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GLIDING
A Yearbook published by Dorset Gliding Club dealing with every aspect of motorless flight

"Methinks
Wisdom is oft-times nearer when we stoop
than when we soar" — Wordsworth

1931

Edited by H. R. R. Goodyear

WEYMOUTH
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FOREWORD


I AM proud to have been invited to write a short foreword to this useful book as I am a firm believer in the future of motorless flying and consider that its development will exercise a beneficial influence on the general advance of aviation.

The progress that has been made during little more than six months has surpassed all expectations. Nearly one hundred clubs have been formed and this figure will shortly be exceeded. Many of these are already in active operation and have become affiliated to the British Gliding Association, the national governing body. This new, or I should rather say, resuscitated movement opens up for the first time a real possibility of flying for the majority. It will enable those interested to obtain an insight into the scientific and technical aspects of aeronautics and meteorology as well as practical ideas on construction and operation.

The sailplane has considerable sporting possibilities and the art of soaring calls for the exercise of the best physical and mental qualities in the individual.

All those who wish to become pilots will be well advised to start their training on a glider as they will more readily obtain a true air sense and possess an advantage over those who learn to fly on power driven machines. Aeroplane pilots should take the first opportunity, which they will never regret, of becoming proficient sailplane pilots.

This book will, I am sure, be of value to members of the various clubs and others interested, and the many authorities who have contributed to this work are to be thanked for helping forward the cause we all have at heart.

January, 1931.
EDITORIAL NOTE.

This year-book, the first of its kind in the British Isles and perhaps in the world, is produced by Dorset Gliding Club as a modest effort to stimulate interest in motorless flight.

A unique feature of Gliding is that its contents have been contributed and collected together voluntarily by authorities and enthusiasts, not only from all parts of the British Isles but from Australia, India, Europe, and America too. A manual containing such information could not otherwise have been produced save at a cost which would prevent it from reaching its proper "public"—men and women in every walk of life who have scant opportunity of appreciating the significance of this fascinating subject.

All this voluntary effort has, of course, a purpose; and it is this:—To show that the sphere of activity covered by the term gliding is vitally important; that gliding is not just a joy—if somewhat laborious—sport, indulged in for sheer joy of sliding down slopes in a winged machine, but is the ideal means of fostering democratic air-mindedness.

A secondary, but none the less fundamental, purpose of Gliding, is to be of help to established gliding clubs (about a hundred such organisations have come into existence in the British Isles in less than twelve months) and to encourage the formation of others. Our twofold aim is not easy of accomplishment. Clubs need technical information, while the man and woman in the street hate to be bored by plans and formulae. We have tried to use discretion in this direction, and hope the contents of Gliding attest that we have not altogether failed.

Any imperfections in Gliding we plead to be forgiven on the score that the British gliding movement is in its first infant year—and we are part of it. We considered the job needed doing. The publication was not thought of before late in October 1930, so to bring it out in time to be of use this year we had to "hustle."

Thanks are due to every contributor to and advertiser in Gliding, and to many other willing helpers. To mention one name when space limits debar a host equally worthy would be out of keeping with the splendid team spirit in which all our friends have helped us in the effort. Apologies are due to many who have provided material which unavoidably cannot appear in the present issue.

Profits, if any, on the sale of Gliding will be devoted to Dorset Gliding Club funds. It is intended to continue the publication year by year, dealing with new phases of the movement as they arise. All inquiries with regard to Gliding should be addressed to:

"Gliding."
10 Victoria Street,
Weymouth, Dorset.

COME GLIDING.

How healthy, enjoyable, and within the reach of everyone is the new sport of gliding is described in this happy article by Mr. Charles Byron, an expert aeroplane pilot and an enthusiastic "A" pilot member of Dorset Gliding Club.

"I WISH I could afford to fly!"

Says the Young Man in the Street, gazing enviously at the small aeroplane that has just passed overhead.

"Lucky blighters!"
The Modern Maiden sighs wistfully as she too watches the aircraft humming cheerfully. Then she departs, with an unspoken malediction against her bank balance, which does not permit (or so she thinks) indulgence in flight as a hobby.

Both, however, are wrong in this idea that the thrill of aviation are available only to the wealthy few or to those whose profession is in aeronautics.

It is true that, although everybody now realizes the vital importance of air transport in modern life, only comparatively a few are favoured with the opportunity themselves to fly powered planes; but it has to be remembered that the already stupendous aerial achievements of to-day are the result of only 27 years' development.

It is inevitable that with the march of progress, the handicap of expense which at present deters the man of modest means from running his aeroplane as he at present runs his car will be very substantially reduced.
But the average person whose enthusiasm has already been stimulated by the dawn of the air-age, will feel but cold comfort in the hope that some day he will be able to afford a plane. He wants to fly now.

BENEVOLENT DJINN.

At this moment, in answer to such air-minded aspirations, which do without doubt exist in the minds of tens of thousands of young people to-day, a door has opened and the absorbing sport of gliding enters like a benevolent djinn, moreover unmixed with any bitters!

Through gliding may be experienced not only all the glorious sensations of flight, but a great deal of the fundamental knowledge of design and construction of machines and of the theory of flight may be acquired; without which, it need hardly be said, nobody can hope successfully to pilot a plane when sooner or later the long-looked for opportunity to do so presents itself. This last fact alone constitutes reason enough for the sincerely interested student of aviation to enter upon the sport of gliding, and successfully counters the opinion sometimes uttered that the whole sport is objectless.

Gliding may be made to serve as the novitiate stage to the later "full profession" without more than a very nominal expenditure. Any self-constituted club, for the purpose of gliding, can obtain the necessary primary machine for round about £90, and the normal membership fee of such club varies from one to two guineas.

After this, a gentle slope, a moderate breeze, an elastic rope, an old shirt and an old pair of "bags" are all the equipage one requires—and after all, most of us possess an old pair of "bags," make of us nothing but old ones! At any rate, the charges under "initial outlay" are not very formidable, are they?

SO GOOD FOR YOU.

Lest you should be scared by the thought that gliding is much too technical or educational a game at which to spend your playing hours, let us think of other attractions it offers. Firstly—and of primary importance with any spare time hobby—gliding takes you into the open air. More, it takes you into the hills which, like Guiness, are good for you (there is no objection to a combination of the two, I believe). To this add the vigorous exercise in which (if you are a loyal member of your club) you are compelled to indulge; for no one member can be launched solo without the energetic co-operation of at least eight others.

There he sits, directing his team. "Walk!" he says, and the rope tightens; "Run!" he shouts, and the rope quivers at tension: "Let go!" and he is catapulted off; but the team has exerted all its muscular strength and has duly profited thereby. Fresh air then, and exercise, interest, and adventurous thrills; for nobody quite knows when (if you are a loyal member of your club) you are compelled to indulge; for no one member can be launched solo without the energetic co-operation of at least eight others.

A primary Glider in flight—Photo, "Airways."

GLIDING comes nearest of all aerial achievement to the natural effortless flight of birds of the gull class. Most of us pilots of powered machines admit that we have extracted a far greater thrill from our first glides than ever we got from our first "solo" in power-planes. No doubt it is the silence which makes so vivid the illusion of being carried through the air on bird-wings: whatever it is, the sport is fascinating and absorbing to an extraordinary degree. I, who fly power-machines pretty regularly and glide whenever I can, certainly maintain that the latter sport offers thrills every whit as great as the former.

AND SO.

So now then, all you fellows who cannot afford a plane, cease repining, wait not for the moon; instead, come gliding; take your turn in the air, take your turn on the rope: Are you ready chaps? Then Walk, Run, Let Go!!
FORTY YEARS OF GLIDING.

In this resume of the history of gliding and soaring flight, Herr Enrich Offerman shows how greatly the world is indebted to Germany for the development of the movement. He deals with vital factors in gliding history. Derect Gliding Club is indebted to "Airways" for permission to reproduce this article.

The German gliding movement of 1920 really represents the third epoch in the history of human flight. The first epoch to be taken seriously began with Lilienthal's engineless flights in 1891, and ended with his death in 1896. The second epoch began with the engineless flights of the brothers Wright in America in 1901, and ended when they fitted an engine to their machine; this was in 1903. The third epoch, as already mentioned, began in the year 1920. This last epoch differed fundamentally from the first two in that its object from the outset was soaring flight, whereas the flights of Lilienthal and the brothers Wright were only preliminary steps to power flight. What was then a necessary preliminary step is still very valuable, as in soaring flight the flying characteristics of the aircraft can be studied, and experiments made in a natural manner.

A LONG PAUSE.

The Wright brothers flew with an engine for the first time on December 17, 1903. From this time onward all work was concentrated on the improvement of flying bodies until nearly 1916. The progress in the building of aeroplane engines diverted all interest from the aero-dynamical improvement of the flying body. It was only after the problems of lift and resistance had been elucidated that the teaching according to Junkers' patent of 1910 that all parts causing resistance and not producing lift should be avoided, finally produced a change. This change first became evident in 1916, when the unbraced cantilever thick wing was first built by Junkers.

It was these aerodynamical principles that to all intents saved the life of the soaring flight movement of 1920, and, regarded technically, rendered in any way possible the performance of the next ten years. When in 1920, thanks to the initiative of a few men and more particularly the German engineer Herr Ursinus, the first soaring flight competition took place on that famous ground on the slopes of the Wasserkuppe, it was the outcome of the enthusiastic desire of a group of young men to take up flying in accordance with the principles of Treaty of Versailles, rather than for technical considerations. In this Treaty engineless flight was not taken into consideration, perhaps because its possibilities, from which the whole world is now benefitting, were not then realised.

GREAT ACHIEVEMENT.

The movement arising from this first competition in the Rhön, grew in power like an avalanche, and all forces capable of bringing about technical progress in its broadest sense were brought within its sphere of influence. The many branches of engineering were set in motion, the relation between meteorology and aeronautics changed fundamentally, and aeronautical knowledge was considerably increased. Those who have shared the experience of the past ten years can indeed say with conviction that the soaring movement in Germany deserves to be regarded as the most gratifying achievement in post-war times.

To begin with, the work of Lilienthal and the brothers Wright, so far as it related to practical engineless flight, was recorded historically as former epochs of the modern soaring flight movement. This was right as, strictly speaking, there is no difference between gliding and soaring. It is generally said of Lilienthal that he merely made gliding flights. This is, however, only partly true. In order to make the position clear it may be well to give the following brief definitions of gliding and soaring.

Gliding is flight, accompanied by progressive loss of height, the direct motive power being gravity.

Soaring is flight without loss of height, the direct motive power also being gravity.

In the case of soaring flight the loss of height is only compensated by the machine being lifted by the vertical up currents which originate in various ways. From the outset, those interested in soaring flight have sought to investigate these up currents. Direct evidence of the progress made in the knowledge of the sources of energy governing soaring flight is to be found in the corresponding improvement of the maximum performance. When it was said that Lilienthal was gliding flight accompanied by progressive loss of height, and soaring gliding flight without loss of height, the opinion may be advanced, that Lilienthal may be credited with having performed short soaring flights. It was natural that owing to the aerodynamical inferiority of his machine, this soaring could be only of short duration. If, however, an absolute and just standard is adopted, Lilienthal's undulating flight may be classed, not as pure gliding, but rather as soaring. His literary works proves he was aware of the existence of vertical up currents. As is well known, such ascending currents are caused by the wind being obstructed, particularly by woods, hills, and mountains, and thereby deflected upwards. That is, in fact, our most elementary knowledge regarding the sources of energy governing soaring flight. The use of these sources of energy is, of course, immediately connected with the dependence upon the ground in question, which in conjunction with the wind is able to provide this source of energy.

The brothers Wright provided the first data relating to actual soaring flight. History relates that in Kitty Hawk in America, with a machine of their own construction, they flew over a measured distance of only 35 yards in one minute twelve seconds. These figures are sufficient to satisfy an airman that this must certainly have been soaring flight, that is, use was made of the ascending winds produced by the dunes on the coast.

SACRIFICE.

When in 1920, with the most primitive material, the first Rhön soaring competition was arranged, the enterprise was at first marred by ill luck. The weather was extremely bad, and the performances rendered possible were
consequently poor. It was not until August that fairly long flights were achieved. On August 9, Eugen von Lüsèr crashed with a broken elevator, but not before he had sacrificed his life in a worthy cause.

Then, on September 4, 1920, Klemperer in the Scheweitzer Taufel covered a distance of about one mile, and one may say that this flight saved the soaring movement. The Scheweitzer Taufel was the first machine to be built according to Junkers' principles, and it was the forerunner of what we now term the machine of similar design, flew for 13 minutes. In September of the same year, Martens flew a distance of 43 miles and then followed a series of record flights, both in respect of distance and duration, which woke the interest of the whole world and brought German soaring to the fore. On August 19, 1922, Martens flew a distance of 15 miles. At the same time the soaring flight duration record of 21 minutes 30 seconds established by Harth of Plohn was increased in 1923 to 1 hour 6 minutes by Martens in the Vampyr. In the same year Hentzen in the Vampyr, remained in the air for two hours, and a few days later, on August 24, 1922, he beat his own record by a flight lasting 3 hours 6 minutes.

ASCENDING CURRENTS.

In all these performances merely ascending currents were used as source of energy, apart from assistance obtained from any difference in height of energy. In 1924, Ferdinand Schulz made the duration record of 8 hours 42 minutes at Rossitten. In 1927, also at Rossitten, he remained in the air for 14 hours 7 minutes. In the same year, at Rossitten, Schulz flew a distance of 37 miles and also made a number of local records.

In the meantime the decentralization of the soaring movement spread increasingly. Germany has now nine recognised soaring flight grounds, recognised in such as the prescribed duration flight of one hour has been carried out there.

CLOUD SOARING.

Soaring in an ascending wind, as already stated, is more or less dependent upon the nature of the ground, but it is apparent that the improving technique of cloud soarimg is gradually overcoming this dependency. Soaring records and their recognition were hitherto dependent upon the ground. The conditions for these records were made to suit the limited possibilities as regards aerodynamics.

MOVEMENT EXPANDS.

It was then duly recognised that the soaring flight movement had reached a point in its upward way where it could and should expand. The increasingly insistent demand that other grounds besides the Rhön should be utilised, and that a soaring flight movement should be recognised, was recognised. Thus in 1924, the first soaring flight, now termed the "Soaring in an ascending wind, as already stated, is more or less dependent upon the nature of the ground, but it is apparent that the improving technique of cloud soaring is gradually overcoming this dependency. Soaring records and their recognition were hitherto dependent upon the ground. The conditions for these records were made to suit the limited possibilities as regards aerodynamics.

The soaring flight movement was already taken up abroad in 1922. The English soaring competition at Icford Hill will be remembered. A number of expeditions made by German soaring pilots have contributed to the propulsion of the movement, for instance the expedition to Italy in 1924, to the Crimea in 1925, and to France and the U.S.A. in 1928.* Since surpassed (see Records).
GLIDING IN THE BRITISH ISLES: 1930 in Retrospect.

The growth of the gliding movement in the British Isles during 1930 is detailed month by month in this valuable contribution from Mr. L. Howard Flanders, A.F.R.Ae.S., M.I.Ae.E., A.M.I.Mech.E., first Secretary of the British Gliding Association and now a member of the B.G.A. Council, Mr. Howard Flanders is also joint author of "Gliding and Motorless Flight," the first handbook on gliding produced in Britain.

ALTHOUGH gliding in the British Isles commenced with the experiments of Sir George Cayley in 1807, and periods of interest in the science occurred in the years 1896-1899 (Percy Fichner), 1905-1910 (Danne, Weiss and others), and again in 1922 (contest at Itford), it may be correctly stated that gliding as a club movement started in 1930. The foundation of the British Gliding Association in November, 1929, formed a focus for the interest in motorless flight which reached this country as a result of the work done by the British Gliding Association and now a member of the B.G.A. Council, Mr. Howard Flanders. It is of some interest that the Air Navigation Acts are so worded that gliders may be included in their scope. Thus, it could be enforced that all gliders be built under Government inspection and receive certificates of air-worthiness from the Air Ministry, the minimum charge for which is £25. The late Sir Sefton Brancier, first President of the B.G.A. freed the gliding movement of charges so high as to have increased the price of gliders by at least 25 per cent.

Lord Wakefield of Hythe made a donation to the Association of £1,000 in January which enabled it to undertake the work of organisation before income from membership and affiliation could provide necessary funds. The first glider pilot certificates were granted by the Royal Aero Clubs to (No. 1) Mr. Lowe-Wylye, (No. 2) Mr. Howard Flanders. The first glider presented to the Club by Mr. L. Howard Flanders was also sent drawings of a primary type glider, which with modifications became the prototype of a well-known make. This design was based on German practice and had necessary features which appear to be peculiar to German aircraft design which are unsuitable for British workshop methods. When these were modified the gliders proved most satisfactory.

HIGH SPEED WORK.

At the same time, Mr. Lowe-Wylye, assisted by the Kent Gliding Club produced a primary glider in the amazingly short period of five weeks from a specially designed machine made it the forerunner of another successful make of glider. The London Gliding Club held its inaugural meeting on February 25, and held its first gliding meet at Guildford on March 16 with the trials of a "Daring" glider presented by the Club. The subsequent week-end the tests were continued at Aldbury, near Tring. During February, the North Cotswold Club was formed, and the Lancashire Aero Club formed a gliding section. March was more productive of events of importance. The Midland and Winchester Clubs were formed. The first number of the "Journal of the British Gliding Association" appeared with a reprint of the lecture which Dr. G. Herr Stamer had read before the Royal Aeronautical Society on February 19.

IMPORTANT OF THE B.G.A.

The inaugural meeting of the British Gliding Association on March 27, 1930, definitely centred the responsibility for the development of the movement on that Association. The late Air Vice-Marshal Sir Sefton Brancier, then Director of Civil Aviation, presided and stated that the Air Ministry had decided to allow the British Gliding Association to provide for the safety of gliding by the issue of certificates of air-worthiness, that he held it responsible for the air-worthiness of gliders. It is of some interest that the Air Navigation Acts are so worded that gliders may be included in their scope. Thus, it could be enforced that all gliders be built under Government inspection and receive certificates of air-worthiness from the Air Ministry, the minimum charge for which is £25. The late Sir Sefton Brancier, first President of the B.G.A. freed the gliding movement of charges so high as to have increased the price of gliders by at least 25 per cent.

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London Gliding Club brought their "Prufing." Kent brought their well-travelled glider, and the B.G.A. provided a "Dagling." For the Whitsun there was a strong wind which was strong enough for Mr. Lowe-Wyld to land the B.G.A. at Ditchling. Captain Latimer Needham set aside flights of 20 minutes on primary training gliders. Flights of over an hour were made on the "Prufing."

Primary training was given by Herr Kronfeld which enabled club instructors present to learn the way to teaching gliding to candidates. The meeting lasted until the Tuesday, but adverse weather and the development of cross-country flights by both the foreign pilots.

Herr Kronfeld flew across country from Itford Hill and landed at about 1000 feet in a straight line. This was one of the longest cross-country flights that had been made and of course, quite the longest in the British Isles. It was not officially observed for record purposes.

The wind was unsuitable, and even the "Wien" could only make long glides. The demonstrations were continued at Folkstone (June 28-29), Akenwell (July 5-6), Ilkeby (July 9-10), and Scarborough (July 11-12), where Herr Mageser had to make a forced landing in the sea.

The third quarter of 1930 opened with demonstrations organized by the British Gliding Association drawing to a close. After this many new clubs were busy forming and making arrangements to start. The date which may prove of interest is July 6, when successful experiments in auto-launching were carried out by the Experimental Light Plane Club. With these experiments in launching no runway or block and tackle was used, and three persons only were required to effect a launch.

INTER-CLUB CONTEST.

The first inter-club gliding contest took place on July 27 between the London Club and the Gliding Section of the Lancashire Aero Club at Ivinghoe Beacon. Both clubs used the "Prufing" belonging to London.

The times registered were:—London, 12 mins. 52 secs.; Lancashire, 8 mins. 5 2/3 secs.

The first gliding camp was held by the London Club at Ivinghoe Beacon, July 27-August 3.

At this camp seven ab-initio pilots qualified for their "A" certificates. Among gliding clubs started in July were Bradford, Herts and Essex, Isle of Wight, Kilmarnock, Merthyr, and South Essex.

August produced no events of outstanding interest. The most noteworthy feature of September was the first appearance of "The Sailplane," the weekly publication, and the first weekly publication in the world solely devoted to gliding. The fourth quarter of 1930 was marked by the inter-club competition organised at Ditchling Beacon by the B.G.A. on October 18 and 19. This meeting produced some satisfactory results in the form of pilots' certificates and the prizes won by the competing clubs—London, Kent, Lancashire, Channel, Portsmouth and Southsea, and Surrey.

Short notice and the rather remote situation prevented the bulk of clubs from entering. The centre of the gliding movement is considerably north of London.

This meeting at Ditchling terminated the major events of the gliding year. November and December were devoted to the formation of new clubs and the training for pilot certificates, but the Scarborough Club held a notable rally on Boxing Day.

Rapid Progress.

Reviewing the year as a whole it is an undoubted fact that progress in the formation of clubs has been much more rapid than was expected. The other hand the number of "B" and "C" pilot certificates issued has been very small.

No cross-country flights have been made by British Pilots, and it is a regrettable fact that no scientific work has been attempted. The day of the British gliding movement will dawn when club members begin to make cross-country flights, and when it becomes a general custom to land on the top of the hill instead of at the bottom.

The Safety of Gliding.

The safety of gliding is here discussed by Captain C. H. Latimer Needham, M.Sc. (Eng.), F.R.Ae.S., who, with a distinguished career in aviation and wide experience in the light aeroplane movement, is a founder-member of the British Gliding Association. With a flight of 1 hour 5 minutes in June 1930, he was the first Englishman to qualify for the "C" glider pilot certificate. He is also the designer of the first English sailplane, the "Albatross."

Gliding has now been carried out on a large and increasing scale for the past ten years, and one factor which seems to stand out above all others is the remarkable freedom from casualties amongst its thousands of participants.

The first season's operations have just concluded in this country, and although clubs have sprung up almost everywhere and many thousands of flights have been made it is a very satisfactory and convincing fact that very few personal injuries have been recorded, and not a single fatality.

It is the more surprising when it is realised that at the beginning of 1930 there were scarcely a dozen people in this country with experience of gliding so that it has been a case of the blind leading the blind, and certainly many experiments have been made that would startle the experienced gliding pilot.

Yet we have come through. Although different nations, according to their national characteristics, have different ways of carrying out a sport, and while gliding in this country is not being run on the same lines as in other parts of the world, at the same time much can be learnt from a perusal of the statistics of other countries.
Gennany, the birthplace and nursery of gliding flight, holds the most remarkable record of over ten years’ intensive operations with less than one fatal accident per year. Is there any other form of sport with such a clean sheet? This shows quite conclusively what may be achieved where proper care is exercised and dangerous practices are discouraged.

On the other hand America cannot make the same claim and, in fact, accidents have been far too numerous. This has been solely due to the adopted policy of introducing motor power in one form or another.

WHY IS GLIDING SAFE?

Gliding is infinitely safer than power flying largely because the causes of accidents applying to aeroplanes are either non-existent or greatly reduced with gliders and sailplanes. The chief dangers of flying are fire, the results of stalling, and high landing speeds. Fire cannot, of course, take place with gliders, landing speed is low, whilst the effects of stalls are seldom serious. Owing to the light wing loading, stalls are little more than parachute descents, and flying speed is regained in a very short distance. Even when the stall turns into a spin to the ground, the machine generally takes the brunt of the crash.

One other factor contributing towards safety in gliding is the light structural weight. There is no heavy engine or petrol tank to pull the machine down and, although crashes are quite common occurrences with both gliders and sailplanes, contact with the ground is comparatively gentle, so that the force is spent in breaking up the wings or fuselage, leaving the pilot unhurt. This at first appears hard to believe, but after seeing many crashes take place, this conclusion is forced on one.

AUTO-LAUNCHING AND TOWED FLIGHT.

German gliding authorities believe that gliding and sailplaning should be entirely motorless and that engines should not be used in any form, apart from which this has been found to be the only safe course. America has desired quicker results and has therefore resorted to auto-launching (launching by motor car), auto-towing and aeroplane towing. This has accounted for many accidents, so many in fact, that towing by aeroplane has been prohibited. After a year’s successful operating with hand launching in this country several clubs are beginning to experiment with methods of replacing the team by motor cars and also auto-towing and the time is ripe for issuing a warning.

Motor launching possesses the advantage of enabling gliding and sailing flights to be started with a very small crew, but it is attended with dangers. If it is resorted to, the utmost care should be exercised and it should only be undertaken by those having considerable flying and sailplaning experience and should never be used for novices.

Auto-towing and motor boat towing enable long flights to be made and have certain instructional advantages, but can easily lead to disaster. Such flights should only be carried out directly into wind; turns out of wind or down wind should be avoided. To explain this—Consider a glider being towed at 20 m.p.h. into a 10 m.p.h. wind, giving a flying speed of 30 m.p.h. As soon as the turn down wind has been made the air speed is 10 m.p.h. and a stall to earth is inevitable. Or again, it is possible for the glider pilot to hold the machine in a stalling attitude but owing to the continuous pull from the motor, the glider stays in the air. This induces bad habits which will prove disastrous when free flight is returned to. Auto-towing therefore, should only be attempted when experienced persons are in charge of operations, and is more suitable for schools than clubs.
STICK TO THE SHOCK CORD.

Power pilots find it difficult to get used to the small element of danger attached to gliding and stand aghast when they first see pupils stalling elementary machines at about 30 or 40 feet off the ground or at the sight of sailplanes being landed down-wind or side-wind with perfect safety, or again when they see pupils of only a few minutes’ instructional flying experience make their qualifying flights for the “A,” “B,” and “C” certificates. Let the British gliding motto remain “Hasten slowly.” Do not forsake the elastic rope method of launching until it is “found wanting,” and if motor power must be used let there be no lack of caution. And remember lastly that safe gliding means safer flying.

THE THEORY OF FLIGHT.

Mr. H. J. Penrose, A.F.R.A.C.S., sets out here an exposition of the theory of flight which is of especial use to beginners in gliding, carrying them far into the why and wherefore of the subject. Mr. Penrose, who made his first glide in 1924, is an R.A.F. Reserve and Civil Pilot, being on the sales staff of Westland Aircraft. A “B” glider pilot, he is hon. instructor to Dorset Gliding Club.

When an inclined plane is presented to the wind two forces are exerted on it:—
(a) A lifting or upward force, acting perpendicular to the chord, and
(b) A drag or backward force at right angles to it.

Of these two forces, the lift is the greater for small angles of incidence. The lift and drag can be resolved, or combined into a single resultant force which usually forms an angle to the chord, and the point at which it acts on the surface is termed the Centre of Pressure.

This principle is made use of in the kite, the centre of pressure being the point of attachment of the string.

However, a flat plate is not the most efficient surface, and it has been found through study of the bird’s wing and by means of countless experiments that a cambered surface offers much higher lift and a lower corresponding drag.

When the lines of air-flow round a cambered wing-section are studied it is found that they follow fairly straight lines below the surface but that on the top surface they curve upwards as shown in fig. 2.

Now if the flow line meeting at the leading edge and dividing there takes a steady streamline flow on the lower surface but has to curve on its journey when going over the top surface, it must gain velocity to get round the curve.

If the pressure is high the velocity is low, and vice versa. This means that if our flow line above the wing increases velocity on the top surface there must be a decrease in pressure or a suction there compared with the pressure below, and in consequence the wing will lift upwards.

As the angle of the wing to the wind is increased so the amount of suction or Lift, increases, and with it the ever present evil Drag, until an angle of some sixteen degrees is reached, when the airflow breaks down and becomes turbulent. When this point is reached the wing is said to have stalled, and the Lift suddenly and rapidly falls off thereafter, while the Drag mounts up.

THE STALL.

The Stall is usually associated with slow flying when the relative flight path of the glider has steepened and virtually increased the angle of the wings. If a glider of a given weight and area is flown slowly then it must fly at a large angle of incidence where the Lift is great in order to make up for the loss of lifting power due to the slow airspeed. This slow speed tends to become more
and more reduced owing to the rapid increase in the Drag, and the gliding angle becomes steeper.

In power-driven aircraft and gliders this condition usually results in complete loss of control due to lack of force on the ailerons and rudder, followed by a very heavy landing or a crash, depending on the height above the ground of the machine. On a glider it is usually possible to recover from the stalled condition by depressing the nose and thus reducing the angle of incidence, diving for some 30 feet and then flattening out to a normal angle again. It will be shown later that there is a most efficient angle of incidence, which a glider should fly, and this angle is invariably a small one; therefore the machine flies fast.

To fly fast, the glider wing is placed at a small angle of incidence to the relative flight path (and this must not be confused with a flat flight path—the flight path the less the lifting power is small, but so is the drag, and it is due to the velocity that the necessary lift is produced and the glider maintained in flight.

**FUNDAMENTAL RELATION.**

Aeronautical engineers have made a unit, the lift co-efficient, or Kl, to express the lift at each square foot of surface at each angle of incidence, and it can be shown that—

\[ \text{Lift} = \text{Weight of Glider} \times \text{Lift Co-efficient} \times \text{Area} \times (\text{Velocity})^2 \]

and from this it follows that small weight, combined with a big area or light loading, produces a slow speed of flight for a given Kl.

It has been found in practice that a loading of some 11 to 22 lbs. per square foot gives a slow enough forward speed and landing speed for the primary type glider, and although the angle of the downward path along which the machine glides is relatively steep compared to sailplanes, because of the slow forward speed necessary to sustain the glider, the time to descend is fairly long (i.e. the sinking speed is low). Lighter loadings prove dangerous in gusts.

**MEDIUM PERFORMANCE.**

Some sailplanes also have this light loading and can therefore work in winds of low velocity, but the usual high performance sailplane is designed to operate in higher winds and the loading is therefore made about 28 lbs. per square foot or very slightly more, the landing speed increasing with the load.

However, in the case of these machines the drag is very much reduced and the lifting power of the large span wing is great in proportion, so that the net sinking speed is even lower than that of the elementary glider and at the same time the angle of the glide is at least three times as flat.

**ANGLE OF GLIDE. RATE OF DESCENT.**

It can be proved that the angle of glide is equal to the inverse ratio of the lift to the drag, L/D.

Therefore, the greater the ratio the greater the efficiency of the glider and the faster the angle, so that in a sailplane a wing giving the highest possible value of L/D must be secured.

Thus, an L/D of 20 to 1, which is quite feasible with a sailplane, would mean that in still air the machine would glide for a distance of 200 feet from a height of ten feet, but the usual school glider with open body would only have an L/D of about 8, and therefore from the same height would only glide 80 feet. It is found in practice that the best ratio of L/D is found usually at a fairly small angles of incidence of about 0 to 5 degrees or so.

If, however, the lift coefficient corresponding to optimum L/D ratio is low the machine will descend at high speed though at a flat angle, and the net rate of descent will be high. Thus it is obvious that a high lift coefficient at small angles of incidence must be obtained at the same time as the high L/D ratio in order to obtain the slowest possible rate of descent,

\[ \frac{v}{\sqrt{g}} = \frac{1}{\sqrt{\text{LID}}} \]

and the angle of incidence of a particular wing of a given loading producing the highest value of this ratio will be the most efficient attitude at which to fly the glider if a long flight is desired.

In practice, the speed can be calculated from the lift co-efficient at the angle, and the pilot must then fly his machine at this speed as indicated on his airspeed indicator if he is to secure the best result.

**SPAN AND DRAG.**

However, a wing section conforming to the factors previously mentioned, would not necessarily produce an efficient soaring machine if the wing was of any shape. The greater the span (or the higher the aspect ratio) the greater is the reduction in drag.

At the wing tip the air spills over the edge from the underside to the top owing to the suction on the top surface, imposing on the normal flow from leading edge to trailing edge a motion towards the centre of the wing on the top surface, and vice versa. This motion induces the formation of vortices at the tip, and the downwash on the top surfaces causes the resultant of lift to slope slightly back instead of at right angles to the wind. The lift is then aiding the drag, and this drag is termed the induced drag. This induced drag is proportional to the square of the lift coefficient, and as it has been shown that in a sailplane it is necessary to have a high lift coefficient it is obvious that the question of induced drag is serious.

It has been found that the greater the span of a wing the less the induced drag, until with a wing of infinite span there is no induced drag at all. Therefore the greater the span of the sailplane the greater its efficiency.

Whatever the span, there will be a secondary, or profile, drag due to the friction of the air passing over the wing surface. This drag is substantially the same whatever the lift coefficient or angle of incidence.

**SOARING.**

It may be concluded therefore, that in designing the sailplane it is necessary to utilise a lightly loaded wing having a section giving a high lift and a good

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**Figs.**

1. Slow flight at large angles of incidence.
2. Fast flight at small angles of incidence.
3. High speed diving flight at zero angle of incidence and very steep glide.
4. Slight wing path.
ratio of lift to profile drag, and that in addition the span must be made as great as possible to reduce the induced drag, at the same time making the overall resistance of the body and components small by good streamlining so that the overall L/D is very large.

It should be noted by all embryo soaring pilots that soaring is only gliding downwards at the angle giving the slowest rate of descent combined with the best L/D or the highest value of \( \frac{L}{D} \times K \), and that the machine will only maintain level flight or climb when the air currents have an upward trend equal to or greater than the sinking speed of the sailplane. Sailplanes have a vertical sinking velocity of not more than 5 ft per second. In a wind of that upward speed the machine will maintain height, if less it will descend, and flying at greater angles of incidence, i.e., getting towards the stalling point, will not help matters in the least; rather, due to the increased drag at the higher angle, the flight path will become steeper.

**STABILITY.**

It is interesting to discover why a given arrangement of wings and tail, etc., should provide a machine that will fly safely and not plunge to the ground at the slightest disturbance by wind.

Imagine a beam balanced on a fulcrum. Then, for the beam to be in balance, the moment of the beam on the right must balance that on the left, or the fulcrum must be placed at the centre of gravity. In the same way a glider to be in equilibrium (i.e. to glide steadily without altering its attitude), must have the resultant of the air forces passing through its centre of gravity.

**LONGITUDINAL STABILITY.**

Assume a cambered wing in equilibrium (i.e. with the forces balanced) for a given angle of attack.

If the wing has its angle of incidence increased then the centre of pressure or C.P. will move forward and the wing will tend still further to increase its incidence. With decrease of incidence the C.P. will move in the opposite direction. Now attach a tail to the main plane at zero angle with the wing in flying position. If there is no disturbance the combination will fly in equilibrium as the tail can exert no force, neglecting any downwash on the tail.

Then, if the angle of the wing is increased (i.e. the nose goes up) the tail is dropped, so increasing its angle of incidence and therefore lifts in opposition to the lift of the wing and tends to bring the system back to equilibrium. If the wing incidence decreases the tail is placed at a negative angle of incidence and again exerts a force in the opposite sense to that of the wing.

**DIRECTIONAL AND LATERAL STABILITY.**

In order that the glider may have weathercock (or directional) stability, it should have a preponderage of area to the rear of the centre of gravity. Then, if the glider swings sideways, the resultant air force is composed of the forward motion of the machine and the side gust (or side slip) and this resultant force acting on the major area behind will swing the machine into the gust or side slip.

Directional and lateral stability are very closely allied, and lateral displacement or roll, if left uncorrected, will turn the glider into the side slip. However, it is desirable to prevent the roll from becoming side-slip and to this end wind tunnel experiments have indicated that a dihedral (or upward) angle to the wings as viewed from the front, gives a powerful restoring moment. The major effect of this is due to the relative angle of incidence of the wing entering the side slip which is greater than that on the wing furthest from the slip.

Imagine the glider slipping to the left and with forward speed. Then the wing is not meeting the air symmetrically but on a plane inclined to the axis, and it can be seen that if a section of the wing is taken on each side the effective angle on the left wing will be the greater.

Dihedral also has the effect of throwing the resultant lift to a line passing perpendicularly through the C.G. in a manner similar to the beam example first mentioned, and thus equilibrium is achieved.

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**HOW GLIDING IS TAUGHT AT THE WASSERKUPPE.**

By courtesy of "The Sailplane" we reproduce here some remarks by Mr. C. H. Jackson dealing with his experience at the predominant gliding school in Germany. Novices at gliding will find themselves well repaid by study of Mr. Jackson's account of methods of instruction at the Wasserkuppe.

The students at the Wasserkuppe are divided up into three groups: beginners training for the "A"; those with the "A" training for the "B"; and those with the "B" training for the "C".

The "A" certificate is now a nominal affair. It is not considered important enough for a certificate and a badge with one gull is granted instead. One must however do the 30 seconds in a straight line before attempting anything other than a straight flight.

The possession of a "B" certificate labels one as a glider pilot, and of a "C" certificate as a sailplane pilot, or Segelflieger. The former requires five flights each of not less than one minute's duration and of "S" path. The "C" licence requires a flight of five minutes above the starting point.

When the best wind is available, the pilot who is trying for a "C" certificate usually starts from the Kuppe, the right-hand point of the horsehoe, turns left and goes with the wind to a point across the valley and more or less.
at the head of the horse-shoe. This is ideal for soaring but involves the unofficial recommendation that the pilot return to the starting point—if possible. Some pilots managed to overshoot the first point and then landed on the road about half a mile away and well across the plain.

STUDENTS' LOG BOOK.

Each student has a log book which should have a record of each flight and each attempt at flight. Its pages are most impressive. The information required is: strength and direction of wind; the flying ground (three are available and these are used according to students' capabilities and the prevailing wind); pilot's mistakes; damage (to the machine); the height and the duration of the flight; also any remarks. This may seem to favour of red-tape, yet such a detailed record is of great use both to instructors and pupils.

The procedure with ab initio pupils is sketched in the following notes. It is usually reckoned that a beginner who is going to spend a month at camp should leave with at least the "A," possibly with some "B" flights accomplished and certain lucky pupils might get the "B." The "A" should be gained after between 15 and 25 flights, on occasion with even fewer. On the other hand gliding, even at the Wasserkuppe, is at the mercy of the weather, and the time required varies between ten days and four weeks, but the course does not guarantee the gain of even an "A." The beginner is given a "joy stick." How not to hold the "joy-stick." The "B" is subject to the same limitations but the five flights counted on the balance the pupils' increased rate of learning, so that even a month might not yield a "B" licence. Yet, a power pilot can gain his "C" after two weeks' tuition, but with the machines used, he must have a fairly good wind; one good enough for the Professor type is not necessarily sufficient for a student on a Leichtwindsegler or on a Hangwind.

MACHINES USED.

Both "A" and "B" licences are still taken on the Zögling. The "C" is taken on the two types above mentioned. The former has the normal type built-up fuselage which is covered with fabric; the latter has a nacelle and the tail unit is carried by a form of grid on the Zögling. There is also the Prüfling, but this is as little as possible, only when the other machines are not of use. It is most unpopular owing to its heavy build and large forward and sinking velocities. A machine, the Falcon, or Falke, has recently been produced to replace these types, or be intermediate between them and the Professor. The beginner is given a lecture on the controls. The rudder control is contrasted with that of a bicycle; the use of the control-stick is explained, and the need of thought before each movement is emphasised. The futility of pulling back the stick, with its loss of speed and consequent danger of stalling is early demonstrated.

It is found that many pupils consider that it is correct to gain as much height as possible and that it is absurd to fly at anything less than an altitude of fifteen feet. This does not show at an early stage and does not manifest much at later stages when the slopes allow a reasonable altitude without an unduly large angle of incidence, but it definitely becomes obvious with some pupils after the first half-dozen flights. If it is not done consciously it is often caused by the acceleration at the start. To counteract this pupils are told to manipulate the stick so as to maintain a balance between the amount of land and the amount of sky in sight. If it is in favour of the latter and one feels the speed, or the noise of the wind in the wires decreasing, one is told to ease the stick forward, to flatten out before landing and once on the ground to put the stick forward and stay on the ground.

ABOUT THE RUDDER.

But at all stages of tuition, pulling was considered a serious fault, worse than pushing. Another point emphasised was the danger of applying right rudder and pushing the stick to the left or vice versa. This was continually harped upon and the general advice was not to use the rudder unless previously given permission. This meant that the instructor had to choose the direction of flight to avoid obstacles and to be into wind. The pilot had to select a distant point for his direction and keep his eyes on it so that if he flew off the course he should use rudder to regain it. This apparently contradicts other instructions but I soon found that it was advisable to leave the rudder alone, indeed, many found it hard enough to keep it in a neutral position.

With regard to the control stick, further instructions were given to use it to control any tendency to hang to right or left, but when doing this neither to pull or to push. The instructor adjusts the elevator controls the machine is at rest and not to get out before there is somebody at hand to hold the machine.

ORAL EXAMINATION.

Now all these instructions are given before the first flight and most of it is repeated for each succeeding one. Not only that, but the instructor asks the pupil what he would do, if in some unfortunate predilection such as barging into a clump of trees or drifting to the left and hanging to the left. Two minutes only are put on each side of the rope for the first flights and the pupil is not permitted to give the words of command, he was to repeat them according to the instructor's timing.

On later flights, say for the "A" and those preceding it, an interval of about six seconds between each command is satisfactory, on the earlier ones, three to four.

The instructor has full control over these early flights. He adjusts the elevators so that even if the pilot does pull a trifle the machine will not leave the ground. This precaution is necessary. The procedure is to let each student have three successive "flights." Of these at least the first two are
merely “skids” along the ground. They are, of course, quite short and merely to accustom one to the acceleration of the machine, but, apart from that, the instructor can see if the rudder has remained neutral and if either of the wings dropped; also, if the pupil felt this and made any attempt to correct it. It can be seen that such flights are fairly useful tests.

JUST KEEPING STRAIGHT.

For his third flight the pilot is allowed to rise anything from one to six feet above the ground. This is entirely the work of the instructor, he adjusts the controls and the timing of the words of command to his own satisfaction. The pupil’s job is to maintain a straight course. At this stage and the next for a flight, the instructor can see if pupils are capable of keeping the machine straight, in the predetermined direction and without banking to right or left. The real test of these flights is the landing. The usual early effort is either to push the machine down to the ground with an awful thump, or to over-do the flattening-out, and proceed with a series of hops and bumps till the machine stops.

After the first three or four flights the number of men on each side of the rope is increased, first to three, then soon after to four. The maximum number of men on the ropes up to the “A” stage is ten, and two on the tail.

Later, when “B” flights are approached, the former number was increased to 12 men. This was found to be enough, even for the heavier Hangwind and Leichtwind machines. Such a number are rarely used on a Zogling.

The procedure described is carried on until the “A” stage is approached. Up to this stage and after the very beginning the number of successive flights was reduced to two and only to one. The correct placing of the landing team is important, not only to the flight, but to the men. On one occasion when the “V” was narrow the start was bad because the machine was not placed so as to fly down the centre-line. The result was that the left wing dropped, and since the machine was not at any height a somewhat lazy starter was damaged in the ribs. Fortunately the damage was not serious, merely two cracked ribs and no flying for five days, but we took more care in the future.

CLUBS, PLEASE NOTE.

Around the 10th flight pupils give their own words of command and are started off from a reasonable height. The gradient of the slope is about the same as the gliding angle of the machine and it is an important point that absolute beginners must only be trained on slopes of this kind. Even on this slope three Zöglings were badly damaged. On one occasion a pilot pulled badly at the start, he did not stall, but went right off his course. He tried to correct this and to hang to the right at the same time, side-slipped and the machine was completely written-off. Another machine was almost as badly damaged through a stall, pure and simple. The third crash was of this type, but it only smashed one wing, the flying and landing wires and also the nose of the skid. The danger to the machine of a sideslip was continually emphasised and on several occasions demonstrated. Even a hop on comparatively “early” ground produced two cartwheels. This was not a serious matter at the Wasserkuppe, but it would be for a small club with one machine.

When trying for the “A” students are allowed three flights in succession and indeed the majority only succeed on the third. The usual successful flights were between 33 and 45 seconds in duration.

CONTINUAL PRACTICE.

Practice in long straight flights is continued before anyone is allowed to attempt curved flight. Students for the “A” are not allowed to go off the top of the Kuppe because there is a considerable drop before the slope approaches the gliding angle of the Zogling. Spot-landings are not attempted before the “A” certificate has been gained. When the pupil has got this and made some left and right-hand turns as well as an “S” path, spot-landings are introduced for turning practice. This spot is a white flag which is placed at the foot of the Kuppe so that a pilot who takes-off from there has to turn through 180 to 270 degrees if he is to land anywhere near the flag.

When I was at the Wasserkuppe the first good soaring wind was the signal for the advanced pupils to attempt their “C” tests. The power-pilots, if they managed to get to the correct place, came out quite well on this. Three of them obtained their licences after nearly three weeks’ training. They fared far better than those who had only flown gliders and had obtained their “A” and “B” certificates. But it must be noted that these had to serve an apprenticeship on the Zogling before passing on to the Leichtwind. This latter and the Hangwind were used for the “C” licences, the Drilling not at all.

A ZOGLING POINT.

The particular type of Zogling used for “A” and “B” flights had a rough fairing built on behind the pilot, this was said to improve the general performance by about 20 per cent.

Two things worth noting are that the safety belt was fixed to the fuselage by pieces of elastic cord. This saved many a wrench when a bad landing was made. All three machines mentioned had as “foundation” a triangular structure, familiar to those using the Zogling, with the upper part acting as a cabane. It is easy enough to pass the belt round the upright of this structure. The other point is that the Zogling is flown with knotted cord hanging from the wing root on the front spar. This enables the pilot usefully to dispose of his spare hand so that he will not overdo movements by putting two hands to the stick.
TAIL-LESS GLIDERS.

The value of a glider as a weapon of research is demonstrated in this notable contribution by Captain T. R. Hill, M.C., M.Sc., F.R.Ae.S., inventor of the “Pterodactyl” tail-less aeroplane. Captain Hill, who is a member of the “Dorset Gliders” of this district, describes how he carried out trials of his first “Pterodactyl” as a glider and furthermore gives an engrossing account of the work of his fellow pioneers in this specialised realm of aircraft design.

WHAT is all this talk about tail-less aeroplanes? Look at birds; they all have tails; why is anyone so foolish as to think that a flying machine can fly without a tail? This is what I am always hearing, though it is wrapped up in varying degrees of politeness, so as not to hurt my feelings.

While to some minds, the modern conventional aeroplane appears as a highly perfected piece of apparatus, it is only too painfully clear to others what a long way there is to go in the achievement of safety, comfort, speed and real fitness for one of the many duties now performed by aircraft of the present day.

The object, then, of the tail-less type, is the achievement of greater safety, comfort, speed and effectiveness than can be obtained from the conventional design.

THE WING AND THE LOAD.

The broad argument on which this hoped-for advance is based, is simply that while a wing is required for lifting the useful load, all the other surfaces, such as tail plane, elevators, fins and rudder are in the nature of parasitic surfaces; these parasitic surfaces are productive of unnecessary weight and air resistance, but they are essential on the conventional type of aeroplane to make good the shortcomings of the main wing or wings in respect of stability and control of the aeroplane as a whole.

The whole problem therefore is to design a wing so that good stability and control are inherent in its shape, and it is to this end that a number of people are now working all over the world.

The conception of an aeroplane without a tail is by no means new, and in the early days of this century, when the aeroplane designer was classed with the seer after perpetual motion, there were one or two bold spirits not content to follow the general trend of design, although it must be remembered that in those days design was infinitely less stereotyped than it is now.

To those of us who are keen on gliding, it is of the greatest interest to see how the glider has been used and is being used almost without exception in the development of the various types of tailless aeroplanes, and I propose to make brief reference in this article to the work of those pioneers who have sought success in what is aptly named in Germany the “wing only” type.

DUNNE’S PAPER MODELS.

The two names which first spring to mind are those of Dunne and Weiss. Dunne’s gliding experiments began as long ago as 1906, I believe, if not before, and were carried out with great secrecy in a remote part of Scotland. In his earlier work his gliders were biplanes, as were his first power-driven aeroplanes, while later he built a monoplane of roughly the same plan form.

He used a plain V-form with a heavy sweep-back and washout in incidence towards the wing tips, and his planes were of constant chord along the span.

These readers who are lucky enough to possess the early volumes of “Flight” will find some good pictures in the issue of September, 1910; so fascinating are these volumes that those not possessing them are strongly recommended to come by them by any means whatsoever.

In these days of tunnel tests in small wind tunnels, large wind tunnels, compressed air tunnels and all the paraphernalia of modern aeronautical research, it is interesting to remember that Dunne carried out many of his preliminary experiments on paper gliders, dropped from the top of the Balloon Shed at Farnborough. It seems to us now almost incredible that he successfully managed to fix the position of his centre of gravity from his paper glider trials, yet he has assured me that that was actually his method. From his gliding trials Dunne then progressed to power-driven aeroplanes, which suffered, along with many other types of that time, from an excess of struts, and thereby lost the fine performance they might otherwise have had. It is sad to think that one of his undercarriages had no fewer than 42 struts in it!

WEISS AT WORK.

The Weiss gliders were much more bird-like than the Dunne types; Weiss often used a small tail, though he derived his stability primarily from his gracefully curved and tapered wings; most modern looking in their heavy camber near the body. One of his gliders is illustrated in “Flight” of May 1912. Weiss made great use of large gliding models, just as they do in Germany to-day and launched his man-carrying gliders with ballast from the downs near Amberley, in Sussex.

In Austria, Lippisch was working along lines somewhat reminiscent of Weiss, and in Germany since the war, tail-less types have blossomed forth on all sides. Most notable among them are the designs of Herr Lippich, who has produced the extremely efficient “Storch” series, starting with the machines as gliders and then equipping them with very low powered motors.

Lippisch’s work is approximately contemporaneous with my own experiments on the Pterodactyl, which is illustrated here in flight after the engine had been installed. I carried out the trials of this first Pterodactyl as a glider in December, 1924. These trials nearly ended in disaster to the machine, owing to the heavy gales which raged in continuous succession just at that time. The road along the sea-front along which the glider had to be taken to its tent on the downs was nearly washed away by the sea and the tent, an old wartime R.E. 7 tent, was so rotten with age that constant repair day and night was needed to prevent it collapsing on to the glider trembling in the darkness beneath.

However, in spite of these difficulties, I carried out some successful glides and proved that the machine flew the right way up, with the sharp end first, and was well under control. It is at this stage in development that a glider is of great value; the structure being designed to carry two people and an
engine, there is a large reserve of strength when flying as a glider; and if a crash does occur, the light loading ensures that contact with the ground will be of relatively moderate severity.

**GEASELESS EXPERIMENT.**

Since the days of these gliding trials in England, Herr Lippisch, as previously stated, has been experimenting continuously with tailless types, in addition to designing what are generally agreed as the most successful conventional type gliders which have ever been seen. The Wien, so ably demonstrated over here during the summer by Herr Kronfeld, is a beautiful example of Herr Lippisch's skill in the art. I was recently privileged to see the very latest products of the Rhön-Rositten Gesellschaft at the Wasserkuppe.

Although it is not possible to give any details, I can say that the new machines from Herr Lippisch's board are truly wonderful pieces of work, commanding the greatest admiration both for their clever construction, and also for the way in which his extensive theoretical investigations have been embodied in the design of the wings and their control surfaces.

Space limits forbid the description of the tailless gliders of Dr. Kuppe and others, but without doubt the German investigators are deriving an immense amount of help from their gliding experiments in the development of their tailless aeroplanes. Is not their work an example to us over here of the value of the glider as a weapon of research?

**CHOOSING GLIDING SITES.**

A subject which is of first importance to all gliding clubs is dealt with here by Herr Robert Kronfeld, the Austrian soaring flight expert and the world's foremost exponent of the science. His demonstrations in Britain last year under the auspices of the British Gliding Association did much to spread public interest in the movement. We are indebted to Herr Kronfeld for permission to reproduce this article, which has also appeared in "Airways."

Perhaps the most important question that confronts the founders of every new gliding club is the choice of a suitable site from which to commence operations. For upon this choice depends to a great extent the choice of machines, as different sites require different types of gliders and vice versa. The three main requirements to be met in the selection of a site are these: the site should be readily accessible, it should involve no dangers of any kind for either pilots or machines, and its position should be such that the air and wind currents are favourable to gliding.

**THE DIFFICULTY.**

Unfortunately, any one of these requirements is, in most cases, incompatible with the others. In the majority of cases the sites that are most suitable for gliding and which offer the most favourable meteorological conditions are situated far away from human habitation. A case in point is the Rhön site in Germany, which, though it was only decided upon after a search extending over several years, is an hour and a half distant from the nearest small township and three hours distant from the nearest large town. It is equally probable that the ideal gliding site in England will prove to be situated somewhere remote from the summer's resorts. The several clubs now being formed are not so much to discover an ideal site suitable for a great national training centre, but rather a suitable local venue where they can practise their sport conveniently. And such sites are to be found practically everywhere.

For gliding and soaring, grounds of quite different natures are necessary, but in selecting a site for the one sport the possibility of practising the other branch of engineless flying must also be taken into account.

The ideal site for gliding is a conical-shaped hill or slope which slants downwards first steeply on every side and then more gently towards the level. It should have a plateau on its summit to allow of launching gliders, irrespective of whatever the direction of the wind may be. Any obstacle, either in the form of roads, houses, trees or large stones on the landing site is a drawback and even decisive. The most favourable site is grass soil, such as meadow land. The wind should be free to flow in from as many sides as possible, so as to remove all risk of eddying or unnecessary buoyancy. In no case should the site be situated in a deep valley or crater-shaped cavity or be in the immediate vicinity of high mountains, as in both cases down currents and other undesirable air flows would result. Abrupt changes of level, such as might be created by high cliffs or precipitous coasts should be avoided at all hazards, as treacherous eddy currents are invariably found in such localities.

The site chosen should be adapted for the type of machine employed, in so far as the major part of the drop should slope only a little more steeply than the maximum gliding angle of the machine. In order to satisfy the tests for an "A" licence, which demands a glide of thirty seconds duration, a difference in height of 180 to 300 feet will generally suffice, while for the "B" licence a glide of the "A" licence tests, a flying stretch of 1,200 to 2,400 feet should be available, with a stretch of twice this length or over for the "B" licence tests. These figures should give some idea of the unobstructed area required.

**SOARING FLIGHT.**

Glaiding alone, however, is not the sole ambition of those who have taken up this fascinating sport. Soaring flight, with its noiseless, unhurried progress through the air is the real aim of gliding enthusiasts. Hence anyone entrusted with the selection of gliding sites will have to consider whether these will also be suitable for soaring flight at a later date. In soaring, the slope must be such as to face into the prevailing wind. The longer the slope, the fewer will be the curves necessary, and the more easy it will be to fly in a "C" licence test. A quarter of a mile may safely be taken as the lowest limit admissible for the slope's length, while a half-mile is considerably more favourable and one mile the ideal. The height and steepness demanded depend on the adjacent ground-levels and the wind conditions, and no hard-and-fast rule can be given for any case. On sites which are completely accessible to the air, such as coast-lines, lesser heights will frequently suffice. Hence it is that the sand-dunes of the soaring-flight training centre at Rositten, which are less than 180 feet high, yield splendid up-currents, whereas the lift would prove inadequate in the central mountain chains or in the interior. The majority of
the favourable soaring sites known to me all possess, in their upper reaches, a gradient of at least 20 to 30 degrees. If our gliding sites are to allow of soaring flight also, we shall have to adopt the conical, stump-shaped site in preference to a pyramidal multi-sided one. In other words we shall require a hill with a small plateau on top sloping away on each side towards different wind-directions. As an example of these features the Cliff Hill at Lewes may be cited.

OBSTACLE-FREE SLOPES.

By soaring, I mean flying at a height either above the starting spot or at least on the same level. When, therefore, a site is considered from the soaring pilot's standpoint, it is not absolutely necessary that the slopes and the valley below them should be free from obstacles. The landing is, in most instances, effected on the summit of the hill, or it may happen that the gliding angle of the machine, allied to high proficiency, allows the pilot to select from several suitable landing sites in the valley. In any case these should not be too scanty, to avoid the risk of mishap in trial flights.

Many clubs will find it impossible to secure, within reasonable reach of their town headquarters, a site combining all the virtues to which I have referred. But this by no means need deter clubs from starting operations. Provided that their organisation is flexible enough, it will depend entirely on the proficiency of the members, and on the type of machines and the experience of the different pilots, to choose a site that will at least satisfy requirements. A normal aerodrome, for example, will serve for the first "hops.

To the regret of the pilot of power-driven aircraft the majority of aerodromes are not by any means level, and as a rise and fall in the ground level of several feet are common everywhere, training in rising above these can also be given. Some shed or hangar will doubtless be found available for storage, and a complete course of training can be carried out to enable each member to accomplish his first fifteen or twenty "hops."

SEEKING WIDER SCOPE.

Later, when all the members are so far advanced that the aerodrome site offers no further appeal, and provided, of course, that the pilots have gained sufficient control of their machines, there comes a day when the club must depart to a suitable slope with a favourable wind direction. Then, one after the other, they are launched into the air for their thirty-second flights to qualify for their "A" licences. Admittedly, training of this nature is not ideal, but it may be essential in some districts and certainly permits of a sound preliminary education in handling a glider. Further, there is the advantage of acquiring the machines used can be easily entered and left and that they should be capable of rapid transport to any desired site on a small truck. For the carrying out of soaring flights of this nature, which demonstrate how effectively it is possible to adapt oneself to unfavourable conditions in sailplaning, no hangars are necessary, and the machines may, when not in use, be stored on the transport-trucks in any garage.

TAKE CARE.

The care which should be taken in the selection of a site cannot too often be emphasised. It is far better to devote days, weeks, or even months, to finding a site that is the best the whole locality can offer, rather than, as is so frequently done, to set about erecting a hangar anywhere, which will probably have to be demolished at trouble and much expense, a few months later in favour of a more suitable site, probably about a mile away. The best method of all is to hold a series of demonstration trials at each of the possible sites available, and to make the final selection as the result of these trials.
ACHIEVEMENTS IN GERMANY.

The setting up of a new distance flight record by Herr Robert Kronfeld of 100 miles and other achievements at the Wasserkuppe and elsewhere are described by Herr Ronald Flinsch in this instructional account, which will be of valuable information also as to the form taken by German contests during 1930.

Of all gliding meetings held in Germany the International Rhön Soaring Competition is by far the most important and popular. The 11th Rhön Competition, held on the Wasserkuppe from August 9-24, 1930, was a complete success for the international gliding movement. Several records were broken by high-performance pilots and the competitors in the training competition also progressed considerably.

There are two classes included in the Rhön contests. The training competition is reserved for pilots who have passed their "C" tests, and who have not taken part in any performance-competition. The performance-competition is open to anyone.

TRAINING COMPETITION.

I.—Prize given by the Prussian Ministry of Commerce and Industry for the largest total of time flown in different flights, divided among three machines:—1, "Darmstadt," pilot Starck, total 27 hours 28 minutes; 2, "Luftikus," pilot Bedau, 24 hours 35 minutes; 3, "M 11," pilot Patz, 16 hours 51 minutes. Any number of flights could be undertaken for this prize, a minimum of two flights being required and only flights of at least 60 minutes each being counted.

II.—Prize given by the Bavarian Ministry of Foreign Affairs for the largest sum total of heights attained was divided among:—1, "Luftikus," pilot Bedau, sum of heights attained in five flights, 2422 feet; 2, "Darmstadt," pilot Starck, five flights and 1716 feet; 3, "Mainberg," pilot Hemmer, five flights and 852 feet.

Altitude over starting point was measured, and only flights of more than 330 feet in height were allowed for.

III.—Prize for first pilots to succeed in flying a distance of three miles away from the Wasserkuppe and returning again without making a landing. Won by:—1, "Darmstadt," pilot Starck, 31 miles; 2, "Luftikus," pilot Bedau, 3 miles.

PERFORMANCE CONTEST.

I.—Prize for distance, given by the German Minister for Transport. Won by Pilot Robert Kronfeld on his "Wien" for a flight of 100 miles from the Wasserkuppe to Wolsauerhammer on August 24. Kronfeld, under the same conditions and on the same day, flew four times as far as the next best pilot.

II.—Prize for distance flight to a given point, divided between:—"Wien," pilot Kronfeld, and "Fafnir," pilot Groenhoff. Both flew to a given point, more than nine miles from the Wasserkuppe, and back to starting point.

More than two hundred flights were carried out during the competition. Duration varied from one minute to eight hours 37 minutes. Actual distance flights were small in number. The longest flight made was by V. Husen on "Jupp-Pitter" on August 17. On August 24, Bedau on the "Luftikus" achieved a height of 5,412 feet above starting point, the greatest height reached during the competition.

Besides three prizes given in each class there were many other smaller so called "day-prizes," for which certain conditions had to be fulfilled. Flights undertaken for these prizes were often most interesting.

Bedau, when reaching his greatest height, climbed to an altitude of about 3,000 feet at a rate of 30 feet per second, through a cloud. From below one suddenly saw a plane come tumbling out of a cloud in a spin, make two sloppy loops, begin to spin again; and after another sloppy loop, Bedau at last was able to steady the machine again. He continued to fly for several hours. To come out of a cloud in a spin because you have lost all sense of balance in blind-flying is unnerving enough, but to go on flying after that requires a tremendous amount of energy and iron nerves.

NEW WORLD'S RECORD.

During the competition, to give some statistics, ten flights of over six hours were performed by the pilots Muschick, Patz, Starck, Mayer, V. Husen, Bedau and Hemmer; five of these were in the training competition and only Mayer and V. Husen belonged to the performance class. The performance competition did not include a prize for duration, which is the reason why you do not find such names as Kronfeld and Groenhoff among them. Prizes for duration given in the "training-class" are intended to get the young pilots accustomed to their machines during the long hours of these flights.

Six flights of more than 25 miles were accomplished by pilots Kronfeld, Mayer, and Hurtig, and of these three alone were made by Kronfeld, among them being the now officially recognized world’s record of one hundred miles to Wolsauerhammer measured as the crow flies, on August 24. Pilots Groenhoff, Starck, Bedau, Mayer, Röhm, and Hemmer reached heights of over 1,500 feet in altogether 11 flights.

Forty machines entered the competition, among them an altogether new design, the "Fafnir," flown by pilot Groenhoff. The shape of the wings closely resembles those of the gull having a bend or shoulder. The likeness to a bird is thus emphasized when in the air. Mayer's machine, his own construction, was very successful.

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During the first week of October a Bavarian soaring meeting was held near Bayreuth on the Hesselberg. Unfortunately on several occasions the wind proved to be too strong and on these days some flights had to be called off. The longest flight was made by pilot Medikus with one hour and nine minutes. More than 150 starts were undertaken and although the site cannot be compared to the Wasserkuppe, performances shown were extremely advanced. At the two West German gliding meeting performances shown were too, unhappily on unfavourable wind conditions predominated some fine flights were made. At the West German gliding meeting performances shown were crippled by unfavourable wind conditions. The longest flight undertaken there was one of only 3 minutes 46 seconds. Besides the competitions mentioned above, others have taken place in different parts of Germany, but after all, the most important event in German gliding always is the one at the Rhön.

PILOTS AND MACHINES.

In the German gliding and soaring movement up to date 400 "C" certificates, 1200 "B" certificates and 1500 "A" certificates have been issued. In 1929, 643 machines were registered in clubs affiliated to the Deutsche Luft Verband, i.e., not counting machines of clubs not affiliated. In 1927 there were 124 machines and in 1928, 231.

GLIDING IN AMERICA.

America's gliding problems and aims and achievements in soaring flight are unfolded in this article by Mr. Donald P. Walker, Manager of the National Glider Association, which fulfils the functions under­taken by the British Gliding Association in the British Isles.

In 1884, John J. Montgomery of Otay, California, made the first heavier-than-air flight in America, using what to-day would be known as a very crude glider. Professor Montgomery's experiments lasted for several years, ending in his death, and included the work of several assistants. One of these took a glider to a height said to have approximated 4,000 feet above the ground and executed on his way down, quite possibly by accident, the equivalent of the modern "barrel-roll." Years later Chanute at Chicago and the Wright brothers at Dayton, Ohio, used data secured by Montgomery in developing innovations of their own.

In 1912, the Wrights, flying a glider at Kitty Hawk, made a true soaring flight of over nine minutes, which remained as a world record until after the world war and an American record (un-official) until August, 1928, and officially until November, 1929.

There are many members of the "Early Birds," a society of pilots who flew before 1917, whose sole claim to membership is based on being able to prove that they flew a glider of sorts during 1910-1915. Among these are Lieut. R. S. Barnaby, U.S.N., first American pilot to pass the modern "B" test for an F.A.I. glider certificate, and W. H. Bowker, former official holder of the American duration record.

Following the revival of interest in gliding in Germany in 1919 in which Dr. Wolfgang Klemperer, now first vice-president of the National Glider Association and chairman of its technical committee, played an important part, Professor Edward P. Warner, of the Massachusetts Institute of Technology encouraged his students to design, build and fly gliders. In 1922, the Professor took a team to the Wasserkuppe. The "star" pilot was Eddie Allen, a former war pilot. In 1928, J. C. Penny, Jr., financed an expedition to America headed by Paul Franz Roche, head of the Rossitten School in Germany. In addition to Zoglings and Prudings, they brought with them the first of the great soaring stars to bear the actual name of "Darmstadt." Herr Hesselbach flew this great ship on Cape Cod for over four hours, establishing a new un-official American record.

**EXTENT OF THE MOVEMENT.**

Early in 1928, Edward S. Evans, chairman of the Aircraft Bureau of Detroit Board of Commerce, launched a national organization for the promotion of the sport in America which is now the National Glider Association.

As time went on clubs were formed throughout the country. Many requests for assistance were received from Canada, Mexico, Australia and New Zealand, and contacts were established with the Rhön-Rossitten Gesellschaft and the British Gliding Association.

To-day the Association numbers 60 clubs and approximately 1,500 members. There are nearly 200 glider clubs in the United States with roughly 3,000 members.

Too much emphasis has been laid in America on the primary training glider, copied from the Zogling. It was thought that aircraft manufacturers would be able to sell them for as little as £50 each. This was found to be impossible, and manufacturers' sales prices have ranged from £70-£100 for this type. Many clubs sought to build their own from plans provided by the...
National Glider Association, but relatively few of these were completed and very few were very satisfactory.

Americans have never liked the shock-cord method of launching. It is too much labour.

Early in 1929, University of Michigan students began to experiment with towing primary gliders on ice behind an automobile. They found that, under proper leadership, this method of training was more efficient than shock-cord from a hill-side.

Where a trained instructor is available the auto-towing method of primary instruction is preferable. In no case should a primary training glider be towed to an altitude of over 30 feet from the ground and only then at a speed that would just permit of getting it there. Training by this method in high or gusty winds should be avoided.

Professor Franklin, of the University of Michigan, pioneered the "utility" glider. This is a ship with an enclosed steel-tube fuselage, not very different in general appearance to the Prufing. Stressing with great care for every type of gliding it can be used for shock-cord primary work, is especially suited for auto-towing primary and advanced work on account of a single balloon-tyred wheel set in the centre of the fuselage and is a very efficient soaring glider. It sells for between £120 and £140 and could be built for £40. There have been but two deaths in this type, both of them due to failure on the part of the pilots. There have been eighteen deaths in primaries.

Over 600 gliders have been identified by the Department of Commerce and of these it is probable that more than 40 were utilities.

AEROPLANE TOWING.

Although aeroplane-towing has been given a bad name in the United States (—and is now forbidden—Ed.) due to the death of two poor fellows who unwisely attempted to tow primary training gliders, there has been but one mishap in all of the aeroplane-towing by persons connected with Professor Franklin, and his work has included building the glider for and to a large extent supervising the spectacular flight of Captain Frank M. Hawks across the continent behind an aeroplane.

Aeroplane-towing offers a method of gaining the altitude of clouds which are indicative of the presence of up-winds and, after releasing from the tow-ship, engaging in soaring flight for quite long periods of time. This may be done over level as well as hilly country. It also offers means of getting into the up-wind along ridges and hills where there are no clearances for shock-cord take-off points on the summits.

After having been one of three glider pilots to be towed to an altitude of some 7,000 feet behind an aeroplane at Cleveland, Mr. Wallace Backus, a native of England, but now of New York, brought his ship into the up-wind beneath a cumulus cloud and flew from Cleveland Airport for several miles out over Lake Erie, returning with sufficient altitude to permit of landing back again on the airport in September, 1930.

In 1929, the Baker-McMillen Co. of Akron, Ohio, built what became known as the "Akron-Kondor," an American "Darmstadt" which attracted national interest especially as it was used by Dr. Klemperer.

BOWLUS SAILPLANE RECORD.

For several years at San Diego, Cal., Mr. William Hawley Bowlus has been experimenting with gliders. In 1929, he finally completed a sail-plane with a 60 ft. span in which he has increased the American official duration record to over nine hours. When Colonel Charles Lindbergh visited him at San Diego the Colonel on his first glider flight stayed in the air for 40 minutes.

While Mr. Bowlus was in California on business, one of his pupils and associates, Jack Barstow, took up a sail-plane of Bowlus manufacture for what he thought would be a relatively brief afternoon's flight. Finding conditions unusually favourable, he stayed aloft for 15 hours and 15 minutes, beating the official international record by over an hour and the unofficial record of Dinort by 28 minutes.

An interesting experiment in gliding was made early in 1930 by Lieut. Barnaby, U.S.N. The Navy purchased a Prufing, and this was attached to the 'Los Angeles,' American naval dirigible. The ship then went aloft and at several thousand feet altitude, the Lieutenant stepped into the cockpit of the glider, released it and glided to earth.

FIRST NATIONAL CONTEST.

The first national soaring contest opened at Elmira, N.Y., on September 21 and lasted until October 3. Entries were limited to enclosed fuselage gliders and pilots were required to be either holders of the F.A.I. first-class certificates; the second-class license; holders of the Department of Commerce commercial glider pilot license or motored airplane pilots with prior successful glider experience.

The ridges where the contest was held are quite "sporty." Their sides are largely wooded and in nearly every case there were fringes of either trees or bushes along the base of the take-off points. With the exception of the south, there were ridges facing in every direction and that is why the spot was chosen. We have found no Wasserkuppe in America as yet.

In all, there were 118 hours of soaring flight by the 14 gliders and 24 pilots registered. The longest flight was made by Albert Hastings of Los Angeles, Cal., in a Franklin "Utility," lasting for seven hours and 43 minutes. He is first winner of the Edward S. Evans Trophy for duration.

Second place went to Warren Eaton, of Norwich, N.Y., flying a Baker-McMillen utility with a flight of seven hours and 21 mins., and third place to J. K. O'Mears, flying a utility of the same company, whose flight of six hours and 48 minutes established a new official American record as he landed at the take-off point as required by F.A.I. rules.

Five ships accomplished 109 miles of measured distance flying, and here the German soaringers established a definite supremacy over the American.
utilities. Herr Wolf Birth made the greatest distance of 33 miles flying. A. C. Haller of Pittsburgh, Pa., flying a German soarer, made the next best flight of 13 miles. O’Meara in his utility flew 10.43 miles.

Nine “C” tests were passed. The contest was sanctioned by the National Aeronautic Association, representing the F.A.I.

GOVERNMENT REGULATIONS.

The United States Department of Commerce issues an approved type certificate for gliders manufactured by standard firms. The department requires data of all builders. Pilots engaging in gliding as a business must pass a physical test and flight examination, including 360 degree turns. Non-commercial licences are issued without the physical examination and on completion of a general test including at least 180 degree turns. Students are supposed to register for a permit and to agree to fly only under a licensed instructor. The Department, however, has little authority over aircraft not engaged in inter-state traffic.

American pilots look forward to the time when conditions will enable them to be the hosts of an international meet and when they may have the privilege of visiting the terrain of their friends overseas.

Our British friends have different problems to face than we have, but we are all working towards a common end—the further advance of aviation in general through that wonderful sport, soaring flight.

BRITISH GLIDING ASSOCIATION.

The aims and objects of the British Gliding Association are described here by Mr. Douglas W. Genge, a founder-member of the Association and the representative of Dorset Gliding Club on the Council of the organisation.


TO all those who, like myself, have followed the progress of aviation for many years, the revival of interest in gliding and motorless flight must have awakened considerable curiosity as to its future and development.

Towards the end of 1929, it became apparent that in this country there was so great a desire on the part of such a large number of individuals over a widespread area wishing to commence the sport of gliding, with its ultimate aim of soaring flight, that before long many clubs would be formed for that purpose.

It was therefore desirable that a central body, who would be responsible for the proper development and control of the sport, should be formed to which the various clubs might become affiliated. To that end, the British Gliding Association came into being and I think it may safely be said the Association has met with some success, much good work having been done since its inauguration.

On March 27, 1930, the inaugural meeting of the British Gliding Association was held, the first president, the late Sir Sefton Brancker, being in the chair.

Subsequently, Herr Robert Kronfeld was selected by the Association to give demonstrations in different localities, the first public meeting being held at Itford Hill during Whitsun and the following week last year. These demonstrations drew very large crowds, and evoked considerable excitement, especially in those people who had no previous knowledge of the wonderful possibilities of a high-performance sail-plane.

Although in almost every case the soaring ground was in a inaccessible locality the size of the visiting crowds was a good augury for the future of the sport. Certainly I think the Dorset Club’s particular show at Eggardon Hill on July 5 and 6, was a distinct success, and the numbers present must have surprised many.

AIMS AND OBJECTS.

The Association sent representatives to the international meeting held at the Wasserkupe, in August, 1930, and offered a prize for the pilot flying the longest distance not less than 89 km., the prize taking the form of a week’s visit to England. This prize was won by Herr Kronfeld, who we thus again had the pleasure of meeting in October. A complimentary dinner was held at the Tocadero Restaurant on October 14 to welcome Herr Kronfeld.

I must now outline some of the Associations objects and hopes for the future.

The Association, which is an association of affiliated clubs controlled by the clubs themselves for their own benefit, is engaged in the promotion of motorless flight within the British Isles, and is available for help and is willing to give information to any country in the world. Its constitution provides for two main classes of membership, affiliated clubs and personal members, and the control of the Association is in the hands of the representatives of affiliated clubs who comprise the majority of its council.

The rules provide for every affiliated club to have a member on the council at the time of affiliation, and another representative on the Council is allowed for every 100 members of the club. There are 40 clubs affiliated to the British Gliding Association, and approximately 60 clubs just formed or in process of formation will no doubt become affiliated as soon as they are able to qualify. Isolated clubs cannot hope to obtain the benefits which become available on affiliation to the Association. The personal membership has now reached the gratifying total of 173, and one wishes that all those interested in the gliding movement would endeavour to increase the membership of the Association by every means in their power.

The Association has made, and is making every effort to form gliding clubs all over the country.
JOURNAL AND BLUE PRINTS.

The Association publishes a Journal which contains valuable information. This is issued free to members, and copies may be obtained by non-members at the price of 2/6.

Many valuable cups and prizes have been presented to the Association to be competed for by affiliated clubs.

The Association is in close touch with the Rhön Rossitten Gesellschaft, which is the parent body of the gliding movement in Germany, and sent a delegate last year to the conference on international regulations. It is also in touch with Associations which are being formed in the British Dominions, and receives many requests for information from most out-of-the-way places. The movement, which is now seen to be of world-wide-importance, is being developed and promoted by a group of national associations of which the British Gliding Association is the representative for the Empire.

Glider pilots' licences are issued in accordance with the regulations of the Federation Aeronautique Internationale, and by the Royal Aero Club, through the British Gliding Association, to whom all applications must be made for the appointment of observers and the issue of licences.

All gliders that are to be used either in competitions, or for the purpose of obtaining glider pilots' licences must be approved as airworthy by the Association.

HELP IN FORMING CLUBS.

The Association will send to anyone desirous of forming a local club, the fullest information as to the best way to proceed with the organisation. A representative is available to go to any locality, and would be prepared to assist in the formation of a gliding club if requested, provided that reasonable expenses only are paid.

The Association will also, in the event of any clubs or individuals desiring to establish gliding and soaring sites in their vicinity, be pleased to send a representative to any place to advise on the suitability or otherwise of the site, provided reasonable expenses only are paid.

With regard to the question of insurance, the Association will on request furnish the names of insurance companies willing to effect this.

The Association, as the body governing the sport in Britain, is responsible for the administration of the gliding movement. In addition to organising on a national basis the numerous gliding clubs already established, it is the purpose of the Association to gain for the new sport the official recognition it so rightly deserves, and it is hoped that public interest will manifest itself very strongly in order to obtain the Government's financial support.

ABOUT THE FUTURE.

With regard to the future it may be said that there is a great need for study of the various problems of a technical and meteorological nature, and were it possible for the Association to set up a central research and testing institution similar to that of the Rhön Rossitten Gesellschaft at the Wassertuppe, there would be plenty of work to keep it fully occupied. In point of fact it is hoped that funds may be shortly available to enable such an institution to come into being.

One cannot conclude even a short account of the Association's work without mentioning the great assistance received from the Royal Aeronautical Society, and its past-president, Colonel The Master of Sempill, A.F.C., A.F.R.Ae.S. Mr. E. C. Gordon England, the chairman of the Association, is also most active in its service. Mr. L. Howard Flanders, who was the secretary on the formation of the Association, and Mr. J. L. R. Waplington, the present secretary, have had a strenuous time dealing with all the enquiries and organisation incidental to a new body.
ASSOCIATION OF NORTHERN GLIDING CLUBS.

Mr. E. T. W. Addyman (hon. sec. pro tem) supplies the following information concerning the Association of Northern Gliding Clubs.

An organisation with headquarters in London is of limited usefulness to clubs in the North of England. The chance of sending representatives to council meetings, etc., is such a great drain on finances that in actual practice northern clubs cannot be properly represented on the council of the British Gliding Association in London.

Many folk do not understand the vast differences between the North and the South in weather, character of the country, density of the population and temperament of the people.

Existing regulations controlling civil aviation as applied to northern conditions give so little scope and contain so many restrictions that for the average northerner flying is beset with difficulties.

The above are some of the reasons which have led to the formation of the Association of Northern Gliding Clubs.

EXCHANGING EXPERIENCES.

Three meetings of the Association had been held up to December, 1930. Preliminary discussions have taken place with regard to provision of hangars, and sailplanes to be used jointly on joint sites by several clubs. Very useful exchanges of experiences have taken place. To give an example, after hearing of the experience of the Bolton and Ilkley Clubs with their gliders, the Aircraft Club of Harrogate decided to adopt a more forward loading on the glider which they were then building. This was done with beneficial results.

British Gliding Association representatives were invited to a meeting, where a number of matters were explained which were not previously clear to the Northern Clubs, and some concessions were obtained.

Although the chief function of the A.N.G.C. has been to enable clubs to meet regularly and discuss matters of mutual interest there are possibilities in the future of more definite activity. It is felt that the present moment is not ripe for such an extension, as clubs are all in their babyhood and do not yet fully realise the problems they are up against.

No club is pressed to join the A.N.G.C. The expenses of running the Association have been almost negligible. It has not been necessary to send round a request for subscriptions, although clubs attending regularly are expected to send £1 to the hon. treasurer when it suits their convenience.

The A.N.G.C. does not force itself on any club, neither does it issue a host of regulations. It simply exists for the benefit of its members, and it rests with them whether they make use of it or not.

The hon. secretary's address is The White House, Starbeck, Harrogate. The hon. treasurer is Mr. E. Craven, 15 Kirkgate, Bradford, and the chairman is Mr. R. F. L. Goolding.

THE FEMININE POINT OF VIEW.

Over 130 women are among the flying members of gliding clubs in the British Isles, and the national movement already boasts of lady "A" pilots. This was reason enough for asking Mlle. Susi Lippens to give her views on the sport, for this Belgian sportswoman first flew in a glider in January, 1930—and gained her "C" certificate at the Rhon (Germany) in the following May! A member of the Channel Gliding Club, Mlle. Lippens made several flights in her "Professor" in Britain last year. She is also an "A" aeroplane pilot.

I feel that as soon as a proper gliding and soaring school is established in England, it will be crowded with girls—who, after all, often have more time at their disposal than men.

And after having said that, I find that I have not much more to say, because women's success in other sports speaks for me.

Most people know by this time that ladies do a great many things as well as men, and, in the sphere of flying only, the names of Lady Bailey, Miss Spooner, Miss Amy Johnson, Miss Winifred Brown, and the Hon. Mrs. Victor Bruce prove this.

I do not think that in the realm of soaring they will stay far behind.

I feel that as soon as a proper gliding and soaring school is established in England, it will be crowded with girls—who, after all, often have more time at their disposal than men.

LOOKING AHEAD.

Gilding is a very healthy kind of sport, and gives one quite a lot of exercise, as all people who have pushed or pulled a glider up a hill will tell you... and although I do not think that it will be included in the prospectus of one of the bigger girls' schools for 1931, I should not be surprised if we read quite a matter of course in a few years' time:

"Highcliffe School... Ideal school for girls. Sewing, gliding, cookery and hockey included."

Nor shall we be surprised when we see busy city workers gliding down to their work from Hampstead Heath, inhaling thus a little invigorating fresh air on the way. They would alight on one of the big aerodromes that at the moment do not exist, but which it is proposed to erect over the stations of London.

Nothing will surprise us. Even when we hear of such surprising things as Herr Kronfeld reaching the altitude of 9,000ft. in his sailplane, we are not taken aback, but discuss it.

I have only my own private point of view to put forward, as I do not know any of the other ladies who soar, and so, have not had the opportunity of discussing the matter with them and therefore cannot give a more general point of view.

But, women should not go in for soaring as well as men.

I feel that as soon as a proper gliding and soaring school is established in England, it will be crowded with girls—who, after all, often have more time at their disposal than men.
TALK GLIDING AND WRITE GLIDING.

Mr. C. F. Carr gives this advice to all who want to help the gliding movement.
He is joint author of "Gliding and Masterless Flight."

ALTHOUGH gliding is an all-the-year-round sport (providing, of course, that the periods of air activity in the winter are discreetly chosen), the British gliding movement has not yet succeeded in making this fact generally known. This is not the fault of the movement, which is still sufficiently young to have much spade work before it.

So far as gliding in this country is concerned, it may be said that so far it has only had one season in which to accomplish anything. It would be unfair to expect that in only a few months much progress would be made in educating the general public in a gliding sense.

If we are to consider a matter of fact, excellent progress has been made in this direction in the short time which has passed in which gliding has been brought prominently to the notice of the public generally. Already the public is beginning to realize what gliding is, and what possibilities it holds for the future, both as a sport and as a means for the spreading of air-mindedness.

At the same time, it is only too obvious that there are still many misconceptions concerning gliding and sail-planing. Only a few days ago, for instance, the writer casually showed an excellent photograph of a sailplane in flight to a male friend who takes a great interest in most other sports. He evinced great surprise when he saw the photograph, and explained that he had always been under the impression that a sailplane was a contrivance of his imagination sailed through the air in some obscure way like a boat and which had sails. He had apparently thought that the curious contrivance of his imagination sailed through the air in some obscure way like the wind that occasionally brings fish into harbour.

There is probably some sort of excuse for little misconceptions of this kind, which may be rather amusing to the initiated, but are really understandable when so many people have had no opportunity of seeing a glider or sailplane at close quarters.

LOSE THIS PREJUDICE.

This preamble is intended to lead up to the point that one of the important considerations for the immediate future in the gliding world is the question of gliding propaganda and publicity. Both "propaganda" and "publicity" are words against which many people have some sort of prejudices. They do not know quite why it is, but the reason probably is that they associate both words with the activities of people who spend their time trying to get them to buy things they do not want, or to join movements in which they have not the slightest interest. It may be said, however, that both propagandas and publicity have an important part in modern life, whether in the commercial, industrial, social service or purely social spheres. It is not too much to say that no movement can really succeed without a well organised and a persistent publicity department.

As far as gliding is concerned, it is not a matter of thrusting upon the public, for ulterior motives, something which they do not want. It is plainly evident that a very large section of the public is keenly interested in gliding, and there is no doubt that this proportion will be even larger when more publicity is given to the sport.

This is a matter in which every club official, and, for the matter of that, every club member, should have a special interest. The first concern, of course, is to make one's own club as strong as possible. There is little doubt that the most effective method of building up a club is to get as large a nucleus as possible of people who are actively interested in gliding, but are keen not only to get into the air, but also to take a fair share of ground work, including the launching and recovery of gliders, and constructional and repair work.

These are the members who are the most valuable to a club, and unless they are fairly numerous then it follows that nearly all the hard work will fall on the shoulders of a few. But it must not be thought that these are the only people about whom a club should worry. Each club should be the centre for spreading the "gospel" of gliding. Each member should seize every opportunity which presents itself of interesting "outsiders" in the new sport. Most people have a habit of talking about new experiences, and if you succeed in introducing one person by getting him to go to the "meet" of a gliding club, you can be assured that he will talk about gliding for a good many weeks afterwards. All this is good publicity, which helps not only an individual club but the movement generally.

THE HELPFUL PRESS.

Another important point to which clubs should be careful to give attention is press publicity, which is of the greatest possible value because it reaches so many people. Every club secretary should take care to see that his club's activities are regularly recorded in the local newspapers. It is, indeed, a very good plan for a club to appoint a press secretary especially for this duty.

New clubs especially should be careful to keep in touch with their local newspapers, and should invite the editor of each paper to send a representative to their inaugural gliding meetings.

It is important, too, in this connection to see that the press representatives are given a careful and accurate explanation of what gliding is, and they should be given every facility for obtaining any details of which they may need. Any club member who has a few minutes to spare can render useful service by offering a series of brief articles on gliding to a local newspaper.

There are one or two outstanding points which should always be emphasised in publicity matter concerning gliding, whether it be for publication or whether it simply forms the basis of a conversational explanation. They are:

1. Gliding is a sport with a thrill in it.
2. Gliding is remarkably safe.
3. Gliding tends to develop sterling traits of character and invaluable human qualities. It is an unselfish sport, because the work has to be shared; and it helps to develop individuality, the faculty of quick decision and self-reliance.

4. Gliding is a fascinating and comparatively safe introduction to ordinary flying in a powered machine.

5. Gliding has a stimulating competitive aspect, and Great Britain should be in the forefront as in other sports.

6. The design and construction of gliders in club workshops give welcome opportunities to young people who are interested in handicrafts and who like to make things for themselves.

Get these points well home whenever you have an opportunity of talking or writing about gliding, and you will be doing quite a lot to give the new sport an abiding national popularity.

WHAT IS A GLIDER?

Newcomers to the gliding movement are advised to read this "schoolboy" explanation of the nature of engineless aircraft.

A GLIDER is an engineless aircraft. How does it work? Well, think of a kite which is maintained in the air by the wind acting on its sloping surface, which is kept at its right angle by a cord attached at the correct point and anchored on a small boy on the ground. A glider is a kite, but the pull of the cord is replaced by the weight of a man placed at just the right position, but who can vary the angle of the wing relative to his position and so make his weight more effective or less effective, just as the boy pulls the string and so can sometimes increase the height of his kite.

A primary glider is a machine of simple form for teaching beginners. The pupil sits on an open seat to which he is strapped. Then the centre of a 100 foot length of elastic cord is attached to the nose of the machine in such a way that it will fall off when the machine takes the air. Men on each end of the rope pull until the elastic is stretched to about twice its original length, whilst the machine is held back by other men or by an anchoring device with a quick release.

At the correct moment the pilot shouts "Let go," and the men holding back leave go (or the quick release is "tripped") and the stored up energy of the elastic cord which the pulling team continue to pull, then causes the machine to slide forward, gathering speed so that when faced into a wind of five to 15 miles per hour the machine will, if the controls are correctly held, become air-borne.

The primary type is robust and simple, and has therefore a wing of oblong form, with a span from tip to tip of only 30 feet or so. The centre section is a large skid with a seat and control mounted in front and carrying the tail on struts behind. The gliding angle of this type is about one in eight.

SECONDARY TYPE.

Secondary training is carried out on an intermediate type machine, where the pilot is seated inside a faired body which reduces the resistance to motion through the air. This type of machine has other improvements, all of which are to make it cleaner in form and so make it travel through the air more easily. It can therefore be held more nearly level and will descend in still air at a gliding angle of 1 in 12 to 1 in 18.

THE SAILPLANE.

The third type of machine is called a sailplane and is a much more efficient type. Not only is the body very carefully designed for true streamlined shape but also the wings are of greater span, usually from 50 to 60 feet from tip to tip. The chord, or front-to-back width of the plane is often tapered from say five to six feet at the centre to two or three feet at the tip. The careful fairing of all parts of a sailplane and the elimination of external wires and struts wherever possible makes this machine so efficient that its gliding angle is often only one in 30, and with such a slow sinking speed it is obvious that if launched on the brow of a hill up which the wind is blowing the upward force will be sufficient to keep the machine in the air, just as the gulls can be seen to soar.

On the following pages appear specifications and drawings of important designs of the three classes of machines.
WHAT CLUBS CAN AND CANNOT DO.

Mr. J. H. Payne, Captain of the Imperial College Gliding Club, is well qualified to write on this subject, for his club is among the few in Britain which have successfully constructed their own machine. Every “tip” he gives is of importance.

Among those who join a club for the sport of gliding, there are generally some who, overflowing with mechanical ability, have a natural desire to build their own glider. Constructional work is extremely interesting in itself, and is amply rewarded by the feeling of real ownership which attaches to a home-built machine, changing to justifiable pride when (or if) the glider finally flies. A considerable number of the most successful German sailplanes have been produced by clubs and schools. To mention only one example, a very successful series of sailplanes, including the “Vampyr,” “Greif” (1921-22), and “Pelikan” (1924) were designed by students of the Hanover Technical High School.

For sailplane construction a club has this advantage over the business firm, that the methods of construction employed are less dependent on the cost of manufacture, and in particular the cost of labour need not be considered. To offset this must be reckoned the very serious disadvantage that an ordinary club has rarely the use of machinery and tools, or the experience, necessary for this highly specialised work. By careful design the need of special tools can be overcome, but experience can only come with practice. The building of advanced sailplanes therefore, whilst it should be the ultimate aim of a constructional group, must at first remain a goal towards which to strive by less spectacular, but none the less exacting, constructional efforts.

THE EXPENSE FACTOR.

At this point a word about the cost of building a glider may not be out of place. Granted that a large percentage of the price of a bought machine (£35 for a primary machine in Germany, but £55 for a similar British machine) consists of the cost of labour, and manufacturer’s profit—for neither of which the club has to pay when constructing its own machine—nevertheless, I should not advise a club to construct its own glider if the saving in cost were the only consideration. When one has taken into account that the material is probably going to cost a club perhaps fifty per cent more than the manufacturer pays owing to the smaller quantity ordered; and when one has also considered the cost of experience, in the form of mistakes and bad workmanship (of which more anon), the cost of a club-built machine will not be very much less than that of a similar bought machine—and may even work out to be more. The construc-
tion of a complete machine should not be undertaken unless there is a sufficient number of members, say ten at least, enthusiastic about doing the thing for the pleasure of it and for the experience.

A comparatively new club, in which most of the members are still striving for their "A" certificates, cannot do better than start with the common or garden "Zogling." When they have finished this, they can use the experience they have gained to build the more difficult intermediate type of glider. By the time they have finished building this, they will have reached a stage of flying experience which will enable them to fly it. In this way constructional work will keep pace with the flying, and the machines built will be of real use to the club. Also, what is just as important, the constructors will gradually accumulate that experience, and acquire that skill which is absolutely necessary for sailplane construction.

There are many practical advantages in starting with the primary type of glider. It is the cheapest to construct. Working drawings are easily and cheaply obtainable (from the British Gliding Association, and elsewhere) so that the work can begin right away. The glider will not take a great while to build; six men working 20 hours a week should finish it in eight or ten weeks at the most. Last, but not least, when the machine is finished the constructors will have the pleasure of flying it—and if they have "botched" the work, their sins will descend on their own heads, and not on the head of some unfortunate pupil. "C" pilot borrowed to "try it out." Whilst it is quite easy to terminate one's existence with an entirely wrong spirit. A man who bends a metal fitting in the wrong direction, and, finding his mistake, surreptitiously bends it the other way, should be cast out from the workshop amid howls of indignation.

Nothing tends to lower the quality of work more than rushing. It should never be said "we must get it finished by such-and-such a date." Difficulties and set-backs are bound to crop up, and for several weeks the work ahead will appear enormous in comparison with what has already been done. Don't worry, and don't keep thinking ahead. Take an interest in the job in hand, and do it as well as you possibly can, without hurrying, and in a remarkably short space of time the glider will begin to sit up and take nourishment.

**ALWAYS USE THE BEST.**

Materials used should be the best obtainable. When making a machine to an approved design, the materials for each part are specified. But in any case, it pays in the end to get the best. Most of the tools required for the work will be found in an ordinary set of carpenters' tools. There should be at least one set to three constructors. Other tools can be bought as required. Great care should be taken of the club's tools. The use of a chisel for removing nails should be viewed with disfavour, as also should planing off the heads of panel-pins.

Covering the wings of a primary glider presents little difficulty, but a sewing machine (lockstitch of course) is a great help for sewing the strips of fabric together. It makes a strong and neat job, and reduces the time to about a quarter. Any hand sewing that is required can be done by the ladies, if there are any in the club. If not, it should be quite easy to find a married man who knows how to use a needle.

Doping requires great care, especially if undertaken during the winter months, and generally it will be found better to arrange for the doping to be done by an aircraft firm, if one exists in the district, with a proper doping shop.

Though only a few clubs may undertake the construction of a complete machine, most clubs do some construction, such as repairing their own minor crashes.

The remarks above are generally applicable to all such work. A dry shed on the gliding ground, and a strong box fitted with proper racks for the tools, should be obtained by the club at the outset. Some capable person should be made definitely responsible for all repairs.

**WINTER THE TIME.**

Winter is the time to make spare parts for your gliders. A pair of new wings, made in the dark evenings, may prevent the waste of many precious flying hours during the following year. A further outlet for mechanical ingenuity lies in the "cleaning-up" of the club's present machine. A new coat of dope and varnish, and the addition of a streamlined fairing behind the pilot will make a remarkable improvement in the performance of the aircraft, and may prove a telling factor in competition work.
AIRWORTHINESS AND HOW TO ENSURE IT.

Attention is drawn to the vital need for the airworthiness of gliders, and thorough, practical means for ensuring it are given in this article by Mr. V. S. Gaunt, A.M.I.Ae E., chairman of technical sub-committee and hon. ground engineer to Dorset Gliding Club. Mr. Gaunt is a licensed Air Ministry Ground Engineer in categories A, B, & C, and is hon. secretary of Westland Aircraft Society (Yeovil branch Royal Aeronautical Society).

WHAT is airworthiness? Those who have to deal with the maintenance and construction of power-driven aircraft may know the answer but those who have first come into touch with matters aeronautical through the medium of gliding will perhaps desire to know more of the why and wherefore.

In 1919 there was convened a gathering of representatives of various nations with the object of introducing regulations governing the design, construction, operation and maintenance of aircraft. As a result commercial aviation (in its broadest sense) has progressed on a sound basis. Generally speaking, the designs of aircraft approved as airworthy in one country will, with but slight, if any, modification, be given official approval in another country. Much research and study has enabled factors of safety to be specified which will ensure that the aircraft designed thereto will be safe to fly and only if, these aircraft are maintained in condition.

What we must understand by "condition" is that all essential structural requirements the factors of safety laid down have been maintained.

For power driven aircraft the Air Ministry have issued very detailed regulations (see Air Ministry Publication No. 1208) which should be in the hands of every engineer who is concerned with the maintenance of gliders.

REGULATIONS TO FOLLOW.

The maintenance of aircraft used for hire or reward is in the hands of certified ground engineers whose experience and knowledge has been proved by oral examination by Air Ministry officials. Before the first flight of the day the ground engineer in charge has to issue a certificate to say that he has examined the aircraft and found it airworthy. Apart from the "clearance for flight" a ground engineer must see that the log books are entered up to date with details of all adjustments, repairs and alterations.

These, then, are the lines on which glider maintenance should be based. Every club should appoint one or more ground engineers, preferably those holding Air Ministry licences. Regulations for power-driven aircraft should be our guide in so far as they are applicable and bearing in mind the reasonable interpretation which an engineer of experience should exercise in their use.

A log book should be kept for every glider, and suitable column headings are as follows:

<table>
<thead>
<tr>
<th>Entry No.</th>
<th>Date</th>
<th>Rigged by</th>
<th>Team Capt. by</th>
<th>Flown by</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Wind Force</td>
</tr>
</tbody>
</table>

PRACTICAL MAINTENANCE.

Turning now to paper-work to the practical routine of maintenance the following notes may be of service. They are based on my experience of the R.F.D. type of glider as used by Dorset Gliding Club.

TRANSPORT.

Having ordered your glider you must consider what is the cheapest way of taking delivery, and bearing in mind the probable need for moving the machine from site to site (and possibly back to the workshops for repair) the best solution is to build or obtain a suitable trailer. This matter of first sight be considered beyond the scope of this article but, as the incorrect ground handling of machines may easily render them unairworthy, it is felt that a brief reference to a suitable trailer may be of some value to new clubs. A suitable trailer (Figs. 1 & 2), comprises a "Ford" back axle and wheels mounted with suitable stays to a draw bar, comprising telescopic tubing which allows one section to over-ride the other when the trailer is moving down hill otherwise tending to move faster than its tractor and in so doing applies the brakes to the trailer wheels. The superstructure is of rough deal members and comprises essentially two sides troughs in which the main planes rest on their leading edges in canvas slings, whilst padded uprights opposite two ribs in each plane have their complement in two clamp bars dowelled to the trough longitudinal below and bolted to the top framework above. Similarly, felt lined supports serve for the support and location of tail
unit (less rudder), centre section (skid), tail outrigger tubes and the rudder. The illustrations will make clear the general layout, from which an intelligent carpenter, millwright or handy man can produce a suitable trailer.

IDEALS TO AIM AT.

Ideals to aim at are to secure adequate support and location for all components at their strong points, which should be protected from chafing by means of felt, rubber or sacking. Clamps should be easily removed and refitted so that loading and unloading can be quickly carried out. A number plate board with celluloid facing and provided with a tail lamp will enable cards bearing the appropriate car no. to be easily fitted, as it is hardly to be expected that one car will always do the towing. The tail light should be wired up to plug in to the rear lamp socket of the car, and sufficient slack cable must naturally be left to permit of full-lock steering. A tool-box can conveniently be mounted on the trailer for general use.

LOADING.

The above notes and illustrations will make clear this operation, bearing in mind that the order of loading is:— 1, centre section skid; 2, outrigger tubes; 3, tail unit; 4, rudder; 5, main planes.

UNLOADING.

This operation will naturally be carried out in the reverse order given for loading. Novices should be warned to handle the planes by the spars at root and tip, and never to touch the trailing edges. Ailerons can be conveniently kept from straining their hinges by a simple clamp (fig 3), which can be made from the solid, or two pieces of 3-ply joined by a bolt. The clamp is slipped in the gap between main plane and aileron end ribs and so aligns these until controls are coupled up. Planes can safely be laid flat on the ground providing someone is told off to see that spectators, dogs, etc., do not stumble over them. If the weather is gusty these light components must be held until erected.

ERECTION.

Erection procedure is as follows:—
(a). Place centre section skid at a suitable, preferably sheltered and level, point.
(b). Attach main planes by their root joint pins, letting tips either rest on ground or be supported by a helper.
(c). Attach landing wires to both planes. These wires should always remain on centre section and after first accurate rigging can be set to “dead length” and uncoupled by removing lower end pins, so leaving turnbuckles locked. The weight of each plane should be taken care of until both sets of wires are attached, to avoid straining the king post.
(d). Attach flying wires on both sides loosely before tightening any. Then proceed to tighten the front wire on each side, then the rear wire on each side finally the diagonal wires in turn, thus maintaining even bracing, otherwise the centre section may be strained out of its correct vertical alignment.
(e). Attach tail plane outrigger struts to skid with a member holding each until the tail unit is affixed and bracing wires (“X” in Fig. 4) are attached. This prevents undue strain on the welded, trapped ends of the tubes where they are bolted to the skid.
(f). Fit rudder and couple up all controls remembering:—
(1). Joy stick upright means ailerons should be level with main planes (sometimes both ailerons are rigged with, say, 3\(^\circ\) droop below main plane trailing edge to allow for air pressure bringing to neutral), and elevators in line with tail plane in side view.
(2). Pulling stick back should cause trailing edge of elevators to rise.
(3). Moving stick to right should cause right hand aileron trailing edge to rise.
(4). Rudder should be in line with fin with rudder bar true athwartships, and on pushing right foot the trailing edge should move to right.
(g). Lock main attachment bolts and strainers after checking alignment of tail with main planes by eye. (This assumes that the glider has been previously rigged and checked by measurement).

(h). Finally, look round to see that all bolts, nuts, and pins are in place and again check control movements before signing the machine as airworthy—Remember that a man's life depends on your careful attention to these points.

DISMANTLING.

This will naturally proceed in reverse order to "erection," and as each pin is removed it is best to replace it in one of the members dismantled and lock it there by wire or safety pin. Similarly, where strainers are uncoupled the barrel portion should be screwed well on to one male end and wired there. Wires should be neatly coiled and taped to some convenient portion of the centre section.

The leaving of the landing wires "dead length" has been already mentioned. Another time saving method is by leaving one of the tail unit bracing wires ("X" in Fig. 4), locked dead length and uncoupling the strainer of the opposite wire. All strainers should be painted whilst the machine is rigged so that the paint marks serve as a guide in subsequent re-assembly.

INTERESTING MODIFICATIONS.

GENERAL IMPROVEMENTS.—The R.F.D. glider of Dorset Gliding Club has been modified in several minor respects which it may be of interest to enumerate. References are to Fig. 4.

1.—The R.F.D. skid shoe plate was worn out in one day on the rough ground from which we first operated. We re-shod the ash-sole with a stainless steel channel 3-in. by 4-in. by 6 ft., secured by screws through lugs welded on at about 2 ft. intervals. This shoe is still in use, after over 450 landings (December 1930).

2.—Where diagonal and rear flying wires converge a 2 B.A. bolt replaces the A.G.S. pin.

3.—Landing wires were changed from high tensile steel to 15 cwt. cables, and a new top anchorage fitting made with a 1 in. thick block of rubber interposed between the fitting and the cabane king post. This fitting has elongated bolt holes to allow the rubber to absorb the landing shocks.

4.—Main plane joint bolts replaced by pins in stainless steel and with a tapered end to facilitate entry. Safety pins replace split pins wherever possible.

5.—The joint between skid and upright strut was too weak in the early machines so we made and fitted a dural flanged plate on each side and fastened with through bolts.

6.—The rudder bar pivot fitting was replaced by a slightly stronger plate with edges turned over sides of skid, and using longer fixing screws.

7.—Joy stick reduced in length.

8.—A handle was fitted to left-hand side of seat pan to induce "actions" to use right hand only on joy stick.

9.—A larger rudder designed to our requirements and built for us by the R.F.D. Co. was fitted and proved far more effective than that originally fitted.

10.—Control levers of all moving surfaces attached more securely to spar and adjacent rib by fillets and screws.

11.—Forward ends of tail outriggers cut off, and new trapped end of stronger type fixed by 2-5/16 in. diam by 20 G. tubular steel rivets.

12.—To restrain bowing tendency in tail outriggers (due to ground handling we fitted dural spacer tubes as shown, the ends being secured by clips clamped around but not pinned or bolted to outriggers.

13.—A stronger ash rudder bar made and fitted.

14.—Stronger wing tip skids and sockets fitted.

15.—A stronger safety belt fitted after the first type broke in a crash.
as shown in Fig. 5. If a rib boom or bracing is broken it is always necessary entirely to replace. A piece of spruce or ash of same section could be used in many repairs.

At a reasonable level floor from which inventions can be taken to centres of leading and trailing edges at equidistant plumb lineR. -Csually 

Dimensions (a).

Always check the rigging of a new glider by reference to the maker's rigging diagram or instructions. This should be done initially in a shed with a reasonably level floor from which inventions can be taken to centres of leading and trailing edges at equidistant plumb lineR. -Csually 

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(l) Small holes in fabric surfaces should be immediately repaired by doped-on patches. Large holes or tears above 2in. should be sewn before doping on patches, which should overlap sewing by 1in to 2in.

(m) Oil all moving parts and paint exposed metal fittings, tubes and wires, remembering that paint is heavy but rust is dangerous.

(n) To save the machine from rough handling up-hill a suitable light bogy as illustrated in Figs. 6 and 7 is a useful item of ground equipment. It can be towed up by a rope passed around a pulley block anchored to a tree or to stakes, a car being used along the hill top where the surface permits. Failing this, members will find it easier to pull the rope-end down hill than to push the machine up.

(o) With a privately designed and built glider it will be advisable to submit the design for B.G.A. approval, for which a fee of £5 5s. is charged for first machine and £2 2s. for subsequent certificates of airworthiness. An authorised inspector will need to approve of the wings and other components before covering, and the completed machine will require to be weighed and have its centre of gravity checked. Unless clubs include aircraft designers and engineers amongst their members they would be well advised to buy their machines and reserve their constructional energies for repair work and the building of spare components to approved designs.

(p) Finally, all members should be encouraged to learn how to rig and maintain the club machines and not rely entirely on the ground engineer. Every member should be considered as a prospective private owner of a sailplane. Lectures should be held to teach the elements of aeronautics and to explain the practical points of aircraft maintenance more fully than I have been permitted to do in this short article. The B.G.A. or the Royal Aeronautical Society (which has branches in Leeds, Coventry, Bristol, Oxford, Manchester, Cambridge, Hallon and Yeovil) will do no doubt be willing to advise as to suitable lecturers, etc.

Additional improvements to Dorset Club's R.F.D. glider worthy of mention are—

Fairing panels with hinged inspection flaps fitted to gap between root of main planes and skid pylon.

Fabric closing strips doped over top of rear spar, thence down aileron gaps and beneath aileron spars, so preventing air leakage, without interfering with hinging.

Main plane fabric formerly glued to ribs had come loose due to damp, so was strung thereto by kite cord at 6in. intervals in the orthodox power plane method.

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### MATERIALS USED IN GLIDER CONSTRUCTION.

From the point of view of diversity of materials used, the aeroplane with its equipment is as complicated as any other piece of mechanism or transport vehicle. The modern tendency is towards all-metal construction, but the composite construction of yesterday is more likely to hold its own in the construction of gliders and sailplanes, partly on account of the reduced cost when only a few machines are constructed, partly because of the ease of construction and repair and lack of the type of glider workshops but largely because for the light loadings and stresses met with in gliders it would be hard to obtain a greater economy of weight than is possible with timber of light scantlings as the main material.

The main materials used for glider construction, their purposes and where they may be met with are as follows:

<table>
<thead>
<tr>
<th>Material</th>
<th>Purpose</th>
<th>Where to be met with</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Silver Spruce</td>
<td>Spars, ribs, struts, bracings and skin framework in fact anywhere where the part is to be as light yet strong as possible and where it is not liable to be unduly bent or subjected to wear.</td>
<td>-</td>
</tr>
<tr>
<td>2. English Ash</td>
<td>Pulpking blocks, wing tip spars, main skin shoes, wing tip spars or any other bent members and parts liable to wear and tear where a tough resilient timber is needed.</td>
<td>-</td>
</tr>
<tr>
<td>3. American Rock Elm</td>
<td>Can be used in lies of ash, but its main advantage is that it withstands moisture better and is therefore used largely in float and hull construction.</td>
<td>-</td>
</tr>
<tr>
<td>4. Plywood</td>
<td>For leading edge covering, webs of box spars, rib and other gusset pieces, etc.</td>
<td>-</td>
</tr>
<tr>
<td>5. Oregon Pine</td>
<td>As a substitute for spruce where its use has been authorized by the designer.</td>
<td>-</td>
</tr>
<tr>
<td>6. Mahogany</td>
<td>For straight members subjected to such wear and handling as would invalidate the use of the lighter and higher spruce, also for veneers, ply and planking for bulk or other monocoque construction.</td>
<td>-</td>
</tr>
<tr>
<td>7. Balsa Wood</td>
<td>A very light, pithy wood only used for packings, fairings and sometimes the centre laminates of spars of 3-ply.</td>
<td>-</td>
</tr>
<tr>
<td>8. Mild Steel</td>
<td>For metal fittings of all types, especially where a welded construction is indicated or for parts subjected to withstand much wear and tear. Also for stay tubes and struts, bolts and nuts, strainers and wood screws.</td>
<td>-</td>
</tr>
<tr>
<td>9. Stainless Steel</td>
<td>For replacing mild steel where the stainless characteristics justify the higher cost.</td>
<td>-</td>
</tr>
<tr>
<td>10. High Tensile Steel</td>
<td>For link plates, wing bolts, nuts and shackles: fork ends, tie rods, streamline and other wires, and in tubular forms for stems and axles. Some stainless steels are of much greater strength than mild steel and may therefore be used for most of the above purposes.</td>
<td>-</td>
</tr>
</tbody>
</table>

**WEIGHTS, STRENGTHS, AND SPECIFICATION NUMBERS.**

The above-mentioned materials are tabulated on pages 72-73 to show their comparative strengths and weights, and in most cases the specification number has been added. This should be quoted when ordering. Approved supplies of aircraft material will furnish, when required, a release note certifying that the material complies with Air Ministry requirements. As such certification costs money it will be to the advantage of the glider clubs to mention when quoting specifications that the material is for glider construction and/or repair by so doing they may be supplied with suitable materials at lower prices.

(The list of materials and the table of weights and strengths is compiled by Mr. V. S. Gaunt, A.M.I.A.E., hon. ground engineer, Dorset Gliding Club.)
<table>
<thead>
<tr>
<th>Item No.</th>
<th>Material, Specification</th>
<th>Weight to sq. in.</th>
<th>Lbs. per sq. in.</th>
<th>Tons per sq. in.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Silver spruce (Pine Stichenis) 28A 28A</td>
<td>0.0156</td>
<td>1,500,000</td>
<td>5,000 (5,000</td>
<td>Mild Steel Tube, 28A is for rough timber</td>
</tr>
<tr>
<td>2</td>
<td>Ash 31 S.V.4</td>
<td>0.0211</td>
<td>1,750,000</td>
<td>5,800</td>
<td>BRITISH</td>
</tr>
<tr>
<td>3</td>
<td>Rock elm 34A V.8</td>
<td>0.0255</td>
<td>1,450,000</td>
<td>4,800</td>
<td>DTD 34A is for rough timber</td>
</tr>
<tr>
<td>4</td>
<td>Plywood 4 S.V.3</td>
<td>0.024</td>
<td>1,300,000</td>
<td>3,800</td>
<td>(Tension) Outer plys Birch, Inner—Poplar</td>
</tr>
<tr>
<td>5</td>
<td>Oregon Pine 26A</td>
<td>0.030</td>
<td>1,000,000</td>
<td>3,250</td>
<td>DTD 34A is for rough timber</td>
</tr>
<tr>
<td>6</td>
<td>Mahogany 28A S.V.7</td>
<td>0.0186</td>
<td>1,500,000</td>
<td>5,250</td>
<td>DTD 34A is for rough timber</td>
</tr>
<tr>
<td>7</td>
<td>Balsa Wood None</td>
<td>0.003/0.0078</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Mild Steel Sheet 2.5.3</td>
<td>0.28</td>
<td>18</td>
<td>28</td>
<td>For welding</td>
</tr>
<tr>
<td>9</td>
<td>Mild Steel Bar 3.5.1</td>
<td>0.28</td>
<td>20</td>
<td>28</td>
<td>For Bolts, Nuts, etc.</td>
</tr>
<tr>
<td>10</td>
<td>Mild Steel Tube T.26</td>
<td>0.28</td>
<td>11</td>
<td>28</td>
<td>For sockets and stays</td>
</tr>
<tr>
<td>11</td>
<td>Mild Steel Tube T.1</td>
<td>0.28</td>
<td>30</td>
<td>35</td>
<td>Blunt for oval tubes</td>
</tr>
<tr>
<td>12</td>
<td>Mild Steel Tube T.21</td>
<td>0.28</td>
<td>18</td>
<td>28</td>
<td>Annealed</td>
</tr>
<tr>
<td>13</td>
<td>Mild Steel Tube 41 T.6</td>
<td>0.28</td>
<td>28</td>
<td>30</td>
<td>For welding</td>
</tr>
<tr>
<td>14</td>
<td>Mild Steel Tube 80A</td>
<td>0.28</td>
<td>40</td>
<td>45</td>
<td>Before welding</td>
</tr>
<tr>
<td>15</td>
<td>S.S. Sheet 20 S.S.2 97.2</td>
<td>0.28</td>
<td>15</td>
<td>28</td>
<td>After welding</td>
</tr>
<tr>
<td>16</td>
<td>S.S. Bar 28</td>
<td>0.28</td>
<td>18</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>H.T.S. Tube</td>
<td>T.2</td>
<td>28</td>
<td>40</td>
<td>45</td>
</tr>
<tr>
<td>18</td>
<td>H.T.S. Tube</td>
<td>T.2</td>
<td>50</td>
<td>55</td>
<td>For axles</td>
</tr>
</tbody>
</table>

**FOR GLIDER CONSTRUCTION.**

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Material, Specification</th>
<th>Weight to sq. in.</th>
<th>Lbs. per sq. in.</th>
<th>Tons per sq. in.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>H.T.S. Sheet 2.5.4</td>
<td>0.28</td>
<td>18</td>
<td>28</td>
<td>Not for welding. Harden and Temper</td>
</tr>
<tr>
<td>21</td>
<td>H.T.S. Bar 3.5</td>
<td>0.28</td>
<td>45</td>
<td>55</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>H.T.S. Stainless Sheet 37B</td>
<td>0.28</td>
<td>40</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>H.T.S. Stainless Sheet 8.80</td>
<td>0.28</td>
<td>45</td>
<td>55</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Brass Bar 2.B.6</td>
<td>0.28</td>
<td>22/26</td>
<td>22/26</td>
<td>Soft</td>
</tr>
<tr>
<td>25</td>
<td>Brass Sheet 2.B.5</td>
<td>0.3</td>
<td>30</td>
<td>30</td>
<td>Hard rolled</td>
</tr>
<tr>
<td>26</td>
<td>Brass Sheet 2.B.12</td>
<td>0.3</td>
<td>18/24</td>
<td>18/24</td>
<td>Soft</td>
</tr>
<tr>
<td>27</td>
<td>Duralumin Sheet 3.L.3</td>
<td>0.1</td>
<td>15</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Duralumin Bar 3.L.1</td>
<td>0.1</td>
<td>15</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Duralumin Tube 3.L.4</td>
<td>0.1</td>
<td>16</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Aluminum 2.L.4</td>
<td>0.1</td>
<td>9</td>
<td>9</td>
<td>Hard Sheet</td>
</tr>
<tr>
<td>31</td>
<td>Aluminum 2.L.16</td>
<td>0.1</td>
<td>7/9</td>
<td>7/9</td>
<td>Half-hard sheet</td>
</tr>
<tr>
<td>32</td>
<td>Aluminum 2.L.17</td>
<td>0.1</td>
<td>6/9</td>
<td>6/9</td>
<td>Soft sheet</td>
</tr>
<tr>
<td>33</td>
<td>Aluminum Bar 2.L.32</td>
<td>0.1</td>
<td>12</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>Copper Sheet 2.0.15</td>
<td>0.22</td>
<td>14/19</td>
<td>14/19</td>
<td>Half hard</td>
</tr>
<tr>
<td>35</td>
<td>Linen Fabric 4.F.1</td>
<td>4 oz. sq. yd.</td>
<td>82/97 lbs. per inch tensile strength</td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Cotton Fabric 4.F.5</td>
<td>4 oz.</td>
<td>80 lbs. per inch tensile strength</td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>Linen thread</td>
<td>F.04</td>
<td></td>
<td></td>
<td>For sewing</td>
</tr>
<tr>
<td>38</td>
<td>Cotton tapes 2.F.47</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>Rubber cord 3.F. 18</td>
<td>200 lbs. pull gives 100% stretch of 1/min. dia. cord used for launching of gliders</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>Flax cordage 3.F. 35</td>
<td></td>
<td></td>
<td></td>
<td>No. 1 for stringing</td>
</tr>
<tr>
<td>41</td>
<td>Geotextile glue 3.V.11</td>
<td>Shear strength=1100 lbs. per sq. in.</td>
<td></td>
<td>&quot;Hot-water Glue&quot;</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Casein cement 2.V.2</td>
<td>Shear strength=1100 lbs. per sq. in.</td>
<td></td>
<td>&quot;Cold-water Glue&quot;</td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>Dope (clear)</td>
<td>35</td>
<td>1 coat weights about 2 oz. per sq. yd.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>Dope (alum.) 27</td>
<td>2 oz. per sq. yd.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The Doping of Gliders

The following information is supplied by Messrs. Colson, Ltd.

The doping of gliders differs in several respects from the doping of power-driven aircraft. In the first place it is a well-known fact that ordinary dope shop facilities are available, and the second is that the fabric to which the dope is applied is not exposed to the elements as in the case of the heavier machines, otherwise the framework of wings may become distorted. The object of the dope is to render the fabric water and air proof and to provide as smooth a surface as possible and to render the fabric fire resistant. A well-doped wing also facilitates cleaning the fabric, and is only necessary to wash it down with soap and water.

To meet the conditions under which the average glider is built it is possible to reduce the number of coats and times of allowing. It is advisable to give at least 24 hours between coats of dope. The fabric to be doped should be free from dust and any material which might prevent the glue from spreading evenly. The fabric must also be thoroughly wet all over before applying the dope. The fabric should be kept taut during the operation of applying the dope.

A fairly stiff flat bristle brush should be employed, preferably with a round tip, and the brush should be kept clean and fresh. If the dope is not applied straight from the bottle it should be thoroughly mixed before use. A well-doped wing is better tolerated than a wet wing.

It is essential that brushers and containers into which the dope is poured should be absolutely clean before use. A fairly stiff flat bristle brush should be employed, preferably riveted or rubber-tipped to avoid loosening by the solvents in the dope. The first coat of dope should be brushed into the fabric with just sufficient pressure to ensure impregnation, the brush being worked from left to right and then up and down. Drying is best carried out by working in sections of about one square yard at a time, and must never be worked after it has become tacky. Half an hour must elapse between each coat of dope. The number of coats necessary depends on the class of finish required, and for an average result three or four coats would be required, which will give an increase of weight of approximately 1 7/8 to 2 1/2 oz. per sq. yd. These figures refer to transparent types of dope, and a slight increase in weight will of course be obtained if the temperature drops below freezing point, or if the relative humidity exceeds 90 per cent.

In the event of the glider becoming damaged new fabric or a patch can be applied to the damaged portion by softening the old dope with a suitable solvent and sticking the patch on the patch and doping over it.

An important point to remember is that owing to the inflammable nature of the dope it is imperative to forward by passenger train, and therefore in the event of a glider becoming damaged, there may be a delay in obtaining a supply of dope for repairs. A speed of 60 miles per hour is recommended that all clubs should keep at least one or two gallons in stock so as to meet any emergency which may arise.

REGISTER OF GLIDING CLUBS

The following register of gliding clubs is not claimed to be complete or in every detail accurate, but care was taken to ensure that the information was correct on December 31st, 1930.

Names of clubs which answered the GLIDING questionnaire are printed in bold type. All others are printed in smaller type.

Aberdeen Gliding Club
Sec., A. F. J. Ord, 299 Hilton Drive, Aberdeen.

Aberdavenny & District Gliding Club
Entrance, Men £1, Ladies £1.

Aberdeen, September, 1930. Entrance, £1 1s. Subscriptions, £1 1s. F.M., £2 1s.; L.F., £2 6d.; N.F., £2 6d.; Hon. Sec., J. M. Bamborough, 29 Rowland Road, Barnsley.

BARNSLEY GLIDING CLUB
Sec., W. Catlow, 49 Church Street, Barnsley.

Barnsley Motor Cycle and Car Club
Gliding Section.
Sec., C. B. King, 20 Rowland Road, Barnsley.

BEDFORD GLIDING AND FLYING CLUB

Gliding ground, Lower Stockland Farm, St. Fagans (4 miles from Cardiff). Meetings, Wed., Sat., 2 p.m., holidays, 10 a.m. Zogging primary machine. Best time, 50 sec. (L.R. Crouch). altitude 490 feet (E. Lewis). straight distance, 170 yards.

Chairman, C. J. Fox; Secretary, and ground engineer, T. E. Llewellyn, 59 Queen Street, Cardiff (holder B.A.G.).

CHESTER GLIDING CLUB
Entrance, £1. Subscriptions, £1 1s. F.M., £2 1s.; N.F., £2 6d.; L.F., £3 5s.; Hon. Sec., R. S. Bevan, 9 Beresford Road, Chester.

CHIPPEWY GLIDING CLUB
Entrance, £1. Subscriptions, £1 1s. F.M., £2 1s.; N.F., £2 6d.; L.F., £3 5s.; Hon. Sec., R. S. Bevan, 9 Beresford Road, Chester.

BRADFORD GLIDING CLUB
July, 1930. Entrance, £1 1s. Subscriptions, £1 1s. F.M., £2 1s.; N.F., £2 6d.; L.F., £3 5s.; Hon. Sec., R. S. Bevan, 9 Beresford Road, Chester.

Gliding grounds, Lower Stockland Farm, St. Fagans (4 miles from Cardiff). Meetings, Wed., Sat., 2 p.m., holidays, 10 a.m. Zogging primary machine. Best time, 50 sec. (L.R. Crouch). altitude 490 feet (E. Lewis). straight distance, 170 yards.

Chairman, C. J. Fox; Secretary, and ground engineer, T. E. Llewellyn, 59 Queen Street, Cardiff (holder B.A.G.).

CHANNEL GLIDING CLUB
June, 1930. Entrance, £1. Subscriptions, £1 1s. F.M., £2 1s.; N.F., £2 6d.; L.F., £3 5s.; Hon. Sec., R. S. Bevan, 9 Beresford Road, Chester.

Glenfield Gliding Club
Entrance, £1. Subscriptions, £1 1s. F.M., £2 1s.; N.F., £2 6d.; L.F., £3 5s.; Hon. Sec., R. S. Bevan, 9 Beresford Road, Chester.

Gliding grounds, Lower Stockland Farm, St. Fagans (4 miles from Cardiff). Meetings, Wed., Sat., 2 p.m., holidays, 10 a.m. Zogging primary machine. Best time, 50 sec. (L.R. Crouch). altitude 490 feet (E. Lewis). straight distance, 170 yards.

Chairman, C. J. Fox; Secretary, and ground engineer, T. E. Llewellyn, 59 Queen Street, Cardiff (holder B.A.G.).

COMBE GLIDING CLUB
Entrance, £1. Subscriptions, £1 1s. F.M., £2 1s.; N.F., £2 6d.; L.F., £3 5s.; Hon. Sec., R. S. Bevan, 9 Beresford Road, Chester.

DENHAM GLIDING CLUB
Entrance, £1. Subscriptions, £1 1s. F.M., £2 1s.; N.F., £2 6d.; L.F., £3 5s.; Hon. Sec., R. S. Bevan, 9 Beresford Road, Chester.
DORSET GLIDING CLUB

March 1930. Entrance, 10s. 6d. Subscription, £1 10s. Equipment, £2. Candidates must be over 18, and have had 60 hours' instruction. Meetings, Wed., Sat., Sun. 3.30 p.m. (summer only); Sat., Sun. 2.30 p.m. (winter). Machines: B.A.C.H primary. Hanseat.


Newton 

EGHAM GLIDING CLUB

September 1930. Entrance, £1 15s. 6d. Subscription, £1 15s. 6d. Meetings, Sat., Sun. 9.30 a.m. Machines: B.A.C.H primary. Hanseat.

President, G. P. Cameron; sec., A. B. Amidon; treasurer, C. H. V. W. A. C. Cameron; instructor, J. B. Stoner, 246 Old Brompton Road, London, S.W. 5.

EGAL GLIDING CLUB

September 1930. Entrance, £1 15s. 6d. Subscription, £1 15s. 6d. Meetings, Sat., Sun. 9.30 a.m. Machines: B.A.C.H primary. Hanseat.

President, A. R. Gardiner, 71 Smith St., Elgin.

ESSEX GLIDING CLUB

April 1930. Entrance, 10s. 6d. Subscription, £1 10s. 6d. Meetings, Sat., Sun. 9.30 a.m. Machines: B.A.C.H primary. Hanseat.


FALKIRK AND DISTRICT GLIDING CLUB

September 1930. Entrance, 10s. 6d. Subscription, £1 10s. 6d. Meetings, Sat., Sun. 9.30 a.m. Machines: B.A.C.H primary. Hanseat.

President, C. M. Paton; sec., H. A. Jones, M.Sc. (official air historian); chairman, H. A. Jones, M.Sc. (official air historian); instructor, D. G. Paton, 27 High St., Falkirk. Meetings, Sat., Sun. 9.30 a.m.

Drumlanrig Castle, Queen's Park, Dumfries.


President, R. D. Gerrans; sec., P. T. Fawcett, the Red Lion Inn, S. Stirling, near Harrogate. Meetings, Sat., Sun. 9.30 a.m.

HURSTEDFIELD GLIDING CLUB

Scraptoft Road, Skipsea, Holderness, Yorks.

President, Major J. A. McKelvie; sec., J. Meads, Broomfield, Alderley Edge, Cheshire.

SOVEREIGN GLIDING CLUB

President, Sir H. Halford, M.C., M.P.; chairman, P. Turner; sec., J. A. Thompson; Aircraft Design Branch of Imperial College Union. Meetings, Sat., Sun. 9.30 a.m.


President, Capt. H. H. Halford, M.C., M.P.; chairman, P. Turner; sec., J. A. Thompson; Aircraft Design Branch of Imperial College Union. Meetings, Sat., Sun. 9.30 a.m.


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President, G. P. Cameron; sec., A. B. Amidon; treasurer, C. H. V. W. A. C. Cameron; instructor, J. B. Stoner, 246 Old Brompton Road, London, S.W. 5.

EGHAM GLIDING CLUB

September 1930. Entrance, £1 15s. 6d. Subscription, £1 15s. 6d. Meetings, Sat., Sun. 9.30 a.m. Machines: B.A.C.H primary. Hanseat.

President, G. P. Cameron; sec., A. B. Amidon; treasurer, C. H. V. W. A. C. Cameron; instructor, J. B. Stoner, 246 Old Brompton Road, London, S.W. 5.

EGAL GLIDING CLUB

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LEEDS GLIDING CLUB. 

May, 1930. Enquiries, 146, Trinity Street; subscriptions, 4s. 6d. a year.

MARCH GLIDING CLUB.

May, 1930. Enquiries, 5, Malvern Place, Lea Road, March; subscriptions, 10s. 6d. per annum.

LEICESTERSHIRE GLIDER CLUB.

March, 1930. Enquiries, 12, Magna House, Magna Road, Leicester; subscriptions, 10s. 6d. per annum.

LITTLEHAMPTON GLIDING CLUB.

Feb., 1930. Enquiries, 13A, West Street, Littlehampton; subscriptions, 10s. 6d. per annum.

LOUTHING GLIDING CLUB.

Feb., 1930. Enquiries, 121, Sothorpe Road, Retford; subscriptions, 10s. 6d. per annum.

MARCH GLIDING CLUB.

May, 1930. Enquiries, 146, Trinity Street; subscriptions, 4s. 6d. a year.

MAYFAIR GLIDING CLUB.

May, 1930. Enquiries, 10, Mayfair Place, London, W. 1; subscriptions, 10s. 6d. per annum.

MALTON AERO CLUB.

May, 1930. Subscriptions, £1 10s. 0d.; meetings, Tues., 7.30 p.m. (summer only).

MALVERN GLIDING CLUB.

Feb., 1930. Enquiries, 27, Little Malvern; subscriptions, 10s. 6d. per annum.

MANCHESTER BRANCH, ROYAL AERONAUTICAL SOCIETY.

Meetings, Sun., 5 p.m.; fees 1s. 6d. for junior members.

March, 1930. Subscriptions, 10s. 0d.; meetings, Wed., 7.30 p.m.; fees 10s. 0d. per annum.

March, 1930. Subscriptions, £1 10s. 0d.; meetings, Tues., 7.30 p.m. (summer only).

Meetings, Sun., 5 p.m.; fees 1s. 6d. for junior members.

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March, 1930. Subscriptions, £1 10s. 0d.; meetings, Tues., 7.30 p.m. (summer only).

Meetings, Sun., 5 p.m.; fees 1s. 6d. for junior members.
###_statistics_of_gliding_clubs

<table>
<thead>
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<td><strong>VICTORIA GLIDER CLUB</strong></td>
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<tr>
<td><strong>GLIDING IN AUSTRALIA AND NEW ZEALAND</strong></td>
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### British Clubs Overseas

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<td><strong>Gliding in Australia and New Zealand</strong></td>
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### SOUTH AFRICA ESOX GLIDING CLUB

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### SOUTHWESTERN ESOX GLIDING CLUB

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## STATISTICS OF GLIDING CLUBS IN THE BRITISH ISLES.

<table>
<thead>
<tr>
<th>Name of Club</th>
<th>Founded</th>
<th>Enrolment Per Period</th>
<th>Saturation Year</th>
<th>Membership</th>
<th>Membership</th>
<th>Flying Height (Turms)</th>
<th>F.A.I. Certificates Granted</th>
<th>Best Flights</th>
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</thead>
<tbody>
<tr>
<td>Aberavenny</td>
<td>Sept</td>
<td>1/10</td>
<td>Sept</td>
<td>5</td>
<td>4</td>
<td>Yes</td>
<td>1</td>
<td>700</td>
</tr>
<tr>
<td>Accrington &amp; District</td>
<td>Sept</td>
<td>2/10</td>
<td>Aug</td>
<td>35</td>
<td>5</td>
<td>Yes</td>
<td>1</td>
<td>320</td>
</tr>
<tr>
<td>Aircraft, Harrogate</td>
<td>Jan</td>
<td>1/10</td>
<td>Dec</td>
<td>40</td>
<td>5</td>
<td>No</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>Bedford</td>
<td>July</td>
<td>1/10</td>
<td>Aug</td>
<td>25</td>
<td>3</td>
<td>Yes</td>
<td>1</td>
<td>1</td>
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<tr>
<td>Bolton</td>
<td>June</td>
<td>1/10</td>
<td>Mar</td>
<td>30</td>
<td>3</td>
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<td>1</td>
<td>1</td>
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<tr>
<td>Bradford</td>
<td>July</td>
<td>1/10</td>
<td>July</td>
<td>45</td>
<td>2</td>
<td>Yes</td>
<td>1</td>
<td>300</td>
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<tr>
<td>Bridlington</td>
<td>Aug</td>
<td>1/10</td>
<td>Sept</td>
<td>35</td>
<td>5</td>
<td>Yes</td>
<td>1</td>
<td>1</td>
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<tr>
<td>Bristol</td>
<td>Oct</td>
<td>1/10</td>
<td>Oct</td>
<td>35</td>
<td>3</td>
<td>Yes</td>
<td>1</td>
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<tr>
<td>Cardiff &amp; County</td>
<td>March</td>
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<td>Mar</td>
<td>40</td>
<td>5</td>
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<tr>
<td>Charnley</td>
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<td>1/10</td>
<td>Mar</td>
<td>50</td>
<td>3</td>
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<td>1</td>
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<td>20</td>
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<td>Apr</td>
<td>W</td>
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<td>Sep</td>
<td>40</td>
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<td>No</td>
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<td>Farnham</td>
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<td>1/10</td>
<td>Aug</td>
<td>50</td>
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<td>Dec</td>
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<td>Dec</td>
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<td>5</td>
<td>No</td>
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<td>Imperial College</td>
<td>March</td>
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<td>Sept</td>
<td>40</td>
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## STATISTICS OF GLIDING CLUBS IN THE BRITISH ISLES.

<table>
<thead>
<tr>
<th>Month</th>
<th>Men</th>
<th>Women</th>
<th>Flying Meetings (Summer)</th>
<th>Membership</th>
<th>Machines Operated</th>
<th>P.A.I. Certified granted</th>
<th>Best Flights.</th>
<th>Remarks</th>
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<tr>
<td>April</td>
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<td>3</td>
<td>2 across</td>
<td>1</td>
<td>0.5</td>
<td>2</td>
<td>T.F.T., 0-15</td>
<td></td>
</tr>
<tr>
<td>May</td>
<td>45</td>
<td>2</td>
<td>1 across</td>
<td>1</td>
<td>0.5</td>
<td>2</td>
<td>T.F.T., 0-15</td>
<td></td>
</tr>
<tr>
<td>June</td>
<td>40</td>
<td>2</td>
<td>1 across</td>
<td>1</td>
<td>0.5</td>
<td>2</td>
<td>T.F.T., 0-15</td>
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### MEMBERSHIP.

<table>
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<th>Month</th>
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<th>P.A.I. Certified granted</th>
<th>Best Flights.</th>
<th>Remarks</th>
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<tbody>
<tr>
<td>Jan</td>
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<td>2</td>
<td>T.F.T., 0-15</td>
<td></td>
</tr>
<tr>
<td>Feb</td>
<td>45</td>
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<td>2</td>
<td>T.F.T., 0-15</td>
<td></td>
</tr>
<tr>
<td>Mar</td>
<td>40</td>
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<td>2</td>
<td>T.F.T., 0-15</td>
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<td>T.F.T., 0-15</td>
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### Flying Meetings (Summer).

<table>
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<th>Best Flights.</th>
<th>Remarks</th>
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<td>2</td>
<td>T.F.T., 0-15</td>
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<tr>
<td>Feb</td>
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<tr>
<td>Mar</td>
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<tr>
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<td>T.F.T., 0-15</td>
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<tr>
<td>May</td>
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<td>45</td>
<td>2</td>
<td>2</td>
<td>T.F.T., 0-15</td>
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<tr>
<td>June</td>
<td></td>
<td>40</td>
<td>2</td>
<td>2</td>
<td>T.F.T., 0-15</td>
<td></td>
</tr>
</tbody>
</table>

### Remarks.

- (a) Gliding Section. Club has 41 members.
- (b) Ladies (1st).
- (c) Use of the club.
- (d) 4 privately-owned machines.
- (e) Manchester branch R.A.C.S. (b) every 3 weeks.
- (f) Year after joining. (b) school every evening.
- (g) Year after joining. (b) school every evening.
- (h) Year after joining. (b) 2 club constructed. (b) average 15 sec.
- (i) Year after joining. (b) school every evening.
- (j) Year after joining. (b) school every evening.
- (k) Year after joining. (b) school every evening.
- (l) Year after joining. (b) school every evening.
- (m) Year after joining. (b) school every evening.
- (n) Year after joining. (b) school every evening.
- (o) Year after joining. (b) school every evening.
- (p) Year after joining. (b) school every evening.
- (q) Year after joining. (b) school every evening.
- (r) Year after joining. (b) school every evening.
- (s) Year after joining. (b) school every evening.
- (t) Year after joining. (b) school every evening.
- (u) Year after joining. (b) school every evening.
- (v) Year after joining. (b) school every evening.
- (w) Year after joining. (b) school every evening.
- (x) Year after joining. (b) school every evening.
- (y) Year after joining. (b) school every evening.
- (z) Year after joining. (b) school every evening.
NEW SOUTH WALES.
New South Wales Gliding Association, in process of formation. 
North Shore Flying Club, 45 Musgrave St., Mosman, N.S.W. Primary and intermediate machines. 28 members.
Glen Innes Gliding Club, Glen Innes, N.S.W. Primary machine, club constructed. 25 members.
Sydney University Glider Club. Primary and intermediate machines. 40 members.
Victoria.
Glider Association of Victoria. Primary machine. club constructed. 25 members.
Colac Glider Club, Colac, Victoria. Primary machine. 35 members.
North Shore Flying Club, 46 Musgrave St., North Sydney, N.S.W. Primary machine. 25 members.
Mornom, Victoria. Primary machine. 15 members.
Carnarvon. Glider Association, in process of formation. 25 members.
Cooma. Club constructed. 25 members.
New South Wales Gliding Association. 50 members.
North Shore Flying Club. 50 members.
Carnarvon. Club constructed. 25 members.
Cooma. Club constructed. 25 members.

GLIDING GLOSSARY.
Compiled by Mr. H. J. Penrose, A.F.R.Ae.S., Hon. instructor, Dorset Gliding Club. In compiling this list of definitions, reference has been made to the Glossary of Terms of the Royal Aeronautical Society.
For information with regard to power-driven aircraft this work should be consulted.

AB-INITIO.—A novice or beginner.
AEROFAB.—A wing-like structure designed to obtain a reaction from the air approximately at right angles to the direction of motion.
AILERON.—Hinged flaps let into the rear portion of the extremities of the main planes. These are operated by a lateral movement of the control lever, causing the machine to roll laterally (i.e. in banking).
AIR-SPEED.—The speed of the machine relative to the air passing it.
AIR-HYDRAULIC.—A spoked wheel used on aircraft. Comprises a large pneumatic tyre at low pressure (15 to 20 lbs. per sq. in.) on a wide runned bush.
AIRWHEEL.—To be fit to fly from the design and constructional point of view. To be signed as fit to fly by a ground engineer.
ALIGHTING GEAR.—The system of spring wheels or sprung or fixed skid incorporated in the glider in which the machine rests when in contact with the ground, stationary, alighting or for alighting.
ALIGHTING GEAR.—The system of sprung wheels or sprung or fixed skid incorporated in the glider in which the machine rests when in contact with the ground, stationary, alighting or for alighting.
ALIGHTING GEAR.—The system of sprung wheels or sprung or fixed skid incorporated in the glider in which the machine rests when in contact with the ground, stationary, alighting or for alighting.
ALTITUDE.—Used colloquially as synonymous with height.
ANEMOMETER.—An instrument for measuring the force of the wind.
ANTI-CYCLONE.—The region of atmosphere surrounding a centre of high barometric pressure.
AREA.—The projected area of the surface of a wing—i.e. in a rectangular aerofoil the span or chord squared.
ASPECT RATIO.—The ratio of span to chord of the wing. The greater the ratio the more efficient the wing.
ATTITUDE.—Determined by the inclination of the three principal axes to the relative wind.
AUTO-TOWING.—The art of towing a glider behind a car into the wind to enable it to become airborne.
AXIS.—Longitudinal. A straight line in the plane of symmetry through the centre of gravity fore and aft. Lateral.—An axis parallel to a line joining the tips and passing through the centre of gravity. Normal.—A straight line in the plane of symmetry, at right angles to the longitudinal axis through the centre of gravity.
BACKING.—Change of the wind anti-clockwise, against the sun in the northern hemisphere.
BALLAST.—The sudden upward flight of a glider when near the ground caused when about to land by the pilot pulling the control lever back too much or too quickly.
BAROGRAPH.—A recording instrument showing the pressure of the atmosphere. Used in soaring records to establish the height of a sailplane.
BAROMETER.—An instrument measuring atmospheric pressure.
BAY.—The space enclosed by a system of struts and spars.
BELT.—The safety strap which secures the pilot to his seat in the glider.
B.G.A.—The British Gliding Association. The body controlling the sport of gliding and soaring in this country. Empowered by the Air Ministry to issue certificates of airworthiness for all gliders and sailplanes.
BIASSED FABRIC.—Fabric laid with its threads inclined to the longitudinal axis of the material.
BIPLANE.—An aircraft with two aerofoils set one above the other, usually with a gap between roughly equivalent to the chord.
BOOM.—A lifting or landing wire which resists the reaction produced by the lift of the apparatus to which it is attached.
BOOMING.—Lining up by eye. Checking the alignment of a structure by sighting.
BUILDING.—The main spars carrying the tail of a gliding machine in which the fuselage does not perform this function.
BRACING WIRES.—The wires taking the loads of the structure, comprising—
(a) Lift wires transferring the lift of the wings to the fuselage or load carrying structure.
(b) Anti-lift or landing wires which resist force in the opposite direction to lift.
(c) Drag wires, transferring the drag of the wings to the body or other part of the structure.
(d) Anti-drag wires taking forces of opposite direction to the drag.
(e) Incidence wires crossing the wings in the plane of a pair of fixed and rear wing slats.
BUILDING.—The main spars carrying the tail of a gliding machine in which the fuselage does not perform this function.
BUMP.—Disturbances of the air due to changes of temperature, pressure or the wind striking ground obstacles.
HEAVY-HANDED, or "Ham-Fisted." — Refers to a pilot who is clumsy with his controls.

HOIK.—To pull the machine up off the ground by giving a forward pull on the control column. This should never be indulged in by any novice, as the glider will not permit such forces to be applied to its controls, and the position of the controls will not work properly. The pilot has time to correct his position.

HUSHING.—To jam the machine by means of rubber cord, or in other ways, so that the machine will not respond to the controls. This is done to prevent the machine from working properly.

INSPECTION.—For rigging purposes the angle at which the trailing edge of the wing is set with respect to the direction of the relative wind. The angle of the wing relative to the direction of the relative wind is the most correct view. The plane of reference to keep the machine in equilibrium with the aerodynamic forces on the wing is called the "keel face" of the machine.

KING POST.—A bracing strut in a sub­structure of a machine. This strut is usually comprising rudder, fin, elevator, and fixed tail plane, as the "keel" of the machine. It is often termed the "keel" of the machine.

LANDING.—The action of bringing a machine in land on its wheels. Usually by catapulting it into the air by means of rubber cord.

LEADING EDGE.—The portion of the wing first entering the air stream. The leading edge of the glider.

LEEWARD.—Away from the wind. The sides of the machine seen by the pilot in his seat.

LENGTH.—The overall dimension of the machine from nose to trailing edge of rudder. The length of the glider.

LINE SQUALL. — Indicated by a sudden gust of wind or air stream against the starting aircraft, or sudden gust of wind over or against a glider. Usually, it is caused by the cold front pushing strong up-currents of air against the starting aircraft, or large gusts from an adjoining gust front.

LOADING.—The weight per unit area carried by an aircraft, including fixed and movable parts.

LOG BOOK.—A record of the incidents and events of a flight, including the weather conditions, the type of aircraft, the type of control column, the type of engine, etc.

NECK.
TAIL.-A small skid at the rear preventing the tail from making contact with the ground.

TERRAIN.-A particular area of ground or locality.

TIE-ROD.-Adjustable tension members with tapered ends screwed in forks.

TRUE-UP.—To adjust the rigging of a glider so that it flies correctly.

TURNBUCKLE.—The fitting used to adjust the tension of wires to which it is attached. Consists of a barrel threaded internally, into each end of which is screwed a headed eyebolt or screw. Turnbuckles are interwoven; in timber a scarf joint is made at a minimum angle of 1 in 9.

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TRUE-UP.—To adjust the rigging of a glider so that it flies correctly.
### DURATION WITH ONE PASSENGER.

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<th>Date</th>
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<th>Country</th>
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### DISTANCE (STRAIGHT LINE).

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<td>Kemperer</td>
<td>Wasserpenningen</td>
<td>&quot;Schwarzer Teufel&quot;</td>
<td>Germany</td>
<td>1 83</td>
</tr>
<tr>
<td>1921</td>
<td>Martron</td>
<td>Wasserpenningen</td>
<td>&quot;Vampyr&quot;</td>
<td>Germany</td>
<td>7 5</td>
</tr>
<tr>
<td>1922</td>
<td>Hentsen</td>
<td>Wasserpenningen</td>
<td>&quot;Vampyr&quot;</td>
<td>Germany</td>
<td>9</td>
</tr>
<tr>
<td>1922</td>
<td>Botch</td>
<td>Wasserpenningen</td>
<td>&quot;Consul&quot;</td>
<td>Germany</td>
<td>18 7</td>
</tr>
<tr>
<td>1924</td>
<td>Martin</td>
<td>Mounte Mazur</td>
<td>&quot;Moritz&quot;</td>
<td>Italy</td>
<td>10 2</td>
</tr>
<tr>
<td>1926</td>
<td>Nehring</td>
<td>Krin</td>
<td>&quot;Consul&quot;</td>
<td>U.S.S.R.</td>
<td>24 4</td>
</tr>
<tr>
<td>1926</td>
<td>Wegel</td>
<td>Wasserpenningen-Gompershausen</td>
<td>&quot;Consul&quot;</td>
<td>Germany</td>
<td>55 3</td>
</tr>
<tr>
<td>1927</td>
<td>Scholz</td>
<td>Rossitten-Cranz</td>
<td>&quot;Westpresse&quot;</td>
<td>Germany</td>
<td>35 3</td>
</tr>
<tr>
<td>1927</td>
<td>Nehring</td>
<td>Rossitten-Neukurer</td>
<td>&quot;Raumzyke Borge&quot;</td>
<td>Germany</td>
<td>45 2</td>
</tr>
<tr>
<td>1927</td>
<td>Schultz</td>
<td>Rossitten-Mesel</td>
<td>&quot;Westpresse&quot;</td>
<td>Germany</td>
<td>90 2</td>
</tr>
<tr>
<td>1927</td>
<td>Nehring</td>
<td>Wasserpenningen-Dad Berka</td>
<td>&quot;Darmstadt&quot;</td>
<td>Germany</td>
<td>81 8</td>
</tr>
<tr>
<td>1928</td>
<td>Nehring</td>
<td>Wasserpenningen-Trecoft</td>
<td>&quot;Darmstadt&quot;</td>
<td>Germany</td>
<td>71 2</td>
</tr>
</tbody>
</table>

### DISTANCE WITH ONE PASSENGER.

<table>
<thead>
<tr>
<th>Date</th>
<th>Pilot</th>
<th>Place</th>
<th>Construction</th>
<th>Country</th>
<th>Distance (Kilometres).</th>
</tr>
</thead>
<tbody>
<tr>
<td>1929</td>
<td>Kronfeld</td>
<td>Wasserpenningen</td>
<td>&quot;Wien&quot;</td>
<td>Germany</td>
<td>102</td>
</tr>
<tr>
<td>1929</td>
<td>Kronfeld</td>
<td>Wasserpenningen-Liass</td>
<td>&quot;Wien&quot;</td>
<td>Germany</td>
<td>150</td>
</tr>
<tr>
<td>1930</td>
<td>Kronfeld</td>
<td>Wasserpenningen-Wolfgangshamme</td>
<td>&quot;Wien&quot;</td>
<td>Germany</td>
<td>184.5 (100.5 miles)</td>
</tr>
</tbody>
</table>

### DISTANCE WITH TWO PASSENGERS.

<table>
<thead>
<tr>
<th>Date</th>
<th>Pilot</th>
<th>Place</th>
<th>Construction</th>
<th>Country</th>
<th>Distance (Kilometres).</th>
</tr>
</thead>
<tbody>
<tr>
<td>1924</td>
<td>Papenmayer</td>
<td>Wasserpenningen</td>
<td>&quot;Margarette&quot;</td>
<td>Germany</td>
<td>1 6 (6 miles)</td>
</tr>
</tbody>
</table>

### ALTITUDE.

<table>
<thead>
<tr>
<th>Date</th>
<th>Pilot</th>
<th>Place</th>
<th>Construction</th>
<th>Country</th>
<th>Height (Metres).</th>
</tr>
</thead>
<tbody>
<tr>
<td>1921</td>
<td>Lilienthal</td>
<td>Germany</td>
<td>Own</td>
<td>Germany</td>
<td></td>
</tr>
<tr>
<td>1922</td>
<td>Wright Bros.</td>
<td>Kitty Hawk</td>
<td>Own</td>
<td>U.S.A.</td>
<td></td>
</tr>
<tr>
<td>1922</td>
<td>Martron</td>
<td>Wasserpenningen</td>
<td>&quot;Vampyr&quot;</td>
<td>Germany</td>
<td>108</td>
</tr>
<tr>
<td>1922</td>
<td>Hentsen</td>
<td>Wasserpenningen</td>
<td>&quot;Vampyr&quot;</td>
<td>Germany</td>
<td>200</td>
</tr>
<tr>
<td>1922</td>
<td>Hentsen</td>
<td>Wasserpenningen</td>
<td>&quot;Vampyr&quot;</td>
<td>Germany</td>
<td>350</td>
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<tr>
<td>1922</td>
<td>Descamps</td>
<td>Biskra</td>
<td>&quot;Dewstone&quot;</td>
<td>Africa</td>
<td>846</td>
</tr>
<tr>
<td>1922</td>
<td>Auger</td>
<td>Vatour</td>
<td>&quot;Abrial-Peirre&quot;</td>
<td>France</td>
<td>700</td>
</tr>
<tr>
<td>1927</td>
<td>Schultz</td>
<td>Rositten</td>
<td>&quot;Westpresse&quot;</td>
<td>Germany</td>
<td>503</td>
</tr>
<tr>
<td>1927</td>
<td>Schultz</td>
<td>Marienburg</td>
<td>&quot;Westpresse&quot;</td>
<td>Germany</td>
<td>553</td>
</tr>
<tr>
<td>1928</td>
<td>Dittmar</td>
<td>Wasserpenningen</td>
<td>&quot;Albart&quot;</td>
<td>Germany</td>
<td>755</td>
</tr>
<tr>
<td>1928</td>
<td>Kronfeld</td>
<td>Wasserpenningen</td>
<td>&quot;Wien&quot;</td>
<td>Germany</td>
<td>2160</td>
</tr>
<tr>
<td>1929</td>
<td>Kronfeld</td>
<td>Wasserpenningen-Liass</td>
<td>&quot;Wien&quot;</td>
<td>U.S.S.R.</td>
<td>8369 (664 ft.)</td>
</tr>
</tbody>
</table>

### HEIGHT WITH ONE PASSENGER.

<table>
<thead>
<tr>
<th>Date</th>
<th>Pilot</th>
<th>Place</th>
<th>Construction</th>
<th>Country</th>
<th>Height (Metres).</th>
</tr>
</thead>
<tbody>
<tr>
<td>1925</td>
<td>Jungmeister</td>
<td>Krim</td>
<td>Own</td>
<td>Norway</td>
<td>330</td>
</tr>
</tbody>
</table>

**NOTE:** At Elmira, N.Y., in October, 1930, Warren Eaton (Norwich, N.Y.) set up a height record for U.S.A. of 1,150 feet (346 ft.).

* E.A.I. official records, others of which are,—Greatest speed within given boundaries: 455-80 km (285 miles) by Schulz in the Rositten, 1927. Greatest speed within given boundaries: 54-55 km per hour (34 miles an hour), Schulz, "Westpresse."
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