and aspect ratio for various k_{ya} with the help of the above values and $\approx k_{ya}S'=4.6$, so that one can place these points on the diagram. From this we can clearly see the effect of change of wing area or of change of aspect ratio. In this connection comes the conclusion that the lift-drag ratio is only noticeably affected by lower aspect ratios. Even from $A=8$ on the change of the lift-drag ratio is very small. This result is also notable and shows the disadvantage of using too large aspect ratios.

In our determination of the sinking speed we have still to estimate the empty weight. For this purpose I have collected a number of actual weight figures, and have attempted to show an analytical connection between this static material. In accordance with a derivation by Dr. Lachmann, I have let the wing weight be

$$W'=mS+s^2/n.$$

Further, let the fuselage weight be

$$W_f+k.s$$

in which, for this approximation, the weight of the empennage is added to that of the fuselage. The experimental results show that these formulæ can be safely used. The gross flying weight may now be expressed as

$$W_{total}=m/S+s^2/n+ks+W_s$$

where W_s=weight of pilot and equipment. Now the span loading is

$$W_{tot}/s^2=m/A+s/n+k/s+W_s/s^2.$$

The coefficient concerned may be expressed as

$m \sim 0.78$ [lb./sq. ft.] $n \sim 1{,}000$ [ft.²/lb.] cantilever
$k \sim 4.4$ [lb./ft.] $n \sim 1{,}840$ [ft.²/lb.] braced.

For our design, which we shall consider as being cantilever, we obtain the curve of sinking speed plotted as a function of the area. It can also be seen here that in no case does an extremely large aspect ratio, *i.e.*, small area give the smallest sinking speed. Although there is no exact relationship expressing the effect of the gliding angle on the "soaring ability," and the general worth of a design, it would seem to be better to use the larger aspect ratios.

If we now go into the design in more detail, we will draw a so-called "speed diagram," using as a basis the now chosen wing section and the calculated values of the final design.

One tries to obtain as flat a curve as possible, which can be achieved through the choice of a good aspect ratio. The mean value of the sinking speed, as influenced by changing the air speed, would not vary very much from the best value. Such a diagram is of special importance for pilots who wish to carry out long distance flights in the aircraft. The parts of the flight during which there is no upwind must obviously be so flown that the gliding angle with respect to the earth is as good as possible. Because of the effect of the wind (head or following) this angle is different to that relative to the surrounding air.

With the use of the speed diagram the flight attitudes concerned are easily determined, as one fixes the best attitude by lessening the airspeed in case of head wind or increasing it in the case of following wind. One realises that it is correct to fly at higher speed with head wind and at lower speed with following wind, rather than fly at the best gliding angle. If there is upwind or even downwind present, one must subtract it from, or add it to, the sinking speed, as the case may be, and then one obtains the best flying attitude by consideration of both effects.

I can unfortunately not go very deeply into the other matters which decide the detail construction of the aircraft. First of all, the designer must always realise that even the machine which is aerodynamically best will be incapable of good performances if the flying qualities are not also good. If the pilot has not perfect trust in his machine and does not know whether she will leave him in the lurch in a difficult situation, it would only be possible under especially good conditions for him to achieve good performances. Because of this it is my opinion that, if it is necessary, it is best to sacrifice a certain amount of aerodynamic efficiency to achieve good flying qualities.

The large spans of sailplanes are naturally only practicable when one uses wings tapered in plan-form. The rectangular plan-form has static and dynamic disadvantages, which cannot be disregarded even for reasons of cheapness of production. This holds true in the same way for the design of engined aircraft, and although there are even to-day many people with the opposite viewpoint, I can only advise them to go to the shipbuilders and tell them that it would really be the best thing for them, to build all their frames the same shape and size! The answer that the shipbuilders would give, is also my opinion.

One could base one's choice on the induced drag of these forms which could be worked out by H. Glauert's method. You will, however, find that there is very little difference between the various forms if they do not deviate too much from the elliptical lift distribution. The effect of the plan-form on the manœuvrability is more important. To achieve good control action, one must make sure that in the case of stalling the air-flow breaks away first from the inner portions of the wing. Then one still maintains lateral stability. The shape of the ailerons should guarantee that there is a reasonably large chord right to the outer ends. Swept-back and twisted wings have shown very pleasant flying characteristics. Such forms are practically spin-proof. The training sailplane *Falke*, which I have designed has confirmed the experience made many years ago. The best position of the fuselage with respect to the wing cannot yet be laid down definitely.

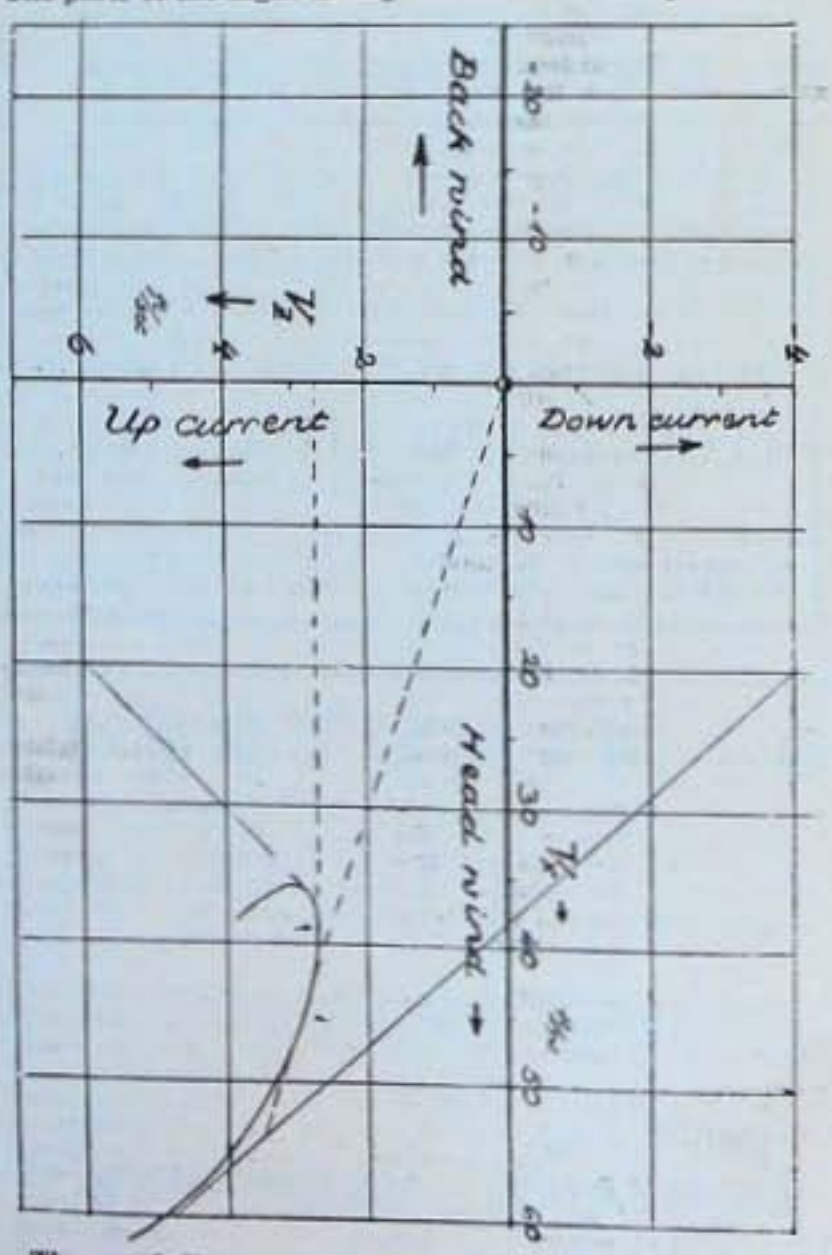
The static construction of sailplanes is to-day almost always of the *Vampyr* type. One spar at the thickest part of the wing, about 30 to 35 per cent. of the chord from the leading edge takes the bending moments. The forward part of the wing, built up as a box or tube, resists the torsional forces. A lighter secondary spar serves as aileron-attachment spar, and to connect the rib-ends together. The shearing strength of the nose-wing covering can, however, only be guaranteed when the ribs are close enough together to prevent any possibility of the covering buckling. Otherwise folds will appear before the breaking stress is reached.

In my experiments I have found that by using plywood attached with grain diagonally over leading edge, the breaking strength is twice as great as normal and the stiffness four to five times as great. A spar built as a thin-walled rectangular box is theoretically best, and is used generally in metal aircraft at present. How to make the thin walls perfectly or suitably stiff with wood construction and also lightly is, however, still a matter for discussion. One is therefore forced to use more material than is necessary, so that the advantage of the construction is only very small. There must be tests carried out in this direction to make the matter clear.

A very important matter is the stiffness of the wings to resist bending and torsional vibrations. The latter can be completely overcome when one places the elastic axis of the wing in front of the most forward position of the centre of pressure. Apart from this one must be careful that there is no aileron flutter present.

These latter as well as other parts of the outer wings must be very lightly built for this reason. The bending stiffness of this large-span cantilever is in the first place dependent on the height of the spar considered in relation to the length of the cantilever, and also on the load (lift) distribution. Thus in every respect the tapered wing is superior to the wing of rectangular plan-form. The same can be said for the torsion resisting structural members.

If one compares two wings of the same span and area, one with a rectangular and the other with a tapered trape-



The speed diagram which is essential for distance flights.

scidal plan-form and assumes the same wing-section and angle of incidence, calculations show that by the use of a tapered wing 50 per cent. in weight is saved in the nose covering and spar flanges. For the same loading, the bending and twisting is much greater for the rectangular wing than for the other.

For large spans, the most favourable, as far as weight is concerned, is the braced (*Professor-Wien*) type. The extra drag of the struts is almost neutralised by the use of a thinner wing section. This type is only reasonable when torsion and bending can be taken up by the struts, as the torsionally stressed parts are at least as heavy as the parts stressed in bending.

We can, of course, not exactly say what is the very best type of wing. Nevertheless, calculations which take into consideration both the aerodynamic and statical points of view are very informative. All these considerations are not only applicable to sailplane design. As far as design is concerned the construction of sailplanes is really a natural experiment plant for all problems connected with power aircraft.

Fuselages of high-class sailplanes are nowadays always of round or elliptical cross-section, and covered with plywood. The three-longeron type with a rounded edge underneath is simple to construct and fits the shape of the sitting man very well. In smaller training aircraft the fuselages are four or six-sided structures. Fuselages of extremely small cross-section permit, of course, only the use of wheel control. For high-performance sailplanes this control is therefore generally used. The control surfaces are designed in the same manner as the wing.

In high-performance sailplanes the pendulum type of elevator is generally used. The construction of the fuselage end like that of the *Professor* or *Wien* is usual. In the case of primary training aircraft the regulations state that the horizontal control surfaces must consist of a fixed tailplane and elevator. There have been no accidents caused by the use of the pendulum type elevator. One must only choose the gear ratio correctly.

In Germany the following regulations guide the strength calculations for gliders and sailplanes.

WING.

Loading case I. Stress corresponding to flight with most forward position of centre of pressure. Factor of safety, 6.

Loading case II. Stress corresponding to flight with maximum torsional load. Factor of safety, 1.

Loading case III. Stress corresponding to a landing (wing weight as load) 6-8 safety factor.

FUSELAGE.

Loading case I. Stress due to load on empennage. Breaking load of empennage is breaking load of fuselage.

Loading case II. Stress by landing. The wing loads are 6-8 times breaking load.

Loading case III. Stressing of wing-fuselage connection by landing on wing. Breaking load 110 lb. applied at wing tip in direction of wing chord.

EMPENNAGE AND AILERONS.

Elevator and rudder: Breaking load 31 lb./sq. ft.

Ailerons: Breaking load 16 lbs./sq. ft.

The polar diagram of the wing and of the complete aircraft must be used in the strength calculations. A proof of the static stability is also necessary.

You will perhaps be surprised that we have only taken two cases of loading into account in the strength calculations for the wing. But I do not see what use a point between the most forward position of the centre of pressure and diving flight would be. The consideration of case (I) proves whether there is enough strength to take care of bending and forward thrust. The consideration of case (II) proves whether there is enough strength to take care of torsion and backward pressure. These cases take care of the extreme forces. Years of experience have shown that the above strength demands are enough. Apart from the above the same methods and bases may be applied and used in sailplane design as are used in power aircraft design. The many detail questions, which would doubtless be very interesting would, I fear, take us too far from our subject.

MOTORLESS FLIGHT AND AVIATION.

Finally I would like to consider the relation of motorless flight to power-driven aircraft. Last year Mr. Stamer told you about the value of gliding as flying training. Therefore I do not need to repeat that the pilot who has learned to master a light sailplane in wind and clouds, has gathered experience for his whole flying career which could never be so clearly taught in a power-aircraft flying school. Soaring flight has brought new knowledge to aerometeorology, and the new researches on the vertical movement in the atmosphere have at least been stimulated by soaring flight.

Since the end of the war (1914-18) aircraft have begun to be used for commercial purposes all over the world. This air traffic has grown from year to year and to-day covers wide districts of various continents. There is air traffic everywhere except where its proper field of activity is, that is there is no air traffic *between* continents where rapid communication is really necessary, and where air traffic could actually "fly by itself" or pay its way. Now I ask you, what is the use of this fastest of all means of communication, if it has no use in its proper field of activity? And what is the sense of this much-advertised speed when it is only procured by a phenomenal waste of energy? I cannot help but think that the main problem of this means of communication, that is, the economics of it, is carelessly handled.

What would you think of anyone who equipped a farmer's waggon with a 100 horse-power engine and drove from petrol station to petrol station at sixty miles an hour. The most sensible thing to do would be to advise him to use ball-bearings to cut down the frictional resistance of his vehicle. Perhaps you laugh at all this, but you must admit that most of our present-day aircraft have not as good a frictional coefficient as our original farmer's waggon (without ball-bearings!) Even the waggon would roll down a grade of 1:15 by itself; but can you tell me of an aeroplane which has a gliding angle as good as 1:15? The only aircraft which can compete with this honourable rival are a couple of high-performance sailplanes which struggle for the first prizes every year on the Rhoen. The comparison shows you where you must start to develop economical aircraft.

The energetic reduction of the frictional coefficient is a vital necessity in aircraft design. One could, of course, make these tests in a wind channel and that is the usual thing to do at present. One soon notices that the wing alone has always a better gliding angle than the whole aircraft with fuselage and empennage. Then it would be clearly the best thing to do, if one tried to build an "all-wing aircraft." But why don't people build such aircraft? Quite obviously because one sees no possibility of safely developing the aircraft from the wind channel state to full size. There is one perfectly safe and proved method and that is called motorless flying.

This method was actually known since the beginning of aviation, and it has only been given up to-day because, on the basis of long experimentation and experience, the behaviour of a normally-built aircraft is well enough known that the controllability and stability of a new type can be guaranteed before the first flight. But how a quite new type of aircraft would behave is beyond our knowledge, and even calculated characteristics with the help of wind channel tests cannot be guaranteed. The method which we have used with good sucess for some years, I will now explain by means of a shortly sketched example.

We will now for example create an "all-wing-aircraft," and work out a suitable project on a basis of various theoretical and design considerations. Before we start designing a man-carrying aircraft, we build a model of such dimensions that we can use the laws of dynamic similarity to advantage. To do this, it is necessary, as is well known, that the Reynolds numbers that appear in flight must exceed the critical region between laminar and turbulent friction, and also that the ratio of the wing-loading between model and full-size aircraft must be to scale. We test this model in free flight, notice the effects of various control settings, the behaviour in flight in very gusty winds, and in short everything that is included in dynamic and static stability. By changing the model we correct any possible deficiencies, and experiment until we are satisfied with the flying properties of the model.

Now we can go a step further and venture into the design of a man-carrying glider. This aircraft will be so built, for practical purposes, that after a successful test an engine may be installed. Perhaps you might ask why we don't use a small engine in the first place? Mainly so we can remove all possibilities of danger, as far as we are able.

Finally we can carry out longer gliding and soaring flights with the aircraft. By these means one can gather enough experience to begin trials with an engine installation. If one still has doubts as to the operation of the airscrew drive, one can use tests with free-flying motor-driven models, as an aid to the solution. If one hasn't a large landing field at one's disposal it is better if possible to use the skid (instead of wheel undercarriage) for the first flights with the engine.

I would like to stress once more that motorless flight and the researches stimulated by motorless flight are not only of use in the province of the gliding and soaring flight movement. The value of this new branch of aviation lies in the broadening of our knowledge in scientific, technical, and practical flying fields, and those whose vocation is concerned with the success of aviation cannot help occupying themselves seriously with the gliding and soaring movement.

The meaning and purpose of my lecture would be fulfilled if I have succeeded in giving new knowledge to those who are already interested in these things and have won over as future collaborators, those who have been looking on.

CORRESPONDENCE.

A New British Sailplane.

Sir,—Regarding Mr. Geale Dickson's comments with reference to Sailplanes.

We should like to advise him that we have a very high-efficiency Sailplane under construction and this will be ready for test within the next fourteen days. This also applies to our intermediate type Sailplane, and we think the description which he mentions in THE SAILPLANE more or less tallies with ours.

After the final test it will be placed at the disposal of anyone who cares to fly it providing they hold a "C" Certificate.

(Signed) R. F. DAGNALL.

The Sailplane Club Explains.

Sir,—Please allow me through the medium of your excellent paper to apologise to the two members of the Southdown Skysailing Club—C. King-Smith and J. H. Lawford—for the inconvenience and expense they were put to in visiting our ground at Horton Farm, Smalldole, Sussex.

There is no excuse and the fact is that you should have been notified last November, for publication under "News from the Clubs," that we were constructing a hangar on a portion of our 500 acres of soaring and gliding ground, and that no gliding would be done until the hangar was completed.

It has taken all this time, for although a small group have been working on it every Sunday, unfortunately the whole job is being done by only about five keen members—the others will no doubt turn up when gliding again commences and the sun is shining. Weather permitting, the hangar should be completed in three Sundays, but will advise you when we actually start gliding again. During this time the R.F.D. has been resting on its laurels—I mean the main skid—in a barn at Horton Farm.

With reference to the two notices that your correspondents observed, the method of approach to the ground is being modified so that the road directional notices direct to one rendezvous where a large notice board will give all information, including whether gliding is being carried out that day or not, and so save unnecessary mountaineering.

Very much appreciating your valuable publication, and wishing it a long life.

Yours faithfully,

(Signed) F. WILKINSON

(Chairman, Sailplane Club of T.M.A.C.)

Contra Catapultam.

Sir,—You have had two letters from Surrey Club members who bless the catapult. Here is a curse from a third member of the same Club.

The catapult has got me, who am essentially commonplace, temporarily beat. I have first-hand knowledge of balloons, kite and free, as well as parachutes, have tried an airship, have joy-ridden freely in aeroplanes, and have played about on a couple of chimneys with a London steeple-jack; so am reasonably hardened to heights.

Yet this is what happens under the influence of a catapult. Being seated, strapped in, I take the stick from Captain Stratton, to whom compliments, praise and respects, and swear to keep it still. Some seconds afterwards I land all ends up, but still free from emotion, absolutely convinced that the stick has not moved.

In the last seven efforts it has three times gone forward, and three times wandered back into my tummy. Last Sunday I snored straight up to thirty or forty feet, just like a balloon leaping out of a gas-works; stalled hideously, and by the usual miracle escaped with a paltry eight pounds worth of damage. *Still utterly unconscious of having moved the stick.* And still without emotion.

Such action can only be explained in one of three ways: (1) Insubordination, (2) Idiotic Over-confidence, (3) The anæsthetising effect of catapulting.

Mine must honestly be case (3).

Apparently the catapulting period is to me, at present, nearly as deadening as the initial drop with a parachute. Just at the moment when one's wits are wanted, they seem, judging by results, to go numb under the influence of acceleration, and do not recover until too late. One would presumably master the trouble in time, but meanwhile the Club's finances would be shattered as completely as their Dagling.

This is just exactly where Auto-towing would come in. When I have twice circled Hanworth and District in one flight from behind a Bentley I will let you know. Only then shall I return to thoughts of soaring.

(Signed) SEBERT HUMPHRIES.

Gliding Clubs in Aircraft Factories.

Sir,—It is a pleasure to learn from the current editorial "Events of the Week" that, among other good things, a gliding club may be formed among the staff of Handley Page Ltd.

I believe that, to draw the fullest value and interest from the Movement, clubs should be encouraged to produce their own types of intermediate and high-efficiency machines, and that a strong constructive element would mean a stronger foundation than the sporting aspect, alone, can bring about.

The support of members of the Aircraft Industry is sure to assist this outlook, and at the same time that industry will benefit by the centring of the enthusiasm of these members within its own sphere.

When the Surrey Gliding Club was being formed a strong local branch was instituted at Vickers (Aviation) Ltd., Weybridge, under the Presidency of Mr. Maxwell Muller, the Superintendent of the firm, and with the added support of Mr. R. K. Pierson, Chief Designer, and Mr. Knight, Works Manager, who are Vice-Presidents. This branch will definitely support your suggestion of a gain of sympathy for other aspects of our business of aircraft manufacture, from our efforts with the Surrey Gliding Club.

No doubt the Dorset Club can also confirm your opinion through its members at Westlands.

(Signed) F. PILLING.

ANOTHER AMERICAN BOOK.

[*Gliders and Gliding.* By R. Stanton Barnaby. 170 pp. 9 in. by 5½ in., 49 photographic illustrations, 74 sketches and diagrams, 4 tables. The Ronald Press Co., New York. From THE AEROPLANE Book Department, Cannon House, Pilgrim Street, E.C.4. 15s. 6d. post free.]

Although the author has not succeeded in achieving his ambitions as stated in the preface, "This book is written for members of gliding clubs, students of technical high schools, for aeronautical engineering students who desire theory and aerodynamic principles, and to all who are interested in gliding and soaring," he has, however, provided a book which can be read with interest by anyone seeking a good broad outline of motorless flight in all its branches.

The first chapter, headed "General Considerations," is an excellent outline of the Gliding Movement as it is to-day, and is in fact so carefully worded that it is probably the strongest justification for the furtherance of the Movement that has ever appeared in print. This is followed by a brief historic survey, in which practically the only historic event which has been left out is the Itford Meeting of 1922.

Chapter three deals with the classification of machines, and details of the control system, but one is surprised to find that the author is apparently unaware that wheels are used in place of sticks in high efficiency machines, the *Wien, Darmstadt, Fafnir* and *Luftikus* are all so equipped, as this is one of the few points mentioned in his comparison of sailplanes and large aeroplanes. One would have also welcomed some justification of his statement that metal construction will prevail for use with training machines.

Instructional methods are then discussed at length, and one is pleased to note the author's emphasis concerning the danger of trying to run before one can walk. The next chapter dealing with the control of a glider in flight is excellent, and is made additionally clear by the free use of sketches. It is also quite obvious that the author himself has had considerable instructional experience, as the majority of the most dubious points are dealt with in considerable detail.

Then follows a chapter on "Soaring," which is both short and disappointing. Chapter 7, entitled "Types of Gliders," is dangerously near becoming a repetition of a previous chapter entitled "Classification of Machines."

The section on design and construction is thoroughly sound, and it is interesting to note that the author does not favour a wheeled undercarriage in spite of its almost universal use in his own country. Continuing the design and construction section, the author devotes a chapter to the detailed examination of various successful soaring machines; this is brought to a conclusion by a first-class section entitled the "Trend of Design," although the author is apparently not in touch with the latest developments of tailless machines, particularly as incorporated in Herr Lippisch's latest triangular wing machine.

In spite of these criticisms, however, the book is well written, exceptionally well illustrated, and is worthy of a place in the library of every gliding enthusiast.—J. R. A-C.

NEWS FROM THE CLUBS.

WHERE GLIDING CAN BE SEEN.

Beds.—The Bedford Gliding and Flying Club. Week-ends at Wilstead Hill, 3 miles from Bedford on Bedford—Luton road.
—The London Gliding Club. Meeting place, Turveys Farm, near Tottenhoe, on Saturdays and Sundays.
Dorset.—See under Somerset.
Edinburgh.—The Edinburgh Gliding Club. Sundays, at West Craigs Farm, between Corstorphine and Turnhouse Aerodrome.
Glam.—Merthyr and District Gliding Club. Sundays, 10 a.m. to sunset. ½-mile left Dynevor Arms, Merthyr Tydfil—Swansea Road.
Hants.—Surrey Gliding Club. Sundays from 10 a.m., weather permitting, at Stocks Farm, Meonstoke (Old Winchester Hill).
Herts.—Herts. and Essex Gliding Club. Sunday afternoons, Eastern Roadways Garage, one mile north of Stortford.
I.O.W.—The Isle of Wight Gliding Club. Whiteley Bank, near Godshill. Every Sunday from 11 a.m.
Kent.—Channel Gliding Club. Adjoining Hawkinge R.A.F. Aerodrome, 2 miles from Folkestone, on main Canterbury road. Every Wednesday and Saturday afternoon and all Sunday.
—North Kent Gliding Club. Saturdays 1 p.m., Sundays 10 a.m. Joyce Green Aerodrome, near Dartford.
—Kent Gliding Club. Week-ends above Lenham, on the Maidstone—Ashford road.
—The Isle of Thanet Gliding Club. Saturdays and Sundays from 2 p.m. Manston Aerodrome, Thanet.
Lanark.—The Glasgow Gliding Club. Barrance Farm, Easter Whitecraigs, near Glasgow. Every Sunday from 11.15 a.m.
Lancs.—The Furness Gliding Club, at Gleaston Park Farm, Gleaston, near Ulverston (midway between Gleaston and the Coast road). Sundays 10.30 a.m., by arrangement and weather permitting.
—The Stockport Gliding Club. Every Sunday afternoon at Woodford Aerodrome, Manchester.
—The Preston and District Glider Club. Week-ends at Butler's Farm, Beacon Fell, 2 miles from Inglewhite and 7 miles from Preston.
Notts.—The Nottingham Gliding Club, Mr. Ellis's Farm, Kneeton Road, East Bridgford, Notts. Every Sunday, weather permitting.
Somerset.—The Dorset Gliding Club, Westland Aerodrome, Yeovil.
Staffs.—The North Staffs. Gliding Club. Week-ends at The Downs Banks, Barlaston Downs, near Stone, Staffs.
Sussex.—The Southdown Skysailing Club. Sundays from 10.30 a.m. Newmarket Farm, near Palmer.
Warwick.—Rugby District Gliding Club. Cote Hill Aerodrome, Husbands Bosworth, Rugby.
Wilts.—The Wiltshire Light Aeroplane and Glider Club at Easton Hill, Alton Priors Range, Bishops Cannings, near Devizes.
Worcs.—North Cotswold Gliding Club. Every Sunday at Fish Hill, above Broadway Village, from 10 a.m. to sunset. Saturdays and Wednesdays from 2 p.m.
Yorks.—The Bradford Gliding Club, at The Pastures, Apperley Bridge. Saturday 1.30 p.m., Sunday 9 a.m.
—The Huddersfield Gliding Club. All day every Sunday at Bradley Bar, Huddersfield.
—The Leeds Gliding Club. Week-ends at Warfedale with the Harrogate Club.
—The Scarborough Gliding Club. Every week-end at Flixton.

[Clubs are invited to send in full details as to where and when they can be seen at work. This feature should help Clubs considerably as readers who are not members can go to look at the nearest local Clubs and see which they like.—Ed.]

THE CHANNEL GLIDING CLUB.

On Wednesday, Feb. 4, it was bitterly cold at Hawkinge, and those members who were keen enough to turn up for towed flight had their first experience of gliding in falling snow. Fortunately it was very light and short lived, and interfered not at all with operations.

A large portion of our towline being in use for lashing the Zogling to its trailer, the experiment of towing the R.F.D. with the full length of shock cord coupled to some 50 ft. of sash cord was tried. This was not an unqualified success. The car moved off, the glider remained stationary with its 14 st. pilot. When the glider eventually moved, the acceleration was naturally much fiercer than with the normal towline, and the wing-tip men got badly left in the first yard. The glider got off quickly and, as the elastic returned to normal length, began to overtake the car. Its speed then decreasing became insufficient to support it in flight, and a landing had to be made. The car, however, kept on, and the process was repeated in several long hops across the aerodrome.

The final landing promised to achieve local notoriety, as it was very nearly made in the middle of a Cup Tie. The pilot, however, managed to get down on the safe side of the touchline. Decision: A little too hectic for primary instruction. The shock cord was then used double and proved entirely satisfactorily, every member present making successful flights.

The foregoing may appear a trifle dangerous, but it was really not so, as at any moment the pilot or the instructor on the car could have cast off, both being provided with releases.

On Saturday, Feb. 7, the weather was too utterly foul for even the fanatics, and there was no gliding.

On Sunday, Feb. 8, persistent ill fortune dogged the Club. An arrangement had been made to visit the Dover Club, but Mr. Mason, the Dover Club's instructor, arrived early with the news that the wind was entirely unsuitable for his site. It was decided, therefore, to take the R.F.D. fully-rigged to Cox's field. This involved a porterage over five fences in a rather high wind.

Halfway over the first fence one of the members managed to rap the elevator with his head making it unfit for service. It was, however, found to be repairable, so the ground engineer and the instructor pushed off in search of the necessary tools and materials, leaving the remainder to stand by in the icy blast. This stage wait lasted a whole hour due to inability to find a hammer. However, the repair was effected quickly only to find that the ring had disappeared entirely from the end of the rope. The machine was dragged sadly back to the hangar and the members proceeded to lunch.

Someone then had the bright idea that Mr. Mason had taken the ring to Dover by mistake, he having been seen with it earlier in the morning. Information was forthcoming as to where the Dover Club would be flying in the afternoon, so it was decided to pay them a visit after all. The countryside round Dover was scoured but alas without result, and the Club returned to the hangar having lost what should have been a good day's gliding.

[We hesitate to criticise a Club which so clearly and frankly lays bare its faults. We do feel, however, that a definite lack of organisation is shown by those responsible which is unfair to members. No towline, no hammer and no ring all appears to point to haphazard organisation. It seems a pity that so much enthusiasm should be dissipated without adequate reward. We trust that "experientia docet" will prove to be the case.—Ed.]

THE DORSET GLIDING CLUB.

The Dance given by the Dorset Gliding Club in the Town Hall, Yeovil, was a great success, some 120 members and friends taking part, and proved that the gliding exercises had kept them in good form for dancing.

A special menu had been prepared, giving some entirely new names to the various refreshments; some of these names would no doubt shock Mrs. Beeton, but at any rate they were of considerable gliding interest. The refreshments had been prepared by lady members of the Club, and it is hoped that by their efforts the Club funds will be considerably augmented.

Saturday being a very nice day, quite a number of members turned



SEQUENCE.—A series of pictures which tell their own story. The I.O.W. Club are to be congratulated on their excellent Constructive Section, which made such a good job of the new wings.

up on the aerodrome for the first meeting of the season. Everyone seemed to be feeling the effect of the night before, but at the sight of "Freddy" (the Club R.F.D.) emerging from the hangar looking very fresh and full of life after a good overhaul, cheered everyone up and a good afternoon's gliding was put in, 22 launches in all being made without a mishap. Everyone said that the machine seemed to handle better since its overhaul and minor improvements.

No flying took place on Sunday owing to bad weather, although one or two super-enthusiastic members turned up.

THE ISLE OF WIGHT GLIDING CLUB.

For the past month, members have been busily engaged in repairing our B.A.C.II which was badly crashed by Mr. Hurst, who, by the way, discovered a week later that he had broken a rib of his own in the process! This has since been satisfactorily "repaired," and the repairs to our machine are now nearing completion.

The work entailed in restoring our glider to an airworthy condition has consisted of building a new pair of main planes, a new rear centre section strut, and generally overhauling and true-ing up the fuselage. The whole of this work has been done solely by Club members under the able supervision of Mr. J. A. Thompson, our honorary "ground engineer," and the work has proved extremely interesting. Members have expressed the opinion that the "working meetings" have been as enjoyable as the "gliding meetings," and it is certain that the time spent on these repairs cannot be regarded as wasted, because members have now a thorough working knowledge of the construction of at least one type of glider.

In addition, members are also building a trailer to drawings supplied by the B.A.C. Co., and this will be completed at the same time as the glider. This trailer will solve the troublesome question of transport and will enable us to take advantage of sites in various parts of the Island.

While the glider has been in "dock," several likely sites have been inspected, with a view of obtaining one that will afford facilities for work both on slopes and on the flat so that all members will be assured of a flight during the course of a meeting.

In this we believe we have been successful with Bowcombe Down, 1½ miles west of Carisbrooke, on the main Newport/Freshwater road. This place is approximately 600 feet above sea level, has a natural aerodrome on the top, and slopes facing in all directions, some of which we consider will be suitable for soaring at a later date. We intend to make practical gliding tests at this place at the first opportunity, and if found successful the site will be adopted by the Club.

Immediately the repairs to the B.A.C.II are completed, members will commence construction of a new machine designed by Mr. J. A. Thompson. This machine will be a two-seater fitted with dual control, but used as a single-seater it is hoped that soaring flights will be possible. It will be of all-metal construction with the exception of the wing covering. We hope to have pleasure in giving technical details of this machine at a later date.

In order to prevent our disappointing similar enthusiasts as Messrs. C. King-Smith and J. A. Lawford, whose sad tour of Sussex is described in their letter published in the current issue of THE SAILPLANE, we wish to state that at the moment we are not at Whiteley Bank. Members of other Gliding Clubs, however, are assured a cordial welcome at our workshop (next door to the Medina Club, E. Cowes) although they would probably be pressed into service on such work being done at the time of their visit! They would find at any rate, that although not gliding we are far from dead! We hope to be in a position to resume gliding at the end of this month, when the site at Bowcombe Down already mentioned will be tried out.

THE LONDON GLIDING CLUB: HARLINGTON GROUP.

Week-end, Jan. 24-25, the group machine was not out as some members were attending the car-towing demonstrations at Hanworth and others had different engagements.

During the week, however, the opportunity was taken to make a longer set of bolts to facilitate erecting the machine and the Cellophane rudder-covering experiment was carried a stage further by the substitution of the previous week's fabric by Messrs. Cellophane's moisture-proof material applied without any reinforcing netting. It was hoped that this material would not require doping, but it was found difficult to get it stretched sufficiently without dope, so finally two coats of dope were applied. It remains to be seen how this application stands up to wear and tear and to climatic conditions.

On Feb. 1 some field experiments were conducted at Harlington with a new modification of the car-launching method which the Group employ. This is expected to be a great improvement on anything so far attained, but until fully tested it will not be disclosed.

On Feb. 4 the Group planned to indulge in the moonlight gliding which Saturday night's weather made impossible, but again the weather proved unkind.

However, Mr. Allan and Mr. Elliott took the opportunity to bring a Morris back-axle out to Harpenden which will be fitted to the crate, which so far has always been transported on top of the Delage, and so convert it into a trailer. For defraying cost of this conversion the group have to thank Mr. Elliott's generosity.

On arrival at Harpenden at about 9 p.m. Messrs. Allan and Elliott joined Mr. Lander and all three proceeded to Harlington to collect the crate and a second car belonging to Mr. Allan which required towing.

The cirrus, consisting of the Delage with the crate on top of it, and towing Mr. Allan's 30/98 Vauxhall, arrived back at Harpenden at about 2.30 a.m. The party broke up about 3 a.m. and returned home.

It may be of interest to note that while, at 7 p.m. on the 4th, there was a slight drizzle and the temperature was quite mild, a few hours later it was snowing steadily and the sky was overcast with heavy cloud banks. Yet, by 1.30 a.m. the same night, the sky was as clear as could be and a hard frost was coating everything with ice. What is more, the full moon, shining on the snow-powdered landscape, showed up every minute detail with amazing clarity. This condition of things only lasted an hour or so and then another bank of clouds drifted over and blanketed the moon.

The moral which it seems should be drawn from the above is that, to take advantage of conditions, when they are right for night gliding by moonlight, requires a hangar so that the machine can be ready for use at a moment's notice and preferably that those who intend to glide should be able to sleep on the spot.—E. E. L.

R.Ae.S. MANCHESTER BRANCH: GLIDER SECTION.

The Zogling built by members of the Glider Section of the Manchester Branch of the R.Ae.S. has now made about 300 flights. This Club is active every Sunday at Woodford aerodrome from 11 a.m. to dusk. Visitors will be welcomed.

Another machine is to be built shortly. There are about 150 members, but vacancies for a few still exist. Inquiries should be addressed to G. Moore, 18, Crafton Street, Rusholme, Manchester.

THE SAILPLANE CLUB OF T.M.A.C.

The members of the above have been spending many busy weeks recently on important ground work in preparation for the coming season, when a full programme of activities will be launched. One of the most important works has been the erection of their own hangar at Smallidole, Sussex. The site chosen is situated at the bottom of the gliding cup and right beneath the highest point of the rim. The completion of this hangar will, it is claimed, make the Sailplane Club's grounds and facilities amongst the finest in the country, as according to the opinions of advanced pilots who have flown on the site the ground is unusually suitable for soaring flight.

It is a fact, borne out by many local witnesses, that Kronfeld, on his famous 70-mile flight, spent some considerable time over the Smallidole basin in gaining height to carry him on his way. The Club's ground, covering more than 500 acres, is also being logged for air currents in varying winds and, amongst other methods, models are being employed to assist in this work.

The Sailplane Club and its associate body, The Model Aircraft Club, are holding a joint dance at the Suffolk Galleries on Saturday, Mar. 7, when many gliding people will be present. Dance tickets are 2s. 6d. each and refreshments will be obtainable at moderate prices. The dance is open to all interested in Gliding, actively or otherwise. Tickets are obtainable from the Hon. Secretary, E. G. Smettem, 2, Wine Office Court, Fleet Street, London, E.C.4.

THE SOUTHAMPTON GLIDING CLUB.

This Club was formed on Nov. 18, 1930, and a Dickson Primary Training Glider purchased. It was decided not to start flying until the New Year. Through the kindness of Messrs. F. A. Hendy Ltd., Southampton, the machine was exhibited in their showrooms during Christmas and aroused considerable interest.

On Jan. 18, 1931, the first public meeting was held at Swaythling, where the Club instructors, Messrs. Woodley and Puttock, demonstrated their methods of training and also flew the machine. Among the visitors were the Mayor of Southampton, Sir Alliot Roe, Lieut.-Col. W. Pittard, and W. Waplington, Esq. (Secretary of B.G.A.), with a crowd of about 3,000. The actual flying was marred by lack of wind.

Meetings are now held weekly at Bassett, through kind permission of W. C. Browning, Esq., and all the members are receiving instruction, some having made flights. They are all very satisfied with the "Dickson" machine and pay tribute to its sound construction. The Club is fortunate in having a number of members from the local aircraft firms, who give their services, willingly, to keep the machine in flying trim.

On Monday, Feb. 2, the Club took advantage of the full moon and held a very successful night meeting, a number of members making flights.

The subscription is 30s. per annum, with an entrance fee of 10s.

THE SOUTHDOWN SKYSAILING CLUB.

After enforced idleness for two Sundays owing to foot and mouth disease, the Club met on Feb. 8 at Newmarket Farm, near Palmer. We owe the finding of this very fine ground to the energy and foresight of Flt. Lt. LeeRoy Brown and we are very much indebted to Mr. G. Woodman, who allows us to house our machine in his barn and to fly on his land, as also to Mr. Ray for a like privilege.

Although all flying members were notified of the change of ground only about 30 per cent. turned out.

Our R.F.D. was moved to its new quarters on Saturday, so that there was no time wasted on Sunday morning. For this we have to thank our ground engineers, Messrs. S. Wood and Ely, and one of our keenest pilots, Mr. C. King-Smith, and others.

Sunday opened with a strong, steady S.W. wind very suitable to the site chosen for the day's work, and as we believe in going ahead slowly and carefully we started on the simplest among many variable and interesting launching points.

Mr. Russell made the usual test flight, passing our R.F.D. O.K. This machine has now had over 300 launches, which figure speaks well for the quality of the machine and for the care and repair work of our riggers.

Mr. Lawson twice gave us demonstrations of steady and safe gliding and spoke, as did we all, very enthusiastically of the quality of the air and its freedom from eddies, etc., the new ground being very much better than the old one under similar conditions.

The day's labour was made very light by the enterprise of Messrs. King-Smith and Lawford, the one supplying a Trojan car and the other a pair of tractor wheels for it. This combination gave excellent service all day.

Messrs. Cannon and Tully continue to show great promise, but Mr. Tully lacks confidence in his own ability.

The break in the continuity of training has had an adverse effect on some of those who have to think how to handle the controls as against those who do these things instinctively.

Will all interested please note that Mr. Yorke Bramble has resigned his secretaryship of the Club?

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