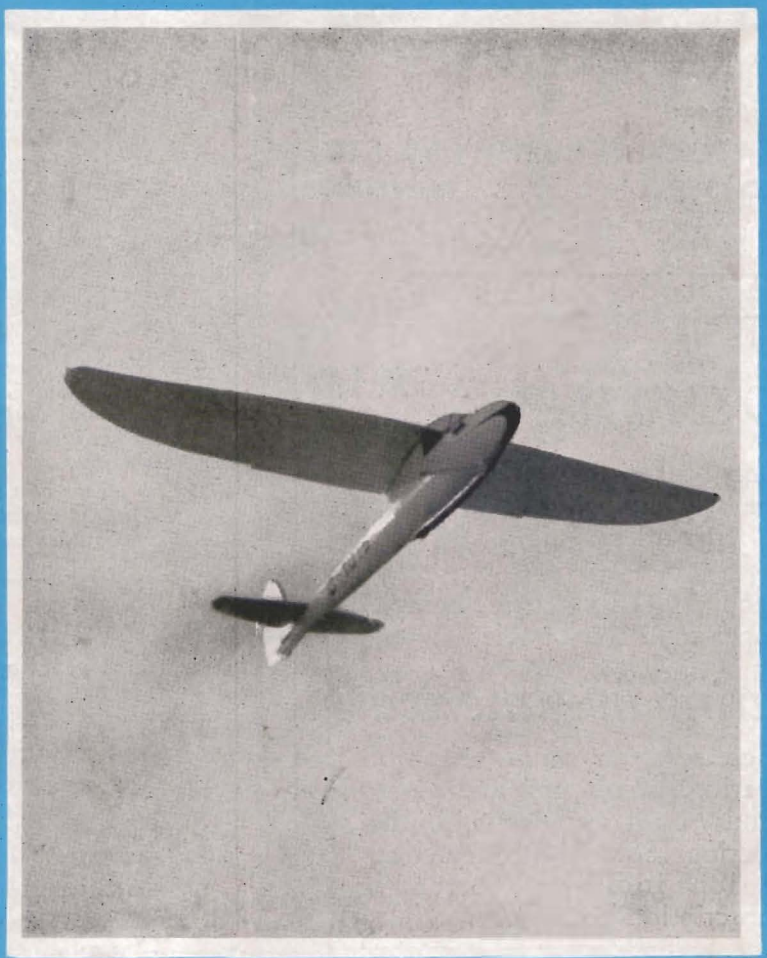
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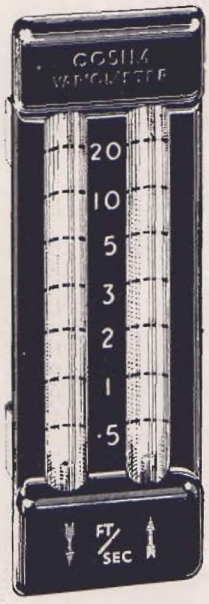
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MARCH 1953 ★ Vol XXI No 3

Editor :
VERNON BLUNT
MA, LLB (Cantab), FRMetS

Asst. Editor :
VERONICA PLATT

Editorial
and
Advertisement Offices :
8, Lower Belgrave Street
London, SW1
PHONE: SLO 7287

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COVER PHOTO :
'LO-100' Zwergreiher

Editorial

SAILPLANE pilots are vitally interested in detecting thermals from afar. Meteorologists are most interested in making their branch of science respectable and accepted by other scientists as a true science. A branch of knowledge qualifies as a science if it can be treated mathematically.

No meteorologist or other scientist will present sailplane pilots with magic thermal detectors. It is up to sailplane pilots to help themselves, to select suitable detection instruments and techniques and to try them out.

A thermal detector with a range of only one hundred yards would double one's random chance of blundering into thermals of 200 yards diameter, quadruple one's chances of contacting thermals of 100 yards in diameter. Detection ranges of 500 yards would multiply one's chances by multiple of six and twelve respectively and ranges of a 1,000 yards by eleven or twenty-two. This is based on a two dimensional study of the random probability of blundering into thermals and the efficiency would be even greater in a three dimensional airspace.

Unlike electric horizons, invertors and their batteries, any extra weight carried in the form of remote thermal detectors would become more valuable the lower the sailplane and the worse the conditions. The improvement in goal and out-and-return flight performance possible with a thermal detection range of only 100 yards probably overshadows the improvements obtainable by any other means.

We do know sufficient facts about the characteristics of most thermals to select various detecting instruments and devices and to apply them to thermal detection. It is hoped that this review will serve to prompt readers who do possess suitable detecting devices to try them.

Common characteristics of thermals as a basis for detection devices.

(a) AIR RISES inside thermals. Other sailplanes or birds circling, birds hunting insects inside thermals, smoke from chimneys, from rockets and jet a/c effluxes can all render thermals visible to the unaided eye. Two sailplanes in formation abreast, 200 yards apart, will double their individual random chance of finding thermals.

(b) AIR inside thermals contains more PARTICLES of dust, smoke, soot, pollen, salt and other solids than environmental air due to its origin from layers in long contact with the ground. More light will be absorbed and reflected in different wave lengths. Friction of particles and vast numbers of ions swept up from the ground will generate an electric field which might be detectable from 200-400 yards. Polaroids, by cutting out scattered blue light between thermal and observer increase the colour saturation of a thermal and thus sometimes render them visible to the trained human eye.

(c) AIR inside most thermals will contain more WATER VAPOUR than the environmental air. Water vapour absorbs and re-radiates in several discrete wave bands of the electro magnetic spectrum. Various infra-red radiation detectors and image convertors might be applicable. The ideal instrument under B, C, D and E would be an image convertor receiving in a narrow wave band sweeping the spectrum from the ultra violet of 0.3 microns to the infra-red of about 15 microns. Polaroids also help to render visible the milkiness which only rarely becomes visible to the unaided eye before condensation takes place.

(d) AIR inside thermals is WARMER than environmental air. Some heat is lost by radiation. Molecules are more agitated and 'blur' vision of the background. Sound travels faster and will be refracted by thermals and might at certain frequencies be reflected. Somewhere in the electro magnetic spectrum reflection might be obtained also.

(e) AIR inside thermals is LESS DENSE. Its refractive index will be less. Pressure gradients, caps and edges might become visible to ultra sensitive or instrumentally assisted eyes as dark and light bands.

To sum up :

The meteorologist might ask "why is a thermal," a sailplane pilot should ask "where is a thermal."

The meteorologist must be cautious in his investigation and prove his hypothesis by differential calculus, else he may lose his reputation as a scientist.

The sailplane pilot has no academic reputation to lose and everything to gain by finding a remote thermal detector with a range over one hundred yards.

SOUTH AFRICAN CHAMPIONSHIPS 1952

We are very grateful to 'WINGS' from which this excellent account has been reproduced.

SPECIAL REVIEW
by
JOHN FIRMIN

THE achievements of some of the pilots in the 1952 National Gliding Championships make the rally one of the most remarkable in the history of gliding. Most of the competing machines were in the intermediate class; yet pilots of these machines obtained two nominated 'diamonds' and made eight flights of more than 140 miles. Several of these flights compare favourably with flights made anywhere in the world on such machines and rank high against the flights by high-performance machines at last year's international rally in Spain.

Bearing this in mind, and also that Helli Lasch in the 'Air-100' exceeded the previous British out-and-return record by a considerable margin, one wonders what South African pilots could achieve, especially with the outstanding soaring conditions in the country, if there were more high-performance machines in the Union. Much of the success of the rally was due to John Firmin, a glider pilot himself, who took his leave to act as organiser. His review of the rally, specially written for Wings, *is amplified by a map on page* 3.

FOR the 1952 South African National Gliding Championships, we were the guests of the S.A.A.F. at Bloemspruit Air Station, and right royally were we entertained. Although the station is now operating with a very skeleton staff, ten times the personnel could not have been more helpful and co-operative.

The line up of competitors was as follows (given in the order: Name; Machine; Club):

H. R. Lasch; 'Air 100'; Johannesburg Soaring Centre.

H. von Michaelis; 'Minimoa'; Cape Gliding Club.

E. Leeman, N. Arbuthnot; Sparlinger 'S 15'; Johannesburg Soaring Centre.

E. Mouat-Biggs, H. Hammond, C. J. Ansell; 'Wolf'; U.D.F. Team (S.A.A.F. Club), Langebaanweg.

E. B. V. Tollis, V. Knott; 'Albatross'; Durban Gliding Club.

E. Pearson, L. Kayne; Sparlinger 'S18'; Rand Flying Club.

K. Newman, W. E. Teague; 'Grunau Baby'; Johannesburg Soaring Centre.

J. Solomon, J. Pullen; 'Grunau Baby'; Rand Flying Club.

B. Rowell (Miss), A. Luyt, N. Downe; 'Wolf'; Cape Gliding Club.

P. J. Beatty, R. Lilienfeld; 'Grunau Baby'; Johannesburg Soaring Centre.

Not on the list are René Comte and the 'Moswey IV,' Peter Leppan and the 'Hutter 17,' Hans Wurth and 'Kranich' and the inimitable 'Boet' Dommissee, all of whom were unable to attend.

Weather conditions on Monday morning looked quite good, and it was not long before the first machine was airborne. Within an hour, using only one tug aircraft, all machines were launched. Three calls came through early and in rapid succession: from Ken Newman and Norman Downie who had both landed at Leeuwkop (16 miles) just outside the 'no score' circle, and from Julian Solomon, who was only some five miles away as the crow flies.

'I SAW A PLANK'

The next call through, some two hours later, was from Helli Lasch, to say that he was on Maseru Aerodrome (74 miles). After releasing he had found good conditions in an easterly direction and had flown fast to Thaba N'chu, thence at 'mealie stalk' height to Maseru. Finding good lift in this area and seeing inviting conditions over Basutoland he flew east into the interior. Conditions, however, were not as good as they appeared, so he returned to Maseru via Ladybrand.

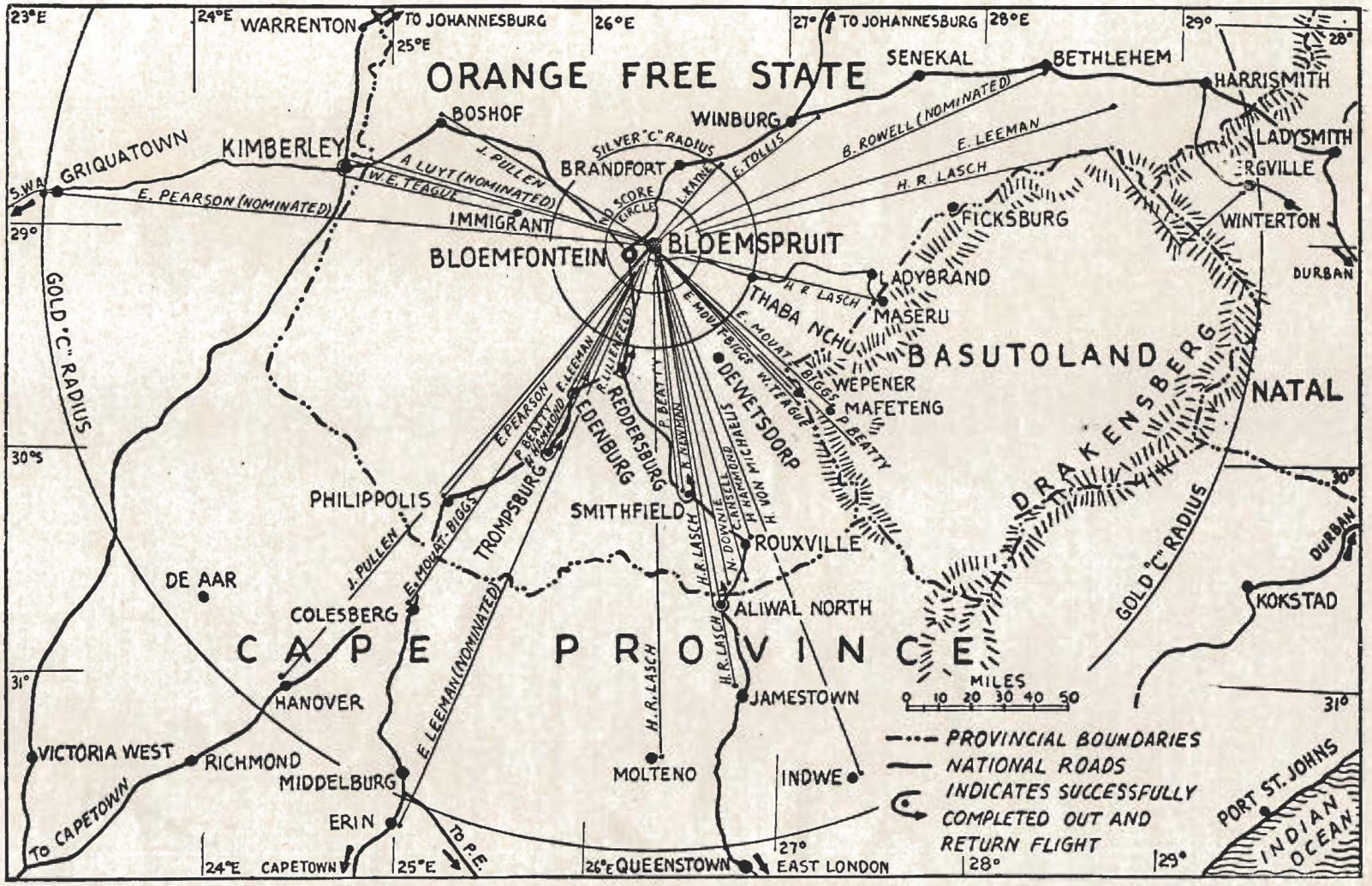
His arrival, it is alleged, caused the biggest stir in the capital since the last visit of Royalty. The literal translation of the Basuto description of his arrival is: 'I began to see a plank in the sky, which grew.' A rather unflattering description of an 'Air 100.'

Eddie Leeman's call was next from a farm 26 miles past Bethlehem (153 miles). Pat Beatty reported that he had landed about 15 miles beyond Mafeteng (92 miles) after getting lost in the Wepener-De Wetsdorp district, and the U.D.F. team machine piloted by Tim Mouat-Biggs reported in from Mafeteng itself (77 miles) a short time later.

The 'S.18' flown by Ted Pearson landed at Philoppolis (105 miles). Goal flights carried a 20 per cent., and completed goal-and-return flights a 30 per cent. bonus, points being in proportion to the best flight of the day, which gained 1,000 points. On this basis the first day's leaders were Leeman with 1,000 and Pearson with 669 points.

OVER THE DRAKENSBERG

Only one tug aircraft was available for towing on Tuesday and, after four machines had been launched, the rudder was damaged and flying was abandoned for the day. Of the machines that took off, Roy Lilienfeld in the 'Cream Baby' returned to the


ORANGE FREE STATE
CAPE PROVINCE
BASUTOLAND
NATAL
WARRENTON
TO JOHANNESBURG
SENEKAL
BETHLEHEM
HARRISMITH
LADYSMITH
BOSHOF
WINBURG
KIMBERLEY
GRIQUATOWN
BRANDFORT
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COLESBERG
HANOVER
VICTORIA WEST
RICHMOND
MIDDELBURG
ERIN
MOLTENO
JAMESTOWN
INDWE
KOKSTAD
PORT ST. JOHNS
INDIAN OCEAN
DRAKENSBERG
GOLD "C" RADIUS
SILVER "C" RADIUS
IMMIGRANT
E. PEARSON (NOMINATED)
A. LUYT (NOMINATED)
W.E. TEAGUE
J. PULLEN
B. ROWELL (NOMINATED)
E. LEEMAN
H. R. LASCH
E. TOLLIS
L. KARNEY
E. MOUAT-BIGGS
P. BEATTY
H. HAMMOND
H. VON MICHAELS
N. DOWNIE
J. CARNSELL
E. LEEMAN (NOMINATED)
TO CAPETOWN
TO P.E.
CAPETOWN
QUEENSTOWN
EAST LONDON
MILES
0 10 20 30 40 50
PROVINCIAL BOUNDARIES
NATIONAL ROADS
INDICATES SUCCESSFULLY COMPLETED OUT AND RETURN FLIGHT

'drome, leaving three on cross-country. They were Betty Rowell in the ' Minimoa,' Helli Lasch in the ' Air 100 ' and Lewis Kayne in the ' S.18.'

It was five o'clock before the first call came through —Helli Lasch phoning from Bergville to say that he had landed there on the polo ground. In a straight line this is approximately 175 miles; the straight line passes over the highest parts of the Drakensberg, and that is exactly what Helli had done.

Following an urge to gratify a long-standing ambition he had flown a north-easterly course and found good lift all the way to Witzieshoek. With 16,000 ft. ASL in hand he looked into Basutoland and saw cu. and cu-nim all the way. Turning on to a S.S.E. course he entered cloud. For half an hour or so, maintaining reasonably steady height, he flew on this course, then turned on to a north-easterly heading.

On breaking cloud he found himself out of the mountains—fortunately—because by this time his height had dropped to below that of the higher peaks of the range.

Conditions over Natal were poor, so rather than risk a landing in the bundu and a night in the open he lost height quickly and landed at Bergville.

FIRST CROSS-COUNTRY

On the same day Betty Rowell of the Cape Gliding Club, flying the ' Minimoa ' had set off with Bethlehem as her nominated goal, a distance of 137 miles, and got there. She is most reticent about what happened on the trip, merely saying ' I just kept flying,' but she admits to a few anxious moments over Bethlehem itself, until a thermal lifted her high enough to get to the aerodrome, further on.

This was Betty's first cross-country and by the alleged lack of incidents during the trip it would seem that we have in our midst one of those natural pilots who fly a machine well because they can't do it any other way. Betty, who is a meteorologist in Cape Town, played a large part in finding the ' standing wave ' which beckons from above Table Mountain whenever a North-Easter blows. The other person responsible was the inimitable Heinie von Michaelis, who taught Betty most of what she knows about gliding.

Lews Kayne, going well, with Brandfort (33 miles) dropping behind, was most unfortunate to lose the wing root cover-strip of the ' S.18 ' and to be obliged to land.

NEW RECORD

With two tug aircraft operating the next day all machines were away by 11.30 as pilots realised that thermals ' coked ' early in the Free State and that to be airborne before 11.30 meant an hour's good flying before conditions reached their peak. With the continued absence of strong upper winds, several competitors favoured out-and-return flights.

First news came from Ken Newman, who made his presence known by doing stall turns over the drome about 4 p.m. He got to Reddersburg in 2¾ hours and had returned (82 miles)—complete with identifying pictures—in almost half the time.

The people of Bloemspruit had never seen or heard a sailplane being aerobatted but they soon became accustomed to the whispering swish of the graceful stall turns as the pilots announced their return to base. An hour later Roy Lilienfeld was also observed arriving back from Reddersburg. He had stayed aloft over Bloemfontein to complete the five hours' flying required for his Silver ' C ' badge.

The sun was below the horizon when ' Pikkie ' Hammond, after squeezing the last inch of height out of a thermal over Bloemfontein, sailed on to the drome with only feet to spare on his return from Trompsburg (148 miles). He had been airborne for 7¾ hours (and looked it from the way he walked) and had wrested the South African Out-and-Return record from Helli Lasch, established at 122 miles at last year's championships.

Arthur Luyt, who has only recently taken up gliding, triumphantly reported that he had ' made ' his goal of Kimberley Aerodrome (98 miles). On visiting the control tower to obtain signatures confirming his time of arrival he was ' torn off a strip ' for landing on a 'drome used by scheduled air lines; for landing without permission; and for not notifying them of his intention to land there. He was further bawled out because he might have damaged a ' Skymaster ' parked on the tarmac—and then charged 5s. landing fee !

SUCCESS—AND THE SEQUEL

The two Rand Flying Club machines were operating on radio so we knew nothing of their whereabouts until next morning. Jackie Pullen made very good progress towards his goal but, with the weather beginning to deteriorate over unpromising country, he decided to call it a day at Boshoff (76 miles).

Ted Pearson's nomination was to put him safely outside the Gold ' C ' distance of 186 miles and he is to be complimented on achieving this goal.

The sequel, however, is rather unhappy. Innocent-looking on a map, the country west of Kimberley is very rocky, with cultivation cut to a bare minimum. His retrieving team, at all times in communication, reported no favourable spots at the nominated position, so he had to land on the road.

Into wind was into a now-setting sun. Half-blinded he had already touched down when the starboard wing tip struck an extra large boulder at the side of the road. In the resulting swing, both the wing and the tailplane were damaged. This put the ' S.18 ' out of the rally.

But as the landing was within the required distance of the nomination, the flight was Gold ' C ' distance (189 miles), plus diamond—only the second such flight achieved in the Union.

RECORD REGAINED

On Thursday conditions were better than ever; light winds aloft, instability up to 7/8,000 feet above ground, cloud forming at 5,000 feet and base rising. All competitors reported later that flying was merely a matter of keeping alert, and barogram records show the delightful undulating line of perfect gliding conditions.

Helli Lasch made an exceptional flight to Aliwal North and back, a distance of 228 miles at an average of 44 m.p.h. regaining for himself the South African Out-and-Return record. (Helli's wife and retriever-

in-chief was heard saying endearing things about her husband as she watched him approach to land). After the Bergville caper—400 miles there and back by road across the Drakensberg and mostly at night—she was only too happy at the thought of a quiet evening in camp.

Eddie Leeman, who first flew solo in January, 1952, reached his nominated goal of Erin, C.P. (189 miles) in the ' S.15,' and in doing so became, as far as we can ascertain, the second person in the world to get a ' diamond ' in an intermediate type sailplane. He is among the few who have done their Gold ' C ' distance in an intermediate machine and now holds the unofficial South African record for a nominated distance in this type of sailplane. He admits to finding conditions so good that to circle more than once in each thermal was irksome.

Ken Newman and Pat Beatty both got back from Smithfield (160 miles) with lots to spare. These two flights were completed in the really remarkable times of less than six hours in ' Grunau Babies.'

Norman Downie and Charles Ansell, both with Aliwal North as their goal, came down within 10 miles of each other and within 10 miles of their goal (105 miles). Maximum points for the day went to Helli Lasch.

STORMY WEATHER

Friday saw even the weather beginning to show signs of strain. Storms were forecast in the south but approaching slowly. Helli nominated Queenstown, preparing to press on to Port Elizabeth should the weather prove suitable. Tim Mouat-Biggs came back after being launched to stretch his nomination to Gold ' C ' distance and take off again. Jackie Pullen and Vic Knott nominated Colesberg ; Pat Beatty, Trompsberg and back ; Nigel Arbuthnot, Smithfield and back. Heinie von Michaelis in the ' Minimoa,' wanted a Gold ' C ' distance flight, so nominated Queenstown.

Results were slow in coming through, but when they did they showed that a long line of thunderstorms stretching across country for some 200 miles and advancing slowly northwards had terminated most of the flights. With the exception of Pat Beatty, who did a remarkably fast trip to Trompsberg and back (148 miles) to collect the 1,000 points, and Nigel Arbuthnot (of whom more anon), everyone was obliged to land because of this advancing change of conditions.

Tim Mouat-Biggs landed at Colesberg (135 miles)—in good time, he thought, to avoid trouble. Unfortunately his landing was not seen and he had to leave the machine unattended while he went for assistance. Unable to obtain official assistance sufficiently quickly he accosted the first vehicle to come along. By great good luck it was a jeep driven by a Swiss, who sized up the urgency of the situation. They arrived at the landing spot just in time to see the first gust lift the machine off the ground and drop it back on its nose, stoving in two panels, but they were able to prevent further damage.

AN EPIC

Jackie Pullen, with a bare 10 miles to go to complete his Gold ' C ' distance, dived at the approaching front to go through but had to retreat before its fury and run for a safe landing at Hanover before it caught him again (176 miles). His retrieving team, who had been backing up well, got to him soon after the storm and found him still in the machine, all control surfaces operating and the whole machine occasionally lifting off the ground with the force of the wind. To be so close to Gold ' C ' distance and then to be literally forced back to one's goal was a great misfortune ; and when one considers that the flight was done in a ' Grunau Baby ' at least 14 years old, it attains the status of an epic.

Helli Lasch hit the front at Molteno (161 miles) and Heinie von Michaelis in the ' Minimoa ' at Indwe (174 miles). Both were obliged to land—Heinie 12 miles short of his much-attempted Gold ' C ' distance.

Vic Knott, going very well from the flying point of view, wasn't so happy in himself. Cold and feeling very sick he hung on as long as possible but eventually at about 6,000 feet above Trompsberg (74 miles), had to give it best—and then took half-an-hour to get down.

Nigel Arbuthnot's description of his flight (to which he solemnly adheres) beggars improvement. ' I got lost soon after I set course, so I just kept flying. After about three hours I saw a large town ahead of me, which I recognised as Bloemfontein, so I landed. Yes, thank you—a beer please.'

FORCED DOWN

On Sunday the speed of the front, which had been very slow during the night, increased, and those who had anticipated a ride home on it were caught before reaching their turning points and forced down.

Bill Teague was watched by his retrieving crew (from where they were parked beside the road) as he battled for half-an-hour to make headway against the wind. Eventually he gave up the struggle, and landed 10 miles back at Edenburgh (52 miles) to find his crew waiting for him.

J. Solomon, having made slower progress, met the same fate at Reddersberg (41 miles). Eric Tollis, primarily concerned with staying aloft for five hours, came off best. He flew before the storm for 36 miles before streaking out ahead to land on a farm near Winburg and get derigged before it caught up. To him went the 1,000 points for the day with a flight of only 64 miles.

Earlier in the day P/O Ken Fitzroy, who with nine other members of the R.A.F. from Southern Rhodesia were attending the championships, was given an opportunity to try for his Gold ' C ' height in the ' Air 100.' He so far exceeded the necessary gain in height that he may have got the height ' diamond.' We still await official news.

DARING FLIGHT JUST FAILS

On Sunday there were no competitions. A certain amount of two-seater flying was done, but most people took the opportunity of relaxing beside the excellent swimming pool which we were permitted to use. The weather was unsettled and much cloud was obvious all round.

On Monday the weather grew worse. A strong wind was blowing from the north with 8/8ths cloud at about 1,000 ft. Met. forecast ' no change ' for the day, so flying was washed out. Tuesday's weather

was like that of Monday, with obvious storms all round.

Unexpectedly, Wednesday dawned fine and clear with the promise of cloud developing later. Upper winds were stronger than previously and nomination was ambitious.

Bill Teague decided to go to the west and failed by only 40 miles to bring off a very daring flight to Kimberley and back. One gap foiled him; beyond it, he could see the clouds stretching all the way to Bloemfontein, but, unable to bridge the space, he was obliged to land at Immigrant (146 miles), a small station on the railway between Bloemfontein and Kimberley. This flight won the 1,000 points for the day.

Eddie Leeman and Helli Lasch both came very close to beating him—Eddie with an out-and-return to Edenburg (104 miles), and Helli with a straight flight to Jamestown (C.P.) (138 miles). Jackie Pullen found the going much more difficult to the north and could get no further than Damplaats (40 miles). 'Pikkie' Hammond, who had nominated Aliwal North, got to Rouxville (98 miles) before the weather forced him down.

CHANCE OF SCORING LOST

On Thursday the weather was bad again, and no flying took place. With only two points between the Johannesburg Soaring Centre and the U.D.F. team, and a maximum of 200 points or so between four individuals for the championship itself, Friday was awaited with anxiety.

It dawned like Thursday—high wind, low cloud, but met. said it might clear later. Most pilots being sceptical about the chances of any competitive flying being done, Helli Lasch and Heinie von Michaelis took off to amuse themselves over the 'drome. This was unfortunate because, when conditions improved slightly, there was no means of recalling them quickly, and both missed the chance of scoring that day. This affected Helli in particular as, up to that stage, he was in the lead.

Soon after midday the first of the remaining machines took off. One after another the others followed into the air but, such is the luck of the game, only the first two were able to get away. Travelling all the time in this apparently one and only good spot, both went south-easterly and both landed at Wepener.

With 3,000 ft. of height above the town Bill Teague was able to land on the far side of the town on the 'drome itself (64 miles). Tim Mouat-Biggs was not so fortunate and had to land in the native location short of the town (62 miles). Although only a distance of two miles apart, it was enough to make all the difference where marks were concerned.

Bill Teague was again the best of the day scoring 1,000 points, thereby putting his team in the lead for the Argus Trophy, and himself winning the Open Championship for the second year in succession.

MEMORABLE FLIGHTS

And so ended another memorable rally, with possibly the finest gliding ever seen in this country. Many flights stand out in one's memory as worthy of honourable mention but, judging by the results of the ballot held among the competitors to decide who should receive the Pilot's Award, Betty Rowell's nominated flight to Bethlehem on her first-ever cross-country was the winner.

Following close behind came Helli Lasch's flight across Basutoland, Eddie Leeman's flight to Erin, C.P., and Jackie Pullen's near miss for Gold 'C' distance.

Adding up the factual results we have 4,000 miles flown by nine machines in eight days of flying.

Diamond for nominated goal of more than 186 miles; E. Leeman, Sparlinger 'S.15' and E. Pearson, 'S.18.'

Diamond for gain in height of more than 16,405 feet: P/O K. Fitzroy, 'Air 100.'

Gold 'C' distance: E. Leeman and E. Pearson.

Gold 'C' height: P/O K. Fitzroy and E. Leeman.

Silver 'C's' completed: E. B. V. Tollis, Miss B. Rowell, A. Luyt, R. Lilienfeld, Lt. C. Ansell, Cpl. E. Mouat-Biggs, K. J. Solomon and N. Downie.

South African Open Champion, Pidsley Trophy: W. E. Teague ('Grunau Baby').

South African Junior Champion, George Ward Trophy: E. Leeman (Sparlinger 'S.15').

Argus Team Trophy: Johannesburg Soaring Centre, K. Newman and W. E. Teague ('Grunau Baby').

Kelvin Bottomley and Baird Trophy for longest flight of the Rally: H. R. Lasch.

H. R. Lasch Trophy for the longest flight to a previously nominated goal: E. Leeman and E. Pearson.

FILMS

By our Special Correspondent

'*Bubbles*' Producers, Scorer and Ludlam.

A fascinating thriller with a moral showing that although BIG BUBBLES might push smaller and slower bubbles out of the way, the latter sometimes enter the larger bubble's wake, overtake them and reach the surface first. The supporting programme consists of cloud time-lapse films in colour by Dr. Malkus showing maritime trade cumulus development and Cumulus development films taken by Mr. Ludlam from Dunstable. It is interesting to note that the hot air which formed them was probably released from Dunstable Downs. Strongly recommended to all soaring pilots, they are well worth seeing several times, one notices new features with every showing.

'*The Net.*' Odeon. The background to the high altitude aircraft scenes appear to be genuine high altitude photographs. The less said about the plot and the incredibly inefficient attempt to steal the aircraft the better.

'*Wilbur Sparrow*' by Lawrence Wright is due to be shown at Dunstable on 21 Feb. It is the world's best soaring cartoon. Will desscribe it next month.

Progress in Two-Seater Sailplane Design

A Summary of Technical Development During the Past Thirty Years

Continued from the February Issue

By B. S. Shenstone, M.A.Sc., A.F.I.Ae.S., F.R.Ae.S.

We are indebted to "AIRCRAFT ENGINEERING" for their kindness in allowing us to reprint this article from the issue of January, 1953.

Three-view drawings of only a limited number of types are shown, mainly because of the great labour involved in drawing them.

The following types have been manufactured in the greatest numbers as far as the author knows. There may be others produced in large numbers, but the author has no information on them.

Type	*Number Manufactured*
Kranich	400
C-800	270
Goevier	125
Laister-Kauffmann TG.4A	125
Schweizer TG.3A	110
Slingsby Sedbergh (T-21B)	106
Castel 25S	100
Slingsby Tandem Tutor	77
Pratt-Read TG-32	74
Schweizer TG-2	55

Kranich and Goevier

Although they are now obsolescent, it is worth studying these types with some care. Kranich (FIG. 6) is a shoulder wing sailplane of wooden construction, with tandem seating, the aft seat being practically on the centre of gravity of the machine, enabling it to be flown as a single-seater without ballast. This characteristic is one which is desirable for any two-seater for obvious reasons. The various means for its fulfilment are described above.

The detail design of the Kranich will not be described, since there are no features which today are of particular interest. General data on the Kranich are reasonably complete. The weight breakdown is given in TABLE II and the measured performance in FIG. 7. It will be seen that its empty weight is below the mean line on FIG. 4 which is to be expected of an experienced designer such as Jacobs. The performance would not nowadays be considered particularly good, but did permit good pilots to put up world records.

It is of interest to see what are the results of actual tests on handling the Kranich. During the war there took place in Germany a series of comparative handling tests of various sailplanes. Of the Kranich the report says among other things that:

'Since there is no trimmer, the stick load under tow is high and only just acceptable. It would have been too high if the free flight trim speed

TABLE I

TYPE	SPAN		GROSS WT		LOAD WT		Equipped WT		WING AREA		ASPECT
	m	ft	kg	lb	kg	lb	kg	lb	m^2	ft^2	RATIO
SGU-2-22	13	43	377	830	173	380	205	450	19·55	210	8·8
Koma	14	46	323	710	161	355	161	355	18·2	195	10·8
Jalon	14·1	46·3	530	1167	205	452	325	715	18·4	198	10·8
TG-1A	14·1	46·3	418	920	191	420	227	500	18·1	194·3	11
Grunau 8	14·5	47·2	360	792	170	374	190	418	22	236	9·57
Göpp 2	14·5	47·6	398	875	200	440	198	435	21·5	231	9·8
Poppenh'n	14·6	47·8	315	692	160	332	155	341	21·9	246	9·3
Göpp 4	14·8	48·5	410	902	196	431	214	471	19	204	11·5
TG-4A	15·2	50	397	911	181	400	232	511	15·4	166	15·05
BG-8	15·3	50·3	465	1020	192	420	273	600	17·7	190	13·3
TG-2	15·7	51·3	390	858	186	410	204	448	20	215	12·65
C-25S	16	52·5	431	950	174	384	257	566	20	215	12·8
C-800	16	52·5	470	1130	230	506	240	528	22·05	237	11·6
T-21B	16·5	54	450	992	182	400	269	592	24·2	260	11·2
TG-32	16·6	54·5	523	1150	173	380	350	770	21·4	230	13
S-25	17·1	56·2	412	905	160	352	250	552			
MÜ-13D	17·1	56·2	400	880	180	395	220	485	18·6	200	15·9
S-21-1	17·3	56·8	380	837	161	355	220	485			
S-21-2	17·5	57·5	382	840	161	355	221	486			
Musger 19	17·6	57·8	438	965	200	440	238	525	20·7	228	14·2
TG-3A	17·7	58	550	1220	182	400	372	820	22·1	237	14·2
MG-9	17·8	58·5	415	913	170	374	245	539	20·9	225	15·1
MÜ-10	17·8	58·5	365	803	180	396	185	407	20	215	15·85
Kranich	18	59	435	957	180	396	255	561	22·7	244	14·25
C-242	18	59	415	913	178	392	237	521	21	233	15·5
Mihm	18	59	532	1170	182	400	350	770	20	215	15·2
CM-7	18	59	574	1260	174	383	400	880	22·27	240	14·6
Yamazaki	18·2	59·6	368	810	150	330	218	480	18·7	201	17·7
Spyr V	18·4	60·5	426	938	161	355	266	586			
Nimbus	18·9	62	546	1200	182	400	364	800	22·27	240	16
MÜ-15	19	62·3	450	990	200	440	250	550	18·8	202	19·3
B-9	19	62·3	480	1055	160	352	320	705	23·1	248	15·6
EW-1	19	62·3	400	880	180	396	220	484	22·8	245	15·85
CV-V6	19·2	63	460	1010	180	396	280	616	21·6	232	17
Hi-21	19·6	64·3	530	1165	250	550	280	616	24	258	16
D-31	20	65·7	350	770	170	374	180	396	20	215	20
Stak.	20·2	66·2	454	1000	160	352	294	647	23	247	17·75
E-3	21·2	68·5	360	792	160	352	200	440	20	215	21·5
Sturm	25	82	560	1230	180	396	380	835	31	333	20·2
Obs	26	85·3	640	1410	250	550	390	858	38	408	17·8

had not been as high as it was, i.e. 65 k.p.h. (40 m.p.h.). At this speed, at which the Kranich trims with free elevator, the aircraft shows a tendency to go into a spiral dive if the stick is left free. This characteristic is met with on many types of aircraft and is not surprising. The stall is first felt at 53 k.p.h. (33 m.p.h.) and at 50 k.p.h. (31 m.p.h.) the wing drops, but not fiercely, and normal flying attitude can be quickly regained by pushing the stick forward slightly. As for the controls themselves it was found that the aileron stick loads were too large compared to those of the other controls. Controls were not well harmonized. The ailerons had an adverse yawing moment of moderate amount. To make a turn reversal from 45 deg. one way to 45 deg. the other took 5·5 seconds using full aileron and rudder. That compares with 4·2 seconds for the Olympia. The best value measured was 4 seconds for the Berlin B-5 single-seater. The longitudinal stability of the Kranich is very small. Static stability is small and dynamic stability at 70 k.p.h. (43 m.p.h.) is neutral and presumably there is instability at higher speeds. Many slightly stable aircraft have been very popular. As for directional stability, it is very great with free rudder and, as indicated above, there is a tendency toward a spiral dive.'

On a Kranich equipped with an elevator trimmer tab tested by the B.G.A. No. 2 Test Flight Group, Cambridge, it was found of course that the elevator stick loads in steady flight were no problem. The control loads on tow were all very small. The stalling speed at 1,150 lb. (523 kg.) was found to be 40 m.p.h. (64·5 k.p.h.), there being a position error of 5 m.p.h. (8 k,p.h.) at that speed. This position error was probably ignored in the German tests. No remarks were made about the harmonization of controls. The time for turn reversal at 60 m.p.h. (97 k.p.h.) was 4·5 seconds from 45 deg. one way to 45 deg. the other way. Although it was found to be statically stable, it was longitudinally dynamically unstable throughout the C.G. range.

In general, Kranich was considered by this group to be suitable for dual training and was considered to be viceless and easy to fly on instruments.

That, briefly described, is probably still the most used two-seater in the world.

In an effort to develop a lighter and more handy two-seater, the Goevier (Gö 4 or Göppingen 4)

TABLE II

NAME		KRANICH		GOEVIER		TG-4A		Hi-21		C-25·S		MC-JALON		CM-7	
Designer		H. Jacobs		W. Huetter		J. Laister		W. Huetter		Castello – Mauboussin					
Seating		Tandem		SS		Tandem		SS		SS		Tandem		Tandem	
Span	ft. m	59	18	48·5	14·8	50	15·2	64·3	19·6	52·5	16	46·3	14·1	59	18
Length	ft. m	25·2	7·7	23·6	7·2	21·3	6·5	27	8·25	24	7·3	25·6	7·8	27·8	8·47
Wing Area	ft² m²	243	22·7	203	19	166	15·4	257	24	215	20	198	18·4	240	22·27
Aspect Ratio		14·3		11·53		15		16		12·8		10·8		14·55	
Wing Section Root		G. 535		Modified Jouk.		NACA-4418		–		–		–		–	
Tip		Symm.				NACA-4409		–		–		–		–	
Thickness/Chord Root		16		–		18		–		–		–		–	
Tip		–		–		9		–		–		–		–	
Twist °		-8·8		-5·5		-4		–		–		–		–	
L/D max		22·8		19·25		22		25·1		22		26		27	
at V	mph, kph	43·4	70·5	42·8	69·3	53·5	86	45·8	74·2	42·2	68	59	95	49·7	80
Min Sink	fps. m/s	2·52	0·77	3·02	0·92	3·5	1·07	2·23	0·68	2·62	0·8	2·95	0·9	2·46	0·75
at V	mph, kph	33·4	54	36·2	58·5	48	77	34·6	56	36	58	52·8	85	43·5	70
at Weight	lb. kg.	1050	465	872	396	911	413	1065	484	950	431	1165	529·7	1260	574
Wing Load	lb/ft² kg/m²	4·32	21·1	4·29	20·8	5·48	26·8	4·14	20·2	4·43	21·6	5·9	28·8	5·5	25·8
Span² Load	"	0·3	1·46	0·37	1·81	0·36	1·76	0·26	1·26	0·345	1·68	0·545	2·66	0·363	1·77
Fus. Beam	in. m	23·6	0·6	36	0·92	24	0·61	45	1·14	–		–		–	
Fus. X Sect.	ft² m²	5·6	0·52	10·4	0·97	5·3	0·49	12·5	1·16	–		–		–	
Fus. Skin Area	"	130		137	12·7	110	10·2	214	19·9	–		–		–	
WEIGHTS lb. kg.															
Wing		352	160	256	116	212·9	96·6	300	136	321·5	146	375	170·4	528	240
Ailerons												19·8	9	35·3	16
Fuselage & Fin		185	84·2	185	84·2	158·4	71·8	238	108	193	87·6	261	118·9	250	113·3
Rudder		27·3	12·4	6·5	3	27·7	12·6	6·5	3	6·8	3·1	8·8	3·95	9·7	4·4
Horiz. Tail Unit				24·2	11			30·5	14	28·2	12·8	33	15	40·4	18·3
Chassis						25·3	11·6	70·5	32	9	4·1	9	4·1	11	5
Skids										7·5	3·4	7·4	3·35	6·6	3
Equipment						86·7	39·4								
Contingency								19·5	9						
EQUIPPED WT.		564·3	256·6	471·7	214	511	232	665	302	566	257	715	324·7	881	400
LOAD		400	182	400	182	400	182	400	182	400	182	400	182	400	182
ALL-UP WT.		964·3	438·6	871·7	396	911	414	1065	484	966	439	1115	506·7	1281	582
Alternate Load		485·7	208·4	440	200			550	250	383	174	452	205	383	174
Alternate All-Up		1050	465	911·7	414			1215	552	949	431	1167	529·7	1264	574

was designed by Huetter. It was the first production side-by-side two-seater with any pretensions toward performance. The crew (see FIG. 1(*s*) and FIG. 8) sit closely side by side in a fuselage just over 36 in. (about 92 cm.) wide. They are set as far back as possible so that the unbalance with one-man crew will not require too much ballast. Such a position allows the wing root to be used locally as increased fuselage width. The relatively small span of 14·8 metres (48·5 ft.) means that the Goevier is lighter than the Kranich but the result is also a lower performance. FIG. 7 shows Huetter's calculated performance. There is no measured performance available. The weight breakdown is in TABLE II.

The German handling study quoted above has also useful remarks about the Goevier. The most interesting are:

'Goevier is very heavy on controls during aerotow. In fact, at speeds over 80 k.p.h. (50 m.p.h.) they are most unpleasantly heavy. This refers not only to elevators, but also to the other controls. The machine hunts about all axes, particularly in yaw. The Goevier trims in free gliding flight at 65 to 70 k.p.h. (40 to 43 m.p.h.). Tests with free elevator were not possible due to the large friction in the system. As for the stall, this starts at 59 k.p.h. (37 m.p.h.) and is complete at 54 k.p.h. (33·5 m.p.h.). In calm air there is no wing dropping, lateral control being retained, but in gusty conditions a wing drops slowly and can be recovered quickly by increasing speed a little. In normal flight the controls are well harmonized, although at high speeds the ailerons are rather heavy. The adverse aileron yaw is very small. The 45 deg. turn reversal time is 5 seconds, achieved with full rudder and only about half aileron travel. Possibly the time might have been shorter had it been possible to use full aileron. In other words, the rudder power should have been greater. Longitudinal stability is small and positive, much like that of the Kranich. It was not possible to measure the directional stability with free rudder due to the high friction in the control system.'

These, then, are our standards, imperfect to be sure, but nevertheless something to go by. To be acceptable today, handling characteristics would have to be very much better indeed.

American Types

Quite independent of the German developments, two-seater development proceeded slowly in the U.S.A. just before the war. When U.S.A. entered the war in December 1941, it was decided to use two-seat gliders for trainers for troop-carrying gliders. Five types were ordered and a total of 389 built. However, there was a change of policy before much of the training was done and before many of the gliders were crashed. As a matter of fact, as late as 1947 about 300 of the 389 still existed. Although these gliders were not meant for sporting purposes and were not designed for quick dis-assembly, they quickly swamped the U.S.A. glider market after the war when they were sold by the Government at mere fractions of the original prices. This series of glider has the designation TG (training glider) and was produced quickly in production without sufficient development time. Some were designed by inexperienced people and some were designed under peculiar difficulties.

A training aircraft has usually a rather short life, but this group has had a long life and as a result many faults appeared which would have been of no importance in their original roles. For instance, the plexiglass canopies have not worn well, nor have the tail skids. Due to the lack of development, the controls tend to lack harmony. There are other aerodynamic and structural faults such as wing-dropping, rough exteriors and secondary structural weaknesses which normal development should have cured. In spite of all this, this group of gliders, and particularly the Laister-Kauffmann TG-4A have done great things for gliding in the U.S.A. as far as the

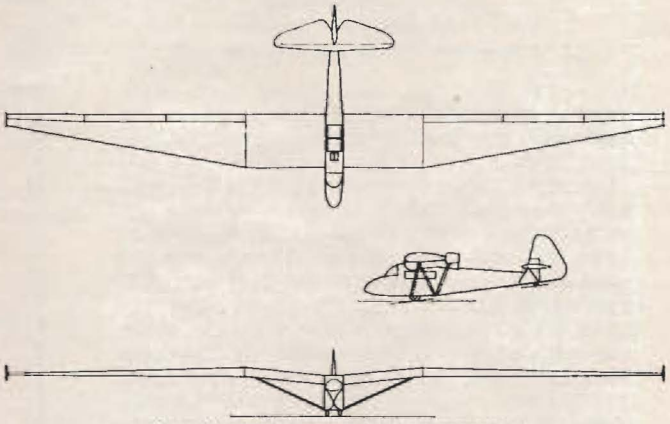


Fig. 5.—Obs: general arrangement

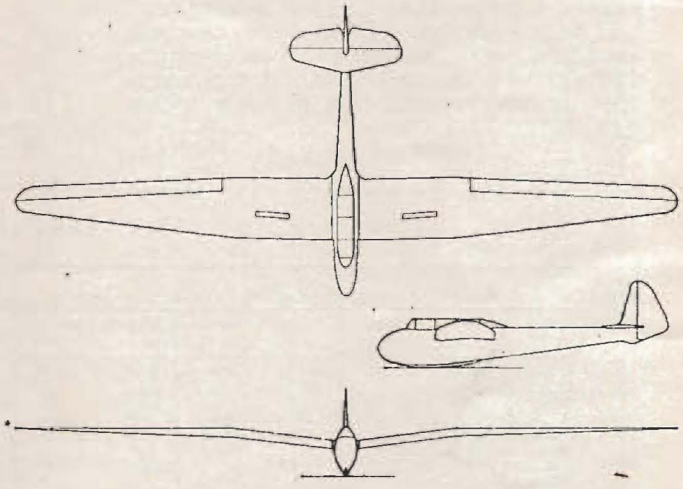


Fig. 6.—Kranich: general arrangement

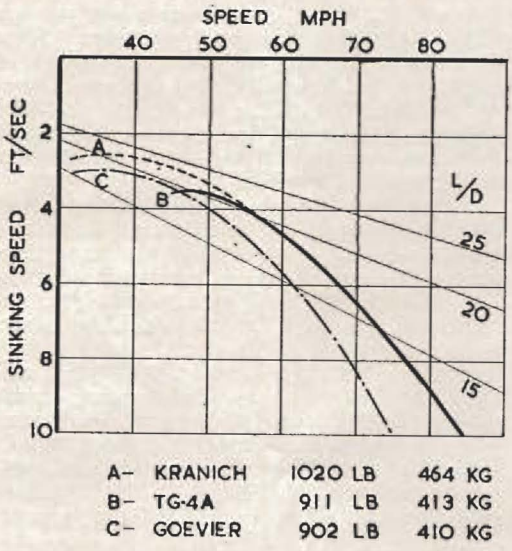


Fig. 7 (above).—Performance: Kranich, TG-4A and Goevier

pilot is concerned, although their existence has prevented the development of a modern two-seater.

In TABLE III the characteristics of the TG series are summarized.

It can be seen at a glance that these are in no sense high performance gliders. They are of short span and heavily loaded, having high minimum sinking speeds.

Of the group many consider the TG-2 to be the best, but the only one on which much data are available is the TG-4A. A three-view drawing of the TG-4A is given in FIG. 9, its weight breakdown on TABLE II, and FIG. 7 shows its performance at the above weight based on tests by August Raspet at 800 lb. (363 kg.). It will be seen that the minimum sink is about 3·5 f.p.s. (1·07 m./sec.) and the best glide is about 1/22. Raspet has made considerable efforts to improve the aerodynamics of the TG-4A. He claims that with the canopy removed, and replaced with a simple bubble canopy for one man, and much detail cleaning-up, the performance is improved to a sink at 860 lb. (390 kg.) of 2·25 f.p.s. (0·5 m./sec.) and a gliding angle of 25·6. Since the TG-4A has practically the same wing area and span as the Olympia and the above quoted performance is almost identical with that quoted for the Olympia at 560 lb. (255 kg.), this is a remarkable claim. However, Dr Raspet's recent work on the successful development of the RJ-5 into a record breaker does show the value of such detailed intelligent studies.

It is hoped that the wide experience obtained by the Americans on these gliders will result in the emergence of a really good two-seater of high performance.

European Two-Seaters

Apart from the important Kranich and Goevier described above, there have been other groups of European two-seaters worth some mention here. For instance, there were the Munich two-seaters, the Mü-10 and Mü-15, both of the typical Munich steel tube fuselage construction with normal wooden wings. Both these show up well on the weight graph, FIG. 4, particularly the Mü-10. Other notable German types were the EW-1 and the E-3 of the FAG-Easlingen. All these were light in structure, but relatively lightest of all was the Darmstadt D-31. This was extremely light and had a high performance. It was a high wing type rather on the lines of the single-seater D-30, having a pod fuselage with single tail boom.

The Swiss two-seaters should not be forgotten, but none have been produced in any quantity. Perhaps the most interesting of the group is the S-25 with its swept forward inner wing and the later Spyr.

The two French two-seaters, the Nord Caudron C-800 and the Castel-Mauboussin 25-S, were both built in considerable quantities. The C-800 is a braced high wing type of 16 m. (52·5 ft.) span with an elliptical plan form. The seating is staggered side by side. The C.25-S is also of 16 m. (52·5 ft.) span, but has a cantilever wing and the seating is side by side.

The loaded and empty weights for both types

TABLE III

Type	TG-1		TG-2		TG-3A		TG-4A		TG-32	
Maker	Frankfort		Schweizer		Schweizer		Laister-Kauffmann		Pratt-Read	
Span (ft.) (m.)	46·3	14·1	51·3	15·65	54	16·5	50	15·2	54·5	16·6
Length (ft.) (m.)	23·2	7·1	25·2	7·7	27·6	8·42	21·25	6·5	26·1	7·97
Wing Area (sq. ft.) (sq. m.)...	194·3	18·1	215	20	237	22·1	166	15·4	230	21·4
Wt. Empty (lb.) (kg.) ...	500	227	448	204	820	372	511	232	770	350
Gross Wt. (lb.) (kg.) ...	920	418	858	390	1,220	555	911	413	1,150	523
Wing Loading (lb./ft.²) (kg./m.²)	4·72	23·1	3·99	19·5	5·15	25·1	5·48	26·8	5	24·5
Span Loading (lb./ft.²) (kg./m.²	·428	2·1	·326	1·59	·418	2·04	·365	1·79	·387	1·9
Aspect Ratio	11		12·65		12·3		15·05		12·9	

are shown in TABLE I and other interesting data given below:

	C-800	*C-25S*
Minimum sink	0·87 m./s. (2·85 f.p.s.)	0·8 m./s. (2·62 f.p.s.)
at speed	65 k.p.h. (40·3 m.p.h.)	58 k.p.h. (36 m.p.h.)
Best L/D	19·7	22
at speed	72 k.p.h. (44·5 m.p.h.)	68 k.p.h. (42·2 m.p.h.)
Sink at 100 k.p.h. (62 m.p.h.)	1·9 m./s.	—
Ultimate factor	9	—
Wing section root	Gö 654	—
tip	Gö 676	—

It will be seen that neither type has any pretensions to high performance and may be classed as specialized trainers.

For data on other French two-seaters see TABLE II.

Wartime German Designs

During the war a specification was issued for an improved two-seater in Germany and it is of great interest to see that it was apparently built around the Kranich and required improvements on it. The main requirements were:

1. Performance better than Kranich.
2. Faultless flying qualities.
3. Load to be carried to be variable between 60 and 250 kg. (132 lb. and 550 lb.) without requiring trimming ballast.
4. Retractable sprung single-wheel chassis.
5. Provision for a detachable sprung normal undercarriage for three-point landing practice.
6. Adjustable controls for pilots of various sizes.
7. Perfect view for both pilots.
8. Dive brakes.
9. Interchangeable wings for aerobatics and performance flying.
10. Plenty of room even for fat pilots (a sop to Goering?).
11. Oxygen equipment.
12. If separate seats, pupil's controls to be so arranged that they could be disconnected if required.
13. The cabin to be constructed of steel tubing with fabric covering to avoid injury from splinters in crashes.

These requirements are of considerable interest. They try to combine a trainer and a high performance machine. Is the roomy cockpit to be balanced by the retractable chassis? Is the costly high performance worth while in a machine used for landing practice or designed for crashery?

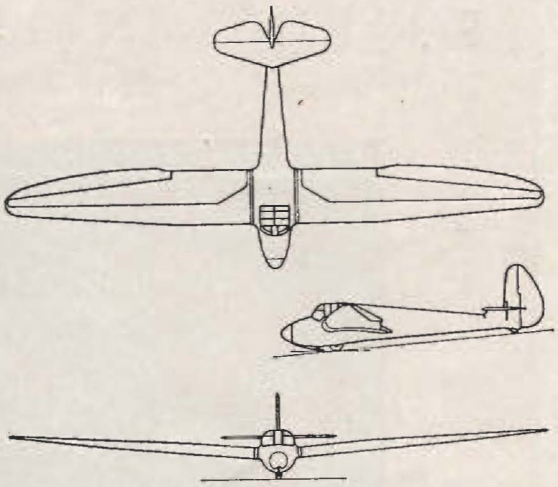


Fig. 8 (right).—Goevier: general arrangement

On this specification three designs were ordered. One by Hans Jacobs was a tandem shoulder wing machine with the second man sitting on the centre of gravity. The pilots were staggered in height like the Yamazaki shown in FIG. 1(*i*). This machine was not completed and the designer advised the writer that he had no drawings or sketches available.

Another design was by Kracht who designed a low wing machine with an undercarriage retractable into the wing. The tandem seats were staggered in height. It will be noted that the undercarriage did not fulfil the specification requirement. This machine was never finished.

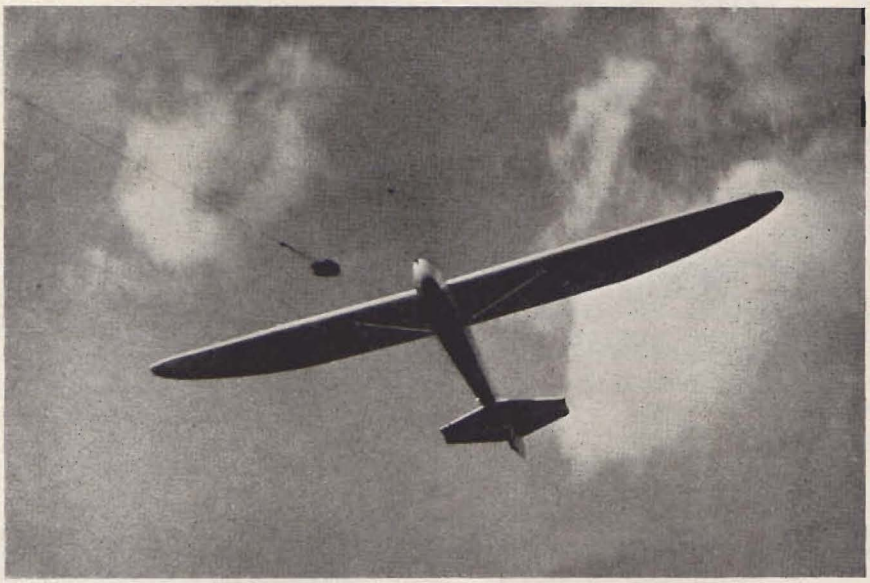
The only machine which was finished was the Hütter Hi-21 which is shown in FIG. 10. This was a side-by-side shoulder wing machine with a bubble canopy and a retractable tail wheel undercarriage. This was also at variance with the specification. The very difficult problem of trimming without ballast is accentuated in a side-by-side machine with the crew fairly far forward as in the Hi-21. It was solved by making the wing angle of sweep adjustable in flight.

The Hi-21 flew in 1944. After the war it was flown by American soldiers at Nabern Teck. It was last heard of in Erding near Munich and was unserviceable. The calculated performance is shown in TABLE II. It will be seen to be better than the Kranich throughout. The measured weight breakdown is also given in TABLE II. The undercarriage geometry is sketched in FIG. 11, and in that figure some indication is given of the fuselage structure. The wooden rear fuselage picks up on three points on the steel tube front portion. The aft part of the front portion carried the wing and chassis, and as far as can be gathered, the nose part containing the cockpit was bolted to this part.

(To be concluded in the April issue).

SOARING IN THE NETHERLANDS

By H. F. V. M. SCHWING



Fokker ' Grunau Baby ' taking off at ' Terlet '

IMMEDIATELY after the liberation in May, 1945, of the last occupied provinces of the Netherlands (which is the correct name for ' Holland,' the country where 10.5 million ' Dutchmen ' live) the rebuilding of our national gliding sport was started. Today, nearly 8 years later, the Royal Aero Club of the Netherlands runs one of the finest and most efficient gliding schools in the world at ' Terlet,' 5 miles north of Arnhem, and 20 associated local gliding clubs with a total of about 1,000 members are active. Several national records were broken and in Spain the Dutch champion and first Golden ' C ' pilot, Ordelman, put up a very good show ending in the 7th place among the 39 participants in the single-seat class.

GOVERNMENT SUBSIDY

Unlike in pre-war days the government shows interest in gliding as a means of pre-power flight training, which has resulted in the grant of a subsidy to the Aero Club. This was spent on building and equipping the national centre ' Terlet ' and at the same time for support of the local clubs. 72 gliders were bought from ' Fokker ' and ' De Schelde ' in 1946-1949 (36 primaries, 24 ' Grunau Babies 11b,' 6 ' Olympias ' and 6 ' Goevier ' two-seaters). In 1951 Slingsby delivered 8 ' Prefects ' and 3 ' Sedberghs ' (' T-21b '). Last year a Slingsby ' Sky ' was added to the fleet and first flights were made by two Dutch prototypes the ' KNVvL-491 ' and the ' T-10,' which soon will form the newest part of the R.N.A.C. fleet. The oldest and only pre-war sailplanes, a ' Minimoa ' and a ' Kranich I,' bought in 1938, are both still in excellent condition.

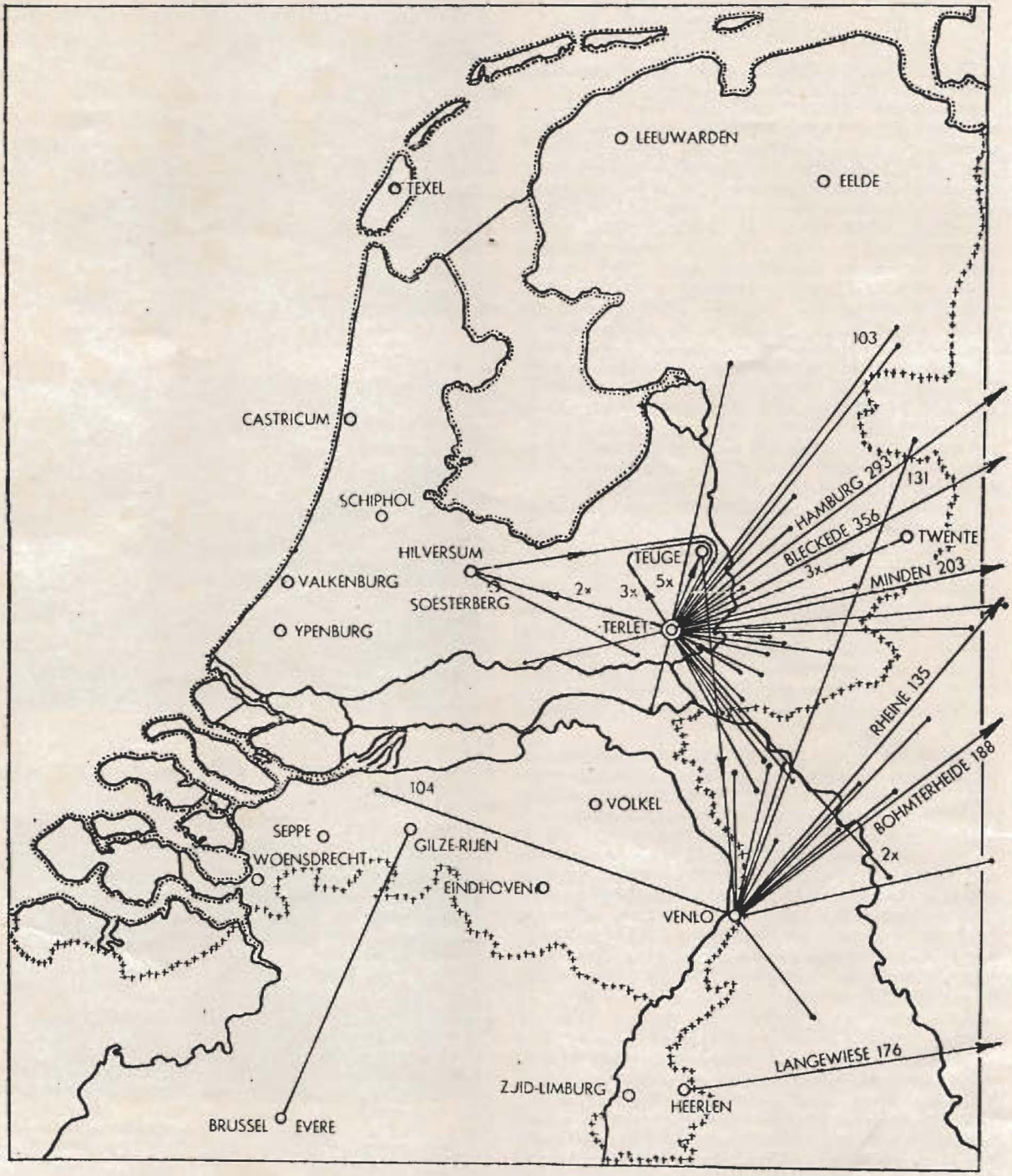
The greater part of these gliders are hired out to the clubs. ' Terlet ' has the use of 4 ' Goevier ' two-seaters, 2 ' Prefects,' 4 ' Babies,' 2 ' Olympias,' the ' Minimoa ' and the ' Sky.'

Besides the rented R.N.A.C. sailplanes the clubs use a number of sailplanes owned by themselves. These include 12 ' Grunau Babies,' a ' Rhön Bussard,' a ' V-20,' a ' T-10,' a ' Grunau 8 ' two-seater, a ' Universal ' (utility type) and about 15 primaries.

The R.N.A.C. has sold most of its primaries to the clubs. Also a Czech built ' Kranich II,' which was bought in 1949, was sold to Germany, the complete overhaul of this ' Kaurit ' glued sailplane being too expensive.

From 1950 on the subsidy is given on condition that every year at least 100 selected boys (16-19 years old) are trained up to the ' B ' licence stage. These boys have to satisfy with the same medical requirements as transport and airforce pilots and they must fulfil certain requirements concerning their school education. Both the civil and military flying schools give preference to these glider pilots. Now that a number of the 300 boys, trained in 1949-1952, are old enough to join the flying schools, these have found that indeed glider pilots are trained more cheaply with less waste of instructor's energy and flying time than pupils without this experience. On the other hand several glider pilots, who had aspirations for a flying career, knew at an early time—when they still easily could change over to another job—that they were unsuitable or that they did not like flying as a profession.

Taking in mind, that the cost to train a transport—or airforce pilot nowadays has risen to more than £15,000, everyone will understand what it means to



Last year's cross-country flights in the Netherlands. The nine flights of more than **100** *kms.* **(62** *miles) are indicated in kms., and in some cases with the name of the landing place. Longest flight was* **356** *kms.* **(223** *miles)*

reduce the risk that a pupil will prove unsuitable and has to break off during this expensive training.

SOARING AS A SPORT BENEFITS

The government subsidy, given to the Aero Club, is divided over both Centre and clubs.

The Centre ' Terlet ' was opened by the Minister of Transport on April 15, 1950. It is run with a professional staff, including 4 full time instructors. The Centre looks after the administration and maintenance of all gliders owned by the Aero Club and all repairs and overhauls can be done in the Central Workshop, which is also at ' Terlet.' All *ab initios* are trained on two-seaters. One of these is fitted with a special hood for blind flying and a ' Link ' trainer is available for synthetic training.

During the summer holidays (July-August) the gliding school at ' Terlet ' holds two special courses, each lasting 3½ weeks, where 40 schoolboys at a time are trained up to the ' B ' licence. They make 25 to 30 winch launches in the ' Goevier ' to 1,200-1,500 feet and 10 solos on the ' Grunau Baby.' Some of them make short thermal flights at the end of the course, but as a rule real soaring is done in their clubs. Unless there is no gliding club in the neighbourhood of their home town, the boys must be club members and after their training at ' Terlet ' they can try to obtain the ' C ' licence. One or two took a Silver ' C ' and last year a 17-years old boy flew 108 miles in a ' Grunau Baby.'

During July and August the Centre ' Terlet ' is closed for all other pilots, but the rest of the year, when only a few ' government pupils ' are under training, the other club members can make good use of the facilities at ' Terlet.' But . . . they have to pay for it, whereas the boys fly without costs (apart from the club subscription and flights after they have won the ' B ' licence).

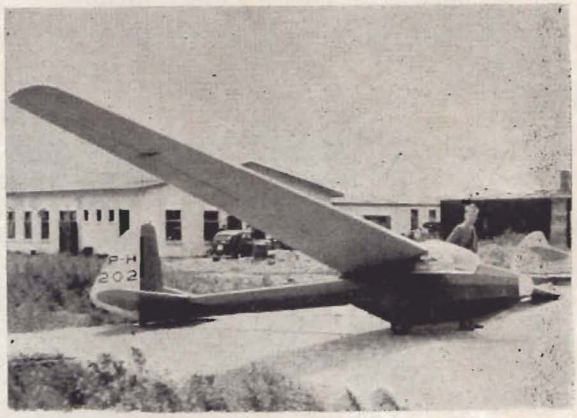
About one-fifth of the boys take their ' B ' licence in the clubs, for which the latter are getting a bonus.

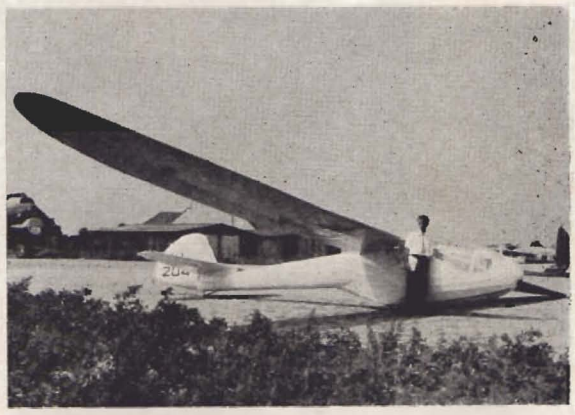
In some clubs the *ab initio* training is still going on with ' ESG ' primaries, several other ones have a two-seater ' Goevier ' or ' Sedbergh.' It is likely that in a few years all clubs will have changed over to two-seater training. The new two-seater type that the R.N.A.C. has in mind is a cheap (£725) tandem seat development of the ' T-10 ' trainer. This can be flown solo by the pupil, which we think is a great advantage over side-by-side gliders. A description of both single and two-seater versions of the ' T-10 ' will be given later on.

LAUNCHING METHODS

Although the R.N.A.C. owns two ' Tiger Moths ' only several hundred aero-tows yearly are made, winching being more economic. ' Terlet ' uses a 145 h.p. General Motors diesel engine with torque converter with excellent results. A second winch has a conventional Cadillac engine. Both have two cable-drums.

Most clubs still use rebuilt cars of 1930-1935 vintage, or home built winches with war surplus engines. There is a tendency to standardise on the double drum type with enough power to launch a two-seater in feeble winds to sufficient heights.







(Top) : The ' T-10 ' trainer in prototype form. This modern trainer with its gliding angle of 1:23 is the probable successor of the ' Grunau Baby ' in Holland. Production of both single and two-seat versions is to begin this year in Rotterdam. The first production ' T-10 ' single-seater is nearly ready.

(Centre) : This ' KNVvL-491 ' prototype began its test flights recently. It has a laminar flow profile and 16 metres (53 feet) span. The ' 491 ' was flown against the ' Sky ' and it proved to be equal to this famous sailplane at all speeds.

(Bottom) : The Slingsby ' Sky ' in front of the hangar and workshop at the national centre ' Terlet.' On the second floor is the dormitory with accommodation for 40 pupils.

' Akulon ' covered cables are successfully tried at ' Terlet '. These are rather expensive but the number of launches before it is worn out is tripled.

Aircraft used for towing include Piper ' Cub ' and ' Super Cruiser ' Fairchild ' Argus,' and several marks of the ' Auster.'

SOME FIGURES

In 1952 22,600 flights were made resulting in 3,000 flying hours. The Centre ' Terlet ' alone produced 8,910 launches and 1,424 hours, the clubs 13,700 launches and 1,575 hours. These figures are the highest ever reached.

The R.N.A.C. issued the following licences :

	pre-war total	*today's total*	1950	1951	1952
' A ' licences	719	1,533	110	186	169
' B ' licences	478	1,195	112	175	180
' B ' licences (Boys)	—	appr. 300	64	111	119
' C ' licences	117	393	35	45	41
Silver ' C ' legs	?	?	?	38	47
Silver ' C's ' compl.	4	46	14	8	8
Golden ' C ' legs	—	5	2	—	3
Golden ' C's ' compl.	—	1	—	—	1

Today we have 65 qualified gliding instructors, 29 of them are two-seater instructors.

CROSS-COUNTRY SOARING NOT VERY POPULAR

Due to the lack of high performance gliders and the poor facilities on most club fields, cross-country flying is still not very popular. Flying on weekdays is—apart from the usual club camps—only possible at ' Terlet.' The Centre is open every day except Tuesday and has quite a reputation for its thermals. The only disadvantage of it is that one has to cross rivers in most directions.

The best flights—both national records for distance—were made in N.E. direction. J. Koek flew 182 miles (293 kms.) to Hamburg and G. J. Ordelman 227 miles (356 kms.) to Bleckede on the Elbe where this river forms the border of the Russian zone.

The second best starting point for cross-countries is the glider field near Venlo. The east end of the field is the German border so it is not surprising that all but one of the flights in 1952 ended in Germany.

The results of the last two years are shown in the following statistics (distances in miles) :

	Number of cross countries		*Total distance*		*Mean distance*	
	1951	1952	1951	1952	1951	1952
			m.	m.	m.	m.
Clubs	44	39	1500	1530	34	39
Centre	23	23	970	1090	42	47
Total	67	62	2470	2620	37	42
' Sky ' team in Spain	—	5	—	535	—	108
' Kranich ' team in Spain ..	—	4	—	315	—	79
Total inc. Spain		71		3470	—	49

In my next article I hope to tell you more about gliding in the Netherlands.

The Hague,
January, 1953.

H. F. V. M. SCHWING

WHITE SILENCE IN THE CLOUDS

14,000 FEET IN A ' GRUNAU BABY '

By FRED HOINVILLE, AUSTRALIA.

' Thank goodness that's finished.' I pushed the typewriter away. Then saw the I've-got-an-idea look in Grace's beautiful blue eyes. ' Why not write up your Narromine cloud flight while you're in the mood ? ' I protested that it wasn't a record or sensational in any way, but Grace insisted. ' Many glider pilots have never been in a cloud. They aren't interested only in records. They want to know what to expect, what it feels like, what to do, and how to do it. Just write what you thought during the flight.' I couldn't think how to evade that one. Come to think of it, I didn't want to evade it. Cloud flying is entrancing and reticence is not a noticeable part of my make-up. I began to feel the old urge to tell all. I pulled the Remington back. I remember . . .

THE weather has been disappointing at Narromine this February, 1952, but today an easterly wind has brought some very high and tempting clouds into view. The lift is weak and slow, but at 2 p.m., a car-tow launch to only 400 feet is successful and I manage to stay up. It is the third launch.

I climb slowly to near cloudbase in the Hinkler Soaring Club's enclosed ' Grunau,' but cannot reach the cloud, so from my top at 7,000 feet I set off towards a better-looking cloud ten miles away, and find slightly better lift there. Gradually the lift increases to a maximum of 8 feet per second, and then with electric turn indicator whirring smoothly, I reach 9,000 and cloudbase. This is it.

THE WHITE SILENCE

I have soared many times in cloud, but the eerie white silence of those first few minutes in each cloud holds a fascination and a thrill that never grows stale. This is a world beyond feel, a mental world, a world where man fights himself and wins, or spins. Here a pilot knows himself, finds his weakness or his strength, makes his tautening grip relax to obey his will.

Here his eyes and his instruments and his mind are pitted against the reeling senses that shout that he is falling, turning, leaning. Here the devils of panic sit on his shoulder and reach for his hands. Here is hell and heaven, fear and courage, doubt and decision. It is man against mighty nature, and when man triumphs, it is victory indeed, the victory of man over his own weaknesses. It is a life-long victory, the conquest of the unknown, the mastery of fear. He who does not fear himself fears nothing.

Grey wisps of vapour drift past the canopy. The dark bowl of the cloudbase shrinks the horizon until the earth below grows dim and swirls away like a dissolving dream. Once again I know the thrill of the white silence. Once more I feel my hand tighten on the stick and consciously make myself relax all over. The lift area is not as wide as usual, and I have to settle into a rate 2 turn.

Airspeed 30. Turn rate 2 left. Bank ball centred. Feet not tensed but firm, locking the rudder. The

stick held low, wrist resting on thigh, hand holding softly, almost lazily putting slow pressure back, forward, over a little. No trim tabs on the ' Grunau.' Speed a little high. That constant nose-heaviness makes a light touch difficult. Speed 30. The green ball drops from its steady 10 f.p.s. Tighten the turn. The ball jerks up. Open the turn again and settle down as before.

It's cold. Close the nose vent. Cold and dank. 11,600 feet. Grope for the disc to close the window. That's much better. Smooth, too. Airspeed 30, turn 2 left, bank ball centred, green ball steady 10. The well-grouped instruments are not hard to co-ordinate. My eyes see the main four as a group, not as individuals.

My left shoulder presses against the sidewall. My senses tell me ' You're slipping in, take off bank.' Reason says ' Re-check the instruments.' No side-slip. Just another case of the ' leans.' I re-position myself in the seat and relax again. Another voice whispers uneasily ' The turn indicator is wrong. I can feel we're turning the other way, we're spinning.' I ignore the voice. Turn indicators may fail but they never read backwards. The indicator is right. Follow it. Believe it. The voice is beaten, fades out.

The silence changes to a light patter of rain. Strange, I can't see it. I glance out along the leading edge. It is only a blur. I look more closely. The canopy is thinly streaked all over with ice. A peep through the window. The blue wing has turned white. It's very beautiful. 13,800 feet. Not so smooth now. It's getting a bit difficult to centre the lift. Not very bumpy, but the lift seems to be broken up. Must be near the top . . . 14,000. The cloud seems to be bubbling. Red ball. Green ball. Red. Green. Not getting any higher. The whiteness is dazzling, blinding. A flash of blue. Another. Straighten into it. Out ! We're out ! Out in the warm, glorious sunshine.

The canopy begins to clear. I open the window. All leading edges are coated with ice, about an inch thick, clear ice with a gravelly white surface. I check the performance. Strangely I cannot detect any effect from the ice. The Raspet nose-pitot has kept the airspeed indicator free from ice and water. It always does.

THE GHOST MOUNTAINS

Through the window I drink in the breathless beauty of the intangible snow-mountain which I have just left. I brush along the face of a tremendous cliff, so close my left wing cleaves through the whiteness. So close that I cannot see the top or bottom. I glide silently through a narrow cleft, wings rocking gently, blue sky above, brilliant whiteness all around me. I turn in the heart of the cloud again, can find no more effective lift, burst forth once more, and fly straight away for half-a-mile, then turn back to study the monster. I had reached the top.

I am now about sixteen miles from my field. Another ghost mountain lures me to the north-west ; perhaps it will grow higher than this ; perhaps there will be diamonds in the sky.

At 10,600 feet I reach the new colossus, and like a probe the ' Grunau ' thrusts silently into the selected spot. Again I find lift, again the variometer goes to 10 f.p.s., again I wait until the green ball begins to fall, then wheel sharply left and settle down on a rate 2 turn. The ball rises ; I reduce the turn. It falls ; I tighten the turn. Soon the ball is steady, the lift is centred. Again the altimeter winds smoothly up. Again I feel that bubbling lift that tells that the top is near. 13,000 feet. Too bad. I open out into a wide sweeping turn, without finding worthwhile lift.

I am at the south end of this cloud. I straighten out and head north, there may be another cell growing there now. There are a few bumps as I go through heavy down-currents, then another bump and the green ball pops up again.

Once more I centre the lift, this time to 13,800. But that is all. Again I search, then fly west out into the sunlight, stand well out and study the shining mountain. It is getting late. There will be nothing higher today, alas. The diamond digging is finished. . . .

A foot-long piece of ice flashes as it hurtles down from the left wing. I wheel and watch it fall. Other pieces vanish with a startling suddenness. Fragments fly back from the nose, tinkling against the now clear canopy and wing.

' I LOVE A SUNBURNT COUNTRY '

I turn slowly to the southwest. Fifteen miles ahead lies Narromine, friendly little town of the broad wheatlands of New South Wales, 200 miles inland from Australia's east coast. I slow the ' Grunau ' to just above the stall. Plenty height. Plenty time. I want to stay up here, to watch the clouds turn to gold and flame in the reddening rays of the lowering sun, sinking now into the eternal dust-haze of the inland. I want to see the grey shadows turn to purple as the day grows weak and the night grows strong. But not yet.

First I want to hang in the heavens like a questing eagle, wheeling on still wings while the daylight lasts. Far below me, dark green trees clothe the low range of hills ; ten thousand 40 acre paddocks lie parched and brown, for this is the dry season. Miles of blackened earth tell their tale of bushfire toll, yet in a few weeks the rains will come and the black will become luscious green overnight. There is Narromine, almost concealed in its thousand trees. Southeast is Dubbo, quite a city, its five huge R.A.A.F. stores shining silver, a landmark good for seventy miles, though almost beneath me now. A hundred miles of the Macquarie River winds from the high country of the southeast into the thirsty northwest. A man-saved river, its many dams keep it and a million sheep alive. From Dubbo five lonely railways radiate like a spider web, with little dots of townships trapped along the threads.

Thirty miles north I see the oil tanks and wheat silos of Gilgandra. Yellow fields of wheat stubble look like postage stamps on a varied brown carpet. Roads link towns and villages. One road runs straight for 150 miles, from Narromine into the flat northwest. No soft land this, yet not unfriendly.

The light is fading. The air is buoyant. I am still at 7,000 feet near Narromine. I turn to the airfield and put the nose down. Earthbound by our little fledgling, Grace is waiting.

FROM *SAILPLANE* 21 YEARS AGO

THE BORGHESE-PARIZZI ROTOR SAILPLANE

By C. H. LATIMER NEEDHAM

(*Chairman of the Technical Committee, British Gliding Association*)

SOME interesting details have been received relating to a novel type of sailplane that has been designed in Italy, known as the Borghese-Parizzi Cycle-plane. It incorporates the Flettner rotor principle in the main planes and is claimed to be the only solution that ' will permit of dynamic flight with the sole aid of man-power.'

The general outline of this aerial cycle (see Fig. 1)

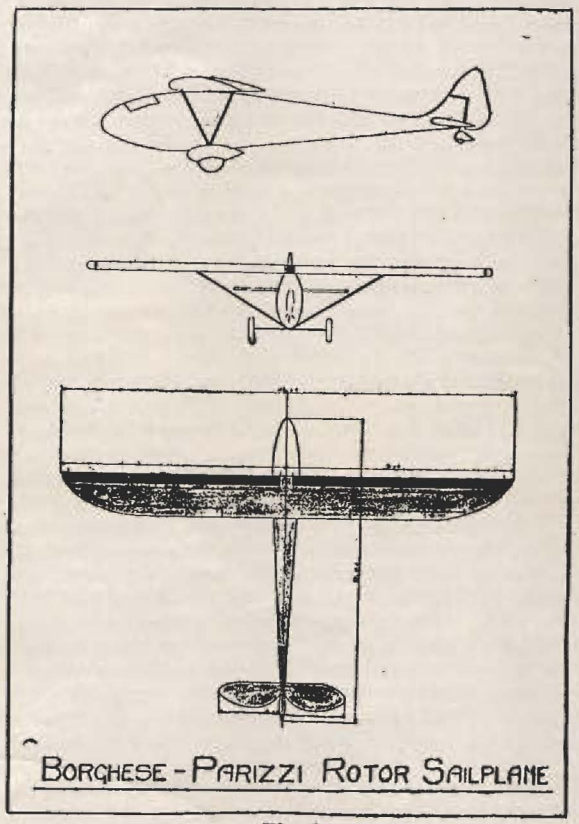


Fig. 1

is not dissimilar to the present-day sailplane, except that two long rotatory cylinders are built into the forward part of the wing so as to form the leading edge. By means of pedals and suitable transmission gear, it is claimed that the pilot is able to keep the cylinders in a state of constant rotation, whilst in flight, thus increasing the lift forces and supplying the forward propulsive power necessary for sustained horizontal flight.

The fact that the introduction and development of the wheel has enabled man to travel at a much higher rate over land, than is otherwise possible by his muscular power alone, is put forward as an argument in favour of exploiting its uses for aerial locomotion, but the reference to the semi-rotational, or rowing motion of the wings of birds and insects, in further support of this theory, does not appear so convincing. In the past, attempts have been made to propel aircraft by man-power with the aid of rotational organs, i.e., propellers, but it is pointed out that a constant force of at least 2 h.p. is required for this purpose and as the muscular power that man can produce is but 0.2 h.p., it follows that some radically different principle is essential for success.

The effect of rotating a cylinder in a stream of air (which is, of course, exactly equivalent to giving combined rotational and translational motion to a cylinder in still air) was first noted by Prof. Magnus, of Berlin University, about 90 years ago.

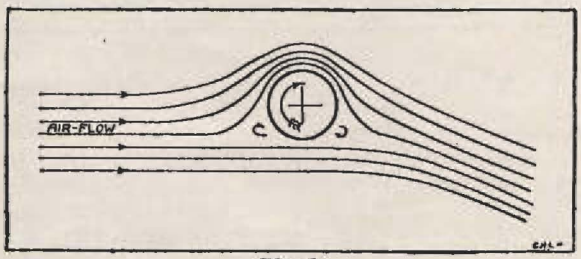


Fig. 2.

By reference to Fig. 2 it will be noticed that rotation has the effect of accelerating the movement of the air on one side (the top in this case) and has a retarding effect on the other (underside), or, in other words, the air-flow is hurried over the top side whilst a building-up process takes place on the lower. This is due to viscosity or friction between the surface of the cylinder and the air, the phenomenon being known as the ' Magnus effect.' The general deflection of the streamlines caused by the passage of the rotating cylinder and resembling the air-flow over an aerofoil will be noticed.

It is well known that when a mass of air, or fluid, has to pass from a tube of a certain size through one of smaller dimensions (Venturi tube) there must be an increase in velocity, with a decrease in pressure, over the narrow part and, in effect, this is what happens over the top of the rotating cylinder, where the air-flow is accelerated, thus causing a fall in pressure. (This can be thought out by imagining the effect of a small hole being drilled in the side of the narrow portion of the tube. A suction would be set up due to the rapid passage of the air-stream). Similarly, there is an increased pressure on the under-side, the net result being that a force is set up which tends to lift the cylinder. (This is made use of in golf by shaping the club face so as to impart a spin to the ball).

The first person to apply this theory to a practical use for purposes of transport was Flettner, who, some years ago, constructed a ship with a vertical

rotating cylinder, resembling a huge funnel and was thus able to make use of the wind as a means of propulsion. Some success was achieved at the time which was the cause of considerable discussion taking place concerning the possible application of the principle to aircraft.

It is said that a rotor-plane was built in America about 2 years ago, in which two large cylinders took the place of wings. All went well until, through a sudden stoppage of the motor, the rotors stopped and the machine crashed into the sea with tragic results.

In the present design such a contingency is guarded against by the fact that the rotors form part only of the main planes and, in the event of their stoppage, the machine is able to glide to earth in the normal way.

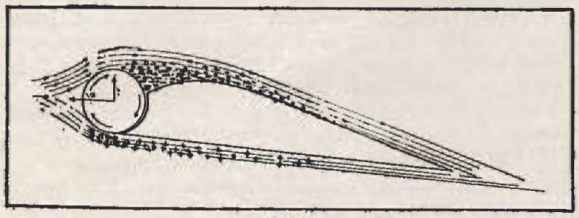


Fig. 3.

Fig. 3 shows the alleged effect of the rotating leading-edge on the air stream which gives rise to the desired qualities, although the flow is likely to conform more to the pattern of Fig. 2 and thus give an increased drag over the forward part of the aerofoil proper instead of the decreased pressure hoped for, whilst the constructional details are made clear in Fig. 4. The wing has a span of 46 ft. with a chord of a little over 4 ft. and an area of 170 sq. ft.

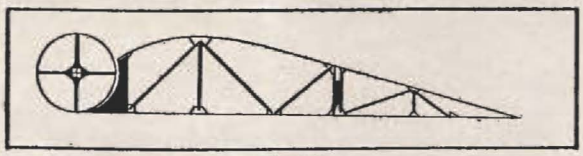


Fig. 4.

There is no doubt that an increase of lift can be obtained by such a design and provided that there is no proportional increase in drag due to the peculiar sectional shape and the added weight, than a finer gliding angle will result.

Furthermore it is claimed that a forward tractive force is obtained by the given arrangement, but for continuous horizontal flight this must equal the total drag of the sailplane, which may be assumed to be in the neighbourhood of 25 lbs for a speed of 30 m.p.h., and a gliding angle of 1 in 20. In short, then, unless a tractive force on the rotors of 2 h.p. is obtainable by the exertion of 1-5 h.p. at the pedals, the experiment is unlikely to meet with complete success. This is likely to be the deciding factor.

Experiments* so far carried out in this country on rotating cylinders have shown high values of lift to be obtainable, but only at the expense of relatively high drag, with consequent poor values of L/D, and it would seem very doubtful whether the combination of rotor-aerofoil can materially alter these conditions.

* R. & Ms. 1,009, 1,018, and 1,082.

From *Sailplane* 21 Years Ago

THE BIRD'S WING AS BASIS FOR THE THEORY OF THE 'Z' WING

By JULIUS F. ZIEGLER

(Translated from 'Flugsport,' No. 19, December 16, 1931)

FROM the time of Lilienthal and Kress our wing-sections have been based on those of birds' wings, although they have only found practical use as membranous wings with unbroken surfaces. But I have been interested in feathered wings, which I have studied and on which I have built my observations. At this point, before going further, I should like to mention the excellent co-operation of Herr Ladislaus Grafen Hoyos, whose personal interest in the matter and whose large collection of birds helped my work considerably.

As is known, considering the vertical projection of our wings in an air-stream, a drag is produced, which, according to the division of the medium into a suction and a pressure zone, realises some of the resultant pressure difference (in the horizontal projection of the wing) as lift. A pressure difference which under the effects of normal pressure tends to become neutralised or lose lift is, up to the present, only overcome by the air-speed.

The already discussed bird's wing is the most suitable means of using the lift-work of the air and is used, except for the concavity behind the leading-edge, universally in aviation. Although in our adaptation of the bird-wing it has been attempted to achieve as smooth a flow as possible, especially the off-flow, the real bird-wing has, by using this concavity on the underside a resistance which causes an eddy, which has been proven to exert positive thrust by Lilienthal, and which has recently been tested for this effect. However, practical experiments with such wings were failures since the general use of such wings in aviation due to the great drag is out of the question.

If one pictures the aerodynamic work on such wings in an air-stream, one comes to the conclusion that the vacuum effect in the concave fore-part of the wing forces the air-stream to reverse direction. However, since these air-streams for lack of a suitable path for them to flow away, find insufficient renewal, they must lead to a greater friction and drag when the air has been 'piled up' as far as the trailing edge. The gain in thrust in such reverse air-streams is much lower than the spoiling effect of the frictional drag caused by the piling-up of the eddies and are therefore of only negative value. A method which in the light of our present experience necessitates extra forces to overcome these drags can therefore not be practically considered to have gained any advantages.

The accuracy of the above argument on this 'widder-eddy' in the bird wing is proven as a result of my experiments and derivations, which led to the following results :—

Firstly we have the well-known bird-wing, which from upper-arm to wrist consists of an elastic skin

(*Continued on page* 22)

'Double, Double, Toil and Trouble, Cu-Nimb Boil and Thermal Bubble'

By J. C. N.

With apologies to W.S.

AROUND twenty years ago, having studied 'Kronfeld on Gliding and Soaring,' I thought I was all set to break the world records. I knew it all, by the book. (A jolly good book too, even now). Practice, they say, makes perfect. I'm beginning to doubt it, because I'm still practising, but it seems there must be others who practice harder. However, there are some who flatter me by suggesting that after twenty years' practice I must surely know something about it. So I have been asked to contribute something technical. At the risk of being called ignorant, here goes.

The basis of cross-country gliding is the art of thermal soaring. For the purposes of discussion this can be divided into two parts, viz., (1) Circling Technique and (2) Sky Interpretation. You can get a Silver 'C' by being fair at No. 1, but you need No. 2 for a Gold 'C.'

CIRCLING TECHNIQUE

Thermals differ so much in size, shape and effect that it is useless to lay down a hard and fast 'best technique.' Furthermore, two pilots flying at about the same time find the thermals differing in difficulty. It is hard to decide how much of this is due to the pilots' respective skill and how much can be attributed to the thermals.

The life of a thermal is a relatively short thing, and a lapse of a few minutes can result in widely different rates of climb being attained. The rate of thermal propagation is almost unforecastable. On June 28, when Wally Kahn flew the 'Weihe' to Coningsby, he said the thermals were good ones all the way until near the end when they were cut off by high cloud. Taking off about an hour later, although my first thermal (and best one) was definitely good, I then had a very thin time until I reached Reading, after which they were reasonable but not first class, until the high cloud also cut off my means of uplift near Rugby. I was down to 1,100 feet about 14 miles from Lasham, and found my thermals seemed to have a similar structure to an iron spiral staircase, with perforated cores in ever-changing locations. My average rate of climb was therefore only 84 feet/min., and my ground speed consequently only 20 m.p.h., as against Wally's 35 m.p.h.

Personally I find I generally do better in thermals if I circle fast and furiously as close into the core as I can get. Either direction does just as well, but having found a core I stick to about a 60° banked turn at an airspeed ('Olympia') of 45 to 50 m.p.h. I find this enables me to maintain a steady rate of turn, much less affected by turbulence than when I do larger, slower circles. This holds good for morning and early afternoon thermals. Later ones I find are generally more widespread with a less well-marked core, which makes them easier. The disadvantage of the tight circling, an increased sinking speed (proportional to the square of something or other) is more than cancelled by the additional lift found in a well-marked core. If it isn't well marked, of course, I do it more gently. On reaching cloud base I also have to flatten out the turn so as not to have the turn indicator hard against the rate 4 stop.

There are some who say they get better results when they circle to the right, or maybe it's the left. This seems to be because they are in need of a dual check in Daisy of their turns to the left, or maybe it's the right. There seems to be no notable difference in rates of climb in different directions if the turns are correctly flown.

One rarely gets away from the site before lunch-time, and the time for thermals is therefore limited, and so it is being more widely appreciated that Speed in cross-country flying is important. In between thermals one either guesses the right speed or uses a panacea of some kind to calculate it, but the prize still goes to the man who makes the most of his thermals, which means that he *quickly* finds the *best* lift, stays in it successfully, and having reached the economic top he just as quickly gets cracking on his cruise. The quick climb in the thermal is more important than the subsequent glide in saving time.

It will surprise many to find what their average rate of climb is over a number of thermals. I can recommend the practice of taking a ruled knee-pad with columns for recording the time and height of entering and leaving thermals. It is a beneficial exercise in concentration, it is instructive and it is irksome. Try it and see for yourself.

SKY INTERPRETATION

Perhaps this should really be called Cloud Interpretation, seeing that 99% of cross-country flights are made by use of thermal up-currents which are usually marked by their crowning clouds.

Now the life of a cumulus cloud is divided quite simply into two parts—growing and decaying. The aim of the cross-country pilot is to get into the up-current of a growing cumulus and to avoid like the plague the down-currents of a decaying one. Ann Douglas gives some very interesting photographic life histories of cumulus clouds in her excellent book *Cloud Reading for Pilots*, without which no aspiring cross-country pilot should be. The life of a Cu can vary immensely, from merely a minute or two, to several hours, depending on the nature of the air and the terrain over which it travels. The photographs in her book, however, are taken mostly from the ground, while the glider pilot's view of his next cloud is, he hopes, from fairly near cloudbase. He may see what appears to be a growing cloud, but when he gets there he finds only infinitesimal up-currents in a small part of it, and down-currents or dead air under the greater part of it. Or he may see only a dull grey amorphous mass of cloud because he is so close to it.

The general features by which to recognise a cloud as growing or decaying are :—*Growth*, a firmly

rounded appearance, a soft fluffiness, or a milky vapour showing that condensation is beginning to take place. *Decay* is usually shown by a ragged appearance or a chaotic arrangement with holes here and there.

Large vertical development indicates formation, but while the upper part may be still going up, decay may have set in in the lower parts. Gradual flattening of a cloud indicates decay, but if all the clouds are flat it may only indicate that there is a fairly strong inversion layer through which the up-currents cannot penetrate, but that up-currents are quite active up to within 500 feet or so of the tops. This type of cumulus is frequently seen when a warm front is approaching in fairly dry-air conditions. A good flat darkish-coloured base usually indicates continuing activity. On a windy day it will often be found that only the upwind end of a cloud has up-currents, while the middle and down-wind side of it has descending currents. In fact the cloud can be regarded as a wheel rolling along with the wind.

Many a cross-country flight has ended prematurely because high cloud has spread over and cut off the sun, but there is no reason to give up hope when this happens, as many flights have continued under such conditions. For instance, on one occasion when the 'Weihe' completed a cross-wind goal flight from Redhill to Friston, the last bit of sunshine was seen on leaving Redhill, the flight being continued with the aid of small flat cumulus clouds under a high grey overcast associated with an approaching warm front. It took an hour and a half to get to Friston, but the goal was reached. Again, in June this year at Lasham several pilots were able to soar 'Olympias' under rapidly decaying cumulus clouds in continuous light rain from another approaching warm front, for periods of up to forty-five minutes. So don't give up hope just because it looks bad.

The decision which comes to all on a goal flight is whether to crack off between thermals on a pre-computed or estimated compass course to make good the required track, or to divert one way or the other to make use of the best looking clouds. Not having been able to record a high degree of success at this decision, I hesitate to advise, and in any case I think the only cut-and-dried answer can be —'It all depends.' If lift has proved to be fairly plentiful, waste no time going off course chasing what may turn out to be past its prime, and keep as close to track as possible. If however, the thermals have hitherto been weak or widely separated, go for what looks the best. But guard against going too far down-wind of track in a cross-wind flight, for it just makes things all the more difficult later when you have to fly into wind to reach goal. If there is choice of lift up or down-wind of track, choose the upwind lot if within easy reach. A cloud-street is always worth making a slight diversion for, if inclined at all towards the goal. Several miles may be flown with no loss of height.

Acknowledgments to

'The Lasham News Letter'

SURREY GLIDING CLUB
1952 STATISTICS

from "The Lasham News Letter"

Aircraft. 1 'T21-B' (Daisy); 2 'Tutors'; 4 'Olympias'; 1 'Weihe.'

Launches. On Club site, 5,939; on Club site by Club gliders, 5,467.

Hours. On Club site, 431; on Club site by Club gliders, 360.

Days on which we flew, 126; and which were soarable, 61.

Miles flown from Lasham, 1,184.

Certificates. 'A' 12; 'B' 10; 'C' 10; Silver 'C' 3 legs; Gold 'C' 2 legs (1 in France, 1 in Africa); Diamond 'C' 2 legs.

Membership. Flying, 139; non-flying, 30.

Average utilisation of gliders. A criterion, 45 hours; B criterion, 0 hours.

Average hours soared per member on club gliders: 2.6 hours.

LONDON GLIDING CLUB
DUNSTABLE, 1952

Total Hours, 2,007. Total Launches, 6,598.

Flying Membership, 212. Associate Membership 56.

New 'A', 19; 'B', 22; 'C', 15; Silver 'C' Legs, 19; Silver 'C', 4; Gold 'C', 1 (Dr. D. B. James in France); Diamond Height, 1 (in Spain, awaiting Gold 'C' Distance).

Recorded Cross-Country Flights from Dunstable, 36 totalling 1,009 miles. 255 Flying days, of which 193 days were soarable.

Number of sailplanes, 9.

Utilisation of sailplanes:

'Olympia' (with wheel)	197 h. 55 m.
'Olympia' (without wheel)	139 h. 19 m.
'Prefect' (with wheel)	275 h. 26 m. (A/C hrs. over 1,000).
'Grunau Baby' (without wheel) ..	132 h. 32 m.
'Tutor' (with instruments)	105 h. 27 m.
'Tutor' (unserviceable since April) ..	47 h. 21 m. (A/C hrs. over 1,000).
'Tutor' (without instruments) ..	47 h. 04 m.
'T-21' Two-seater (without windscreen)	215 h. 24 m. (A/C hrs. over 1,000).
'T-21 B' Two-seater (with windscreen)	330 h. 27 m.
Private sailplanes	516 h. 09 m.

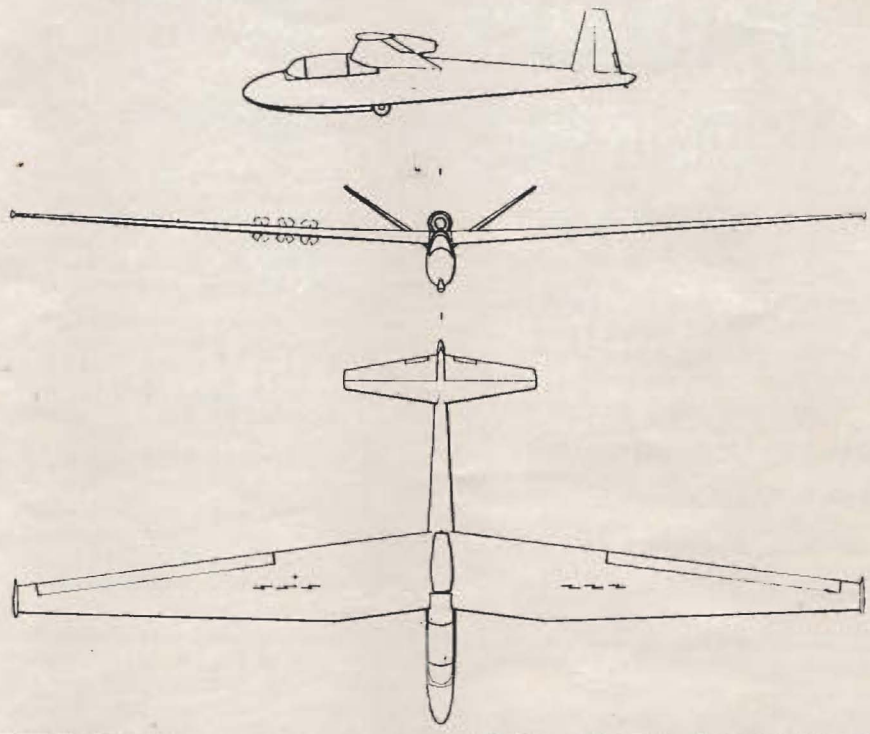
'A' Criterion (HRS/Sailplanes), 169 hrs., average utilisation; 'B' Criterion (HRS/new Silver 'C') 501 hrs. (the number of Silver 'C's' at Dunstable is very large).

Hours soared by the 'average' member, 9 hrs.

1953 additions to the club fleet, 1 'Sky' and 1 'Olympia.'

It is intended to make better use of the club's 4 winches in 1953 especially on non-slope soaring days by providing 1,200ft. launches. Special encouragement will be given to members to complete out-and-return flights.

'FOUGA' TYPE CM-72 JET POWERED TWO-SEATER SAILPLANE



Turbine 1. Turbomeca Palas.

Thrust, static, take-off	160 Kgs.
Thrust, static, max. cruise, sea level	138 Kgs.
Weight	69 Kgs.

Construction.

High wing cantilever. Dive brakes type ' Fouga '. V tail. Single landing wheel and skid. Mixed, wood and metal.

Span	18 m.
Length	8.47 m.
Total surface	22.27 m².

Weights.

Wt. of sailplane	350 kgs.
Wt. of turbine	76 kgs.
Wt. of mounting and equipment	40 kgs.
Weight empty	466 kgs.
Wt. fuel and oil	86 kgs.
2 pilots	174 kgs.
Take-off Weight	726 kgs.

Performance.

Max. Speed, sea level, 260 km./h.
Speed, max. cruise at 3,000 m, 245 km./h.
Rate of climb, take-off, 6 m./sec.
Rate of climb, max. cruise, 4.6 m./sec.
Take-off distance, 190 m.
Take-off distance to clear 20 m., 310 m.
Climb to 360 m. (1,180 ft.), 1 min. 30 sec.
Practical ceiling (limited by fuel capacity) 8,000 m.
Range, 310 km.
Endurance (sea level), 1 hour.
Range (sea level), 150 km.
Min. sink (empty fuel tanks), 1.05 m./sec.

' Fouga ' CM-71 two-seater sailplane is identical to the ' CM-72 ' but without a jet engine.

Weight	385 kg.
2 pilots	166 kg.
	551 kg.

Min. sink : 0.85 m./sec. at 75 km./h.
Best Gliding Angle : 1:26 at 85 km./h.
Sink : 1 m./sec. at 90 km./h.
Sink : 2 m./sec. at 115 km./h.

It is evident that the jet unit, in its present position, constitutes a fairly efficient airbrake. In order to compete in the most promising new class of sailplanes exemplified by the ' Hummingbird ' (which although more expensive in initial cost might provide cheaper and more frequent soaring) the jet unit would have to be buried inside the fuselage. After experience with the type ' 170 ' with buried jet engines Fouga might redesign its earlier types for buried jet installations. Fouga produce a vast range of sailplanes and miniature single and two-seater jet planes all of great interest.

The Bird's Wing as Basis for the Theory of the 'Z' Wing—*Contd. from page 18*

as lifting part, which by means of a muscular structure (curving downward) forms the leading-edge and behind it, the thrust-pocket. As against this type of wing, to which the researches up to the present have been confined, the actual bird-wing has purposely laid out **connecting paths** from the under side to the top side (from pressure side to vacuum side). Through the effect of the low-pressure zone the lifting stream is retained (or in landing forced in place), reversed and led through the connecting path in the flight direction, i.e., opposite to that of the normal flow, into the vacuum zone. The amount passed through depends on the form and strength of the pressure difference and is limited by the size of the connecting passages through the wing, so that the air masses passing through are fully used.

The action (see Fig. 1) causes, with the aid of the vacuum zone, a considerable retention of the lifting air, which, on collision with newly entering air forces increases the eddy stream for thrust effect. The boundary layer of the under-side is broken through by the flow to the vacuum zone, strong air forces are brought to play on the wing, which on their way to the vacuum zone, give up extra thrust and lift force. The outflow of this well-used air-stream follows under the outer covering of the wing, which not only prevents a disturbance of the vacuum zone, but the harmful effect of breaking the boundary layer on the top side is prevented to a considerable extent, which seems to diminish the eddies at the wing-tips. If we examine the structure of a bird-wing, we find the equipment for the above-described action confirmed. Firstly, through the streamlined form of even the smallest detail of the wing, and on closer examination, the arrangement explained above.

The wing consists of a keel of feathers growing out of the upper and lower arm, on which, after suitable free space for the passage through (Fig. 2) to the vacuum zone, the actual feathers are attached in their peculiar design and order.

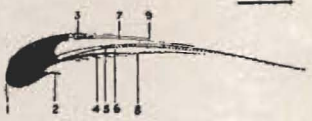
The porous (pervious) part of the feathers is covered with cover-feathers on the under-side, which grow out of the keel at a sharp angle and are considerably narrower in order to let the air through. These cover-feathers are connected by an impervious skin which just reached beyond the porous part of the main feathers and therefore forms a pressure zone between the main and under-feathers, in which the life-air penetrates, and after giving up-lift and thrust forces, flows away in the vacuum zone. This pressure zone is lined with light down in order to raise the resistance of the flow-through. The upper side of the wing is covered by several layers of cover-feathers which form the upper side of the wing to their roots. Thus between them is passage room (vacuum zone) through which the used air is led into the outer vacuum zone.

A limited porosity of the feathers prevents the formation of an isolated boundary layer so that the above-described action always remains active in flight. However, limitation on the removal of the

FIG. 1.

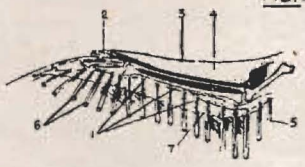


FIG. 2



(1) Membranous nose. (2) Thrust pocket (3) Framework, free, light down-covering. (4) Nonporous wall. (5) Beginning of main feathers. (6) Pressure zone. (7) Low pressure or vacuum zone. (8) Lower cover feathers. (9) Upper cover feathers.

FIG. 3.



(1) Wall. (2) Front pocket. (3) Membranous skin. (4) Thrust pocket. (5) Feather framework. (6) Cover-feather framework. (7) Commencement of feathers.

air-stream results in a further thrust effect with the damming-up of the air at the entrances. This is favoured by the special shape of the leading-edge of the bird-wing, forming the well-known 'widder-eddy' and the claw-pockets aid its utilisation in the cambered part of the wing-nose. Frictional drag through pushing off this eddy in the direction of the trailing-edge is avoided in the above action and the widder-eddy is continually renewed by fresh air made possible by the removal of used air to the upper surface.

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Full particulars from :—S. H. JONES, 82 Ravenhurst Road, Harborne, Birmingham, 17.

CORRESPONDENCE

SIR,

I was very interested in the article by Fred Hoinville, *Suggestions for Reducing the Cost of Soaring Flight*, in your January issue.

One part I was especially interested in was a paragraph which refers to a glider produced by the Japanese in 1937 with a weight of 50 lb., and I would be very grateful to anyone who can give me any drawings or information concerning this, or any similar glider.

I fully agree with Fred Hoinville that the present manufacturers appear to be concentrating on the production of more efficient sailplanes, which are getting more expensive, but are making available the best machines to our very proficient pilots, who have shown their capabilities at the recent international contests, but in the interests of the mass of the gliding minded people, we would welcome a ' Henry Ford ' of gliding who would produce a machine within the means of every gliding club, and also within the means of many of the members.

I am quite sure that the ownership of even a very humble glider would stimulate interest in the movement and be beneficial to both clubs and members, therefore we should build on Fred Hoinville's statements instead of tearing them to strips as he expects.

—**James B. Hardie, Tayside House, Newburgh, Fife.**

Ed.—Details of Japanese Tondo Kuro will be published next month.

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'B' .. 72
'C' .. 12
Silver 'C' 2
Gold 'C'

'B' CERTIFICATES

No.	Name.	A.T.C. School or Gliding Club.	Date taken.
7329	P. J. Holbrook	Scharfoldendorf G.C.	14. 5.52
7732	J. G. Dobson	No. 31 G.S.	20. 9.52
9679	W. E. Dench	No. 49 G.S.	26.12.52
9847	T. Patton	No. 203 G.S.	11. 7.52
11770	E. J. Ireland	No. 68 G.S.	25. 1.53
12652	M. H. Briggs	No. 26 G.S.	18. 1.53
13624	G. Brightman	No. 122 G.S.	14.10.51
13690	J. A. Hull	No. 1 G.S.	15. 6.52
14785	L. G. Hert–	H.C.G.I.S.	23.10.52
15654	J. P. McHugh	No. 26 G.S.	4. 1.53
15712	A. Partridge	No. 26 G.S.	25. 1.53
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15867	J. E. Wingate	Bristol G.C.	1. 8.52
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15869	R. C. H. Loveday	No. 168 G.S.	23.12.52
15871	J. F. Collier	No. 146 G.S.	12.10.52
15872	A. A. Daye	No. 146 G.S.	4. 1.53
15873	R. E. Thompson	No. 168 G.S.	25.12.52
15874	J. R. Rose	No. 24 G.S.	9.11.52
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15887	P. G. McWhirr	No. 87 G.S.	1. 9.51
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15889	R. F. Dickens	H.C.G.I.S.	4. 1.53
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15896	A. H. Noon	London G.C.	28. 8.52
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15898	G. E. P. Pipe	No. 102 G.S.	21.12.52
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15900	E. W. Craddock	No. 166 G.S.	31. 7.52
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15902	C. R. Adams	No. 168 G.S.	24.12.52
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15904	K. I. Ward	No. 123 G.S.	18. 1.53
15905	T. Davies	No. 125 G.S.	21.12.52
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15908	B. P. Gale	No. 130 G.S.	23.11.52
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