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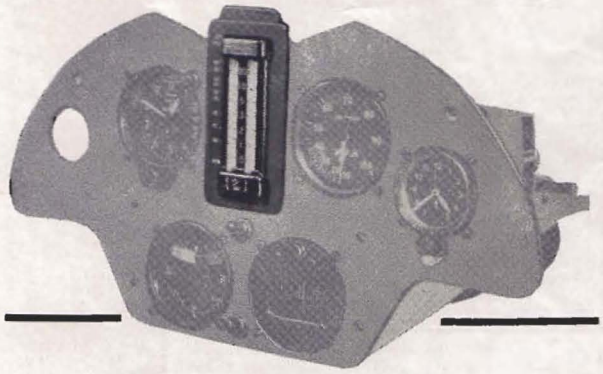


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THE FIRST JOURNAL DEVOTED TO SOARING AND GLIDING

JANUARY 1952 ★ Vol XX No 1

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The *Sailplane and Glider* is published on the 5th of every month. Price Two Shillings per copy : 25s. 6d. per year posted. Advertising Rates on application.

Published for the licencees, Glider Press Ltd., by the Rolls House Publishing Co., Ltd., and printed by The Mendip Press, Ltd., London and Bath.

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COVER PHOTO:

The 'Grunau Baby' and 'Tiger Moth' which flew 520 miles from Sydney, Australia, to Toowoomba recently on a delivery flight. (See December 'Sailplane'). Left to right: Bob Muller, Bob Krick and Fred Hoinville.

Editorial

NOW IS THE TIME

THE recent disclosure in the Australian House of Commons of the strength of Russian Defensive Fighters, which was given as of the order of 10,000 pilots with machines and reserves, must have given a severe shock to anyone interested, whether they were members of the Fighting Forces or not.

The recent disclosure from American sources that the Russian Jet Fighter, derived from Rolls Royce 'Nene' Engines, is superior to anything it has yet come up against is a firm indication of the advanced state of Russian preparedness for hostilities NOW or in the next six months. After that the edge of their superiority may be slightly dulled so far as technical achievements go as the most modern British Fighters and Bombers come into the production line.

The number of fighters needed to defend any given target varies with the nature of the attack, the area and nature of the target and the relative quality of the offensive weapons on both sides in regard to technical matters. It also varies with the quantities of offensive weapons used.

In the appreciations which were made by the Air Staff before and after the outbreak of war the strength of any attacking force which could be expected to operate against us was exaggerated, as all such estimates are found to be, but as the war proceeded our worst expectation of the strength of possible enemy attack were never realised. On the other hand the Germans can never have expected that the Allies could or would mount an Air Offensive of such strength and power as was ultimately directed against the Reich and occupied territory.

In the next war, such are the possibilities of Atomic Warfare that the first blow could be decisive and it is no doubt for this reason that the U.S.S.R. have created such a prodigious fighter defence force. They must know what are their vital targets which may number as many as a hundred or so, and it is possible that not all of these could be attacked at once by Atom Bombs and if so attacked would necessarily be destroyed. But there are limits to the flexibility of Fighter Defence and the vast distances between Russian Targets must mean a dispersal of Russian Defence. We do not therefore subscribe to the view that Russia is now invulnerable.

But on the other hand Great Britain IS most certainly vulnerable and whilst it is true that Fighter Defence does not avail against V.1.'s and V.2.'s it could avail against aircraft-borne bombing attacks and against airborne forces.

It is therefore apparent that the great aviation need of Great Britain to-day is a rapid all-out expansion of its Air Force, in fighters, bombers and air transport.

To provide the flying material on the scale required in the time apparently available is not possible but we could go a long way towards providing the air experienced personnel in a very short time, and cheaply, if we set about it.

We know how Russia has built up its Air Force from the enormous reserve of pilots who have had their early training in gliders and sailplanes. The only leading powers who have not created a vast reserve of embryonic pilots are ourselves and the Americans. The Russians cannot be fools, nor the French, nor were the Germans before the war in this matter, and we refuse to believe that ourselves and the Americans have all the wisdom in this matter either. We therefore suggest that the time is now ripe for the new British Government to begin the creation of a similar reservoir of pilots, both male and female by taking in hand the gliding and light plane movement of this country and organising it as an essential feature of National Defence. This may not be to the liking of our pleasure flying pundits or even the liking of those engaged in high performance flying for achievement's sake, but it appears that it may well be that with the accent on production of large numbers of experienced pilots the interest of the few may not be in such evidence. But if it is necessary for National Defence, and we believe that it is, we are sure that no one will cavil at any disturbance in their private leisure. We don't like regimentation any more than anybody else, but we are sure that given the opportunity, the gliding and light flying movement could make an enormous contribution towards filling the gap in the ranks of our aviation personnel.

For these reasons therefore we would like to think that in the New Year British Gliding, caught up in the events of the time, might achieve more National Recognition than it has ever enjoyed before.

'£4,000 MUST BE FOUND —

7th December, 1951.

THE EDITOR,

'SAILPLANE & GLIDER.'

DEAR SIR,

The World Gliding Championships will be held next May in Spain. The British Gliding Association is most anxious to be represented, and provisional plans are being made to send a contingent of five glider teams, but this will not be possible without financial help.

In 1950 our pilots and crews paid their own expenses but they cannot afford to do so again. The position this year is that if Britain is to be represented, £4,000 must be found. The five gliders of British design, the cars and radio equipment, have already been loaned, and the Spanish authorities will meet all expenses while the teams are in Spain. There are, however, many other costs involved in organising the venture and in carrying it through. These include transport charges, subsistence en route, insurance, repairs, certain hire charges and entry fees.

The efforts which have been made to improve gliding technique and equipment in this country, the importance of this sphere of aeronautics, and the value of British representation at a world event of this nature, are generally appreciated, and I am confident that an appeal to the public, and in particular to our loyal friends in the aircraft industry, will meet with immediate support. Donations should be made out to the British Gliding Association, Ltd., and forwarded to the British Gliding Association at the Royal Aero Club Aviation Centre, Londonderry House, 19, Park Lane, London, W.1.

Yours faithfully,

(*Signed*) THE VISCOUNT KEMSLEY.

President, British Gliding Association.

The British Team

F/L R. C. FORBES, G. H. Stephenson, Lorne Welch, Philip Wills and Foster, have been selected by the World Championships Committee of the B.G.A. for the International Soaring Contests this year.

It is interesting to note that the five chosen are



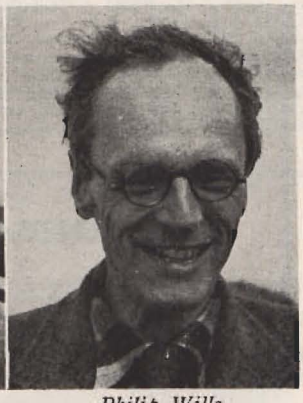
F/L R. C. Forbes



G. H. Stephenson



Lorne Welch



Philip Wills



Frank Foster



The Goodhart Brothers—who are to be left behind

If Britain is to Compete'—*Lord Kemsley*

those who came top of the British National Contests *Individual* Championship table—Forbes being the winner with a lead of four points over ' Steve.'

David Ince, number six on that list is chosen as reserve in the event of one or other being unable to make the journey.

VENUE AND DATE UNDECIDED

Venue and date for the Contests are still to be decided. It is expected that they will be held at Madrid or Huesca in May or June.

WE understand that the British Team for the International Gliding Competitions to be held in Spain this year has been chosen, but we note the omission of the Goodhart Brothers. It is of course a peculiarity of Championships, both National and International, that they are decided on individual performances. But if that is so why send a team, but if you are sending a team surely the nature of the Competitions should be altered so that the achievements of the team will count and not that of individuals.—No prizes for the answer.

GLIDER ACE DIES IN RECORD BID

Oxygen Mask Failed

BISHOP, California, December 26—Swedish glider pilot, Carl Erik Oevgaard, who made an attempt on the glider altitude record near here recently, reached a height of 55,000 feet—12,780 feet above the known record before spiralling to his death, it was stated at an enquiry here.

The coroner said that Oevgaard was probably caught in a violent updraft from which he could not emerge and was tossed like a cork in a fountain to 55,000 feet. His oxygen equipment failed to function, and he fell unconscious and was helpless in his glider when it dived to earth.—*Reuter.*

Australian Gliding 1951

STILL STRUGGLING

DESPITE a history stretching back to 1905, when the first glider was flown in this country, Australian gliding is still in the struggling stage.

Mainly responsible is the high overseas prices of gliders, unfavourable exchange rate, and high cost of shipping machines.

There are only about 25 gliding clubs in the country, with fleets totalling about 50 machines.

The majority of these have the performance of a ' Grunau Baby ' or less, few are fitted with full blind panels. There are three ' Olympias ' at present flying in Australia, nothing better.

Four clubs have two-way radio installed in machines, and only about three have oxygen equipment.

LACK OF INSTRUMENTS

But the most keenly felt deficiency is the lack of barographs—many of Australia's clubs do not have a single barograph, and consequently cannot win F.A.I. certificates.

Although soaring conditions are excellent on a majority of days throughout the year, most of the gliding centres are surrounded by inhospitable country, which is a deterrent to cross-countries. Or lack of retrieving equipment prevents them going away at all.

However, this Christmas is likely to prove the most active period for Australian gliding. Australian soaring pilots have bettered three national records in the last 12 months, but few other outstanding performances have been recorded.

Martin Warner, of Sydney Soaring Club, broke the Australian absolute altitude and gain of altitude records with a Cu.-nim. flight in the ' Gull IV ' to about 23,200 feet, giving a gain of 21,000.

He took the record from Keith Chamberlin, of the Gliding Club of Victoria. In a cu.-nim. he gained 11,600 feet in a ' G.B.' at Benalla.

Len Schultz, of Sydney Soaring Club also, took the Australian goal flight record with a 135-mile cross-wind flight from Narromine to West Wyalong, two inland New South Wales centres.

At the Sydney Soaring Club's summer camp other flights were Martin Warner, 162 miles; Dr. G. A. M. Heydon, 114; Mervyn Waghorn, 113; Keith Collyer, 103.

South Australia is the only other state from which long cross-country flights have been reported.

Waikerie (S.A.) Gliding Club was the scene of a State Competition at Easter, when the best flight was 140 miles from Waikerie to Ouyen (Victoria) by Les Brown in the Australian-built ' Olympia ' Yellow Witch.' '

GLIDER FOR BUSINESS TRIP

' Jock ' Barratt, of Waikerie, during the year achieved history by using a glider for a business trip.

He flew an ' Olympia ' on a 80-mile goal flight from Waikerie to Adelaide, completed his business there, then two days later made the return goal flight to Waikerie.

ANOTHER APPROACH TO OPTIMUM SAILPLANE CRUISING SPEEDS

By

William S. Ivans, Jr.

(Holder of the World Records in Absolute Altitude and Altitude Gain Categories).

A VERY flexible form of the Optimum Cruising Speed equation can be obtained by taking wind velocity into account, in accordance with the following :—

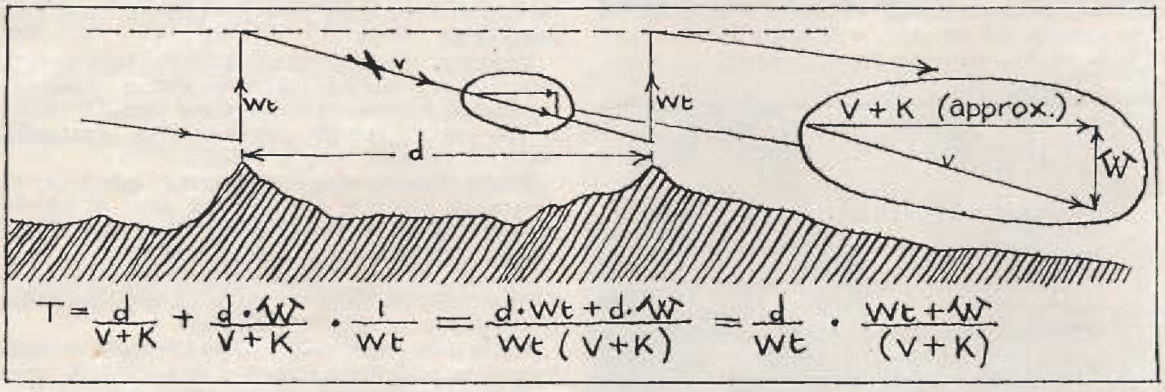
A. Assume that altitude is gained while holding a position over a fixed point on the ground. This assumption will hold for ridge or wave soaring (unless the ridge or wave is left at a point considerably removed from point of entry into the updraft zone) ; the resulting expression can easily be modified to hold for thermal or other soaring in which one drifts while gaining altitude :

$$T = \frac{d}{v+K} + \frac{d \cdot W}{v+K} \cdot \frac{1}{w_t} = \frac{d \cdot w_t + d - W}{w_t (v+K)}$$

$$= \frac{d}{w_t} \cdot \frac{w_t + W}{(v+K)}$$

B. To find T min., differentiate T with respect to v and set numerator equal to zero.

$$(v+K)\,W' - (w_t + W) = 0$$



SYMBOLS :*

v = horizontal velocity of the sailplane through the air.

$w_s = f(v)$ = normal sinking speed of the sailplane in still air at velocity v.

w_d = magnitude of downcurrent in which sailplane is flying.

$W = w_s + w_d$ = variometer reading between updrafts.

w_t = average rate of climb expected in next updraft zone.

d = distance to next updraft.

T = time for sailplane to fly distance d and climb back to its initial altitude.

K = wind velocity in direction of travel. (Positive for a helping wind).

*These are consistent with Paul MacCready's Forum paper notations, with the addition of the Symbol K denoting wind velocity.

since $W' = w_s' = f'(v)$,

$(v+K)\,f'(v) = w_t + W$ or

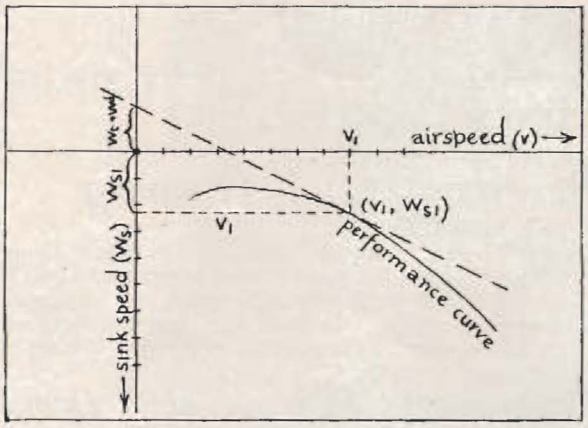
$$(1)\ f'(v) = \frac{w_t + W}{v+K} =$$

C. Equation (1) expresses the condition for maximum cross-country soaring speed if ridge or wave updrafts are utilized, in accordance with the basic assumption. Variations of this equation follow.

D. For thermal soaring, set $K = 0$. (Wind velocity, in this case, does not enter into a calculation of optimum cruising speed, although it has a usually very important effect on net ground speed).

$$(2)\ f'(v) = \frac{w_t + W}{v}$$

E. For maximum ground coverage in the 'last long glide,' assuming that no more updrafts will be encountered, set $w_t = 0$.



$$(3)\ f'(v) = \frac{W}{v + K}$$

F. In order to be useful to a pilot, the foregoing equations must be evaluated in terms of commonly-encountered wind velocities, climb rates and sinking rates for a particular sailplane. The end result of such an evaluation should be a chart or airspeed selector ring which permits the pilot to control airspeed in accordance with variometer indication, once wind velocity and average climb rate have been established.

G. An analytical evaluation of the equations is somewhat tedious, although not especially difficult. If this is undertaken, a suitable expression for $w_s = f(v)$ must be found. Usually, an expression of the form $w_s = A + B(v-c)^2$ will approximate the sailplane performance with reasonable accuracy. The constants A, B and C may be determined from the ship's measured performance data. A and C may be found directly, A being the minimum sink speed and C the airspeed which yields minimum sink. B may be evaluated at a higher airspeed, preferably one in the higher cross-country speed range. For example, a fair approximation to the performance curve of a 'Schweizer 1-23' is $w_s = 2.6. + .003\ (v-40)^2$, with w_s in ft./second and v in miles/hour.

H. Graphical evaluation of the equations is less tedious, and involves the use of simple arithmetic in preparation of the airspeed *vs.* sinking speed charts or selector rings. The preparation of charts relating to equation (2) (for thermal soaring) is described in detail in Paul MacCready's excellent SCSA-AGCSC Forum paper 'Optimum Cross-Country Soaring Speeds.' A simple graphical manoeuvre permits evaluation of equation (1), for various wind velocities, in virtually identical fashion, Equations (2) and (3) then become special cases of equation (1), as explained in foregoing paragraphs C, D and E.

MacCready's paper is devoted to cross-country technique using thermal updrafts. Consequently, the condition for maximum speed is expressed by equation (2)

$$f'(v) = \frac{w_t + W}{v}$$

which states that the slope of the performance curve at any point is equal to the ratio :

updraft plus indicated sink speed / airspeed.

Determining $w_t + W$ *vs.* v for a large number of points on this curve is the first step in the preparation of an optimum airspeed chart or selector for thermal soaring. The final step, if a linear-scale variometer is employed, involves the construction of a rotatable airspeed selector ring, to be mounted concentric with the variometer dial. The airspeed selector ring is a truly ingenious device, easy to construct and easy to use.

I. Charts or selector rings which apply to equation (1) may be prepared for representative values of K (wind velocity). A set of perhaps six selectors will cover virtually all cross-country soaring conditions. The mechanics of construction are an extension of the process described in the MacCready paper. The airspeed axis it displaced by the velocity K for determining the quantity $w_t + W$, in accordance with equation (1).

$$f'(v) = \frac{w_t + W}{v + K}$$

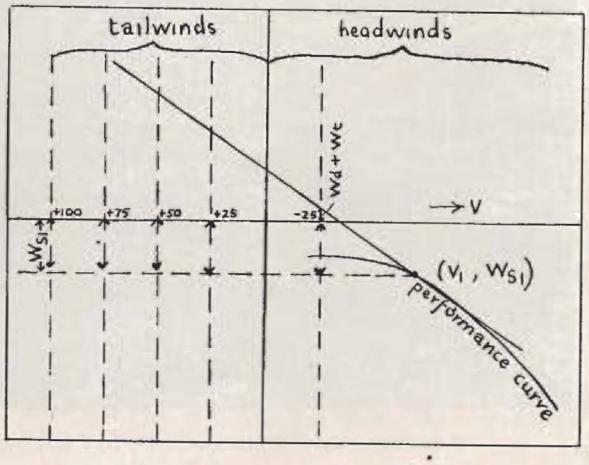
A reasonable set of values for K might be —50, —25, 0, +25, +50, +75, +100 m.p.h. ; the positive values corresponding to tailwinds.

The most-used chart or selector card will ordinarily be that constructed with $K=0$, since this applies to the thermal soaring situation. The higher K values will be most helpful when using standing wave updrafts for cross-country soaring.** Lower velocity negative K cards may prove useful in attempting ridge or wave soaring flights into the wind (a rather unlikely situation), and for stretching the last glide upwind on a thermal soaring day (by setting $w_t = 0$ on chart or airspeed selector card).

J. The foregoing material can be modified, if desired, to include effects of quartering winds, airspeed and variometer altitude errors, etc. Such considerations have been omitted for the sake of clarity in presentation of the basic concept of optimum soaring speeds.

W.S.I.

**This is what prompted me to make an analysis.



SOARING IN FRANCE

1951—A SAD YEAR

Lack of Machines Acute

By GUY BORGÉ

'Possibles' for Spain to Receive Special Training

A BAD YEAR

A SPLENDID soaring year was enjoyed in France during 1949, and 1950 was notable as a transition period. But, 1951 descended the ladder marked by its bad conditions. Rain, storms, no sun, abundant moisture—splendid for snail hunters and umbrella dealers.

People were told that it was an effect of the A. Bomb test. A sorry effect giving no thermals, little cloud or wave soaring—a disaster for sailflying pilots.

TWO OPTIMISTIC NOTES

The only optimistic note was provided by the splendid new diamonds acquired by young Gérerd Pierre, and the nice distance records of Mrs. Marcelle Choisnet-Gohard on the 22nd and 23rd November, when she took the two-seater feminine duration international record with 28 hours 41 minutes in the ' C.M.7 ' sailplane at Les Alpilles airfield.

Only masculine record was established by Captain Fonteilles in a ' Kranich ' two-seater in speed, along a 100 km. base. He made several attempts to break his own record along the same circuit in the single-seater class with an ' Arsenal ' 4111, but bad weather and his departure to Indo-China prevented him from succeeding.

LESS LAUNCHES AND FLYING—MORE CRASHES

In 1951 number of flying hours, launches and badges decreased in relation to the past years. Also the number of sailplanes. Never were so many machines crashed from so small an amount of flying.

List of ' big ' crashes is astonishing. For instance, at the Pont Saint Vincent centre the famous ' Air 100 nr. 4,' which soared to Rodez, vanished near Dijon against an electrical line ; a ' Minimoa ' landed on a tree top and a German ' Weihe ' crashed in the hands of an English pilot during a cross-country flight. But this was a fortunate event because it was discovered later that the corite glue had disappeared and that wing stiffness was insured by fabric and paint!



' Castel 242 ' two-seater *Photo : Borgé*



' Caudron C-800 ' two-seater *Photo : Borgé*

At Beynes a ' Weihe ' was completely destroyed at the end of the only 300 km. leg acquired at this centre last year. At Fayence another ' Weihe ' ended its days at the bottom of a precipice where it remains today.

These crashes are a catastrophe because they occur at a moment when lack of high-performance machines in France has become acute.

Twenty new ' Air 100's ' have been ordered by the S.A.I.S. for the centres and their coming into service next year will be welcomed. Lack of machines is our most important problem.

A NEW SCHEME

To get the best results of the sailplanes at present in service a new scheme is being brought into being, by which only the active airfields, which will receive members of neighbouring clubs, will get some new sailplanes. In fact, since 1946, nearly 300 Aero-clubs have been given a minimum allowance of a winch, a two-seater, three training sailplanes—sometimes many more. In many cases this valuable equipment produced little results as far as new badges and gliding activity.

This new scheme will completely alter the French soaring sites, an absolute necessity in our opinion, because soaring cannot be practised everywhere, even when plenty of machines exist.

INTERNATIONAL CONTESTS—TEN POSSIBLES

Big events in 1952 will be the International Contests in Spain, and they have raised passionate debate about choice of team, sailplane types and equipment. The Beynes National Contests in August were to help select the Spanish team, but had to be cancelled for several reasons, leaving only arbitrary selection possible. The latest news is that ten names have been put forward, and these ten pilots will receive a special training lasting a month. After proving their value five of them will form the official team.

But the list of the ten names remains unofficial, and it would be premature to announce it now because of the possible changes.

A great probability exists for choice of Gérerd Pierre, Max Gasnier, Hubert de Lassageas, Marcelle Choisnet-Gohard among the 10 elects.

Last September a few pilots—Nessler, Gasnier and Lambert—made an expedition to Saint Girons on French side of the Pyrénées chain with two ' Bréguet 900's,' but it met unfavourable weather.

It does not seem that the ' Bréguet 900,' a very fast sailplane in good thermals, but having too great a sinking speed to pick the weak ones, will be retained for Spain and I think that the French machines will consist rather of ' Air 100's ' and perhaps an ' Arsenal 4111.'

CHOICE OF MACHINES

It is my own opinion, acquired in interviewing the best known pilots, and most likely for choice of the team, that official selection of machines has not been made.

A normal choice would be that of four ' Air 100's ' and one ' Bréguet 900 ' with one ' Arsenal 4111 ' in reserve.

In spite of cancellation of the Beynes National Contests, several regional contests were held at many airfields. We have already spoken of the splendid Beynes Regional Contest which proved successful by a large number of successful performances. At Nantes, the West Regional Contest was marred by bad weather, but 1750 km. (1085 miles) were flown, mainly in imposed circuits.

At Grenoble, the same difficulties existed for the Alpine Contest of the Dauphiné Aéro-club which met poor results in stormy weather and had only seven competitors.

No one succeeded in winning the Izarra Cup, but it will be held again in 1952.

We hope that next year meteorological conditions will be better with less snails and umbrellas.

HOW NOT TO COMPLETE A DIAMOND 'C'

By Wally Wiberg

This could be titled ' The Story of My Fallin' Down,' or ' I Musta Done It Wrong.' The story of why the old 'LK' is no more, starts about here, Sept. 9th.—W.W.

FLIGHT TESTING INSTRUMENTS

I ARRIVED at the field (Irving, U.S.A.), shortly after noon and was eager to flight test the new German combined turn and bank and gyro horizon, the installation of which I had just completed.

A storm was moving in from the N.W. as Monty towed off ahead of me in the ' TG-3.' I checked batteries and barograph, as the main purpose of the new instrument was to improve my cloud flying to help make the altitude leg remaining to complete a Diamond ' C.'

Was soon releasing from the ' Stearman ' at 2,000 feet and a couple of miles S.E. of the field. The gyro was immediately revved up and uncaged in level flight. It was impossible to hold altitude with Monty, who was making some passes under scattered clouds ahead of the storm ; and make a decent flight check of the gyro. The horizon seemed to work perfectly though the turn needle seemed not quite as sensitive as it should be. I didn't try to tumble the horizon as bench tests had indicated it would go very nearly to a vertical turn.

After more testing I encountered zero sink north of the field at 800 feet. This was worked for no gain for 5 or 10 minutes and Monty was seen on the ground rolling toward the hangar. The ' Pratt Read ' and ' BG-7 ' were also being put away. Now the leading edge of the storm front made itself apparent by first a gradual and then rapidly accelerating rate of climb.



A ' TG-3 ' two-seater on tow

THREE THOUSAND F.P.M.

The storm passed quickly over the field which was out of sight as I climbed past 3,000 feet in front of the storm at a rate of 2,500 to 3,000 f.p.m. This rate was estimated as my rate of climb pegs at 2,000 f.p.m. At about 5,000 feet the gyro was switched on again and uncaged with wings level and nose down to about 50 m.p.h.

Right here my most important mistake was accomplished. This storm seemed so terrific and an altitude opportunity like this presents itself so seldom that temptation got the best of me. The main reasons I shouldn't have tackled this particular storm was lack of adequate testing of the new instrument and the fact that the large size of the

instrument temporarily prevented the installation of a compass and standby electric bank and turn.

For a trial run, I turned into the storm intending to make a 180° turn and come back out. This had to be done by control feel and gyro horizon and guessing at the turn time since there was no compass and the turn needle was not sufficiently sensitive. After the attempted 180° turn and after flying much longer than it should have taken to get in the clear, it was still very dark and I had obviously misjudged the turn.

The lift continued strong from 1,500 to 2,500 f.p.m., the gyro horizon made it very simple to hold the airspeed within a 3 or 4 m.p.h. range, and so I decided to postpone the escape problem till a higher altitude. It seemed the problem was not apt to become more complicated, and I might break out the side of the storm in the process. Since levelling the horizon didn't bring me out of the storm, the gyro had obviously stabilized in a turn but, since the airspeed could be slowed to nearly normal stall speed and since vertical acceleration had not increased appreciably, it could only be a large moderately banked turn. The direction of the turn could be determined by observing the airspeed on applying right or left rudder, but this was no help as a straight heading couldn't be assumed with neither a good turn indicator nor a compass.

SEVERE TURBULENCE ENCOUNTERED

Above 10,000 feet occasional hard rain was encountered with lift remaining steady and the gyro continuing as before to show variations from the steady turn as variations from straight and level. Just about 14,000 feet the lift dropped off and the usual severe turbulence was encountered. I had hoped to make another 3,000 feet or 4,000 feet which would have been good for Diamond 'C' altitude.

Being unable to take a heading out it was, as I had expected, merely a matter of a few minutes till the turbulence caused the gyro horizon to tumble. Without a standby bank and turn, the only remaining alternative was to spin down through the storm. This is not usually a serious situation as cloud base is normally at 4,000 feet to 8,000 feet, but on passing the 2,000 feet mark after having spun for about six minutes and finding it still very dark, conditions were obviously different.

On entering this storm, the base was seen to be very low at about 2,000 feet and under many storms of this type there is often a very dark column, containing mainly heavy rain, extending nearly to the ground. I was spinning in heavy rain and it was becoming increasingly apparent that this was my unlucky position. I felt that I could just as well have spun down most anywhere else.

LEVELLED OFF AT 150 FEET

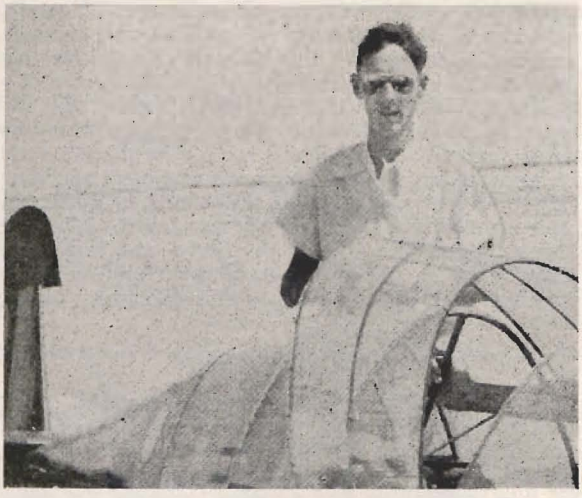
It's really a very eerie feeling to watch the altimeter drop past 500 feet and note that it has a probable lag of about 200 feet when spinning down at nearly 2,000 f.p.m. in the dark. I pulled the hatch open and stuck my head out to make the most of the poor visibility caused by the rain on the canopy. In just a few seconds tree tops appeared rotating through the mist below. An abrupt spin recovery levelled off at about 150 feet. With head stuck out the side and no time to look inside to check the gauges, the reduction of airspeed with still high ground speed indicated a downwind heading. With visibility of about 800 feet I was too low to turn and hadn't time to check the actual wind direction anyway.

Passed quickly over trees, a few scattered houses and then a small field. On easing the stick back to clear the trees on the far side of the field it became obvious that not enough airspeed remained so into the trees at approximately stall speed with a fair tailwind and 15 feet or 20 feet above the ground, and with arms over my face to beat off branches and broken canopy. The right wing came off in the trees a few feet from the fuselage and spun the ship around to the right about 90°. The left wing dug in the ground and was torn off nearly like the right one. The ship continued around another 90° so it headed back the way it came and the nose dug in about 45° down and slightly over on the left side. Down came the tail and the silence was broken only by the crashing of rain on the wreckage.

ONLY A BROKEN ANKLE !

A fast inspection combined with the releasing of safety belt and 'chute harness revealed no personal damage except for one completely broken left ankle, the result of planting the left rudder pedal in the ground. On raising myself to sit on the centre canopy section I found I had fallen about 40 feet short of a road and it was a simple matter to crawl under the barbed wire fence. A car arrived almost immediately and we were off to Carrollton, a mile to the west, in less than five minutes after I hit the ground. Felt sort of silly sitting there in the car holding a boot full of loose foot by the boot strap.

Well, there's the story of how not to do it and why, complete with gory details and obvious errors outlined.



A recent photo of Wally Wiberg

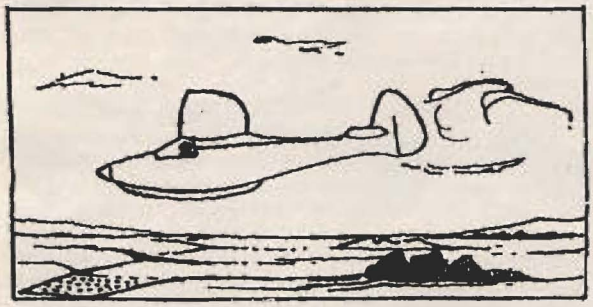
The Plain Man's Guide to Gliding

By Godfrey Lee

Illustrations—Derek A. Mossman

IT must have been about 5,000 years ago, on a windy summer's afternoon, that Oonk the son of Aahk (or so his Mother always declared), made the marvellous discovery that if the wind were blowing at your back you could get across the river on your log without paddling at all. That was the first time that anyone had made use of the power of the wind for the purpose of human locomotion; from that fundamental revelation sprang all the great developments of sailing ships.

At this point the Intelligent Reader may well enquire what on earth all this has got to do with Gliding; he may point out that gliding has been



going on, at the best, for about 50 years and he may ask if I intend to drag in Julius Caesar, 1066, the 100 years' war and all the rest of it. Have no fear, the answer to the last part of the question is: 'No!' Yet sailing ships and gliders are very closely related because both are enabled to carry out their proper functions by virtue of the wind; the ship moves across the water with the aid of horizontal winds, and the Glider is borne aloft by a vertical wind, a current of rising air. But to understand how this may be so, a more detailed study of the nature of a glider is required, and I have got a feeling that my good friend the Intelligent Reader is just coming up with another question (he is!): 'Why do you want to glide at all?' Well, it's a fair and most pertinent question really, so I shall make two sections, one called 'How you Glide,' the other called 'Why you Glide'; and, just to beat my friend, the Intelligent Reader, to it, there will be a third section called 'Where you Glide' (as if you didn't know!)

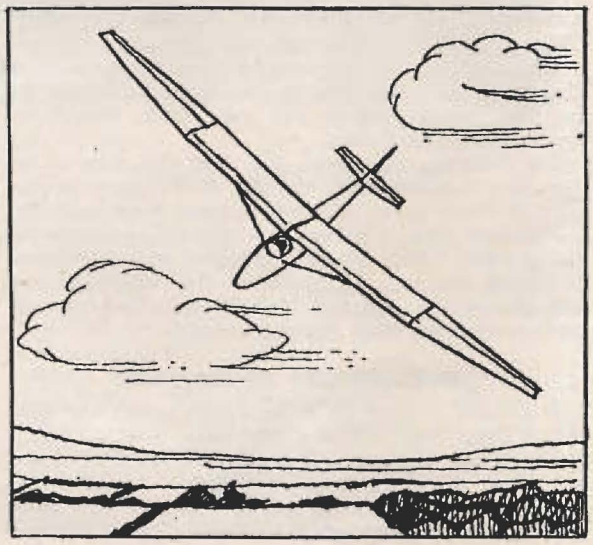
HOW YOU GLIDE

A glider is a controllable piece of apparatus which can move about steadily in the air without requiring an engine and can carry one or more people inside it. It can move about at a steady speed (that is to say, if it is not falling like a stone), because the wings produce an upwards force, or 'lift,' equal to its weight. It is controllable because it is provided with a number of 'Control Surfaces' (usually like the rudder of a boat), which the pilot can move to make the glider take up whatever attitude he wishes.

The wing can only produce a lift so long as the glider is moving forwards through the air. It is fundamental to the nature of air that a glider moving through it must experience some resistance to its motion, or 'drag.'

So you see that every glider has these two important forces, the lift and the drag associated with it. Having got this far, the Intelligent Reader is no doubt wondering why, since there is no engine, the drag doesn't slow the glider up and finally bring it to a standstill, with consequent loss of lift and catastrophe all round. What actually happens is that the pilot has already found the answer to that one and so keeps the glider flying in a downwards direction in relation to the air. That's the real trick about it; in air which has no upward motion, the glider must always fly down an imaginary slope in the air. You can see how it works if you think of a motor car or truck. Because the car has a resistance to movement, or drag, it cannot keep moving along a level road without its engine, but it will roll down a hill.

A car in good condition will trundle down quite a gentle slope; if you fill all the bearings up with treacle, the drag of the car will be increased and it will be necessary to find a steeper slope for it to roll down. The same sort of thing goes for the glider; a glider in which the drag is small compared with the weight will glide down a gentle slope or will have a good 'gliding angle'; when the drag is a greater



proportion of the weight, a steeper slope is necessary and the glider is said to have a poor gliding angle.

Now just think what is happening : the glider is moving forward at, say, 40 miles per hour down a slope of, perhaps, 1 in 20. This means that the vertical, or downwards, velocity of the glider, relative to the air, is equal to 40 divided by 20, or 2 m.p.h. This vertical speed, 2 m.p.h. in our case, is called the sinking speed.' Yes, my dear Intelligent Reader, you are just on the threshold of seeing how it is all done, for, with your accustomed perspicacity, you have realised that if a glider with a 2 m.p.h. sinking speed (relative to the air), is flying in a patch of air which itself is going up at 2 m.p.h., then, *relative to the ground*, the glider will not be sinking at all. It is an easy step from this to see that, when flying in air rising at 3 m.p.h., our glider would be going up at (3—2) or 1 m.p.h. ; and so on for any other vertical air speed you like to think of. (Note to Ordinary or Non-Intelligent Readers! I hope I have made this part of the business clear to you too ; I have to keep on mentioning old I.R. because he's a bit swollen-headed and gets sulky if he thinks he's not being noticed).

A glider pilot who wishes to remain in the air must therefore seek out those parts of the sky where the air is rising ; such pieces of rising air are called ' Up-Currents.' If the speed of the up-current is equal to the Sinking Speed of his glider, he maintains his height ; if the speed of the up-current exceeds the sinking speed, the glider climbs ; if the speed of the up-current is less than the sinking speed, then the glider descends, but less rapidly than it would were it in still air.

Up-currents are produced by three main causes :

1. By a horizontal wind blowing over a hill or range of hills.

2. By uneven heating of the ground by the sun.

3. By variations in the temperature of the air high up in the sky.

Consider now these three methods more carefully.

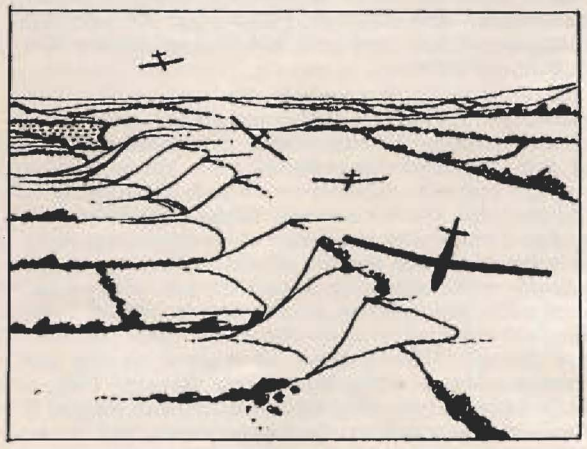
1. *Wind Blowing over a Hill.* The up-current produced in this manner is often called ' Hill Lift ' or, by relatives of the Intelligent Reader, an ' Orthographic Up-current.' If you think about it for a minute or two you will see what happens. When the wind is blowing at a range of hills, it cannot just go on horizontally, but obviously must rise so as to go over the top of the hills (think of a water-fall in reverse) ; the wind near the ground must follow the contour of the ground quite closely. If the hill is, say 500 feet high, then you would not expect to find much effect from the hill at great heights say 10,000 feet up. (When you throw a small stone into a flowing river it doesn't have any noticeable effect on the surface of the water after the ripples have died down, does it ?). The hill lift is therefore strongest just above the top of the hill and falls away as your height above the hill increases. It depends on the shape of the hill and on weather conditions, but as a rule the effect of the hill may be felt up to a height of about three times the height of the hill above it. Clearly, the steeper the hill and the stronger the wind, the faster will the up-current be, or the stronger the hill lift. If the hill is a sort of round isolated lump instead of a nice range of hills, then the up-currents produced are much weaker, since the wind can now partly get round the hill instead of all having to climb over the top.

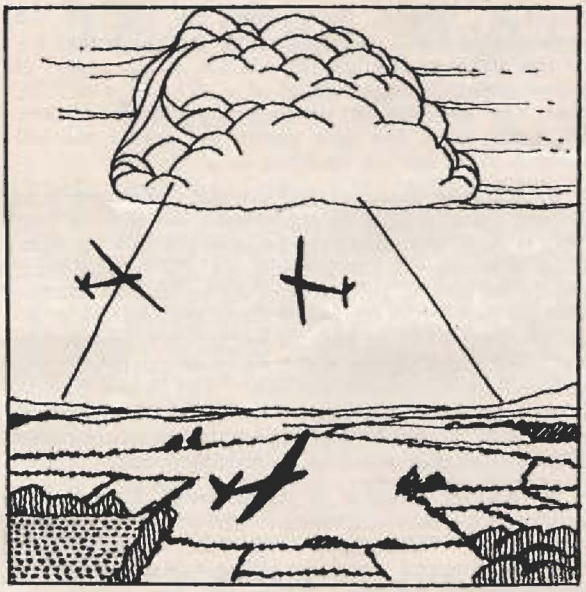
In this case you can see that the up-current is in a fixed place relative to the ground (usually the best part is vertically above the brow of the hill), so that, if he is to stay in the hill lift, the glider pilot must adjust his course through the air so that he flies to and fro parallel to the hill without getting either too far in front of it or too far behind it ; this means that he ' tacks ' along and, as seen from the ground, proceeds in a crabwise manner. This is the process known as ' Hill ' or ' Slope Soaring ' ; the glider will rise above the hill to such a height that the speed of the up-current is equal to its sinking speed.

2. *Uneven Heating of the Ground.* Up-currents produced by uneven heating of the ground are called ' Thermals.' What happens is this : suppose that there is a small town or village situated among meadows and woods. When the sun shines the bricks and roofs of the houses, the pavements and the tarred roads in the town become appreciably warmer than the surrounding moist green woods and fields. This extra heating is passed on to the air above the town, so that, in a little while, this air becomes a few degrees warmer than the rest of the air in that neighbourhood. Because the air is warmer it has expanded and becomes lighter and therefore it is pushed up by the surrounding cool air, and the process starts all over again. Usually, thermals are large, rising bubbles of warm air, rather like hot-air balloons without their skins.

Towns are not the only things which give rise to thermals. They may also be produced by bare rocks or rocky hills with only a shallow covering of soil, fields of ripe corn, dry ploughed fields, sand dunes, and so on.

Since a thermal is, as it were, just a private concern of the air's, it will obviously drift along with the wind once it has been formed. So it is no good the





glider pilot trying to remain over one bit of ground as he did when slope soaring. What he has to do is to stay with the thermal and drift down-wind with it. He does this by flying round inside the thermal in circles, relative to the air. This, believe it or not, is known as ' Circling.' From the ground his course appears as a series of loops because the wind is blowing him along. (Cycloids to you, Intelligent Reader).

The glider carries an instrument known as a ' Variometer ' ; this shows the pilot whether he is rising or falling. If, therefore, the pilot is flying away from any hill lift, he can be pretty sure that he has run into a thermal when his instrument says ' Up.' He then starts to circle, watching the variometer and manoeuvring the glider so that he is circling in the strongest part of the thermal (near the middle as a rule), and, once there can succeed in staying there.

All good things, of course, must some-when come to an end and the same is true of thermals. But the precise way in which a thermal fades is rather complicated and depends on the general weather situation, so this seems to be the appropriate time to start considering :

3. *Upper Air Temperature Variations.* Everyone knows that it is colder at the top of a mountain than at the bottom ; if the mountain is sufficiently high, it will remain snow-covered even throughout a tropical summer. This is simply a demonstration of the fact that the air becomes colder the higher you go up. From the gliding point of view it is important to understand that the rate at which the temperature falls-off with increasing height is not always the same. For example, on an average day the air gets about 2° centigrade cooler for every 1,000 feet that you go up. (The number of degrees cooling per thousand feet is called the ' Lapse Rate '). But on some days this drop of temperature with height is above the average, or the lapse rate is said to be high ; on other days the lapse rate is low, or the rate of cooling with height is smaller than usual. Sometimes, indeed, you will find a layer of air, perhaps a few thousands of feet thick, where the temperature actually increases with height, instead of falling as normally ; such a layer constitutes an ' Inversion.' These day-to-day variations in the temperature of the upper air are due to the fact that the winds are always mixing together air masses of differing origins and temperatures. Suppose, for example, that after a spell of warm weather a north-westerly wind starts to blow. The air which this wind brings has come from the arctic regions near the North Pole and so is colder than the warm air covering the country. Since the wind is stronger at height than near the ground you can see that the cold air will be blowing over the top of the warm air near the ground, so that high lapse rate conditions will be set up.

Having got all those preliminaries straightened out, we can now see how this affects gliding. Think about the thermal bubble which formed over the town in the sunshine ; suppose it has now started to go up. Because it is rising its pressure falls and it expands, since the atmospheric pressure is less at heights, as a result of this expansion it gets cooler. I am afraid that there is no space to explain why expanding the air makes it cooler, so I must ask you to accept this as a scientific fact ; it's all a result of the Laws of Thermodynamics and if you want further information, I would suggest that you ask our erudite friend, the Intelligent Reader, about it : no doubt *he* knows it all. So you see that as the thermal goes up, it too becomes cooler, and it is a fact that it cools off at much the same rate, per thousand feet, that it goes up, whatever the weather conditions are, provided that a cloud does not form. Now you can see why the temperature of the rest of the air at great heights is important because a thermal will only keep going up so long as it is warmer than the surrounding air. On an ordinary average sort of day a thermal will probably go up to about three-thousand feet before it stops because it has cooled so much that it is no warmer than the rest of the air at that height. On a day with a high lapse rate, however, the air up above is colder than usual, so the thermal can go much higher before being brought to a standstill. On the other hand, it is clear that an inversion must act as a very effective blanket by preventing thermals from rising through it. This, I think, establishes the point of importance that I want to make clear : good thermals are formed on days when the lapse rate is high, that is, on days when the upper air is unusually cold.

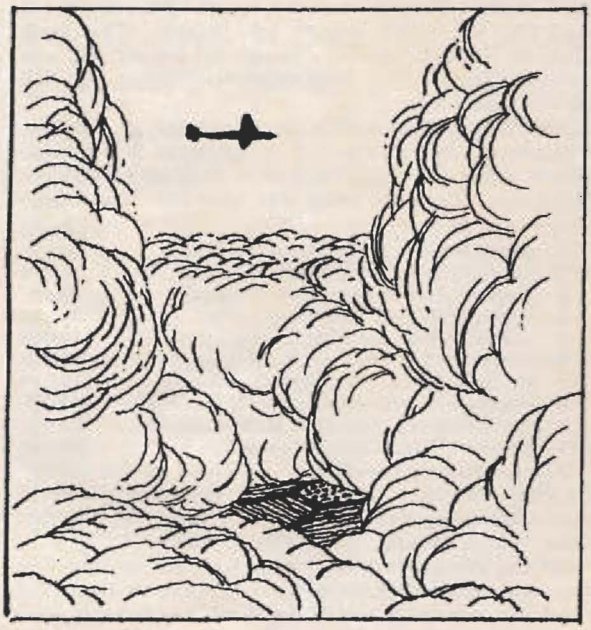
A paragraph or two back I made a reference to the formation of clouds. Clouds are of the greatest importance to glider pilots as well as being the things that the Intelligent Reader gets his head up in from time to time. To understand how clouds are formed, you must realise that the amount of water vapour (that is, really evaporated water, not little drops such as you get in a fog), which the air can hold depends on its temperature ; the hotter the air, the larger the amount of water vapour it can carry. Thermals start off as warm air currents near

the ground so they often begin life containing quite a lot of water (in the form of water vapour). As the thermal rises and cools the quantity of water vapour which it is able to contain gets less and there may come a time when the amount of water vapour which the air actually contains is a little greater than the amount which it is allowed to contain by virtue of its now reduced temperature. When this happens the water has to condense out of the air in the form of tiny drops and a cloud is formed.

There is one other feature about clouds which is important to understand. When the air is rising and condensing to form a cloud it does not cool so quickly as when it is just rising and not forming a cloud. That is to say, the act of condensing water vapour into a cloud warms up the air a little ; it is the exact opposite of the well-known cooling effect that you get when water evaporates (think how cold your hands feel if you go out into a wind when they are wet). This means that when a thermal condenses into a cloud it will be able to go up higher than would otherwise be the case.

So you see, clouds are very useful to the glider pilot. They can tell him where the thermals are and they help to ' boost-up ' the thermals and make them more powerful. This does not mean that every cloud has a thermal underneath and inside it ; for although clouds are nearly always formed by the action of rising air, they may persist long after the thermal which formed them has died away. The glider pilot has to learn which sort of clouds mark thermals and which are ' dead ' ones ; an experienced pilot can tell a great deal from the appearance of the cloud and from a study of the weather forecast and other meteorological data beforehand.

Although many clouds and up-currents are formed in the way that I have described, there are some days when the air below is so warm, and that above so cold, that the cold air comes tumbling down and





the warm air goes rushing up without any particular help from local patches of warm ground. These are the sort of days that produce thunder storms, line squalls and other violent atmospheric upsets. On such occasions enormous clouds are formed and the up-currents may extend up to 5 or 6 miles above the surface of the earth. Although such up-currents are just what the glider pilot wants, it is only the more experienced pilots who are able to make use of them because the air is often very rough and turbulent, and it requires great skill to be able to fly safely inside a cloud in these conditions.

To summarise these different ways of soaring, I will describe very briefly a typical cross-country flight that might be made in England during the summer. The pilot begins by hill soaring and reaches a height of about 800 feet. At this height he makes contact with a small thermal and circles up to a height of 1,500 feet when the thermal dies out. The pilot starts to fly back to the hill and on the way finds another, stronger, thermal which enables him to reach a height of 3,000 feet. From this height the pilot flies off in a downwind direction towards a likely-looking cloud. He finds that there is a good up-current beneath it and circles up till he enters the cloud at 3,300 feet. He continues to circle inside the cloud, using the instruments to tell him that he is (or is not) flying correctly until he finds that he can rise no higher than 4,500 feet. He then flies out of the cloud, and continues on his course looking for further clouds to use as stepping stones. Most of the clouds provide the lift that he is seeking but sometimes he is caught-out by visiting a ' dead ' one by mistake. On one occasion such as this he is able to save the situation by flying over a large area of cornfields which, as he hoped, produce a thermal to carry him back again to the clouds. Finally, as the sun gets lower in the sky, the thermals and cloud lift become weaker and at last the pilot has to find a suitable field and land in it. *(To be continued)*

Polish National Championships 1951

FIVE GAIN DIAMONDS——By R. A. G. Stuart

This Report has had to be held over for several months owing to very heavy pressure on space.—Ed.

THE Polish National Gliding Championships were held at Inowrocaw last year at the Aeroklub Kujawski's airfield. They were remarkable for the eclipse of the veterans by younger and lesser-known pilots.

Official opening was on June 3, but the first event was held on the next day, being a 40-km. goal flight with return to starting point, with points awarded for height too.

First place in this event was taken by Jerzy Wojnar, closely followed by the altitude record holder Andrzej Brzuska, who was flying a two-seater with Zbigniew Kudrewicz as passenger, and Stanisaw Skrzydlewski.

PREVIOUS CHAMPION 9th

Previous champion Irena Kempówna, also flying a two-seater with B. Dankowska as passenger, was only 9th while Adam Zientek (another former champion, who was flying hors concours), Tadeusz Góra (Poland's first Gold ' C ') and Lucja Wlazlo (holder of one of the Polish women's records), were all bringing up the rear.

In this event five pilots gained a Diamond and three completed their Gold ' C '. A similar event, but with 45-km. distance, was held on June 5. This time the victor was Skrzydlewski while Zbigniew Rawicz, who had come in last on the previous day, was 2nd and Jerzy Adamek 3rd.

In aggregate points, Brzuska, who took 6th place in this event, was leading with Skrzydlewski 2nd and Tadeusz Sliwak (4th in the first event and 5th in this one) 3rd.

Wojnar had fallen behind because he was classed 11th in this event. Skrzydlewski's placing was all the more remarkable because he was only piloting a ' Mucha ' intermediate and it was struck by lightning during the second event, resulting in aileron damage. A similar thing happened to Wojnar and probably was the cause of his low placing.

On June 6, there was a race over a 102-km. triangular circuit and the victor was again Wojnar who was thus enabled to reach 3rd place in the aggregate pointing. Brzuska came 2nd in the race and so retained his lead over Skrzydlewski who was 5th home and remained 2nd in the general classification. Edward Makula was 3rd in the race, the veteran Góra 4th.

There followed a day's rest and then a 93-km. goal flight with points for speed. This was won by Makula with Rawicz 2nd and Wojnar 3rd, followed by Stanisaw Wielgus (duration record holder), Góra, Brzuska and Skrzydlewski. This first three places in the general classification remained unaffected.

Next day, June 9, there was another similar flight, this time 95-km. to Kobylnica. The winner was A. Zieminski with Wojnar 2nd and A. Pawlikiewicz 3rd. Not all competitors completed the course, but Skrzydlewski was among the last to do so, beating only two others, Irena Kempówna and Brzuska. Wojnar was now established in the lead, a position which he never relinquished.

ONLY THREE FINISHED

On June 10 there was another race over a 102-km. triangle, but owing to unfavourable weather conditions only three competitors finished. They were Adamek, Skrzydlewski and Wojnar in that order, the winner's speed being only 34.5 km./h.

Two days later there was a goal flight of considerably greater length than the previous two, namely the 347-km. to Lublin. Wojnar won this event too, followed by Makula and Tadeusz Sliwak. Skrzydlewski and Brzuska were again far behind, so Wojnar was able to increase his lead on aggregate points, being nearly 4,500 points ahead of Jerzy Adamek who was second. Sliwak was now in third place with Makula 4th and Adam Witek 5th. During the goal flight to Lublin, Diamonds were gained by Wojnar, Makula, Sliwak, Zdzisaw Przyjemski, Zieminski, Jerzy Popiel, Richard Bitner, M. Czempinski, Witek, Rawicz and Zientek.

Apart from Zientek, Bitner and Czempinski these pilots also obtained conditions for Gold ' C.' The final event was an out-and-return goal flight of 2 X 100 km. with points for height. This took place on June 15 in very difficult conditions and was won by Sliwak, with Wielgus 2nd, Wojnar 3rd and Skrzydlewski 4th.

This event did not change the order of the first five places, but it enabled Przyjemski to displace Bitner from 6th and Wielgus to displace Góra from 8th place. The final order was therefore as follows :

		points
1.	Jerzy Wojnar (Aeroklub Krakowski) ..	46,151
2.	Jerzy Adamek (Aeroklub Pomorski) ..	41,358
3.	Tadeusz Sliwak (Aeroklub Kujawski) ..	40,465
4.	Edward Makula (Aeroklub Slaski)	39,167
5.	Adam Witek (Aeroklub Wrocawski) ..	37,916
6.	Zdzisaw Przyjemski (Aeroklub Kujawski) ..	36,818
7.	Richard Bitner (Aeroklub Warszawski) ..	36,789
8.	Stanisaw Wielgus (Aeroklub Krakowski) ..	36,436
9.	Tadeusz Gora (Aeroklub Bielsko-Bialski) ..	36,271
10.	Stanisaw Skrzydlewski (Aeroklub Slaski) ..	36,041

The remaining competitors followed in the order : Rawicz, Popiel, Ackermann, Zieminski, (Zientek, hors concours), Brzuska, Irena Kempówna, Czempinski, Lucja Wlazlo, Blitz, Pawlikiewicz.

Official closure was on June 17, when the first five were presented with prizes and Wojnar received the challenge cup on behalf of the Krakow Club.

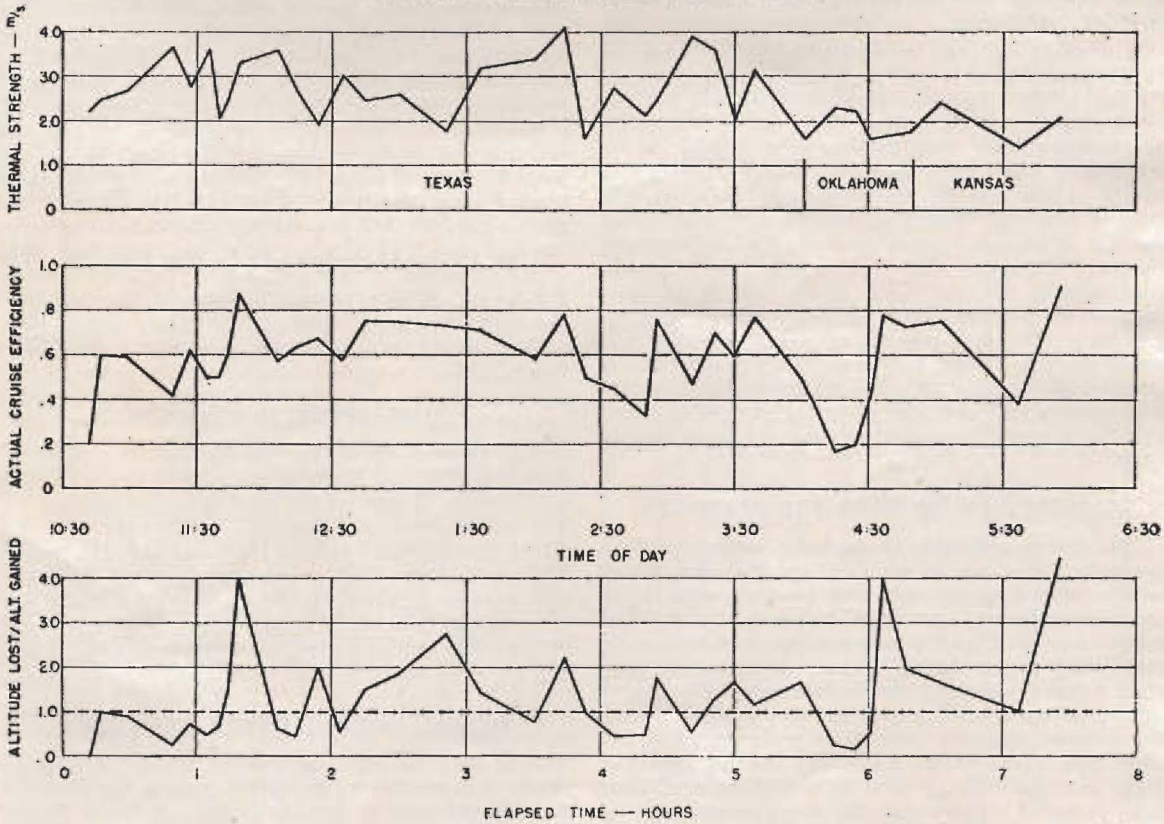
AN ANALYSIS OF JOHNSON'S FLIGHT

By B. H. CARMICHAEL, Scientific Committee, S.S.A.
Senior Aerodynamicist, Goodyear Aircraft Corporation

THE 545 mile sailplane flight which Dick Johnson completed on August 5, 1951, constitutes man's most spectacular accomplishment to date in the field of utilization of the energy in the atmosphere for human flight. It stands as a tribute to the design, construction, and refinement through flight test of the 'RJ-5,' and the meteorological and pilotage, knowledge and skill of the Champion, Dick Johnson. For those of us who soar, the distance and time involved in this flight is information enough to give us an appreciation of the magnitude of the feat. However, an analysis of the data obtained from this flight may perhaps increase this appreciation and also help to promote future long distance flights through the sharing of meteorological and flight technique data.

This flight is outstanding not only for the distance achieved, but for the wealth of data obtained. Probably no sailplane flight in history has been better documented. The Swiss Peravia Barograph is partly responsible, for as pointed out in reference (1) the continuous record, linear altitude scale, and calibrated time base, make record analysis simple. Secondly, the sailplane research flight test experience of the Champion has taught him the value of properly recorded information, and provided him with the ability to record information in flight to supplement the barograph record. Let us take a look at this

JOHNSON'S 545 MILE SOARING FLIGHT OF AUG. 5, 1951 FIG. 1



Acknowledgments to 'Soaring'

record in conjunction with Dick's description, and share (if in a somewhat second-hand manner), the hopes and the fears, the experiences and lessons, the crucial decisions and the final victory of this amazing flight.

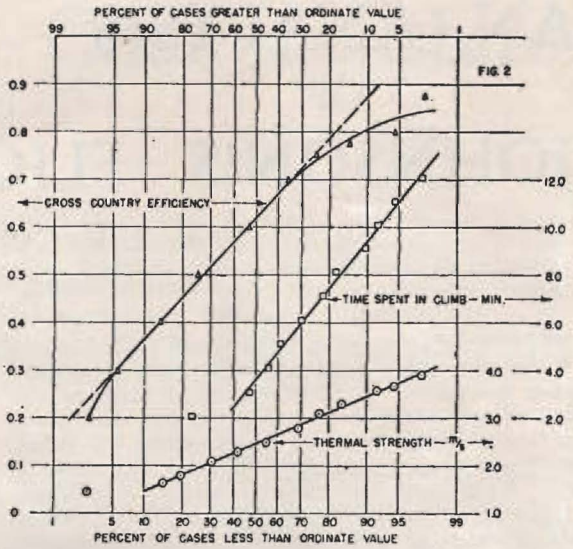
THERMAL STRENGTH

The positive slopes of the barogram represent the rates of ascent, of the 'RJ-5' in the thermals encountered. Each ascent was approximated with a straight line to obtain the average rate of ascent since this is pertinent to the analysis of cross-country technique. Due to the excellent flight technique of Dick Johnson and the meteorological conditions which existed this approximation follows the record very closely. The individual peaks are sharp rather than rounded as they would have been had he worked every thermal to the top rather than leaving it when it weakened. Climbs of under 100 metres or under one minute duration were ignored in order to limit the reduction job to a practical length. The sinking speed of the 'RJ-5' in circling flight must be added to the rates of ascent to obtain the true thermal strength. As derived in various manners by Kalle Tenmes, Dr. Lippisch, and this writer, the sinking speed for optimum turning flight is increased about 50% over the minimum sinking speed in level flight. This works out to 0.8 metres per second for the 'RJ-5' and this value has been added to all ascent rates to obtain the thermal strength values plotted in upper Figure 1.

It is noted that the thermal strength at beginning of flight was over 2 m/s and increased rapidly to 3.5 m/s in the first hour, oscillated between 2.0 and 3.5 during the second hour, dropping to 2.0 to 3.0 for the third hour, then increasing to as high as 4.0 m/s during the fourth and fifth hours, then falling to 1.5 to 2.5 m/s for the remaining two hours of thermal activity. Texas will be proud to note that this fall off occurred precisely at the Texas-Oklahoma border. Others, while conceding the copious quantities of hot air in the Lone Star State, may point to the time of day (4.05 p.m.) as having some influence. The last convection worth working was found slightly before 6.00 p.m. over Kansas. It is interesting to speculate as to whether good thermal activity was still available in Texas at this hour and whether it would have paid to start the flight further south.

DISTRIBUTION OF THERMAL STRENGTH

The number of thermals and the variety in their strengths leads one to wonder how they are distributed; that is to say, what per cent are weak, what per cent moderate, and what per cent strong. The lowest curve of Figure 2 presents this information on probability paper. Many phenomena of nature obey what is called a normal distribution law. The largest number of cases will lie near the average value with the number of cases falling off symmetrically for lower and higher values until very few are found at either extremely low or extremely high values. Now this 'humped' curve can be straightened out by plotting it on a scale that has been compressed in



the middle and stretched at the ends as in Figure 2. We find that our points do fall on a straight line with very little scatter which proves, at least for this one flight, that *thermal strength variation throughout the day followed the normal distribution law.* You will note that the lowest point does not fall on the curve. This is due to the human selectivity element in the form of Dick choosing to ignore the weaker thermals. Again a proof of superior pilotage. Let us look at this plot a little closer. We note thermal strength in feet per second is plotted on the ordinate, or vertical, scale while the percentage of cases less than the ordinate value is plotted on the abscissa at the bottom of the page or, the percentage of cases greater than the ordinate value, at the top of the page. We find that the average thermal strength for the day was 2.45 m/s. It is further seen that 28% of the thermals were under 2 m/s, 75% were under 3 m/s, and 90% were under 4 m/s or, to look at it the other way, 2% were greater than 4 m/s, 25% were greater than 3 m/s, and 72% were greater than 2 m/s.

TIME SPENT IN CLIMBING

The central curve on the probability plots of Figure 2 gives the distribution of time spent circling in thermals. Again we see that the points fall on the line of normal distribution. Since the thermal strength variation followed the same law, this would tend to indicate that a consistently good technique was used in spiralling. It is seen that 3.8 minutes was the average time spent in thermals. Thirty per cent of the cases required over six minutes of circling and five per cent required over 11 minutes.

ACTUAL CROSS-COUNTRY EFFICIENCY

That ratio of effective ground speed for a given climb and descent to the speed used in the glide, or descent portion, is known as the efficiency factor. This is, of course, equal to the ratio of time spent

in the glide to the sum of climbing and gliding time. The central curve of Figure 1 is a plot of the efficiencies for the individual thermals worked, while the lower curve is a plot of the ratio of altitude sacrificed in the glide to that gained in the thermal. The efficiencies were kept low in the first hour as Dick strived to attain a safe altitude. In each case he sacrificed less altitude than he gained. In the second and third hours efficiencies between 0.6 and 0.8 were maintained with a corresponding dangerous value of the altitude ratio. The altitude ratio curve is almost a pure reflection of the efficiency curve as would be expected. The high efficiencies had to be paid for during the fourth hour as indicated by values steadily falling off as Dick replenished his altitude supply. Then came high steady efficiencies again in the fifth hour with reasonable altitude ratios since the thermals were very strong. The remainder of the flight showed large oscillations in the efficiency as thermals became fewer. The final high efficiency point corresponds to the last long glide in which all excess altitude was used up.

DISTRIBUTION OF ACTUAL EFFICIENCY

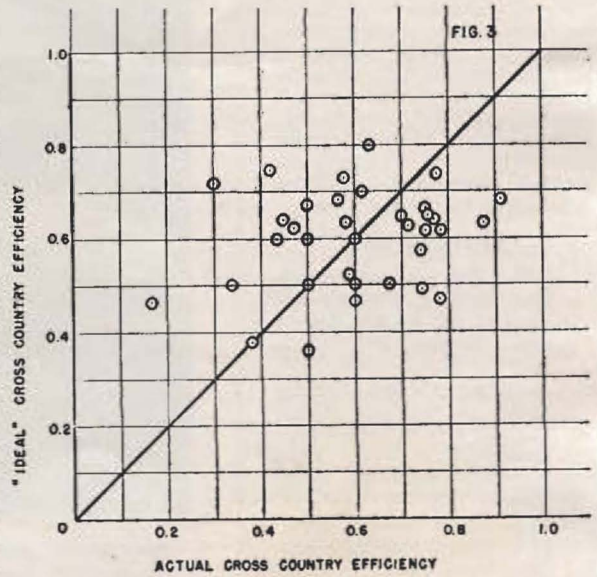
The upper curve of Figure 2 shows the distribution of actual efficiency for the flight. The distribution is normal for efficiency values between 0.3 and 0.7 but shows deviations outside this range. It appears that not a great enough percentage of cases fell in the high range of efficiencies (0.7 to 1.0) and that too many values fell in the low range (0.2 to 0.3) when compared to the majority of the cases. It would be difficult, at this point, to say whether this represents room for improvements in flight technique or whether it was a condition forced on the pilot by prevailing conditions. The normal distribution of thermal strength points to the former but the time-location spacing of thermals may be a modifying factor.

'IDEAL' CROSS-COUNTRY EFFICIENCY

In the ideal case where thermals are very plentiful and a safe initial altitude is assumed, optimum cross-country performance could be attained by always losing the same altitude in the glide as was gained in the last thermal. By equating these altitudes we can express the rates of ascent or descent inversely proportional to the times for ascent and descent. The efficiency equation then becomes the ratio of rate of climb in the thermal to the sum of this rate plus the rate of descent in the glide. The barogram was approximated with a saw tooth curve, the slopes taken, and the 'ideal' efficiency ratio obtained for each thermal worked. Figure 3 is a correlation plot of actual and ideal efficiencies. The fact that often higher efficiencies than desired must be accepted due to lack of thermals, then followed by lower efficiencies, where excessive altitude lost must be replaced, causes the large scatter. Values to the lower right of the line of correlation show higher efficiencies obtained than the ideal values while values to the upper left indicate lower unit efficiencies were obtained than ideal. The scatter was forced on the pilot but the even scatter shows again excellent flight technique. A very conservative pilot would have had a majority of points above the line and while he could have stayed up, his cross-country speed would have been very low. A rash pilot would have had a majority of points below the curve and would have run out of altitude before getting very far.

WING LOADING

The paper of Reference 2 was presented at the 1951 National Soaring Contest at Elmira, New York, by this writer, and established for the first time an analytical relationship between the optimum sinking speed at best L/D and the mean thermal strength of the day. After substituting a non-dimensionalized performance polar (approximately true of any sailplane), into the equation for ideal effective cruising speed, and differentiating, it became apparent that the sinking speed which gave the optimum cross-country performance was a linear function of the thermal strength and equal to approximately 1/3 the thermal strength value. For the mean thermal strength existing for this flight (2.45 m/s) the sink at best L/D should have been 0.817 m/s or 2.68 f.p.s. instead of the 2.0 f.p.s. which the 'RJ-5' operated under on its famous flight. Even with this increased sink, all the major thermals worked on August 5 by the 'RJ-5' could have produced climbs since the sinking speed in the turn would only have increased to 1.07 m/s. This increase in sinking speed could have been accomplished by increasing the wing loading with water ballast. Since the glide ratio remains constant, the speed for best L/D would increase proportional to the sinking speed. In other words, best glide would have been obtained at 67 m.p.h. instead of 50. Since the wing loading is proportional to the square of the speed, it would have been necessary to ballast the 'RJ-5' until its weight was increased a full 80% to take full advantage of



the meteorological conditions existing on the record flight.*

One word of caution is advanced on the foregoing. The above referenced study was carried out for the simple case of constant thermal strength. More study is required to establish the validity of substituting the mean of the variation of thermal strength as a constant value.

CONCLUSION

It is hoped that this paper will help to show what can be learned from the study of record barograms and that similar studies on the part of soaring pilots throughout the country will lead to improvement in their performances. This flight, as remarkable as it is, must not be thought of as a limit just as the 'RJ-5,' the world's finest sailplane to date, must not be considered as the ultimate in aerodynamic perfection. Building on the fine heritage of the German work of the 1930's, America has taken the lead in the sport and science of soaring flight. We are on the threshold of a new era, with new energy sources in the atmosphere to be explored, improvements in flight technique to take advantage of, and vast improvements possible in sailplane performance through the attainment of extensive regions of laminar flow. What has been and is being done by a handful of research workers can be aided and advanced by serious sailplanists throughout the country. The seemingly unattainable Russian distance record of 465 miles has been greatly exceeded. Seven hundred miles begins to come into focus this side of the border of possibility.

* Since this paper was written Dick Johnson has pointed out that the author assumes a constant bank angle of 40 degrees. With ballast the radius of turn would increase and it may be that the core of the thermal could not be circled in with the ballast aboard. More information on the relation of thermal strength and diameter is needed (Ref. 3). See Aircraft Engineering, Sept., 1951 'Design of Sailplanes for High Performance' by K. G. Wilkinson for another viewpoint on the influence of ballast.

REFERENCES

1. The Peravia Barograph For Soaring Performance Studies, by August Raspet and Melvin Swartzberg, *Soaring*, March-April, 1951.
2. Sailplane Design Criteria Based on Thermal Distribution, by B. H. Carmichael. Presented at the 1951 National Soaring Meet, Elmira, New York.
3. Thermals at Low Altitudes, K. O. Lange, *Soaring*, Sept.-Oct., 1945.

WAVE WORKERS' AWARDS

Pins for High Altitudes

THE Bishop 'Wave' Workers' soaring club of Bishop, California, is issuing pins to those who have soared to high altitudes. The pins are about the size of a nickel and have a blue background with either one, or two, or three lenticular clouds in white, upon them.

To qualify, one must have soared, and present evidence, to at least 25,000 feet above sea level (one lenticular), to at least 35,000 feet above sea level (two lenticular), to at least 40,000 feet above sea level (three 'lennies').

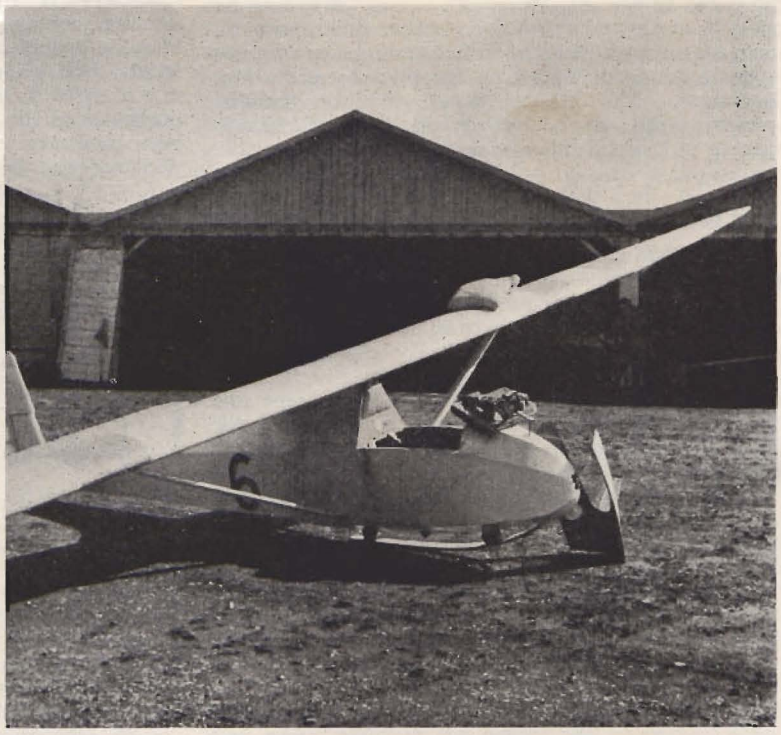
PASSENGERS ELIGIBLE

Differing from other glider awards, now the passenger is also eligible, we believe he, or she, has to undergo quite some danger, hardship, and endurance to make the flight.

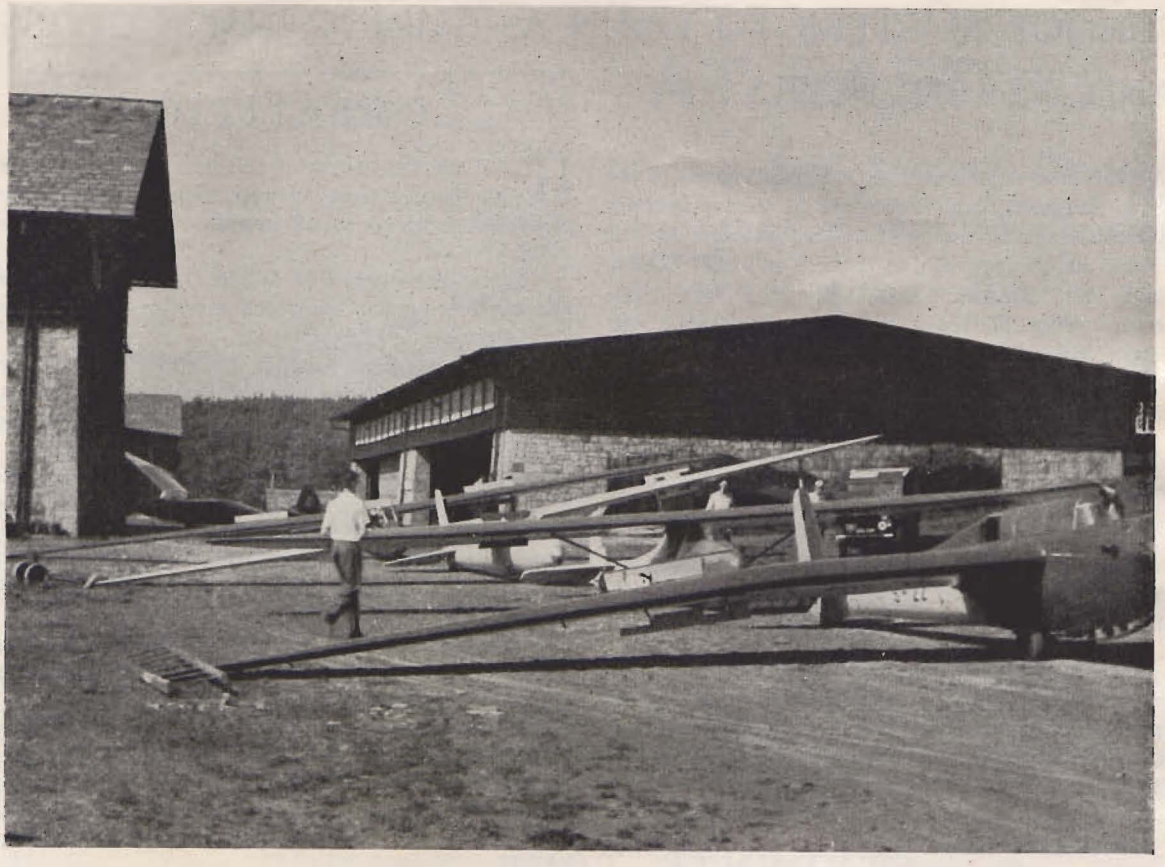
To date, approximately 15 single 'lennies' have been awarded, and four double 'lennies' have been earned (Ross, Deibert, Symons, and Kuettner).

Only one triple 'lennie' has been earned—Bill Ivans.

Anyone, anywhere in the world is eligible, just by presenting proper barograph traces to substantiate it, or records from a Contest Committee.—*Soaring*.



First Cross-Country 'Grunau Baby' at Pont Saint-Vincent Centre. Photo: G. Bacon. Camera: Agfa Isolette f8 at 1/100 sec. on Verichrome film



Morning line-up at Scharfoldendorf H.Q., B.A.F.O. Rest Centre. ' Kranich,'' Grunau Baby,'' Meise,'' Mu-13 ' and ' Minimoa ' sailplanes. Photo: G. Bacon. Camera: Agfa Isolette f8 at 1/100 sec. on 4p3 film

CENTRAL AFRICAN NEWS From Robert Mitchell

C.A.G.A. The Association may now be said to be operating. The Salisbury Gliding Club, being the only club with a two-seater, is weekly establishing National records—much faster than they can be recorded. Jack Wall has produced a tentative Constitution, so, if his recent broadcast is to be believed, we're off.

Bulawayo Gliding Club. The news is bad from Bulawayo. The Club has had to remove its equipment from Kumalo Airport and this has delayed completion of the winch—and flying.

Gwelo (R.A.F.) Gliding Club. This club has at last been formed. Barry Gould is one of the keener members, and is the only Silver ' C ' pilot known to be in Rhodesia. It is understood that a ' Grunau 9 ' and a ' Tutor ' have been acquired from the Rand Flying Club, South Africa, a welcome addition to the Rhodesian fleet.

Gwelo Gliding Club. C. S. Tynan-Blunden has half completed a secondary trainer, to his own designs, and the club formation is postponed prior to its completion. I gather, however, that ex-R.A.F. types may join the R.A.F. club until then.

Salisbury Gliding Club. The Salisbury Gliding Club has been flying hard after months of hard work. ' T.31 ' has flown long and well, every Sunday since its launch two months ago. The thermal season is in, and 10,000 feet is bettered most week-ends—so often, that it has been necessary to limit flying to 30 minutes. Another method of limiting flying appears to be to take me up on a training flight when 10 feet per second down is guaranteed.

The first official Rhodesian altitude record of 10,000 feet was established by Captain Derek Lane and Roy Wallis as co-pilot—which we claim to be a world record for a ' T.31.' Since then, this has been exceeded many times—but not by enough to establish anotherrecord.

The two-seater has revolutionised training and eliminated—to date—our ' grouchery.' Everyone is well pleased with her, including our Assistant Instructor, Eric Bone, who, whilst training me, ran out of aerodrome and executed a text-book landing in an African kraal. From the front seat it was only enjoyable in retrospect—but we are pleased to be the first Salisbury pilots to cross-country!

SCHOOL MASTERS TO TRAIN AS GLIDING INSTRUCTORS AND TEACH PUPILS

ABOUT 60 schools with R.A.F. contingents of the Combined Cadet Force are to receive primary gliders for use by the cadets. The following are the schools at the top of the list : Tonbridge School, Maidstone Grammar School, Dulwich College, Eastbourne College, Marlborough College, Grimsby College, Fettes College, High Wycombe Royal Grammar School, King Edwards School, Birmingham, Oundle School.

These schools are being issued with the ' Eon ' Eton Primary Glider which is a single-seater glider launched by means of a rubber shock cord.

Other schools will be issued with the ' Slingsby ' Primary Glider similar in design to the Eton primary glider but with modifications.

Selected school masters who have volunteered to be trained as gliding instructors were given an opportunity to attend courses of instruction at R.A.F. Detling, near Maidstone, Kent, during the Christmas holidays.

COMPETITION

HERE are the details of the first of a new series of Winter Competitions being arranged by *Sailplane*, news of which appeared in last month's issue.

Readers are invited to tell in their own style of the incident which has stuck most in their minds since they began gliding.

Stories must not be longer than 200 words, they must have a gliding tinge, but can be humorous, can be about yourself or your friends, or anything you like.

Entries to be written on one side of the paper only please and must reach *Sailplane* not later than Friday, February 1st from readers in the British Isles, Overseas readers, February 15th.

A selection of the winning stories will be published in the March issue.

A prize of TWO GUINEAS will be awarded the writer of the best story and there will be several prizes of Free Subscriptions.

Mark your entry ' STORIES ' and send to ' SAILPLANE & GLIDER,' 8, Lower Belgrave Street, LONDON, S.W.1.

STUDENTS TOUR FRANCE



Four Danish University students tour France with their sailplane ' F.J.I.' Picture shows them at the Pont-Saint-Vincent Centre. Photo : G. Bacon. Camera : Agfa Isolette f8 at 1/100 sec. on Verichrome film

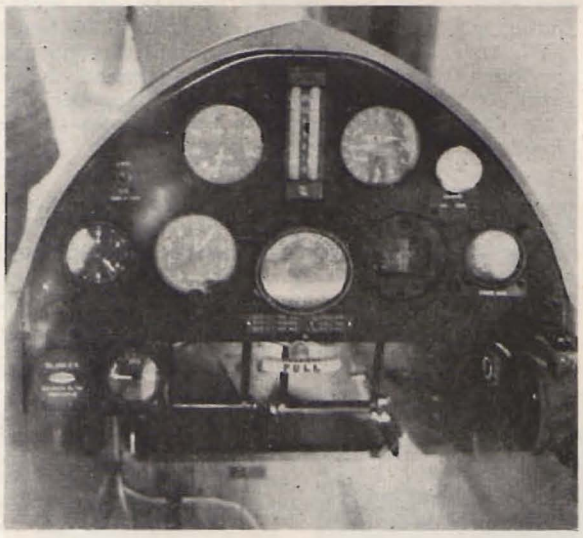
'GOLDEN EAGLE II'

These photos below of the 'Golden Eagle II,' now the property of the Victoria Motorless Flight Group, were taken at Berwick Aerodrome, Australia. The 'Eagle' was flown at Benalla over Christmas.



Above: J. Wallis (Beaufort Gliding Club), L. Williams (Victoria Motorless Flight Group), H. G. Richardson (V.M.F.G.), J. Scully (V.M.F.G.) in cockpit

Below: Cockpit of 'Golden Eagle II.' Instrument Panel. Top Row—Turn and Bank Switch, Airspeed Indicator, Cobb-Slater Variometer, Kollsman Sensitive Rate of Climb Indicator and Cockpit Air Temperature Gauge. Lower Row—Clock, Sensitive Altimeter, Electric Turn and Bank Indicator, Compass, Free Air Temperature Gauge. Centre—Aero Tow and Winch Tow Release Sub Panel. Left, Blinker and Pressure Gauge Oxygen. Right—Diluter Demand Oxygen Regulator. Below Panel can be seen the Adjustable Rudder Controls



FOR SALE

TWO pairs of 'Cadet' wings; one set of 4 struts; one tail unit; £90 the lot. Two nacelled 'Daglings,' £60 each. One open 'Dagling,' brand new, uncovered, £45.—London Gliding Club, Dunstable Downs. Tel.: Dunstable 419.

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THE SAILPLANE AND GLIDER

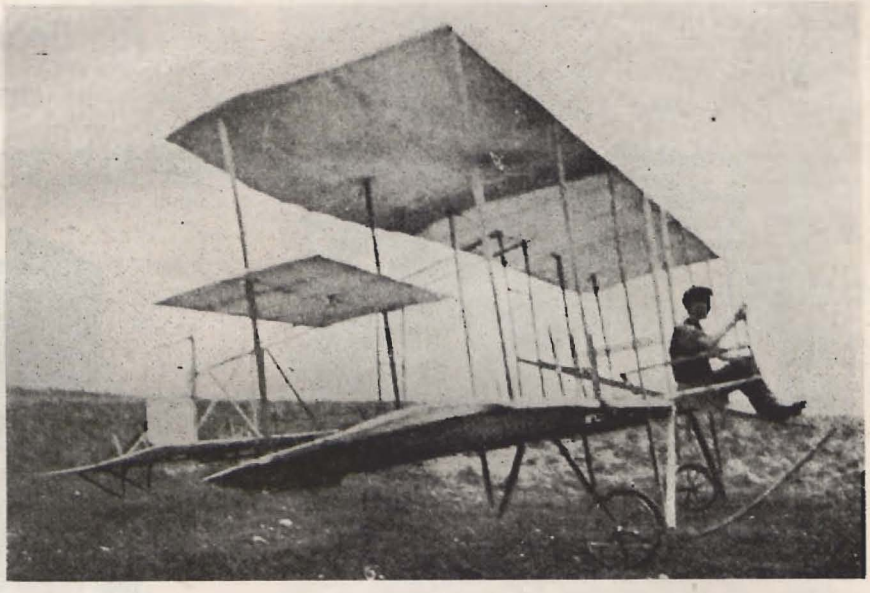
TWENTY YEARS AGO

Throughout the coming year we are publishing in each issue under the above heading items from the pages of 'Sailplane and Glider' twenty years ago. This month all items are taken from the five weekly issues which appeared in January, 1931.

AN EARLY GLIDER

MR. CARLYON, of Glamorgan, had his interest in gliders aroused in 1907, but it was not until 1911 that he began to build his machine. It was not finished until 1914, which shows his pertinacity. He spent all his savings on the job which cost him about £35.

It was a biplane based on the Wright Brothers' machines, but unlike the 'Wright' had the modern idea of a complete tail unit at the back. The wheels were detachable in flight. Pram wheels were used and these were held in place on the skids by wire forks which could be withdrawn by pulling a lever at the side of the pilot. The idea was to run down the hill side, and once in the air, drop the wheels so that on landing the machine should stay put.



Gliding in 1914—*Mr. Carlyon at the controls of his glider*

LONGEST FLIGHT—100 YARDS

The longest flight was one of 100 yards. The machine was wrecked by a storm in December, 1914, and never rebuilt.

The span was 28 feet. The Chord and Gap were both 5 feet. The all-up weight is not available.

JOY-RIDING IN AUSTRALIA

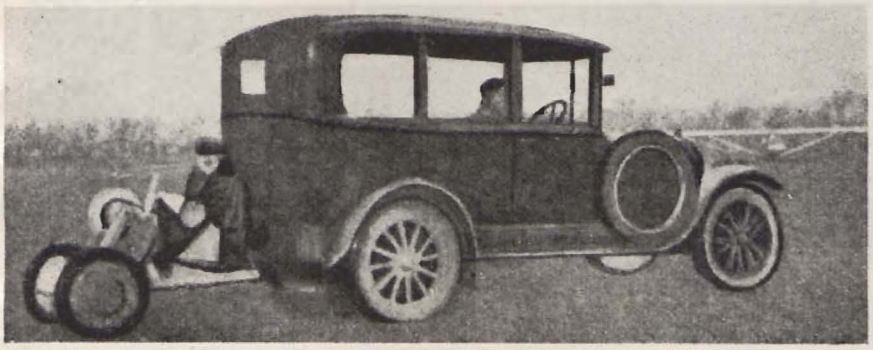
The activities of Mr. P. J. Pratt have been mentioned in *The Sailplane* quite a lot, and on October 31 (1930) we chronicled Mr. Pratt's gaining the Australian duration record of 95 minutes, which was achieved on a 'Zogling' built by Mr. Pratt. During this flight he reached a height of 1,000 feet.

What we have only just discovered, through the courtesy of *Air Travel News*, the Australian flying paper, is that Mr. Pratt took up a passenger the same day and stayed up for five minutes—on a 'Zogling'!

SAVING TIME

SIR,—An objection to the method of pulling back by hand is the time it takes. On flat and gently sloping ground, the following method is quick and has been used with success.

A car is fitted with a tow rope and one member is stationed at the bottom of the slope where the glider is expected to overland. The glider is pulled



Luxury Winch!

The winch which is towed behind the car and on which the instructor sits. In the distance is the 'B.A.C.'



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

off by a launching team in the usual way, and the trolley follows it to the bottom. On landing, the pilot, and the assistant stationed there, turn the glider round and hook on the tow rope. The pilot takes one wing tip and trots back to the top.

This method was used with a crew well accustomed to handling gliders; with a raw lot, an experienced member in the passenger seat of the car might be advisable.

Yours faithfully,
(Signed) 'KENTIGERN.'

FOOD FOR THOUGHT

Mr. H. A. Searby, whose address is Carlton, Nottingham, has organised the Nottingham Gliding School. We are surprised at his rates, which seem to indicate that the School is a philanthropic institution; they are 5s. per quarter and 6d. per glide. These seem to us quite inadequate for the proper running of a school, as we cannot imagine how the salary of a qualified instructor, rent of hangar and depreciation of the machine can be met out of such small sums.

PRESIDENT RETIRES

STAN HALL, President of the Southern California Soaring Association did not stand for re-election at the Annual Meeting of the Association held last month owing to 'additional personal responsibilities.' The new President is not known as we go to press.

THANK-YOU!

THE Editors and Staff of *Sailplane* would like to thank all those at Home and Overseas who have been kind enough to send us Christmas Cards and Calendars.

Their kind thoughts are greatly appreciated.

HAVE YOU A PROBLEM?

Whether you're an expert or a newcomer to gliding, if you need advice or information give the *Sailplane* a ring. Our information is the most up-to-date and reliable in the world.

SLOANE: 7287 handles dozens of calls a month and will help you if you have a problem.

ROYAL AERO CLUB CERTIFICATES

(Issued under delegation by the B.G.A.) **NOVEMBER, 1951**

CERTIFICATES 'A' .. 127 (14050-14176 inc.)
'B' .. 89
'C' .. 12
Silver 'C' 2
Gold 'C' —

'B' CERTIFICATES

No.	*Name.*	*A.T.C. School or Gliding Club.*	*Date taken*
2345	George B. Podger	Bomber Command	9. 9.51
3495	Joseph Bell	No. 27 G.S.	2. 9.51
6175	Geoffrey C. Martin	No. 87 G.S.	2. 9.51
9691	John D. Wheldon	No. 49 G.S.	28.10.51
10475	James M. Drummond	Cranwell	14. 7.51
10710	Thomas W. Bell	Bristol G.C.	14. 9.51
11110	Peter N. Dent	No. 123 G.S.	19. 7.51
11294	R. B. Campbell	R.A.E. Tech.	5. 7.51
12184	Brian P. Richardson	No. 102 G.S.	11.11.51
12641	Brian A. T. Jennings	No. 122 G.S.	21. 1.51

'B' CERTIFICATES (*cont.*)

No.	*Name.*	*A.T.C. School or Gliding Club.*	*Date taken*
12855	Malcolm J. Silver	No. 102 G.S.	28.10.51
12899	John G. Hunter	No. 31 G.S.	8. 7.51
13174	David A. Sharpe	No. 104 G.S.	11.11.51
13324	John J. Bell	No. 188 G.S.	29. 7.51
13327	Brian H. Stelfox	No. 188 G.S.	29. 7.51
13328	William Swift	No. 188 G.S.	29. 7.51
13330	Angus K. Mackay	No. 188 G.S.	29. 7.51
13357	Dennis Blacklock	No. 24 G.S.	2. 9.51
13367	George E. Pringle	No. 84 G.S.	16. 9.51
13485	Colin Sowerby	No. 24 G.S.	2. 9.51
13534	Vivian White	No. 104 G.S.	28.10.51
13886	George S. Rae	No. 2 G.S.	21.10.51
13990	Robert Archer	No. 6 G.S.	14.10.51
14054	Patrick B. Bass	No. 22 G.S.	29. 7.51
14055	Malcolm Lusby	No. 22 G.S.	3. 6.51
14057	James R. Miller	H.Q., B.A.F.O.	18. 6.51
14058	Peter R. Chalk	No. 104 G.S.	28.10.51
14064	Geoffrey M. Wade	Home Command	18.10.51
14067	Margaret P. Yeoman	Derby & Lancs.	1. 9.51
14068	Leslie A. Alder	No. 104 G.S.	28.10.51
14072	Malcolm L. Bowman	No. 42 G.S.	7.10.51
14073	Peter Gordon Claridge	No. 82 G.S.	30. 9.51
14074	Bernard T. Dodd	No. 166 G.S.	28.10.51
14075	Eric J. Downing	Portsmouth N.G.C.	20.10.51
14081	John E. Nevell	No. 168 G.S.	21.10.51
14086	Leslie Grimshaw	No. 183 G.S.	28.10.51
14089	Arthur Dearden	R.A.E. Tech.	19.12.48
14090	Dennis E. Fielder	R.A.E. Tech.	24.10.48
14091	John A. W. Clowes	R.A.E. Tech.	7. 7.51
14092	George R. Cole	R.A.E. Tech.	7. 7.51
14093	Graham A Cropper	R.A.E. Tech.	25. 7.51
14094	Alan G. F. Denten	R.A.E. Tech.	7. 7.51
14095	Ronald J. Finch	R.A.E. Tech.	5. 7.51
14096	John B. Gilder	R.A.E. Tech.	19. 7.51
14097	Russell S. Howell	R.A.E. Tech.	25. 7.51
14098	Francis G. Maccabee	R.A.E. Tech.	25. 7.51
14099	David Markham	R.A.E. Tech.	26. 7.51
14100	John D. Massy-Bevan	R.A.E. Tech.	13. 7.51
14101	Peter Routledge	R.A.E. Tech.	2. 7.51
14102	Lawrence J. Sheldon	R.A.E. Tech.	8. 7.51
14103	William Sidebotham	R.A.E. Tech.	8. 7.51
14104	Edwin M. Tanner	R.A.E. Tech.	7. 7.51
14105	David Walker	R.A.E. Tech.	26. 7.51
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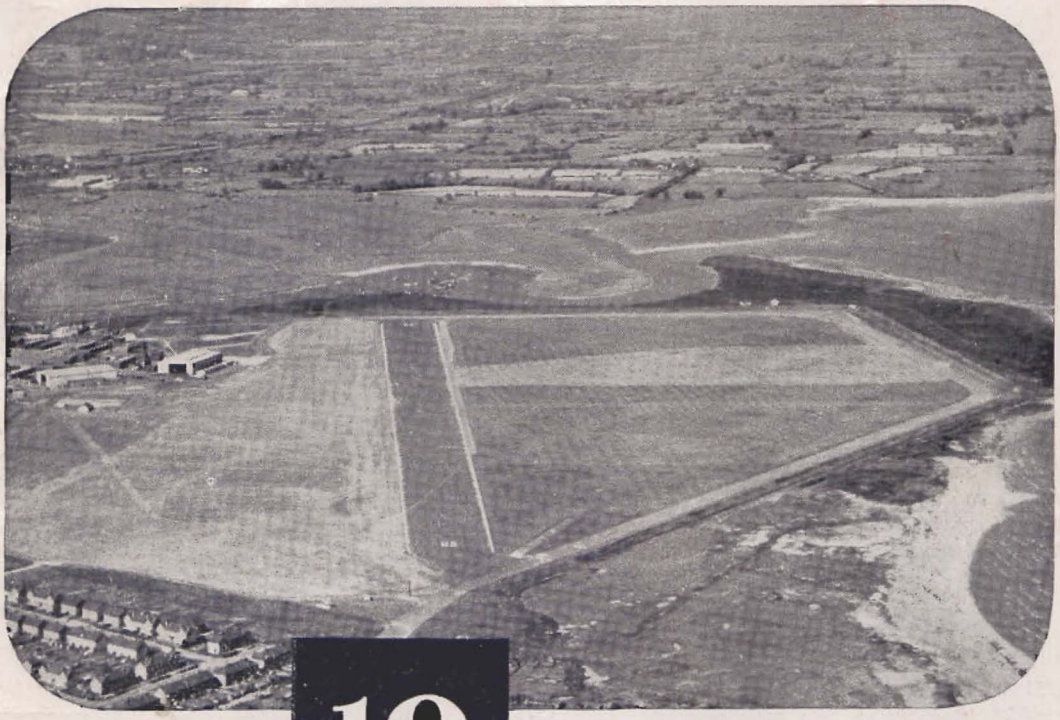
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