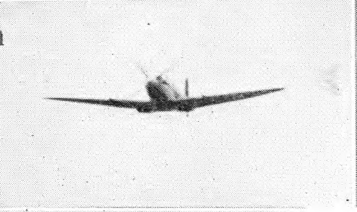
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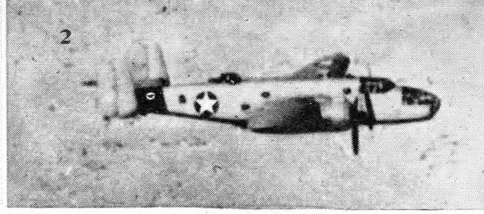
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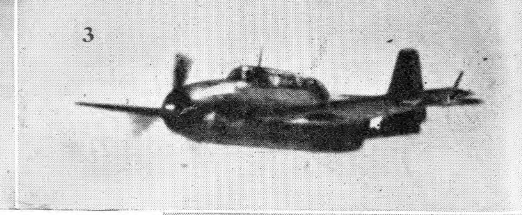
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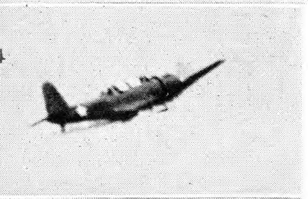
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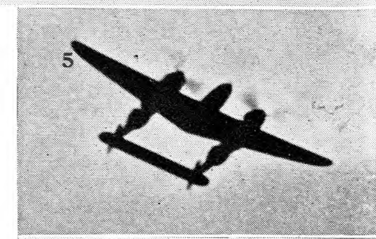
AS YOU SEE THEM

Twenty-four different types of aircraft, all Allied machines, for you to identify.

(Solution on page 23)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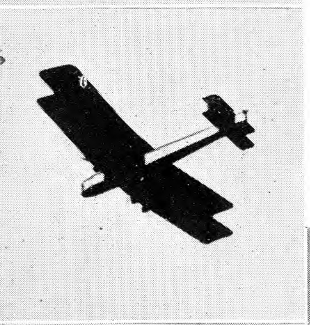
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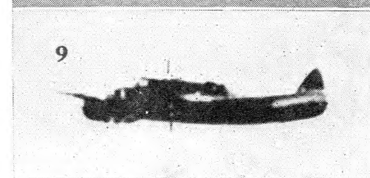
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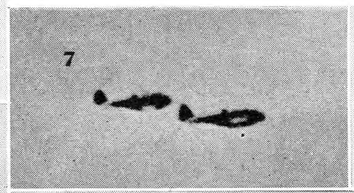
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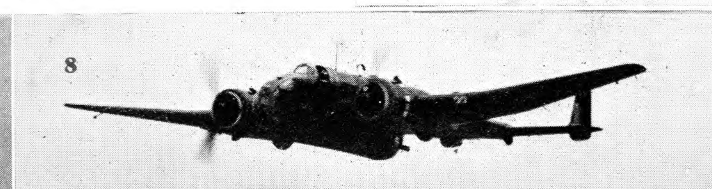
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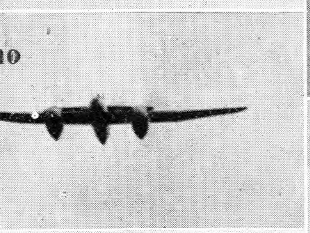
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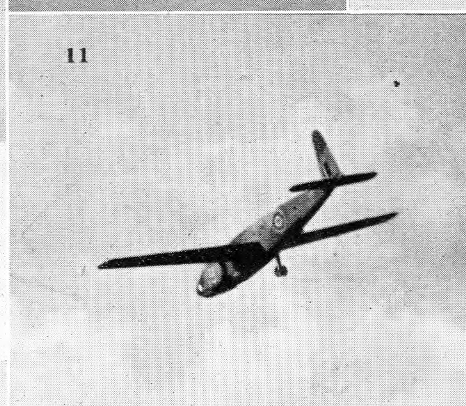
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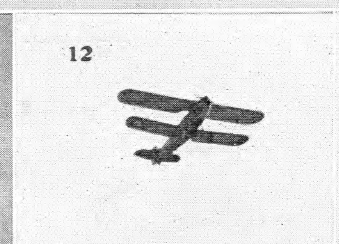
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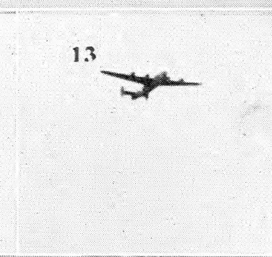
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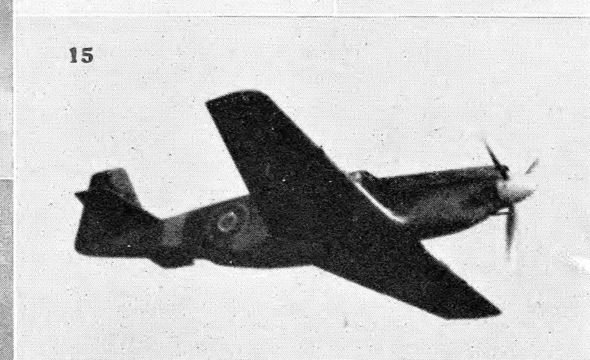
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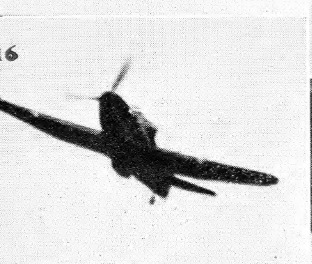
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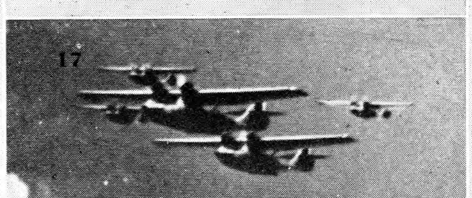
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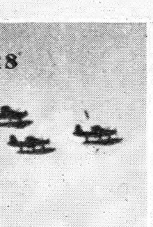
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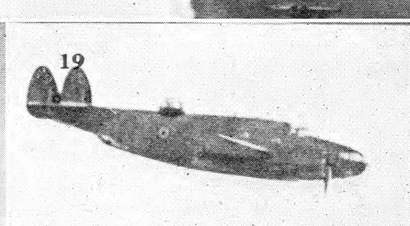
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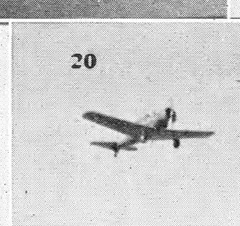
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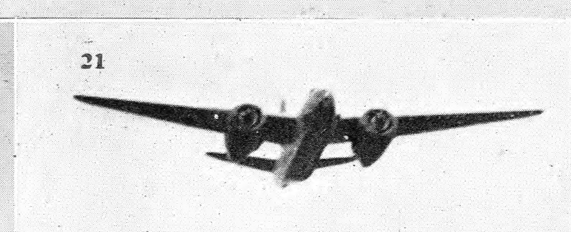
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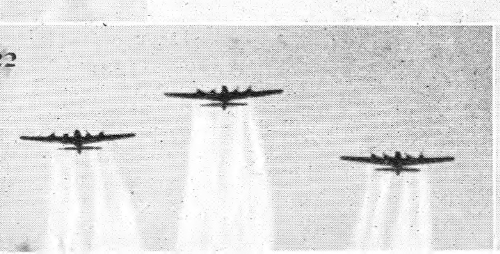
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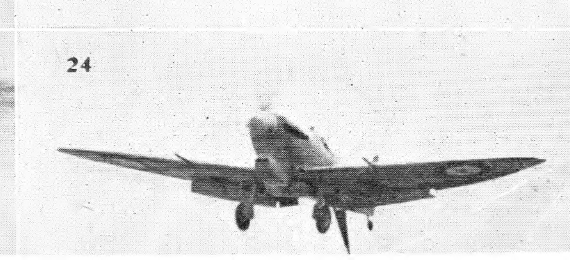
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AIR TRAINING CORPS GAZETTE

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APRIL, 1943
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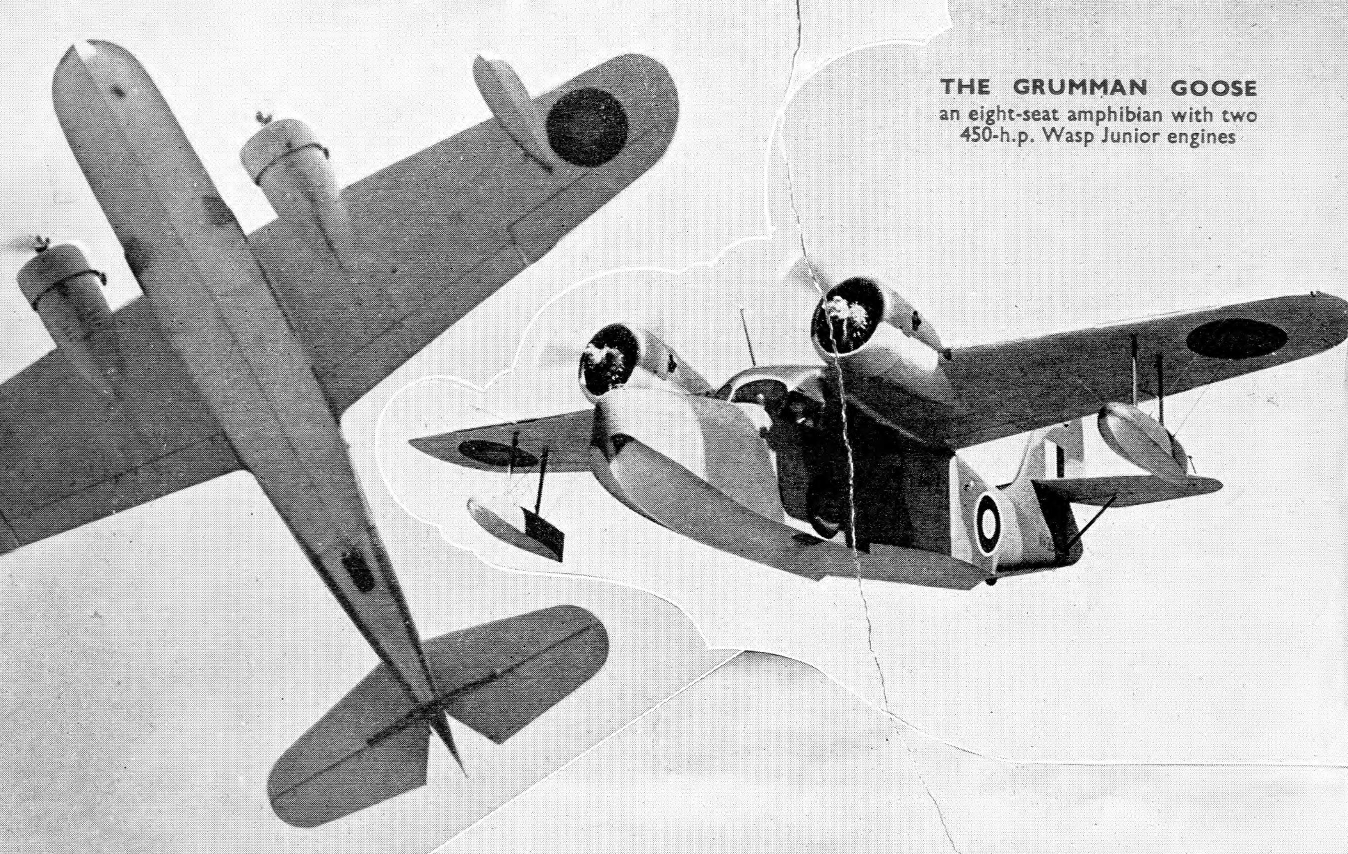
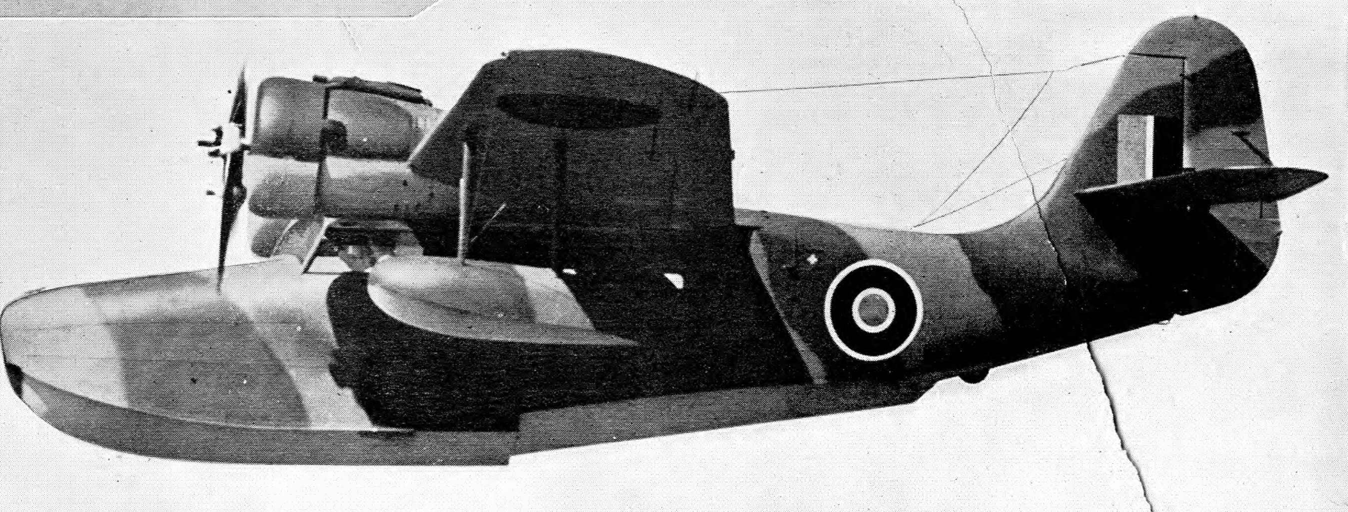
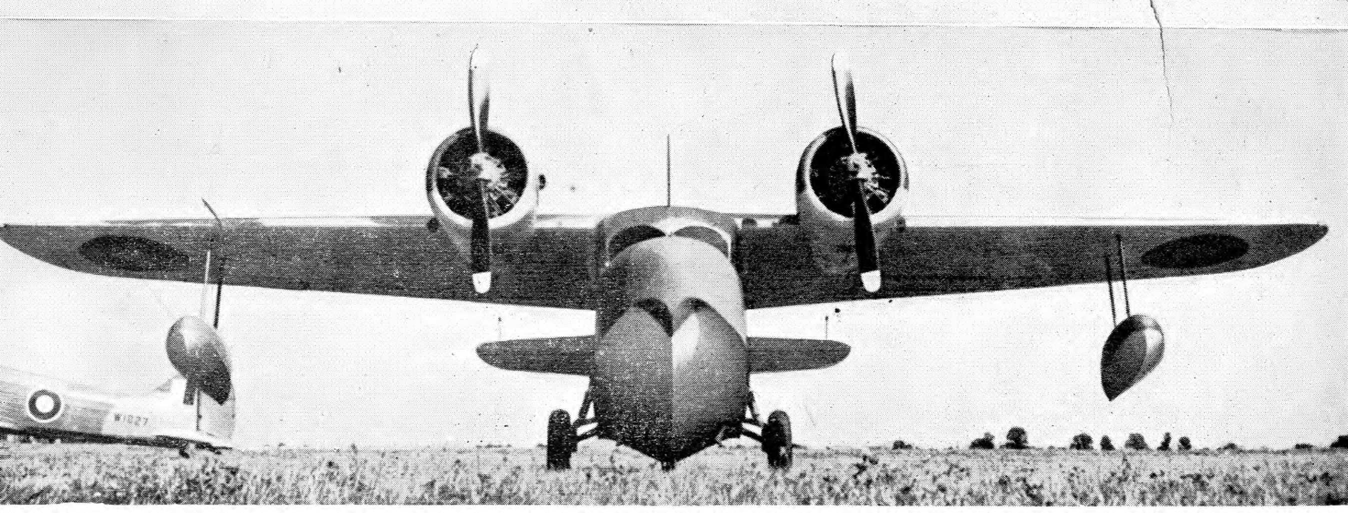


THE GRUMMAN GOOSE
an eight-seat amphibian with two 450-h.p. Wasp Junior engines





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APRIL
1943

AIR TRAINING CORPS GAZETTE

Edited by Leonard Taylor

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The Future of the Air Training Corps

THIS month is celebrated the quarter centenary of the formation of the Royal Air Force.

Under the stress and because of the needs of modern war the Royal Air Force was born twenty-five years ago, offspring of the Royal Flying Corps and the Royal Naval Air Service.

It inherited great traditions. It soon built its own great tradition which, nurtured in times of peace, has grown with the passing years to become the admiration and wonder of the whole world. You cadets who are privileged to join its ranks must be worthy of those who have gone before you and in honouring them you will be true to tradition which we are building in the Air Training Corps.

Wing Commander A. Macpherson-Rait congratulates Pilot Officer R. G. M'Innes, late of No. 62 (Broomhill) Squadron A.T.C.—the first Glasgow cadet to be commissioned as an air bomber.

Message FROM W. W. WAKEFIELD, M.P., DIRECTOR OF THE AIR TRAINING CORPS, TO AIR CHIEF MARSHAL SIR CHARLES PORTAL, G.C.B., D.S.O., M.C., CHIEF OF THE AIR STAFF, ON THE OCCASION OF THE TWENTY-FIFTH ANNIVERSARY OF THE FORMATION OF THE ROYAL AIR FORCE.

"On behalf of the Air Training Corps, I send to the Royal Air Force birthday greetings.

"The glorious deeds of the Royal Air Force inspire the young men of the Corps worthily to follow in the footsteps of those who have built and upheld its traditions.

"W. W. Wakefield,
"DIRECTOR OF THE A.T.C."

What is the future of the Air Training Corps? Is it going to continue? These are questions which I am now frequently asked.

Surely the fact that this month we commemorate the twenty-fifth birthday of the Royal Air Force is the answer.

After the last war the Royal Air Force did not cease to exist, so why when this war is ended and victory is again won should the Air Training Corps stop at a time when the world is entering on the Air age? The Sea Cadets were started in 1859, just when the age of steam at sea was in its big expansion. They are still flourishing.

If ever there was a need for the Air Training Corps, surely it will be in the years to come to provide that flow of eager, airminded young men well grounded in the early stages of flying and manning aircraft, not only for the protection of this Empire, but also to man that great air transport fleet which we are all convinced must be built up and maintained if this country is to remain in the forefront of world commercial activity. Founded in war in the hour of the country's greatest danger, the Air Training Corps is now providing men for the Royal Navy and the Royal Air Force of that quality and quantity which cannot fail to drive the enemy from the skies and to bring us that absolute victory in the air without which our ships at sea and our armies on land cannot get victory. It is therefore only right to expect that in the years of peace as in the years of war the Air Training Corps will not fail to provide opportunities for our young men to prepare themselves to play their part in the great Air age which is now with us.

W W Wakefield

DIRECTOR, AIR TRAINING CORPS

Your FIRST FLIGHT

By MICHAEL GRAY

I HAVE just finished a tour of duty as a flying instructor at a "Grading" E.F.T.S.

There were continuous courses of pupils. Often in the morning it was "Cheerio, all the best"; then "Right. This is a Tiger Moth . . ." The work lacked the glamour of operations, but was none the less interesting. Nearly all the pupils strove their utmost to get off solo in the allotted time. Perhaps the best part of our job lay in working hard with a chap and seeing him make a good circuit on his own, but sometimes there were disappointments when a good man just failed to make the grade. While that by no means debarred him from further pilot's training it naturally caused regret. The more so since an instructor often knew that that small margin might have been overcome had the pupil paid just a little more attention, right from the start, to some small but very important details.

Arrival

Now imagine you, Cadet Blank, finished with the rigours of I.T.W., have just arrived at an E.F.T.S. Here is some informal advice that may be of some help.

To start with, you will probably have a little time to yourself to unpack, get a meal and sign arrival reports. When you have done this, get hold of a senior pupil or ground engineer and go across to a Tiger Moth or a Magister, in the hangar or on the tarmac, and ask him to show you briefly round the aircraft, paying particular attention to the cockpit layout, inter-communication connections and method of strapping yourself in. Then sit in the rear cockpit for a few minutes and try to acclimatise yourself so that you will know where things are in the air. Your instructor, of course, will go over all this in greater detail, but this preliminary check will help you gain the maximum benefit from your first "air experience" flight. Furthermore, if you seem at home in the air you may get a little dual then, instead of waiting for the second trip; which means precious time saved.

See to Your Kit

During your first evening at the school unpack your flying kit and give it a final inspection, paying particular attention to the helmet and goggles. The helmet must be a good, comfortable, firm fit all the way round your face. The goggles should lie comfortably and snugly over your eyes. Make sure that no part of the bracket mountings of the latter obscures your vision. If you have any doubt about these items report to the clothing store immediately after morning parade and request their exchange—you will not need a voucher. It is no use at all you saying "Heck, this is good enough," if you are uncertain; because when you get in the air you will have quite enough on which to concentrate without the additional handicap of the slipstream jerking at your eyes or ears.

When you report for flying do not wear more kit than is necessary. Except on a very cold day an outer Sidcot should be ample. Those soft, brown flying-boots will greatly enhance your appearance, but leave them off—unless there are genuine zero outside temperatures. Some instructors like their pupils to wear gym shoes in the air, particularly in a Tiger Moth, because it is so important to appreciate the different "feels" of the rudder as soon as possible. Incidentally, scarves are not issued, but you will probably need one.

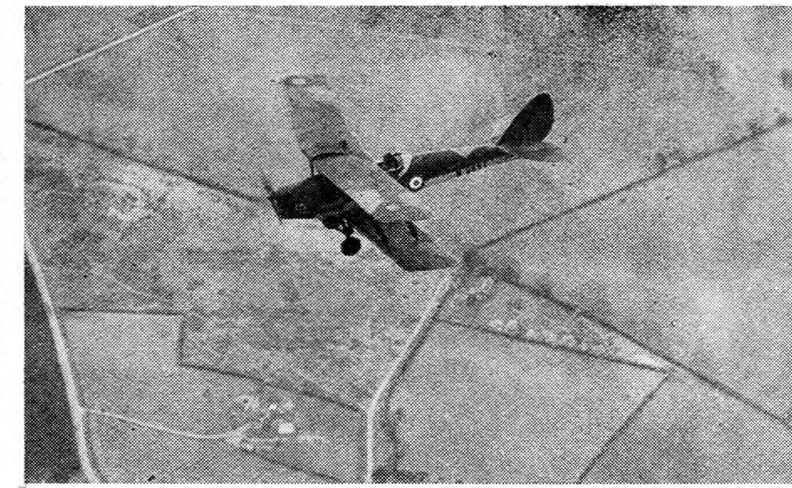
Your First Trip

Unless you are one of those fortunate people with lots of hours in their log-books, your first few trips may seem exciting and strange. Bumps may shake you a little, but they are really nothing to worry about. Try to imagine that you are part of the aircraft, and relax physically, never jerking or tensing. Of course, stay very alert mentally.

Lay off the beer during your initial flying training. You may see one or two people, older than yourself, who drink with seemingly easy indifference and suffer no after-effects. Never follow their example. Pupils who report for flying suffering from a hangover deserve to receive a telegram from Goering thanking them for making his job easier.

After every flight always make sure that you understand exactly what you have been doing, and why. If you have the slightest doubt over any point—however small — report to the instructors' room and ask for your instructor. By getting his first-hand advice you are making his task easier and helping yourself. Go there right away, and do not dart off for a cup of tea, thinking soothingly that you will look the matter up in the evening.

A word of warning. Never "natter" just for the sake of appearing keen. That is a number-one size "Black."



On top of the world. An R.A.F. cadet on his first solo flight over the green chequered countryside of England.

Keep Busy

Instructors these days usually have more than one pupil, so you will probably spend a fair amount of your flying sessions on the ground. Now, this is most important: never hang around. Otherwise, believe you me, you will start to get genuinely fed-up. You will not like it and it will not do you any good. Always find something to do.

Write up, in your own words, summaries of the various exercises. Make the notes as clear and comprehensive as possible. Try to compile them from memory as much as possible. Get your instructor to check the entries every day. This little individual effort can help you a very great deal.

Have a word with the engineers. You cannot know too much about your aircraft.

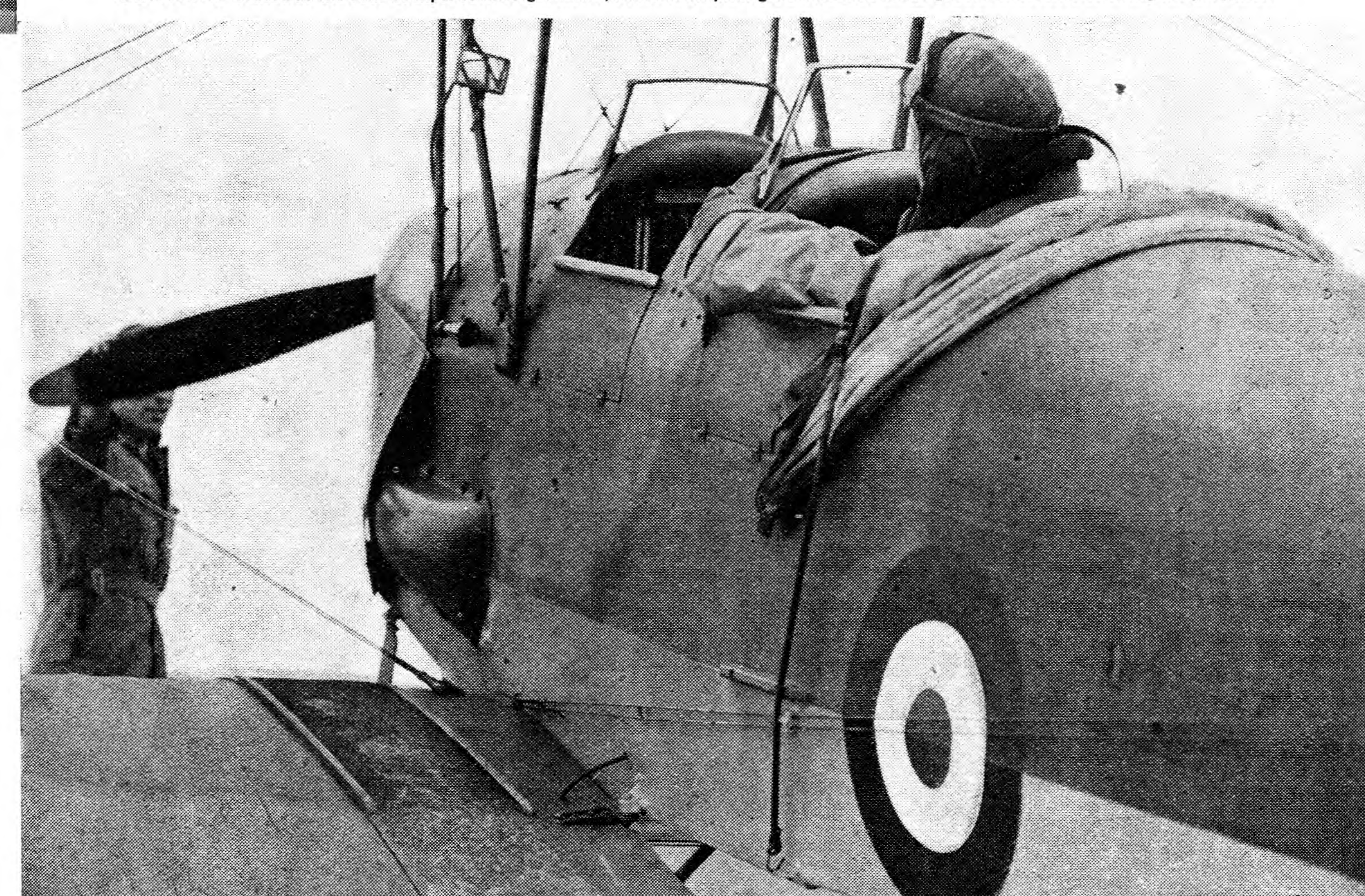
Read up the various Air Publications.

Organise brains trusts on flying and current affairs.

Watch other aircraft landing, if possible standing in line with, and behind, their approach path and trying to gauge for yourself the "checking" sequence.

Taken one by one, these things seem small and superficial. But all too easily they can combine to represent the difference between a reasonable show and the flat-out maximum effort that we need to win this war. Remember them—follow them out—and may you find yourself sitting in that aircraft watching the instructor climbing out of the front cockpit and fastening up his straps, before turning to you, smiling, and saying those magic words: "She's all yours."

CONTACT. Seated in the rear cockpit of his Tiger Moth, the student pilot gives the O.K. to the ground mechanic to swing the propeller.



THE RIGHT KIND OF LINE SHOOTING.

Above: Cadets receive instruction before their first flight. Below: Wing Commander Kingcombe, D.S.O., D.F.C., instructs pupils at a course of instruction for squadron leaders.

Shooting a Line

by Captain W. E. JOHNS

A LITTLE while ago a man, not a member of the Royal Air Force, caused some mischief, and got himself into trouble, by stating that he had been on a bombing raid to Germany, when in fact he had not. The story was a sublime example of what is known in the Service as "line-shooting," or "shooting a line," in its most unpardonable form; but as line-shooting has many facets it is a good thing for a prospective recruit to know what is and what is not permissible.

The Saving Grace

To start with, line-shooting can be put into two broad categories—harmless and pernicious. Let us deal with the harmless variety first. Generally this is a story told for entertainment. The narrator does not expect to be believed—nor is he. Humour, usually introduced by flagrant exaggeration, is the saving grace.

Pernicious line-shooting is a story in which the *raconteur*, deliberately or by implication, probably actuated by vanity, tells a story for self-aggrandisement. This sin is most unpardonable when the story happens to be true. So nervous are most airmen of being dubbed "line-shooter" that it is almost impossible to wring the story of an exploit from them. And the more terrific the exploit the less likely are they to speak of it. Now let us return for a moment to inoffensive line-shooting.

A man who can "shoot a good line" is often a useful member of a mess. He is tolerated, even if he is not deliberately encouraged. He may tell the truth, or he may indulge in flights of fancy; it doesn't really matter. The more the credulity of the listeners is strained the greater the joy with which the story is received. It is not an uncommon thing for someone in a browned-off mess to say: "Let's get old So-and-so to shoot us a line"; or, "Old So-and-so has a marvellous line about this or that." The story is told, then, by invitation, for general entertainment. There is nothing wrong with this sort of line-shooting.

An Old Tradition

When we come to pernicious line-shooting we are faced with a more difficult problem. Hundreds of airmen have, in this war, had adventures so remarkable that, if the full story were told, it would strain credulity to breaking-point. For this reason the story is never told, and history is the loser. If the story is told, much may depend on *how* it is told. The narrator is fairly safe as long as he does not tell the story in such a way that it reflects credit on him. He may boost the skill and valour of his comrades as high as he likes, but if he so much as hints that he, too, has these qualities, he promptly becomes a line-shooter of the worst sort. Which is why most fellows err on the side of understatement. A British pilot who has just had the most hectic scrap of his career, when asked what sort of day he has had, is quite likely to answer: "Fair," or "Not bad."

This form of understatement has been going on for so long that it has become a tradition. The Naval Records of 1813 provide a classic example. On June 1st of that year the British frigate "Shannon" (Captain Philip Vere Broke) fought one of the most bloody duels in naval history with the U.S. battleship "Chesapeake" (Captain Laurence). Captain Broke recorded the affair in these words:

"June 1. Off Boston. Moderate.
N.W. W.(rote) Laurence.
P.M. Took Chesapeake."

No wonder our records are sadly lacking in detail.

Inverted Line-Shooting

There is another angle to line-shooting, more important than ever in these days of international comradeship. To other nations our passion for understatement (which is really a kind of inverted line-shooting, or so they allege) is worse than orthodox line-shooting. Realists like the French do not like it, because they suspect a sinister motive behind such self-effacement, which, they say, isn't natural.

This can lead to trouble, because it is an unfortunate habit of ours to judge other people by our own standards. Not only do we decry what *we* do, but we protest when other people say frankly what they have done, when it is something to be proud of. We sniff and say these people are line-shooters. Which is not fair. Worse, it gets us a bad name. Other nations just don't understand it. Let me give you a simple, a personal, example.

One day I was lounging at the tennis courts at Monte Carlo when a young Frenchman, a stranger, came up and asked if I would play him a set. I agreed. He said: "How do you play?" I answered casually: "Oh, just fair." Said he, frankly: "All right. I'm a strong player. I'll give you fifteen in a game."

As soon as we started playing I knew I had let myself in for trouble. For I had lied—or at least, I had been guilty of avoiding the truth, which was that I happened to be a strong player and was, moreover, at the top of my form. Had I been honest I would have stated this, as my opponent did. His face grew black as thunder. After I had won the first three games he flung down his racket in a passion and demanded in no uncertain terms to be told why I had implied that I was a medium player. People were watching and I had made him look a fool.

Of course, I apologised, and explained that in my country it was not customary for a man to say he was first-class at anything, even though he might be a world champion. That was left for other people to say. To my Frenchman this was a lot of poppycock. He had told the truth about his game; I had lied with the intention of deceiving him—at least, that was how he looked at it. And there was much to be said for his argument.

See what I mean? Another Britisher would have understood, but this lad mentally classed me as a smart-alec throwing my weight about.

It Depends on Where You Were Born

The moral is, one should bear in mind that what constitutes line-shooting depends largely on one's company and the country one happens to be in. In most countries, in all Latin countries, it is in order for a man who has done something to be proud of to make no secret of it. You can't do that here. One might go so far as to say that in British military circles the degree of reticence imposed is in ratio with the cause for boasting. The bigger and better the show the less may you say about it. We hide our light under a bushel, but other people do not; so don't be in a hurry to use the term "line-shooter" in connection with a chap who happened to be born in another country.

Dead Reckoning

by Squadron Leader J. L. MITCHELL, D.F.C.

THE basis of air navigation is *Dead Reckoning*. We define this as the calculation of an aircraft's position from the factors, *course, airspeed, wind*, which have affected it since its last known *position*.

In this definition four terms have been employed which need explanation. Let us take the last one first:

Position

To define position we must have a system of reference which will enable us to refer to any point on the earth's surface. We do this in terms of Latitude and Longitude.

To refresh your memory of school geography, consider the earth as a sphere in the following diagram:

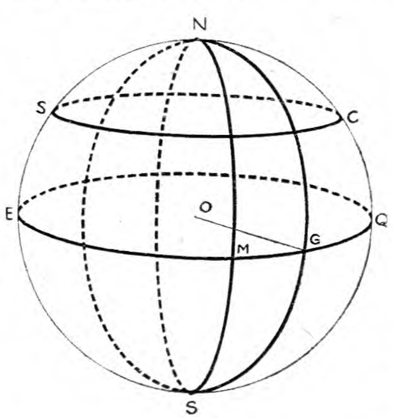


Fig. 1.

The earth spins on the axis through the *poles* (N. and S.). A *great circle* is a circle on this sphere whose plane passes through the centre. The *equator* (EQ) is therefore the only great circle whose plane is at right angles to the earth's axis.

The parallels of latitude are small circles (S.C.) whose planes are parallel with the equator. The *meridians* are half great circles terminated by the poles (N. and S.), for example, N.M.S. *The prime meridian* or *Greenwich meridian* (N.G.S.) was chosen as the reference meridian. All others are measured around the equator from this meridian 180° to the west and 180° to the east.

The meridians of longitude are graduated in degrees from the equator, 0-90 N. to the North Pole, and 0-90 S. to the South Pole.

We can now define the position of any point exactly. Look at the atlas. Greenwich is marked on the prime meridian, and on a parallel of Latitude 51° 28′ north of the equator.

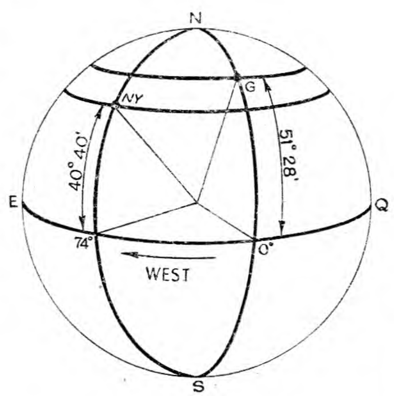


Fig. 2.

Again, New York is on a parallel of Latitude 40° 40′ north of the equator and on a meridian of Longitude 74° west of Greenwich. Its position is referred to as 40° 40′ North 74° 00′ West, Latitude being always expressed first.

Wind

Knowledge of the speed and direction of the wind is of utmost importance to the navigator. Its influence on an aircraft's progress is the hardest problem which the navigator has to solve. The Meteorological Service may forecast an estimate of the wind speed and direction over any route, but as both speed and direction will vary considerably during flight, the wind must be continually checked by the navigator. We shall deal thoroughly later with the methods of doing this.

For the present we should remember that the effect of the wind is similar to that of the river current on a boat. A wind ahead or astern will impede or advance the speed of the aircraft in relation to the ground. An abeam wind will not only affect the aircraft's speed, but it will also cause it to drift off its course.

Speed

The third explanation we need concerns *Speed*. An instrument called an *Airspeed Indicator* has been designed, as the name implies, to record the speed of the aircraft through the air. It can be calibrated to measure "airspeed" in terms of miles per hour or knots (nautical miles per hour) as required.

If an aircraft is flying at a speed of 150 knots against a head-wind of 30 knots, it will travel at only 150−30=120 knots in relation to the ground.

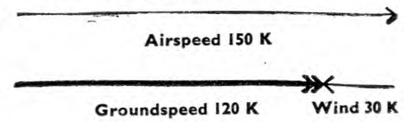


Fig. 3.

If the aircraft is flying at the same airspeed of 150 knots with the 30-knot wind *behind* it, the speed over the ground will be 180 knots.

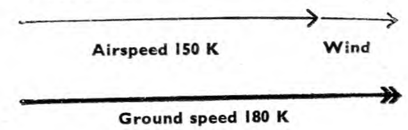


Fig. 4.

We have, therefore, introduced another type of speed. This is *"groundspeed,"* which is the aircraft's speed in relation to the earth.

Direction

To travel from one place to another we shall obviously need more than a sense of direction. We must be able to measure our direction accurately and continuously in relation to some fixed reference.

The fixed reference exists in the system of Latitude and Longitude lines on the earth mentioned in an earlier paragraph. It is most convenient to measure our direction in relation to the meridians.

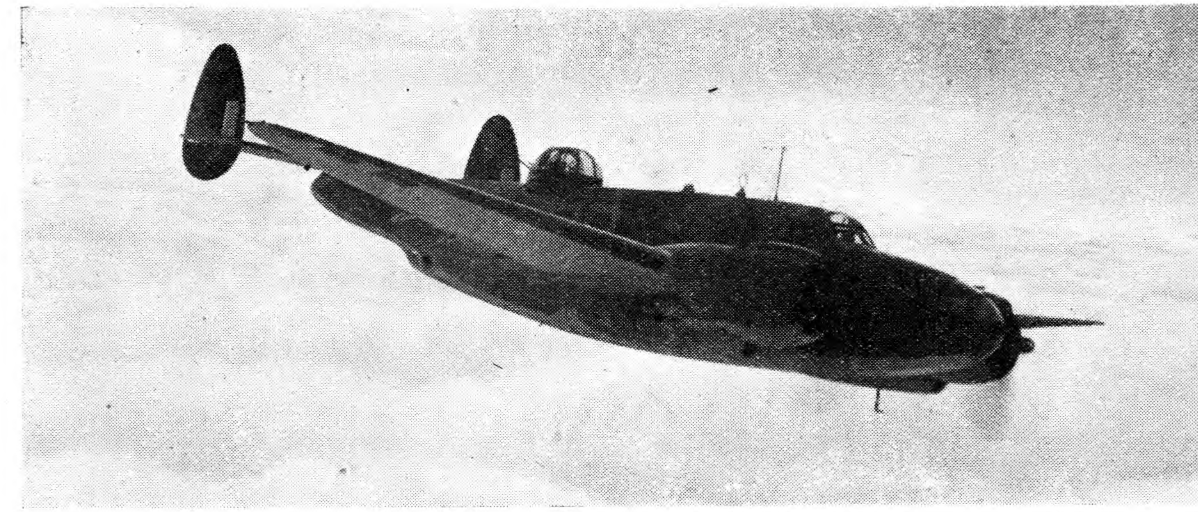
The *Magnetic Compass*, which was invented before Columbus, records direction in relation to a magnetic pole. Unfortunately, this does not coincide with the North Pole, because the magnetism of the earth, considered as a gigantic magnet, does not coincide with the earth's axis.

Fig. 5.

The North Magnetic Pole is somewhere in Hudson Bay. However, it has been possible by survey to measure the differences in direction between the Magnetic Pole and the North Pole all over the world. By the correct application of this difference we can tell at any place in which direction the North Pole lies in relation to the compass needle.

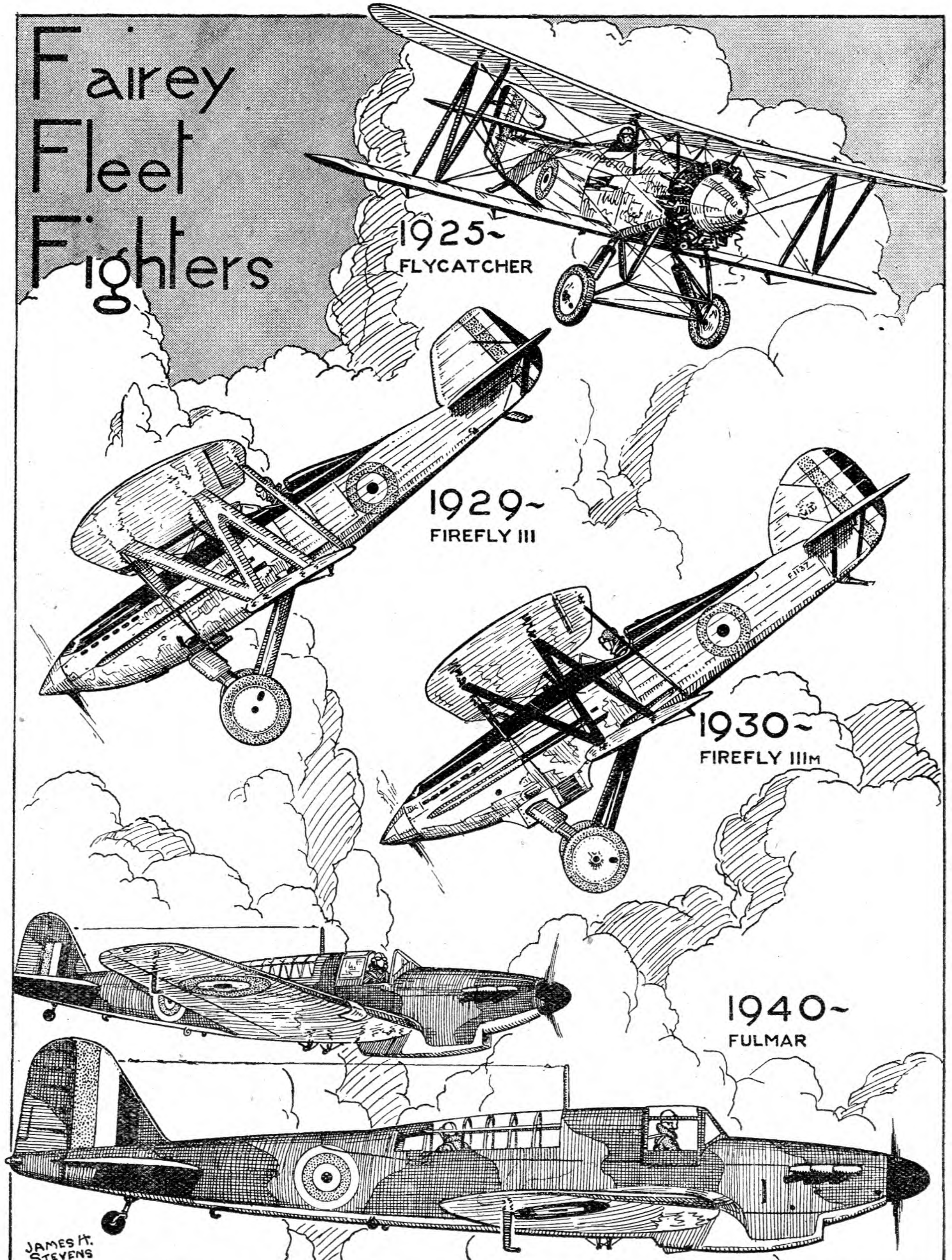
This difference is called *"variation."* To distinguish between the two types of direction we call those measured from the magnetic pole *"magnetic directions,"* and those measured from the North Pole *"true directions."*

We have now exactly defined our position; we can measure our speed and steer in any particular direction. In the next article we shall see how it is possible to measure the wind speed and direction which affects our course in flight.



Above: A Lockheed-Vega Ventura between two layers of cloud.

Below: A practical lesson in air navigation at the No. 1 Air Observers School, London, Ontario.



AEROBIOGRAPHIES No. IX

by C. G. Grey

SIR RICHARD FAIREY

Photo: H. J. Whitlock and Sons, Ltd.

SIR RICHARD FAIREY is definitely one of the big men of the aircraft industry, for—apart from the fact that he is reputed to be a millionaire—he stands about six feet six or seven inches in his socks. The latter fact had a lot to do with his early pre-eminence in British aviation.

Modeller

When I first met him in 1909 Charles Richard Fairey was a lecturer on electricity at Finchley—the Polytechnic, I think—and in his spare time he studied the theory of aerodynamics, especially inherent stability, for in those days whenever an aeroplane turned round the pilot was on the verge of a sticky death. So Dick Fairey made elastic-driven models, of the "flying stick" type, and discovered by trial and error how to make them stable in turning and landing. Also, he won a lot of model-flying competitions, somewhat helped by the fact that his models started a foot or more higher than did anybody else's.

Works Manager

His interest in stability, expressed in letters in the old *Aero*, drew the attention of Mr. J. W. Dunne, then a subaltern in the Army. Mr. Dunne had been experimenting with an inherently stable glider at Blair Atholl—in deady secret, guarded by the fierce Atholl Highlanders. Dunne then built a power-driven biplane at the Aero Club's marsh aerodrome at Leysdown, in the Isle of Sheppey, and when the Club, and Short Bros., the Club's engineers, moved to Eastchurch, Dunne moved too. And soon afterwards Dick Fairey joined him, as works manager, to build a bigger and better biplane.

There young Fairey became friendly with the Shorts and with the naval officers who went there to learn flying after Eastchurch became the regular flying-school of the Naval Wing of the Royal Flying Corps. And in about 1912 Dick Fairey became works manager for Shorts.

Proprietor

In 1915 a financial group wanted to form an aircraft company, and Dick Fairey was invited to be works manager. When he saw how easy forming companies was he dropped their proposition and formed the Fairey Aviation Co., Ltd., on his own—a very shrewd piece of business, for he knew all the R.N.A.S. engineer officers, who were the only market he wanted, and they knew that he could deliver the goods. So by the end of 1918, when the war stopped, he was making float-planes by the hundred, and had built two large flying-boats as well.

On Armistice Day he pushed all his aircraft into one section of the factory, and in a week or two was going full blast on cars. But he saw the car slump coming in 1921, and promptly pushed the car bodies out of the way, and expanded his aircraft output—for in the meantime he had been doing valuable experiments with landing-flaps, take-off flaps, tail-trimmers and amphibian floats.

Designer

Then he started on a new line. When the Air Ministry issued a specification for a new type—fighter, two-seater, torpedo machine, or anything—Fairey and his design staff used to sit down and design a machine to beat the specification.

Perhaps half a dozen other firms would enter for the design competition; the designs, to be approved by Farnborough and the experts, would take a year; and the judging would take a year. Then the two or three best-liked designs would be chosen and the firms would be told to build samples (or prototypes). That took another year, and the trying out and flying tests took another year. Then the designers of the two best would get orders for perhaps 25 each, to equip a couple of squadrons, and that meant another year, making five years so far. And then an order for perhaps 100 would be given, and the type would go into squadron use seven years after the specification.

Hustler

Anyhow, in a year Fairey would have his prototype Private Venture (P.V.) built. In less than two years he would have it tested and all the "bugs" flown and blown out of it. And so, just when the Air Ministry were deciding which of the design competition machines were to be ordered as prototypes, Fairey would go up to the Air Ministry and say: "Look here, I've got a machine flying which beats your specification. Come and have a look at it." And the technical sharps and test pilots would go and look and say: "By Jove, so it does!" Then Fairey would say: "Well, hadn't you better have 50 or 100, just as stop-gaps, till your competition is decided? I can start delivery in six weeks." And the Air Ministry dared not say anything except "Go ahead!"

The result was that at one time there were more Fairey-built machines in the R.A.F. than of all other makes put together, and they were all good. The Fairey IIIDs of the 1920s, on wheels or floats, were grand to fly—a nice "old-gentleman's" machine, as one of our Air Marshals told me. The two-seat Fairey Fox of 1925-6, and the single-seat Firefly, both with U.S. Curtiss D.12 motors, were the most beautiful machines of their time, and none performed better. Moreover, the D.12 motor was the forerunner of the Rolls-Royce Kestrel, and the combination was the beginning of all the "Ever-sharp" noses on modern high-speed machines with liquid-cooled engines.

Knight

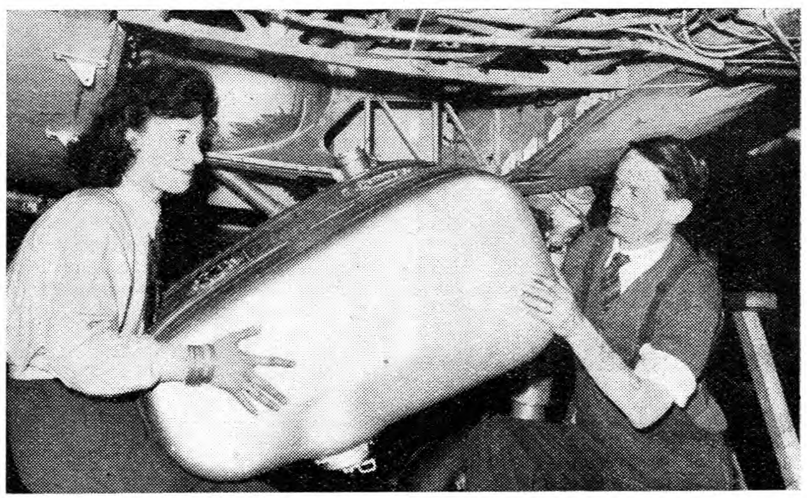
Early in this war Dick Fairey went to the States as head of the British Purchasing Commission (or should I say Acquisition rather than Purchase under Lease-Lend?). All my friends in the States, both U.S. citizens and British, tell me that he has done a wonderful job of work, and fully deserved his knighthood. Personally, I thought years ago that he deserved one for the progress which his competition forced on the aircraft industry and the Air Ministry. And when you think that about 35 years ago Dick Fairey was getting two or three pounds a week as a young lecturer, and had no private means, you see that one does *not* need an old school tie to come to the top.

NO engine, however efficient, can work effectively if the fuel supply is not functioning correctly. One of the basic requirements of a fuel system is that the supply of petrol must be in excess of the normal needs. Thus, in the event of a partial restriction in a pipeline or a fall in the pump output, the engine running will not be affected.

There are two types of fuel supply—gravity-fed and pump-fed. Except in the smaller type of aircraft, a gravity feed is not possible, because carburettors used on modern aircraft require the petrol to be supplied to them at a pressure of between one and four pounds, and that would not be practicable by gravity alone. In addition, the majority of modern aeroplanes carry their petrol tanks in the wings, and the fuel has to be pumped out.

On multi-engined aircraft, where several petrol tanks are fitted, it is necessary for each engine to be able to draw petrol from any tank, so that the tanks will empty at the same rate, and so that in the event of one tank being punctured and the petrol draining from it all the engines will continue to run. To enable this to be done, either all the tanks empty into one main tank or collector box, from which each engine fuel pump draws its supply, or the tanks are interconnected by a series of cross ducts or pipelines.

Fig. 1 shows a layout of a fuel system that might be used for a four-engined machine. There are four main tanks and an auxiliary tank, each supplying fuel to the collector box. In the supply line from each is a cock so that the flow can be cut off or turned on as required. The cock from the auxiliary supply would be kept turned off until such time as the auxiliary supply was required. From the collector box a supply of fuel is fed to each of the four carburettors, in each case passing first through a filter and the fuel pump, which draws the fuel from the collector box and feeds it to the carburettor. In this case the refuelling point feeds the collector box, which in turn feeds the four tanks, though very often the petrol is supplied directly to the tanks through a filler cap on each.



Tank being fitted to a small aircraft.

Tanks

The majority of tanks used now are made of aluminium or light alloy. Aluminium tanks are welded together, which makes a good solid construction, but are difficult to repair, because re-welding is necessary. Light-alloy tanks are riveted together by a special type of rivet called a de Bergue rivet. Fig. 2 shows a section of a de Bergue rivet in place. It will be noticed that, unlike other types of rivet, it bends down the metal which is being riveted together and forms a flange. This flange not only adds to the strength of the shear stress of the rivet, but also increases the strength of the material, because of the corrugated effect in a row of rivets. A strip of petrolite fabric is inserted between the two sheets of metal being riveted together to make a perfect joint.

The shape of the tank varies according to its position in the aeroplane. No two aircraft have petrol tanks the same shape. In some cases the tank actually forms part of the leading edge of the wing, and has to be shaped to aerofoil section. In other cases the tank lies just a little way back from the leading edge and is shaped differently. All tanks must have inspection holes on all sides, so that the tank can be thoroughly inspected inside when required. Baffle plates are fitted inside the tank at intervals of about a foot. These add to the strength of the tank, a very essential necessity when it forms part of the wing structure, and also prevents surging when the fuel is getting low. To allow air to compensate for the loss of petrol as it is used, a vent pipe is fitted to each tank.

Pipelines

Owing to the constant vibration set up, flexible hose is used whenever possible instead of rigid pipelines. It is built up by wrapping a petrol-resisting material round a wire spiral, and the whole is then encased in a wire-braided cover.

Gauges

An electrical type of contents gauge may be used. A float rises and falls with the level of the fuel, and operates a cog-wheel which in turn operates a contact arm at the top of the instrument and registers the amount of fuel on the gauge on the instrument panel.

Fuel Pumps

These are usually engine-driven, and draw the petrol out of the tanks and supply it to the carburettor at the required pressure. A relief valve is fitted to prevent an excessive pressure being supplied.

Fuel Cocks

These cocks regulate the supply of petrol from the tanks to the engine, and are always within reach of the pilot, so that he can turn the petrol on and off as required. If it is not possible to place the actual control cocks in the cockpit, they are controlled remotely, either by push-pull rods or Bowden cable. Another control to which the pilot must have access is the jettison gear, so that he can jettison the fuel whenever he wishes. It usually consists of a valve at the bottom of the tank, and is opened either by compressed air or a cable.

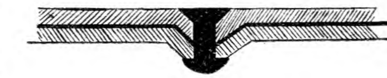


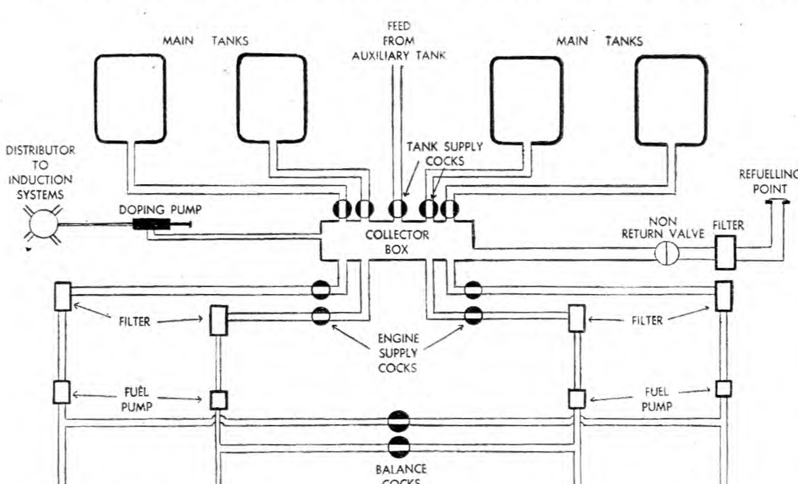
Fig. 2.
de Bergue rivet.

Filter

An essential feature of the fuel system is the filter, which the Air Ministry say must be fitted to all fuel systems between the tank and the carburettor. These filters differ with the type of the machine, but for maintenance purposes must be accessible so that the filter element can be taken out and cleaned.

Priming

It will be noticed in the diagram that a high-pressure doping pump is fitted. To start the engine a certain amount of fuel must be injected into the induction system. The pump draws fuel from the petrol supply and forces it along to a point where sprayers are fitted which atomise the fuel as it is forced into the induction pipe.



FUEL SYSTEM
Fig. 1.

First Course in Air Navigation

(1943.) By F. F. Crossley, B.Sc. Macmillan. 2/6. 90 pages. $7\frac{1}{4}'' \times 4\frac{3}{4}''$. Diagrams.

An elementary booklet in a handy shape giving an outline of basic navigation.

Astronomical Navigation

(December 1942.) By W. M. Smart, M.A., D.Sc., F.R.A.S. Longmans. 5/-. 120 pages. $8\frac{1}{2}'' \times 5\frac{1}{2}''$. Diagrams and charts.

An interesting book explaining very fully the theory of astronomical navigation. Professor Smart is an authority on astronomy, and his books on this subject are well known.

Although too advanced for most cadets, it should be of value to those studying for the First-Class Civil Navigator's Licence. The aircrew cadet might, however, find it a useful work of reference.

East of Malta, West of Suez

The Admiralty Account of the Naval War in the Eastern Mediterranean, September 1939 to March 1941. H.M. Stationery Office. 1/-. 65 pages. $9'' \times 6\frac{3}{4}''$.

A well-illustrated and well-written account of the Naval War in the Eastern Mediterranean, September 1939 to March 1941, revealing the amount of valuable work done for the Navy by its Air Branch.

Practical Morse

By John Clarricoats. Pitman. 1/3. 38 pages. $7\frac{1}{4}'' \times 4\frac{3}{4}''$. Diagrams.

A useful handbook to all undergoing instruction or instructing in Morse. Mr. Clarricoats knows his subject well and knows how to write about it, so he has been able to condense much valuable information and advice into these 38 pages.

Squadron 303

(August 1942.) By Arkady Fiedler. Peter Davies. 6/-. 116 pages. $7\frac{1}{4}'' \times 4\frac{3}{4}''$. 12 illustrations.

Deals with the important part played by the Polish Squadrons and individual Polish pilots in the Battle of Britain. A well-written record, revealing the dash and efficiency of the Poles. The Squadron brought down 126 German aircraft in that battle for the loss of only five pilots.

Is Bombing Decisive?

(February 1942.) By Captain F. O. Miksche. Allen & Unwin. 5/-. 101 pages. $7\frac{1}{4}'' \times 4\frac{3}{4}''$.

A reply to Major Seversky's book *Victory Through Air Power*. The author talks mainly in terms of continental war, and has little to say about sea power and transport. In opposing Major Seversky he is inclined to go to the opposite extreme. For instance, he says: "The Air Arm is incapable of forcing the decision by itself. This was convincingly proved by the Battle of Britain." Surely all that the Battle of Britain proved was that the British were stronger in air defence than the Germans in air attack? Then he says: "The night bombardment of Britain was discontinued on May 10th, 1941." The inhabitants of many of our coastal and other districts—Canterbury and Bath, for instance—when confronted with their ruined buildings will either have to disbelieve that or blame the mice.

Nevertheless, the book is worth reading, as it puts forth the soldier's viewpoint so emphatically.

Ships with Wings

(1942.) By Tod Claymore. Cassell. 7/6. 184 pages. $7\frac{1}{4}'' \times 4\frac{3}{4}''$.

A Coastal Command pilot who is the son of a colonel is in love with a nurse who is the daughter of a general. Another pilot of undisclosed parentage tries to steal the girl.

Around that rather "filmy" social background the author describes the work of a flying-boat station doing Atlantic patrol duties in Sunderlands and Catalinas. The work goes on, the plot unravels itself, and the reader may find interest in one or the other or both. The book is entertaining and the technical information is genuine.

Navigation

(February 1943). By J. C. Kingsland and D. W. Seager. Oxford University Press. 2/6. 95 pages. $7\frac{1}{4}'' \times 4\frac{3}{4}''$. Diagrams.

An elementary introduction to the first principles of navigation. The subject is treated lightly. The authors skip delightfully through the tussle of conversion angles and reach the interception problems after only four pages on D.R. navigation.

Wall Charts

Portland Designs Limited, Portland House, 32 Oxford Road, Manchester, 1, have produced a number of very fine wall charts of an average size of $40'' \times 30''$. The charts deal with navigation, electricity and magnetism, engines and gas precautions. The originals were designed by an A.T.C. officer for use in his squadron.

The prices are 2/6 to 3/- for paper copies, and 5/- to 7/6 for cloth-backed copies.

Although such material should normally be issued by the Air Ministry, many squadrons and individuals may wish to buy these for themselves. Those who wish to do so should get in touch with Portland Designs Limited at the above address.

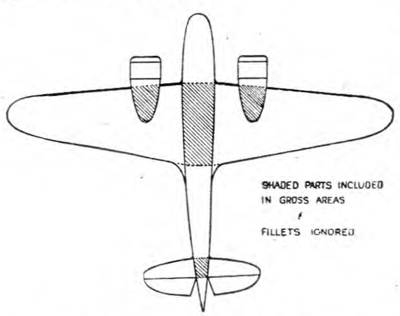
LOADS and LOADINGS AND OTHER TERMS

Defined by R. H. WARRING

MANY aeronautical terms and expressions are frequently employed loosely. In particular, the term *wing area* is subject to considerable misconception.

Wing Areas

When wing area is quoted it nearly always means *gross wing area,* that is, the total projected area enclosed by the wing outline on the plane of the chord, irrespective of whether certain portions are covered by such components as the fuselage, engine nacelles, etc. Avoiding the technicalities of the standard definition, the gross wing area, then, is the area enclosed by the plan of the wing. Where the wing is interrupted by the fuselage the bounding lines of this area are taken as the imaginary lines joining the leading edges and the trailing edges of the two wing halves, where these join the fuselage. Fillets are ignored. Thus gross wing area also includes the ailerons, flaps, etc., but ignores fillets or root fairings, and this is what is generally meant by the term "wing area."



The *nett wing area* is the gross wing area minus that area covered by the fuselage and nacelles, etc., and is thus generally less than the gross wing area in modern machines. It is sometimes, quite erroneously, called the "effective" wing area. This is quite a fallacy, as can be seen from the fact that the "covered" portion of a wing can, and does, contribute lift. Figures given for the efficiency of the "apparent" centre section of a mid-wing monoplane show that it may be up to 75 per cent effective, i.e. behave as that of an actual wing of 75 per cent of the "enclosed" area. This figure varies, of course, with the wing position, and is usually found by wind-tunnel tests.

Figures such as wing loading, etc., are then generally based on *gross wing area,* unless otherwise stated.

The horizontal and vertical tail-surface areas are defined in a similar manner. Thus the area of the horizontal tail surfaces is given by the area enclosed by the outline projected on the plane of the chord. Again no deduction is made for that part covered by the fuselage, the boundaries of the "covered" portion being defined as before and fillets again ignored.

Control-surface areas are measured in the same way, except that in the case of movable surfaces, such as the Frise-type aileron, where the front underpart projects forward of the upper "separation" line, this is ignored, and measurements taken from this upper "separation" or hinge line.

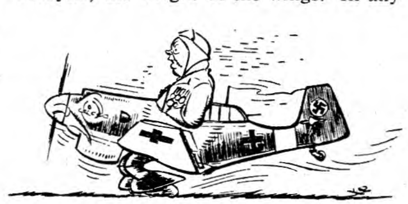
Airscrew Areas

The various defined areas of propellers or airscrews may also cause some confusion. The *blade area* is the developed area of the face of a single blade, ignoring the thickening of the shank and the hub. *The airscrew or propeller area* is the area of a single blade multiplied by the number of blades.

The *projected area* of a propeller or airscrew is the projected area perpendicular to the line of flight, i.e. side view, whilst the *projected blade area* is the projected area in the plane of the line of flight, i.e. head-on view. The *airscrew disc area* is the total swept area, i.e. the area of a circle having the same diameter as the airscrew. The *effective disc area* (not often employed) is the area of a circle having a diameter equal to that of the effective diameter of the airscrew. Under working conditions the effective diameter is less than the actual diameter, due to tip losses. A further definition that may be met with is the solidity of an airscrew or rotor. The *solidity* is the ratio of the total blade area to the disc area.

Weights

The *gross weight* of an aeroplane is the total weight when fully loaded. The *nett weight* is this gross weight minus some specific load. This load may be taken as the useful load, i.e. disposable weight, or, for the purposes of stress analysis, the weight of the wings. In any case, the specific weight subtracted is generally given.


"Gross Weight—Ultimate Load."


"Empty Weight."

The *empty weight* is the structural weight of the machine plus the power unit(s) and all fittings and accessories. The *dry weight* of the power plant is the engine complete with all accessory and ancillary drives, etc., exclusive of fuel and oil and fuel and oil tanks. The radiator system and coolant are included in the empty weight defined above.

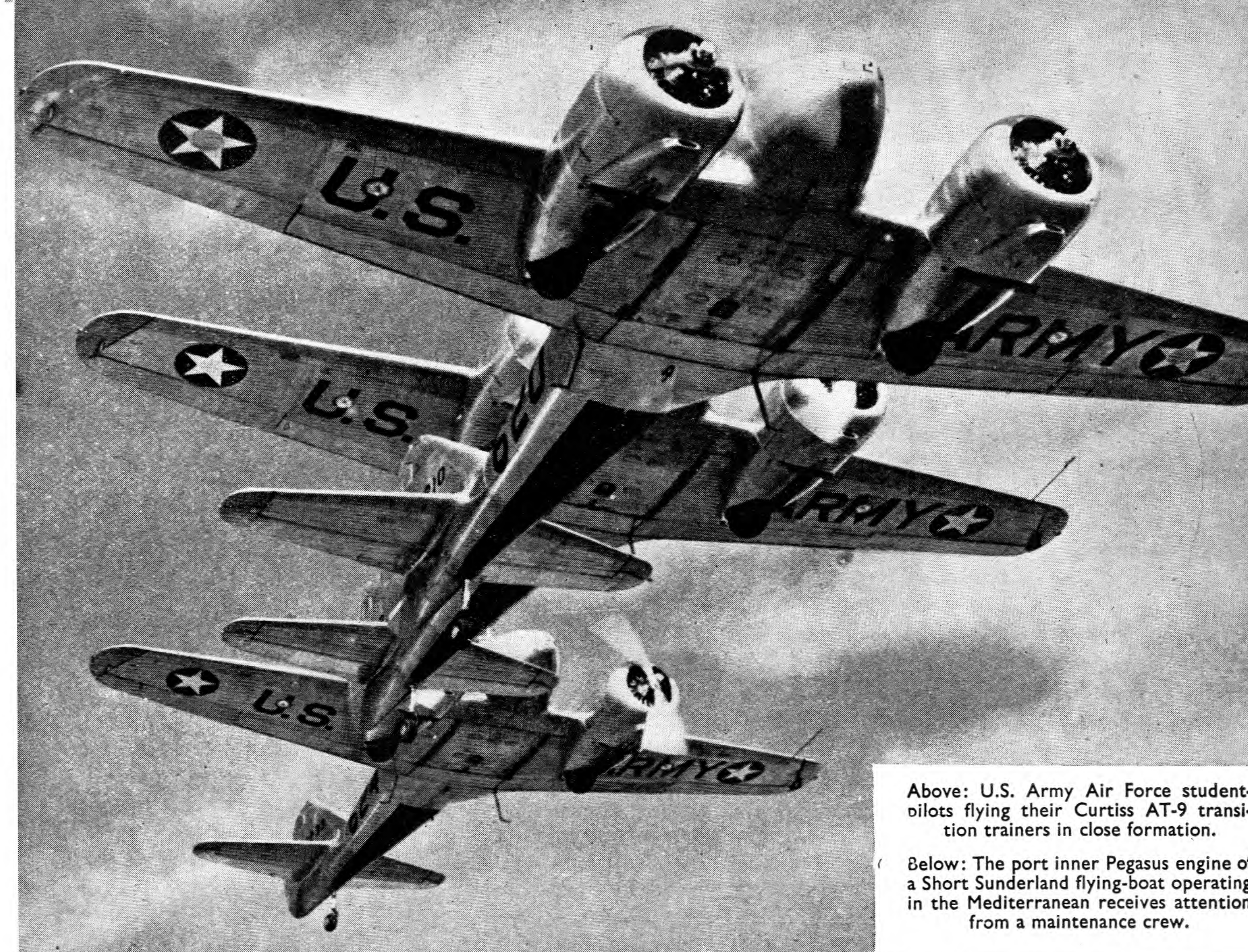
Loads

The *useful load* comprises the weight of passengers, crew, fuel, oil, baggage, portable equipment, etc., carried. The *pay load* is that part of the useful load—freight, passengers and mail—for which payment is made. The *ultimate load* is that load which, if carried, would result in the destruction of part or the whole of the structure. (A generalisation of aircraft design is that all parts of the structure should fail together. If one member is so much stronger than another when the loads they are designed to carry are the same, then the stronger member is probably wastefully heavy. There are, of course, exceptions to this rule.)

"Useful Load."

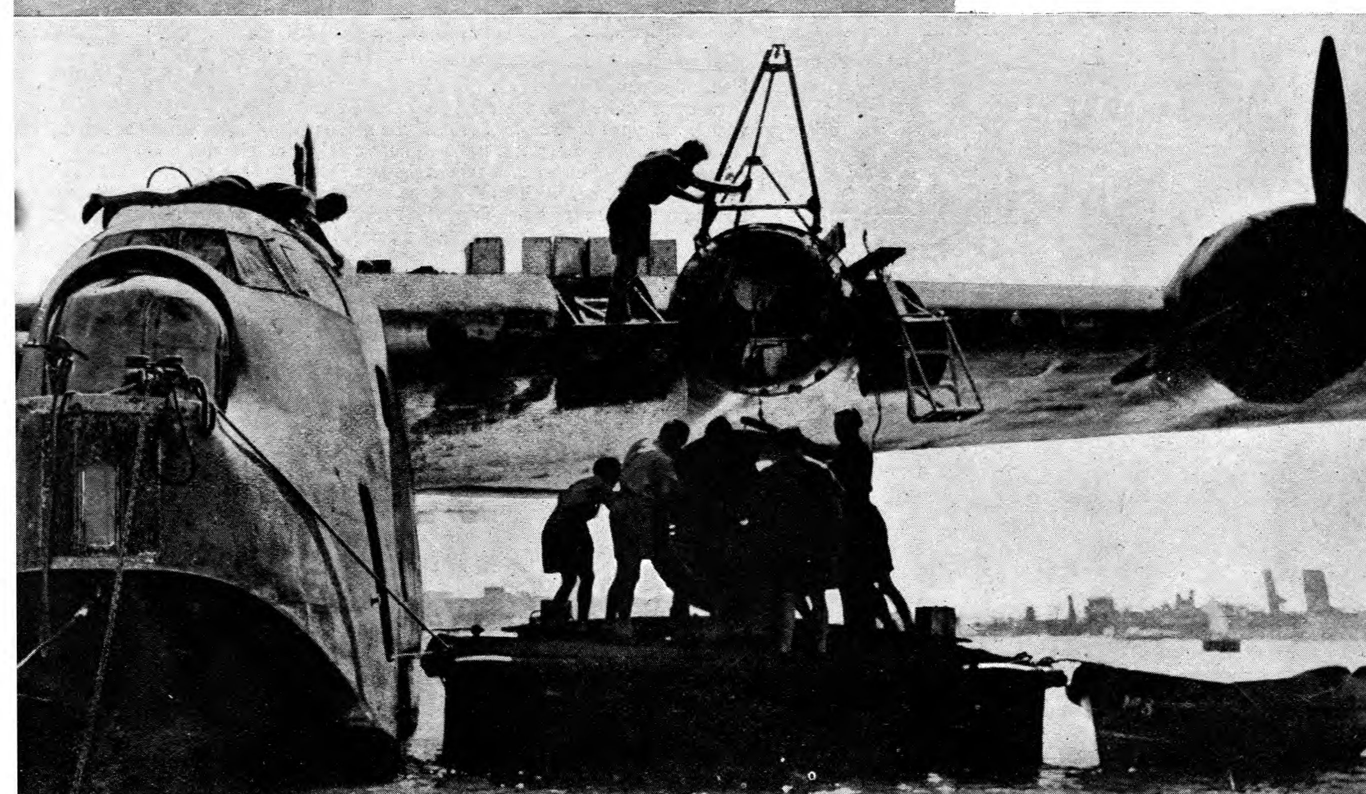
Loadings

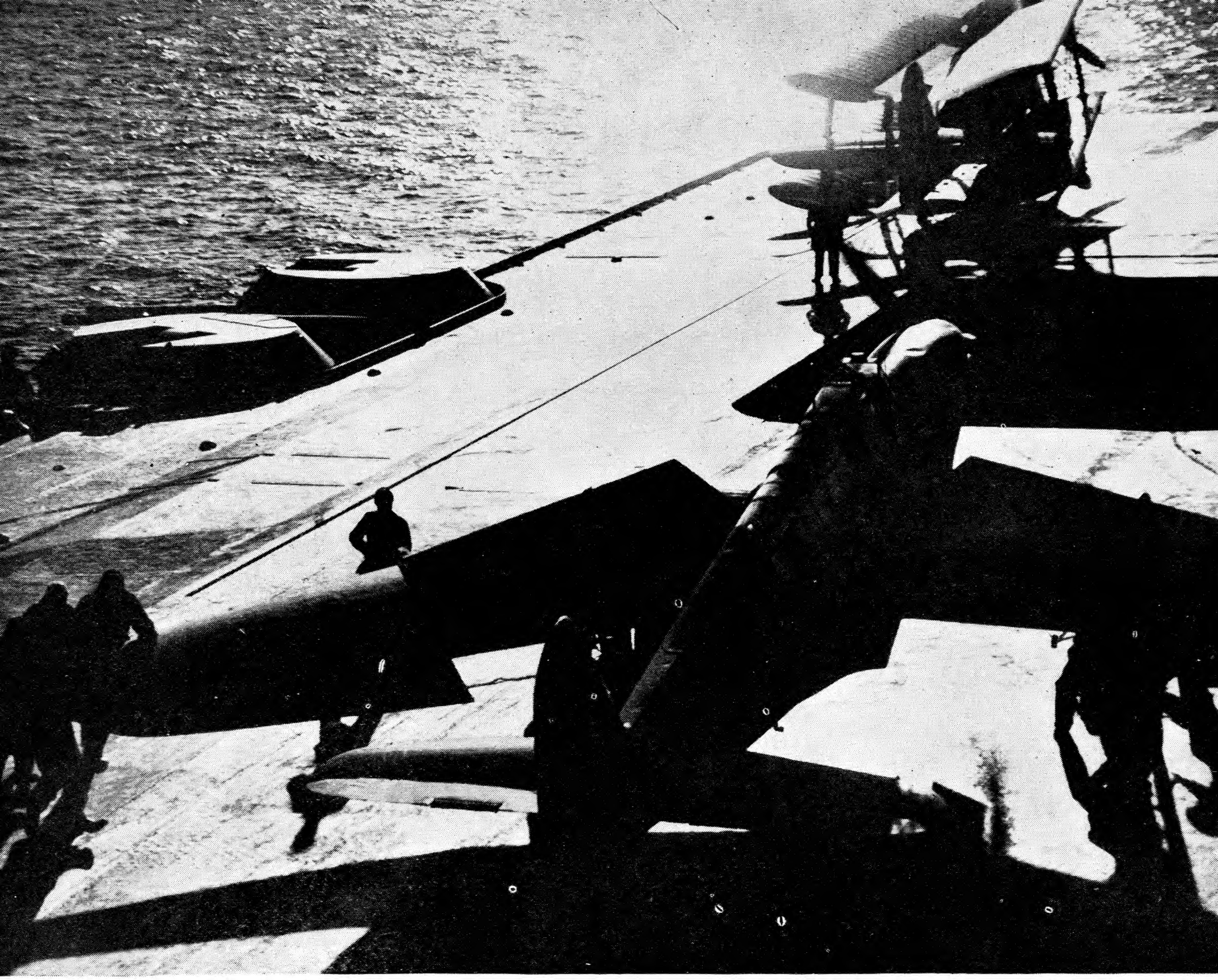
The *wing loading* is the gross weight of the aeroplane divided by the gross wing area. The power loading is the gross weight of the machine divided by the rated h.p. of the engine or engines. Finally, the *span loading*—this is the gross weight of the machine divided by the span (the equivalent monoplane span in the case of a biplane; but this question is too involved for discussion at this point).



Above: U.S. Army Air Force student-pilots flying their Curtiss AT-9 transition trainers in close formation.

Below: The port inner Pegasus engine of a Short Sunderland flying-boat operating in the Mediterranean receives attention from a maintenance crew.

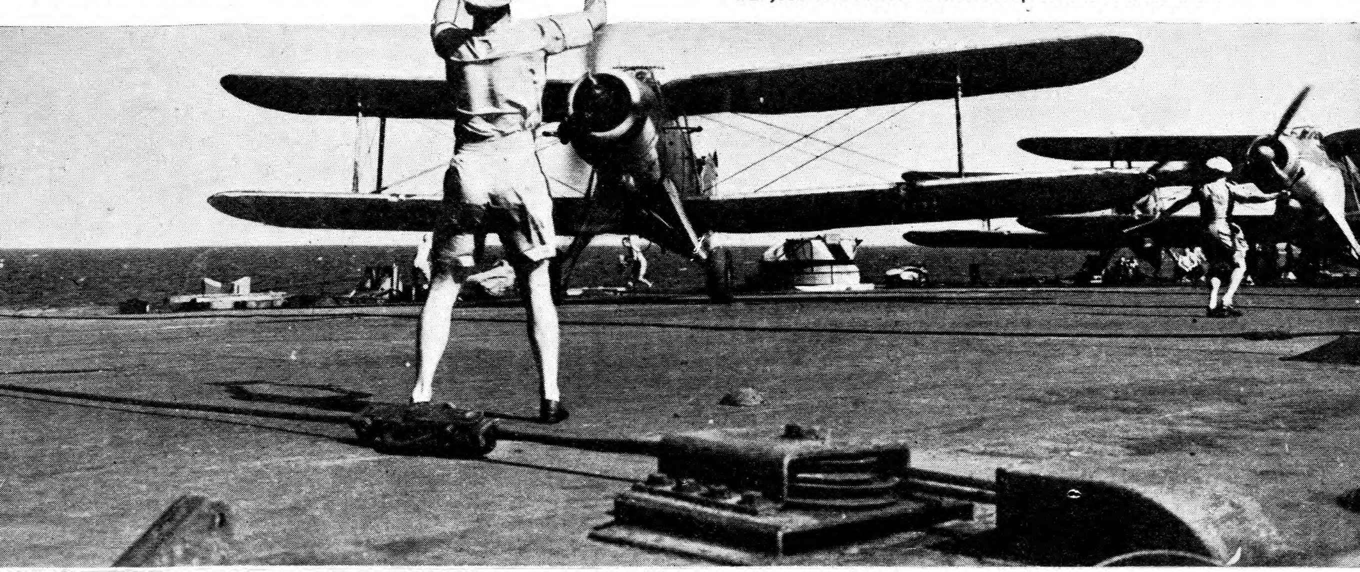


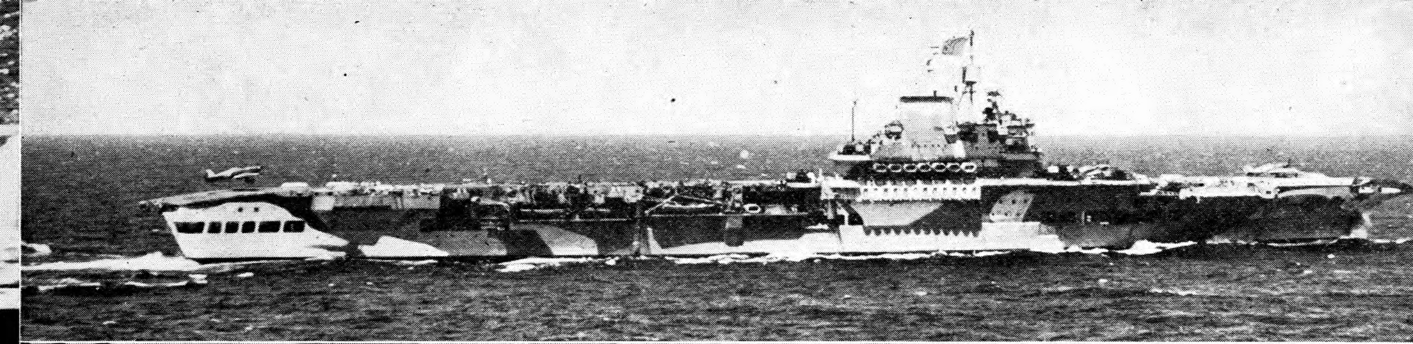


The Navy's Air Branch

The Air Branch of the Royal Navy, perhaps more widely known as the Fleet Air Arm, has been well in the public eye of late. Several authorities have been under fire, their critics accusing them of supplying the F.A.A. with poor types of aircraft. Some of the more widely known and used naval aircraft are shown here on their carriers.

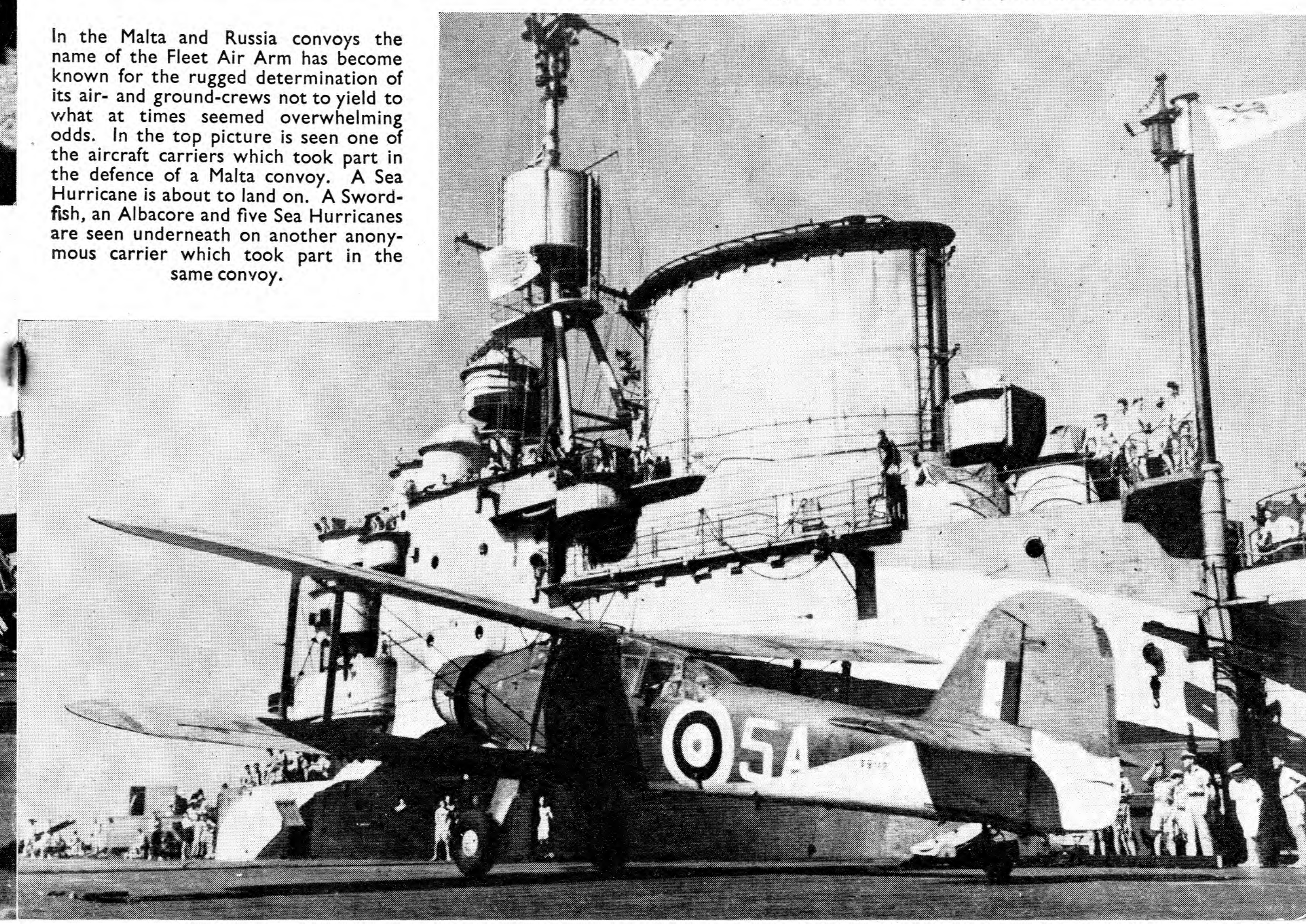
Above, a Fairey Fulmar two-seat eight-gun fighter is seen on the flight deck of H.M.S. *Victorious* with an Albacore torpedo-bomber in the background. Below, Albacores are being flagged off the flight deck of H.M.S. *Formidable*, a 27,000-ton carrier with a complement of 1,600 men.

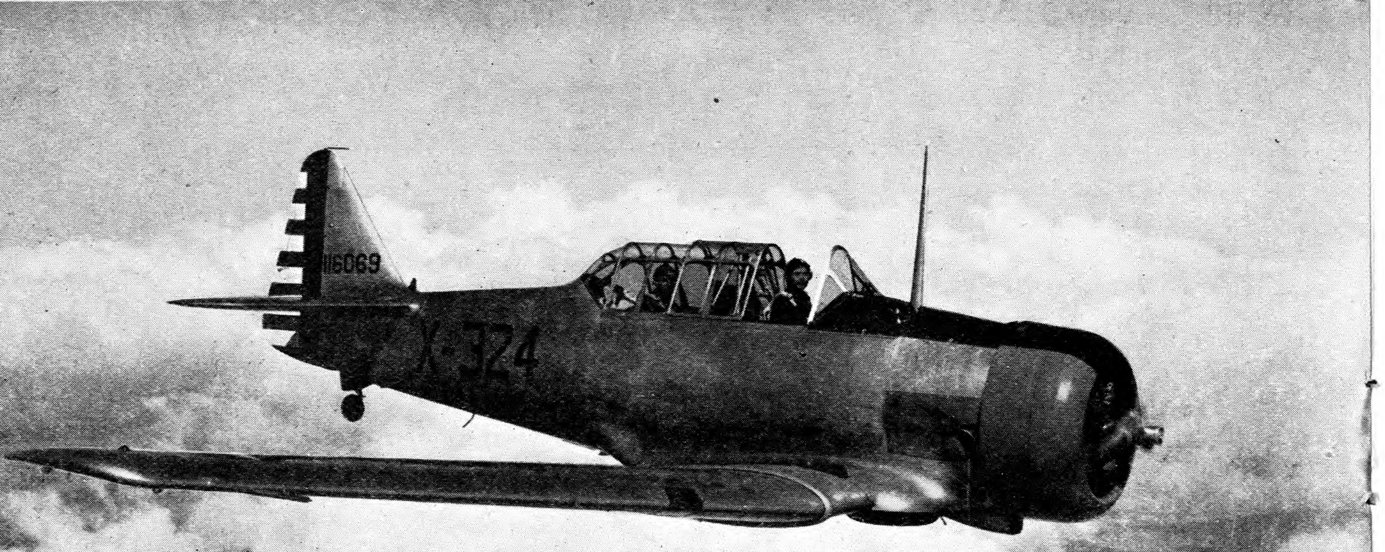




In the Malta and Russia convoys the name of the Fleet Air Arm has become known for the rugged determination of its air- and ground-crews not to yield to what at times seemed overwhelming odds. In the top picture is seen one of the aircraft carriers which took part in the defence of a Malta convoy. A Sea Hurricane is about to land on. A Swordfish, an Albacore and five Sea Hurricanes are seen underneath on another anonymous carrier which took part in the same convoy.

At the bottom of the page an Albacore is seen ready to take off from the flight deck of H.M.S. *Formidable*. On page 18 of this issue of the *Gazette* a naval officer tells something of the work of the Fleet Air Arm with its older aircraft. Now that more up-to-date aircraft are coming into service we may expect further victories.





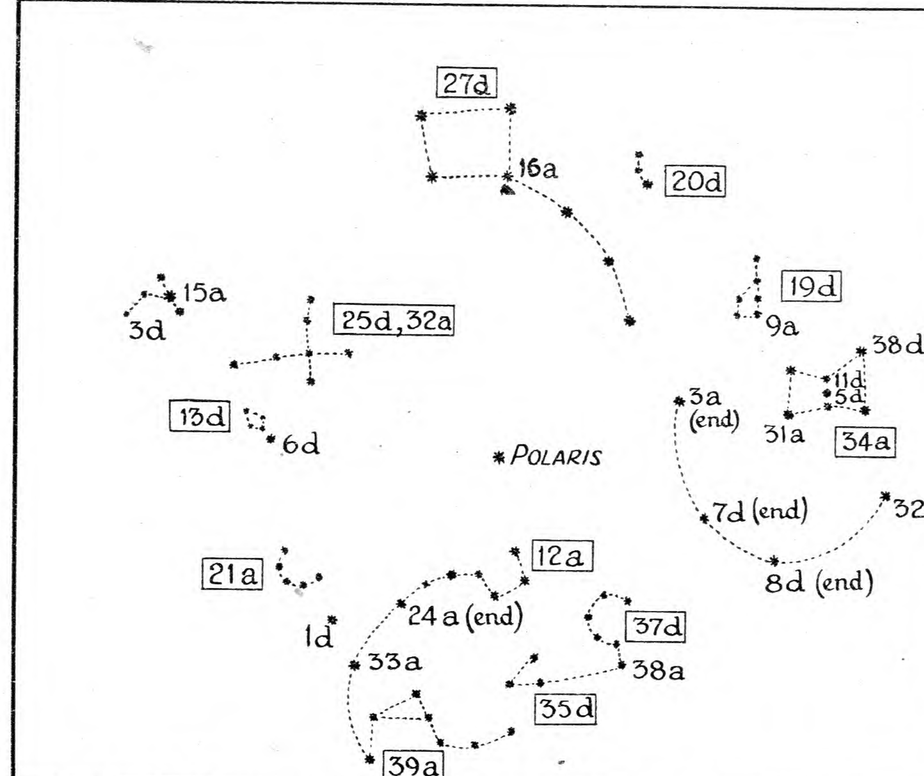
To-day, although by no means a strong air power, the Chinese Air Force is battering the Jap with bigger, better and faster aircraft. The Chinese Government has sent some of its pilot cadets to America to learn to fly on the types of machine they will use when they come back to defend their homeland.

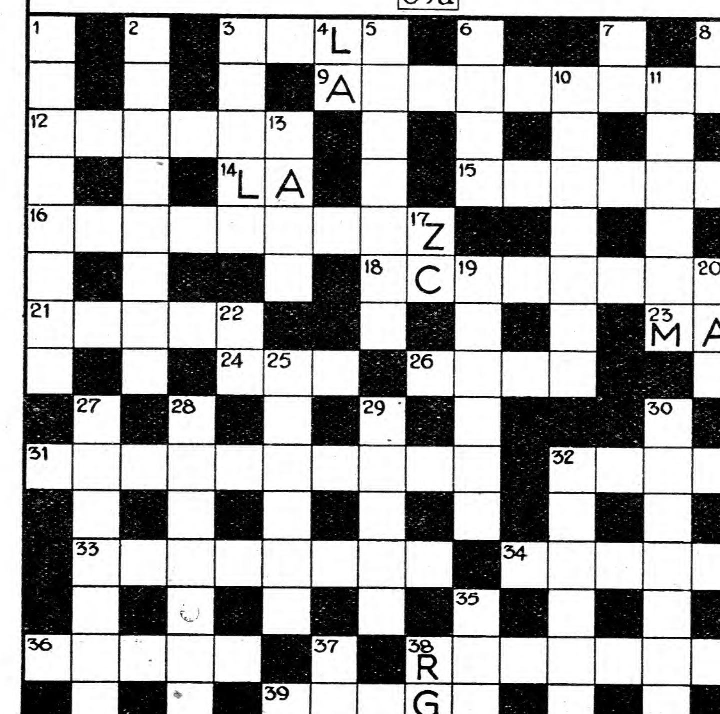
Here Chinese air cadets are seen undergoing their elementary flying training in Arizona. At the top of the page, a Chinese boy named Mo Chung Yung is seen taking dual instruction from the front cockpit of a North American Texan trainer. A formation of these machines is seen underneath, all piloted by boys of the Chinese Air Force under instruction. At the bottom of the page is Chanz Ya Kanz seated in a Link trainer.

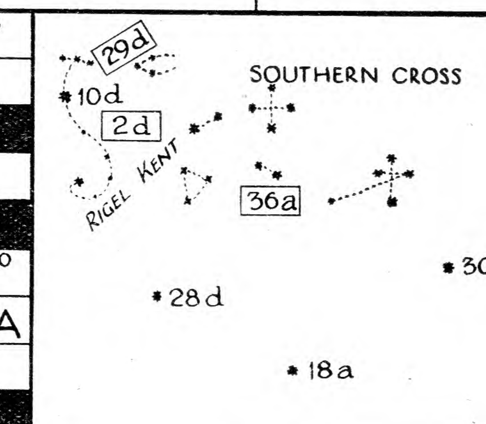
Upon completion of their instruction the Chinese flyers are commissioned as lieutenants in the Chinese Air Force and assigned to immediate service in the Far East. These cadets have been selected by their own officers after receiving preliminary tests and training under American aegis in China.

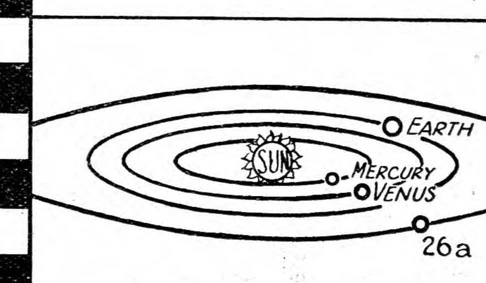
American military observers who have watched the progress of China's first contingent of cadets report that the men have shown exceptional aptitude for flying.

STAR CROSSWORD









NOTES

For the construction of an ordinary crossword one has the choice of a dictionary's abundance of words. Here endeavour is made to use only names of stars and star-groups, selecting, wherever possible, navigational star names.

3 down is a group name. 11 down and 5 down refer to the stars underneath them. In some cases Latin and English names are used.

N.B.:

a = across.

d = down.

[ ] = group names.

22 down = NS.

37 down = first two letters only.

Where only ends of words, this is indicated in clue.

Stringbag Victories

By

K. BRAMAH

When Lord Winster asked in the House of Lords why naval aircraft were so old-fashioned and why hadn't the Fleet Air Arm received the aircraft that had been promised, the House was told that the Navy now has Seafires, Sea Hurricanes and Martlets as fighters, the Kingfisher as a new seaplane, and a new torpedo bomber coming along. This aircraft is said to be the Barracuda. Alert and observant cadets claim to have seen it flying about over the Home Counties. Whether it is on trial or on operations we do not know, but we were promised that before long the Navy will have a more up-to-date aircraft to replace the Swordfish and Albacore.

Even with its old-fashioned aircraft the Fleet Air Arm has appeared in nearly every theatre of war with success, and has done much that the public has never heard of. As its work is often included in Air Ministry communiqués, some people do not realise how great a part the branch plays in our sea, land and air fighting.

The Versatile Swordfish

The old Swordfish, affectionately known in the Service as the "Stringbag," has been a maid of all work and has had to do an endless variety of jobs—bombing, mine-laying, reconnaissance, torpedo-dropping, spotting the fall of shot in a naval bombardment, and also dive-bombing. She has even flown with a motor-cycle fastened to the undercarriage. Remember, the Swordfish has a bigger bomb load than the Blenheim.

Had it not been for Swordfish the *Bismarck* might still be afloat. The hit that damaged the *Bismarck's* steering gear, scored by the late Sub-Lieutenant (A) Tony Beale, D.S.C., R.N., was the one that handed this pride of Germany up on a plate to H.M. ships to finish off. What a pity the Swordfish boys were not allowed to carry on and sink it. When those Swordfish took off from the flight deck of the *Ark Royal* she was pitching and tossing 56 feet. Can you imagine what that means to the pilot? One moment the bows are 28 feet above the horizontal and the next 28 feet below.

In Libya two squadrons of Albacores were disembarked to the Western Desert to carry out the dive-bombing for the Army in that campaign. Targets included Bardia, Tobruk, Derna, Bomba, Benghazi and Tripoli.

Fine Attempts and Successes

Amongst the Air Branch's more notable successes are Taranto, the Battle of Matapan, the sinking of the *Bismarck* and the protection of the Malta convoys and the Russia convoys. The gallant attack by six Swordfish led by the late Lieut.-Commander E. Esmonde, V.C., on the *Scharnhorst, Prinz Eugen* and *Gneisenau* in the English Channel, though not a success, was a fine attempt.

The naval fighters have throughout the war maintained a ratio of four enemy aircraft for the loss of one, which is high by any standard. In the Malta convoy they shot down 39 for certain for the loss of eight, four pilots being saved.

Some "Firsts"

The first time a ship of any importance, a cruiser, was sunk by air attack, was when Skuas sank a Koenigsberg-class cruiser in the Norwegian campaign.

The first time a submarine was *sunk by torpedo* was when an Albacore made an attack on a German U-boat in the Mediterranean.

The first time in this war that aircraft spotted the fall of shot from H.M. ships was when a Seafox flew over the *Graf Spee* and kept our ships informed as to how and where the shells were falling.

Since Italy's entry into the war a small number of naval aircraft operating from Malta against enemy supply routes have sunk or damaged 400,000 tons of enemy shipping in the Mediterranean. In efficiency of air torpedo attacks, particularly at night, naval aircraft lead the world.

Skuas from the *Ark Royal* destroyed the first German aircraft, a Dornier 18, to be shot down by any Allied Service in the present war.

The Battle of Britain

In the Battle of Britain naval aircraft played their part, though it was not publicly admitted until lately that forty of the pilots who flew Spitfires or Hurricanes in those tense and glorious days had been lent by the Admiralty to the R.A.F. Skuas, Rocs and Swordfish did noble work helping to smash up the invasion ports, taking part in over 50 night raids.

Apart from the duties that have already been mentioned, the Air Branch have many others widely varied—communications, transport, meteorological flights, providing air cover for landing operations, as at Madagascar—these being a few.

There is no doubt that the Air Branch has proved its worth, and people are at last waking up to the fact that, without aircraft, the Navy is helpless in modern war.

The Japanese and the Americans have certainly realised the value of aircraft to their navies. None of their battles so far has been between ships and ships alone, the ships acting mainly as aircraft bases and escorts.

Some day, perhaps, we may see the end of battleships and cruisers, and in their place battle-carriers and cruiser-carriers, with a few destroyers to pick up those pilots who drop over the side.

Oxygen

by Astro

On nearly every modern instrument panel will be seen the Oxygen Regulator Mk. VIII. This comprises two instrument dials and a flow control key. The dial on the left is the gauge for informing the pilot whether the oxygen flow for any particular altitude is correct. It does not indicate the actual flow, but the height, and so the pilot must turn the flow-control key below the two dials until the oxygen-flow indicator is reading the same altitude as the altimeter. The amount of oxygen necessary for any altitude is thus automatically regulated by the pilot. The dial is marked from 0 to 40,000 feet. The second instrument dial on the right of the flow indicator is a pressure gauge, and indicates the quantity of oxygen available. The actual oxygen pressure is not indicated. The gauge-dial is marked from "Full" to "Empty." The last portion before "Empty" is marked in red, to indicate that the oxygen supply is dangerously low.

Pressure

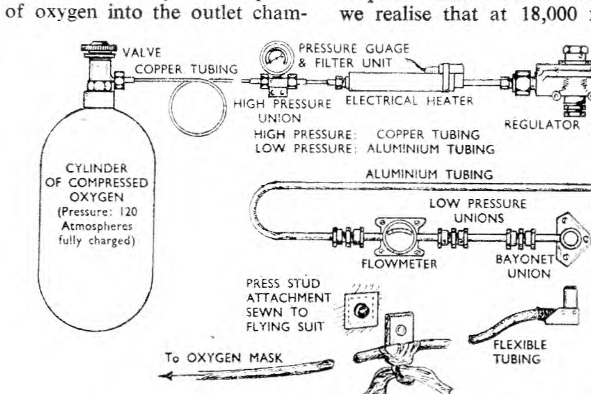
Behind the oxygen regulator panel is fitted a pressure-reduction valve. As the storage pressure of the oxygen is considerably greater than that required for normal breathing, the pressure is reduced by a spring-loaded diaphragm operating a valve, which allows only the required amount of oxygen into the outlet chamber. If the pressure rises excessively the diaphragm is depressed, closing the inlet valve and cutting off the supply until more is needed, when the valve reopens, as the pressure on the diaphragm relaxes.

Why is all this necessary? Why must oxygen be given in doses like medicine? The answer is simpler than the problems involved. If a number of gases are mixed together as oxygen and nitrogen in the atmosphere, each gas exerts its own separate pressure within the whole. This separate pressure is called *partial pressure*. For instance, in the atmosphere oxygen exerts 21 per cent of the total atmospheric pressure. As this is 760 millimetres of mercury, 21 per cent of 760 mm. is 159 mm. of mercury. Thus the oxygen partial pressure of the atmosphere at ground-level is 159 mm. of mercury. This pressure is needed to force sufficient oxygen through the lungs into the blood and tissue. Naturally, our lungs will function best at this ground-level oxygen partial pressure. But up to 12,000 ft. any lack of oxygen may be made up by faster breathing, which is done automatically, just as we get out of breath after exertion.

Effects of Reduction

But there is a limit to the *time* which increased rate of breathing will make up for the reduction in the oxygen partial pressure. For instance, it is dangerous to fly at 10,000 ft. for more than an hour, or 12,000 ft. for more than half an hour, without oxygen. One becomes very much out of breath about 18,000 ft., and the slightest exertion, such as moving the hand to the throttle lever, causes panting like that experienced after intense exertion at ground-level. It is also possible to injure oneself without feeling a great deal of pain. This is better understood when we realise that at 18,000 ft. the atmospheric pressure is about half that at sea-level, and therefore the oxygen partial pressure is only 79.5 mm. of mercury. This partial pressure is much too low to force its vital oxygen, via the lungs, into the body to keep the blood and tissues fully oxygenated; so the bodily functions are bound to be affected. The symptoms vary in different people, but usually a delicious sensation of lassitude accompanies them.

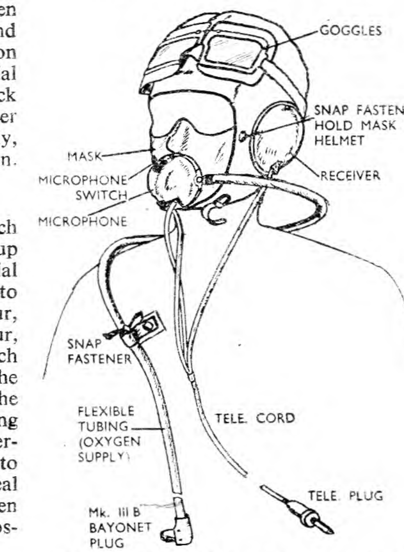
Anyone affected is thus not aware of it, which makes altitude sickness (as general oxygen-lack is called) so much more dangerous to the inexperienced or cocksure pilot. At 25,000 ft. unconsciousness comes very suddenly, and death follows about ten minutes later unless altitude is lost immediately and the partial pressure increased sufficiently to re-oxygenate the blood.



This high-pressure oxygen apparatus for one was produced before the war.

Fitness Counts Slightly

Some pilots may think they can withstand altitude sickness better than others, but they are no less immune than any other pilot at high altitudes, as unconsciousness can be very sudden and appear without warning; that is why, when climbing to 15,000 ft. or more at a rate of climb of 2,000 ft. per minute, oxygen must be used from the moment of take-off. This precaution reduces the danger of the pilot forgetting to turn the flow-control key as he climbs; because if he does forget he may feel too cocksure or too lazy to bother when he reaches his operating height. This feeling is brought on by the malady itself, so the need for care is obvious, otherwise he may be hit by a well-aimed bullet fired by an enemy pilot who has taken greater care with his oxygen supply. If no bandits are about, then the malady itself may prove fatal.



Flying Helmet Type B and associated equipment in use before the war.

Nor can the pilot count on his physical fitness to save him, though it may delay the worst effects. However, ill-health, bad feeding habits, excessive smoking and alcohol will reduce a pilot's resistance to oxygen shortage very considerably. But if a pilot exercises moderation, keeps fit, and properly regulates his oxygen flow, altitudes up to 35,000 ft. or more will have no effect on his efficiency or his health. Contrary to general opinion, excess of oxygen is not harmful.

WOOD WINGS

by DAVID VINE

FIRE is no more likely to break out in a wooden aircraft than in a metal one. It is the petrol which is the fire hazard, not the material of which the aeroplane is made. The ability of a wooden aeroplane to stand up to intense ack-ack is testified by the number of daylight raids into enemy territory recently made by Mosquitoes with small losses.

The chief advantages of wooden aircraft construction are a high strength-weight ratio; cheapness, ease and rapidity of manufacture; easy maintenance; and extra skin smoothness due to the absence of rivet heads, which, however smooth, produce form-drag, which robs metal aircraft of those few extra miles per hour which enable aircraft like the Mosquito to outfly pursuit. This is an especial advantage in the day-bombing Mosquito, which must fly long distances unescorted, relying on its speed to evade its pursuers.

With all these advantages, why has wood never been chosen as the chief material for modern aircraft construction? The answer is, first, certain prejudice against wood; second, the difficulty in obtaining an adequate supply of suitable Sitka spruce; third, and very important in war-time for us, spruce must be imported, and as it is extremely bulky it takes up a lot of shipping space. Most of our spruce comes from Canada.

A New Technique

The history of wooden aircraft during the past ten years shows a slow but certain improvement, leading to the present-day Mosquito. At the moment metal aircraft construction seems to have stagnated in the stressed-skin type, but wooden construction goes on improving as research and experiments continue. These improvements have taken two separate lines which join up in a finished product like the Mosquito. The first line is improvement in wood itself. This sounds rather strange, but wood can be improved chiefly by impregnating the grain with resinous compounds forced in under pressure. Impregnating or "soaking" wood with resin is the result of long research, and wood so treated can be made to have great strength. It is also light in weight and impervious to deterioration. It is seen in the new "Jablo" improved woods of which Rotol airscrews are now made and the "Vita Lignum" used by Weybridge airscrews, and in the modern Bakelite plywoods of which wings, spars and fuselages are now built. Progress in this direction goes on.

Improvements in Construction

The second line of progress in wooden aircraft is in the method of construction itself. This, too, is the product of continuous research and progressive experiment, and will be illustrated here by three out of the many examples of wooden aeroplanes from the famous firm of de Havilland. About 1930 de Havillands began to design a bigger aircraft than their famous Moth, and the result was the widely used Dragon Rapide air-liner, now known in its military form as the Dominie. The Rapide had fabric-covered wings of extreme taper using wooden spars and wooden ribs; and even to-day the Dominie does not strike one as an old-fashioned aeroplane, and yet with very few modifications it is the same type as the Rapide of about ten years ago.

Then, in 1934, when everyone was prophesying the doom of wooden aeroplanes, and Rapides and Moths were flying all over the world, a low-wing, twin-engined, wooden monoplane with hand-operated retractable undercarriage swept across the continents and oceans to reach Melbourne, Australia, in three days. It was aptly named the Comet. Though Comets blazed many a trail in the next few years, not one was so significant as that long dangerous trail over enemy territory which the Mosquitoes made when they bombed Berlin on the tenth anniversary of Nazism, in the now famous first double daylight raid on the German capital. It is significant that the Comet, projected in 1933, the year Hitler came to power, should, in the form of the Mosquito, bomb Berlin on the tenth and probably the last anniversary of Nazism.

The construction of the Comet was a big advance on anything yet seen in wooden aircraft. The fuselage was plywood glued to formers, in fact, a wooden stressed skin. But the wing construction of the Comet was its most revolutionary feature. The spars, made of spruce and plywood in the form of a box, with ribs providing the aerofoil shape, were not unusual, but the "skin," built up of thin wooden laths laid diagonally across each other like closely woven basket-work, was unusual. These strips of wood were about two or three inches wide, decreasing in thickness from root to tip. Nothing like it had been seen before in aircraft, though it had been used in boat construction.

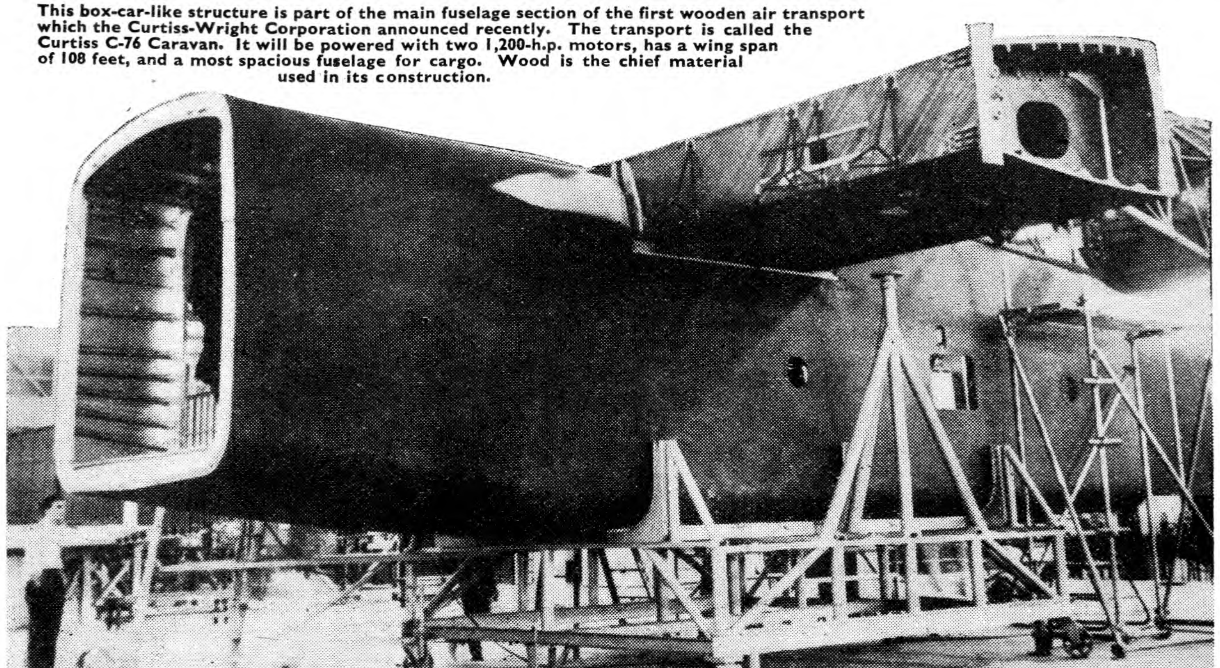
Moulded Wood

Three years later, in 1937, came another surprise and another step forward in the progress of wooden construction. The D.H. Albatross, obviously developed from the Comet, had four 525-h.p. in-line air-cooled engines, and the same wing construction as the Comet. But now the fuselage was entirely different. It had been pressed in a mould, and was made like a sandwich, with balsa wood in the middle and plywood on either side. The Albatross was originally designed as a transatlantic freighter. It weighed 29,500 lbs. fully loaded and had a top speed of 225 m.p.h. It will be remembered chiefly for its extremely long, tapered wings and beautifully streamlined fuselage form, which was cylindrical and tapered to a perfect point just aft of the tail plane.

Then in 1942, five years after the Albatross, and nine years after the Comet, came the Mosquito. Its relationship with the Comet was especially noticeable, and no doubt the Rapide, the Comet and the Albatross have all provided valuable data for the design of this outstanding aircraft.

The question is what will research have achieved in the next five years, for it seems that wood is going ahead, and there is no doubt that the Mosquito will provide, in its turn, data for an even faster air-liner, which may also be a world-beater.

This box-car-like structure is part of the main fuselage section of the first wooden air transport which the Curtiss-Wright Corporation announced recently. The transport is called the Curtiss C-76 Caravan. It will be powered with two 1,200-h.p. motors, has a wing span of 108 feet, and a most spacious fuselage for cargo. Wood is the chief material used in its construction.



Cadet Flying Records

TWELVE hours' flying for a cadet is not a record. Flt. Sergt. Pinnell, who, as we reported last month, flew twelve hours while still a cadet, has been outclassed by Cadet Fellowes of Dumfriesshire, a sergeant of Welwyn Garden City and Flt. Sergt. Stone of Exeter, each with about 14 hours. Four cadets of Belfast claim 100 hours between them, Corporal Humphreys, of Stroud, 20 hours and a parachute jump. Flt. Sergt. Rowell, of Houghton-le-Spring, has 20 hours.

Sergt. Wenyon of Kingswood School (at Uppingham) has done 22 hours in eight different types, some operational. Cadet Catough of Wellington has a log-book which is interesting for the variety of types he has flown. They amount to 17 and include such operational aircraft as Venturas, Bostons, Fortress IIs and Beaufighters. His total flying-time is only 33 hours, which is surpassed by that of Corporal Hogg of Harrow School, who has done over 42 hours, mostly in Oxfords, but also in Whitleys and Hampdens. Cadet Dickinson, also of Kingswood School, has done 50 hours in 12 types, some operational.

The absolute record appears to be held by Cadet Corporal Brown, of No. 155 Squadron, who has flown 170 hours (with twelve hours' dual) in 27 types, including the Mosquito and a secret aircraft. He is employed by the Air Transport Auxiliary.

GERMAN DINGHY TRANSMITTERS

by John Sinclair

AIR-SEA rescue services have frequently been referred to in this journal and in the daily press, but so far little has been published concerning the radio equipment used. Thanks to the Ministry of Aircraft Production, we are now able to shed a little light on the gear employed by the Luftwaffe in its aircraft dinghies.

The technical problems involved are considerably different from those which apply to normal land or sea work. For example, the equipment must be compact and absolutely weatherproof, whilst in order to reduce weight only low power can be employed. This means that the range of dinghy transmitters is limited.

NOTSENDER NS. 1

This equipment, used in the Heinkel 111, consists of a self-contained portable transmitter capable of permitting continuous wave (Morse) transmissions to be made either by hand-keying or automatic sending. On automatic sending it transmits S O S three times followed by a long dash. The transmission is then repeated, thus allowing D.F. bearings to be taken. The frequency coverage is from 320 to 532 kc., corresponding to a wavelength range of from 938 to 565 metres. The equipment is normally tuned to a spot frequency of 500 kc. (600 m.), which is the "guard frequency" used by coast stations and naval vessels.

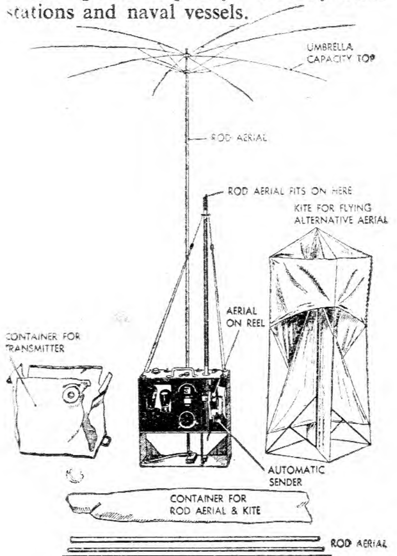


Fig. 1.
Illustrates the Notsender NS.I (Transmitter) used in Heinkel III aircraft dinghies.

Transmitter

The transmitter, pictured in the centre of Fig. 1, measures 18 in. by 10 in. by 18 in. high, and all necessary switches are mounted on the top panel. The whole set is practically weatherproof, and would stand immersion in sea-water for a short period. The exterior is painted bright yellow, and simple instructions for operation are painted with luminous paint—a very useful aid.

As the frequency is preset before the machine takes off, only aerial tuning and switching need be carried out by the crew when an emergency arises.

The weight of the transmitter is about 50 pounds.

Aerials

Aerials are in a separate container, which resembles an aluminium golf-bag. One aerial consists of five sections of aluminium tube to give a total length of five metres (about 17 feet). The other is 165 feet of standard steel wire which can be wound out from a reel in the transmitter and flown on a box kite stowed in the aerial container.

The tube aerial, which has an "umbrella" capacity top, is supported direct in a socket on the transmitter, and stayed with four small guys to the top of the transmitter. Other guys can be attached to the top of the transmitter and thence to the sides of a dinghy.

Transmitter Details

The transmitter consists of two parts: (*a*) the chassis (type S210), (*b*) the auxiliary equipment.

The latter comprises a 480-volts H.T. supply, made up from four 120-volts dry batteries, and a four-volts accumulator for the filaments, etc.

The transmitter employs a triode master oscillator valve of the RS241 type which drives a pair of similar valves in parallel. The master oscillator is variometer-tuned and the output stage is tuned by means of a coupled condenser and variometer.

It is probable that the chassis is capable of use for other purposes.

Fig. 1 shows the complete equipment. No details of range are available, but it is probable that distances up to 100 miles are commonplace.

NOTSENDER NS. 2

This appears to be a more modern type of equipment, as light alloys are used in its construction.

The apparatus (carried loose in the aircraft) consists of two parts: (*a*) the transmitter proper and (*b*) the accessory container, both of which are watertight, buoyant and painted a bright yellow.

Power is obtained from a hand-generator which, with the transmitter, is housed in an aluminium-alloy box weighing only 15 pounds and measuring 11 in. by 10 in. by 7½ in. wide.

The accessories container, also made from a light alloy, measures 24 in. by 8 in. by 5 in., and weighs 12 pounds. This holds a kite, two balloons with filling tubes, two hydrogen generators and an instruction booklet.

In an emergency the crew inflate their dinghy and pull in the radio equipment by means of a tarred rope which is attached to facilitate its transference to the dinghy. The larger container is then opened by first unscrewing the lid and then pulling out the inner packing. This is then stripped by pulling the cord provided for the purpose.

Kite Aerial

If the wind exceeds 13 m.p.h. the kite, which is of the box type, is extracted and erected according to the instructions contained in the booklet. It is not made clear how the crew ascertain that the wind is blowing at 13 m.p.h., but presumably practice makes perfect.

The aerial wire, which consists of 260 feet of stainless-steel wire, is attached by a special hook and reeled out until the kite reaches a suitable height. Ten feet of stainless-steel wire, terminating in a sinker, forms the "earth" wire, and this is lowered over the side of the dinghy.

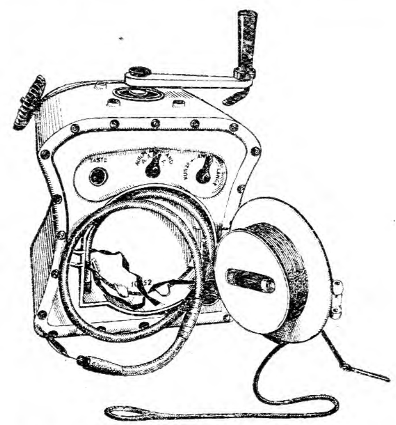


Fig. 2.
View of the transmitter used in the Notsender NS.2. Note the special shape of the case which enables the operator to hold the equipment between his knees whilst operating the hand generator.

Balloon Aerial

When there is little or no wind the balloons may be used to raise the aerial wire. These are inflated by taking one of the hydrogen generators and opening up the top. The tube to which the balloon is attached is then screwed in and the can immersed in water to a depth of 12 inches. An insulated grip is provided, as considerable heat is generated. When the balloon is inflated to a diameter of about three feet, it is detached from the tube, and any water which has accumulated at the bottom is syphoned away by manipulating the clip. The aerial wire is then fixed to the cords provided and raises the aerial.

One of the crew now holds the transmitter (Fig. 2) between his knees (it is specially shaped for this purpose), inserts the handle for the hand-generator and turns at approximately two revolutions per second. After a brief "warming-up" period the aerial condenser is tuned to give maximum brilliance in the neon indicator and the selector switch turned to either hand or automatic sending. C.W. or modulated C.W. may be used.

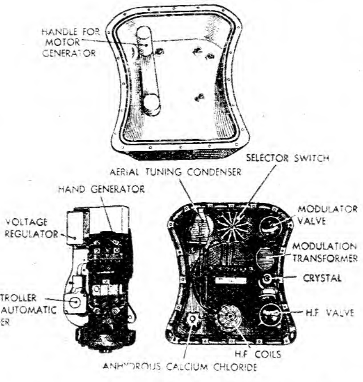


Fig. 3.
Details of the mechanical construction of the Notsender NS.2. The top panel is used as the mounting plate for all components.

Mechanical Construction

The mechanical construction of the transmitter has several interesting features; among these is the use of the top panel as the mounting-plate for all the components. No sub-chassis is employed.

Fig. 3 illustrates the general layout of the components, from which it will be seen that when the two pieces are fitted together the necessary power supplies are transferred from the hand-generator by means of a five-pin plug and socket. A rubber gland between the two sections makes the whole assembly watertight. When the handle of the generator is stowed in the rear of the case, a small cap (which is normally attached by a leather thong) is screwed in to prevent the entrance of any water at this point.

Frequency

The transmitter, which operates on one frequency only, namely, 500 kc. (600 metres) is crystal-controlled, thereby ensuring the stability of transmissions under all conditions of weather. This is the first occasion, to the writer's knowledge, that the system of crystal control has been used in German aircraft radio equipment.

The oscillator and output valve is a Telefunken A.L. 5N. The oscillatory circuit consists of a reaction coil and the crystal (connected between grid and earth), and a tuned circuit which is in the screen-grid circuit. The reaction coil is included to produce clean keying.

The output circuit consists of an untuned choke closely coupled to the aerial coil and its associated tuning condenser. This condenser incorporates a switch which enables the coil to be tapped to compensate for variations in aerial capacity—a function of the angle of elevation. In gusty weather it is necessary to keep a continuous watch on the neon indicator and to maintain the correct tuning by the use of the variable condenser.

The transmitter may be grid-modulated by switching on the filament of the modulator valve—a Telefunken RE13A. This operation also allows M.C.W. to be used for telegraphy transmissions. The RE13A is used as an audio oscillator, its associated transformer being tuned by a condenser to a frequency of 1,000 cycles per second.

Auto Sender

This consists of a step-by-step motor and camshaft and a control unit containing an electrically maintained balance wheel oscillating at "dot frequency." Contacts on the control unit operate the driving magnet of the step-by-step motor, the speed of operation being practically independent of supply voltage variations. A moulded bakelite cam, mounted on the camshaft, carries a series of depressions operating the keying contacts. The transmitter then radiates S O S and long dashes in either C.W. or M.C.W., provided the selector switch is in the automatic-sender position.

When a radio operator is available the hand key may be used to transmit messages additional to the conventional S O S.

Hand Generator

This is a double-pole field-wound type with two commutators and a voltage regulator which operates on the shunt field. The consumption figures are:

L.T. 4 volts 1.7 amps on M.C.W. and 1.55 amps on C.W. operation;

H.T. 325 volts 75 milliamps on M.C.W. and 65 milliamps on C.W. operation.

Performance and Range

The output into the aerial is 6.2 watts and the actual power radiated is 0.91 watt. The estimated range over sea is 250 miles and 120 miles over land.

Good D.F. bearings can be obtained up to 120 miles, although D.F. signals are audible up to 160 miles.

The value of these dinghy transmitters cannot be over-estimated, for without them it is certain that many aircrews would never have been rescued. Although details of the radio equipment used in British aircraft dinghies is not at present available, there is every reason to believe that its performance is in every way equal to that used by the enemy.

The air-sea rescue service, brought to a high state of efficiency during the present war, is as much an integral part of air operations as are field hospitals and sick-bays to military and naval operations.

As You See Them

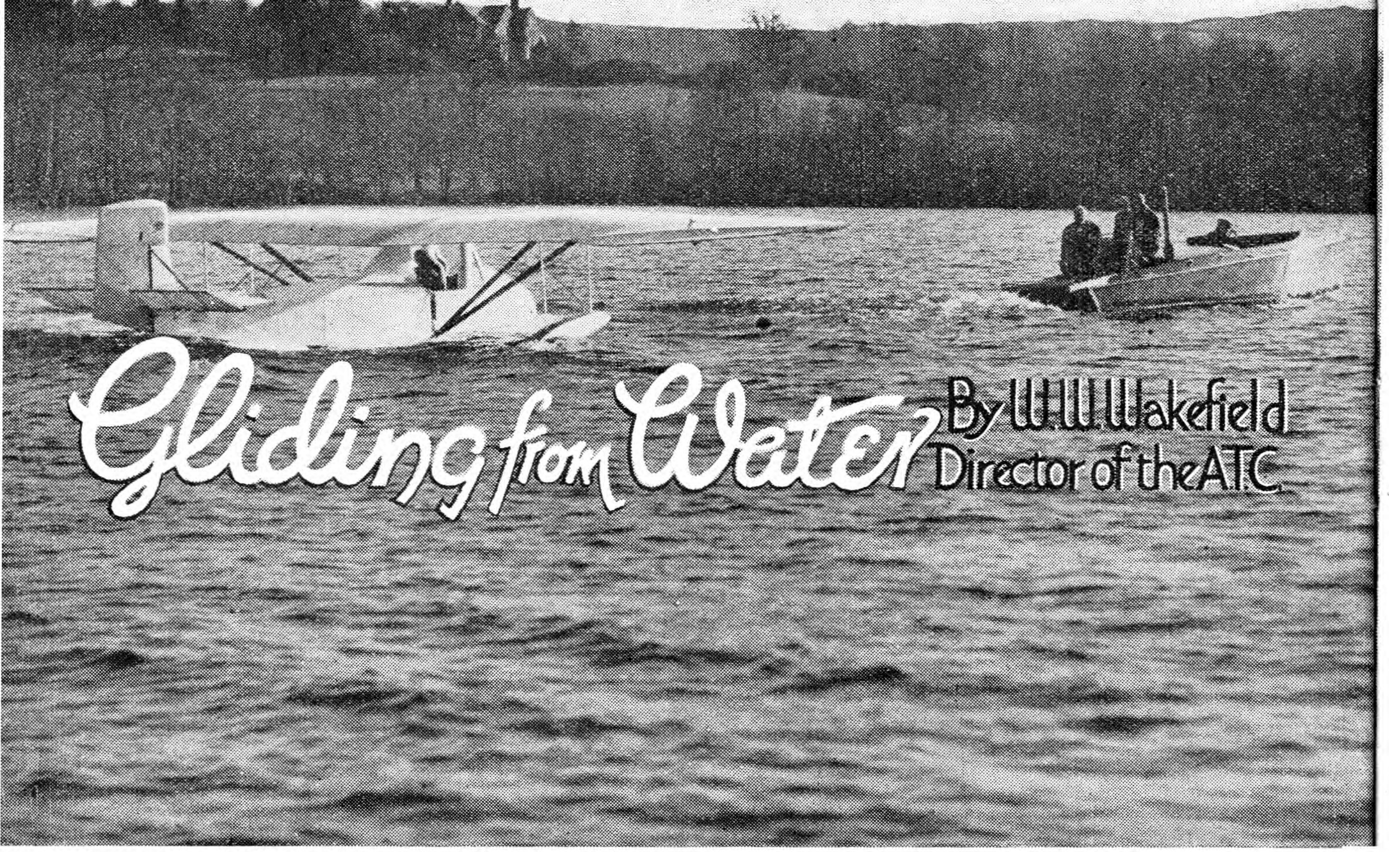
(*see Outside Back Cover*)

1. Supermarine Spitfire IX.
2. North American B-25, Mitchell.
3. Grumman TBF-1, Avenger.
4. Vought-Sikorsky SB2U-2, Vindicator or Chesapeake.
5. Lockheed P-38, Lightning.
6. Vickers Virginia.
7. Martin A-30, Baltimore.
8. Handley Page Hampden.
9. Bristol Beaufort.
10. Westland Whirlwind.
11. General Aircraft Hotspur.
12. Hawker Hector.
13. Consolidated Liberator.
14. Grumman F4F-4, Wildcat or Martlet.
15. North American P-51, Mustang.
16. Boulton-Paul Defiant.
17. Consolidated PBY-5, Catalina.
18. Vought-Sikorsky OS2U-3, Kingfisher.
19. Lockheed-Vega Ventura.
20. Vultee Valiant.
21. Douglas A-20, Boston or Havoc.
22. Boeing B-17F, Fortress II.
23. Hawker Hurricane.
24. Supermarine Seafire.

Star Crossword Solution

(*see page* 17)

A	■	S	■	E	L	L	A	■	V	■	■	O	■	O
L	■	C	■	A	■	A	L	D	E	B	A	R	A	N
P	L	O	U	G	H	■	N	■	G	■	N	■	N	■
H	■	R	■	L	A	■	I	■	A	L	T	A	I	R
A	L	P	H	E	R	A	T	Z	■	■	A	■	L	■
C	■	I	■	■	P	■	A	C	H	E	R	N	A	R
C	R	O	W	N	■	■	K	■	Y	■	E	■	M	A
A	■	N	■	S	C	H	■	M	A	R	S	■	■	M
■	P	■	P	■	Y	■	L	■	D	■	■	■	C	■
B	E	T	E	L	G	E	U	S	E	■	S	W	A	N
■	G	■	A	■	N	■	P	■	S	■	I	■	N	■
■	A	R	C	T	U	R	U	S	■	O	R	I	O	N
■	S	■	O	■	S	■	S	■	L	■	I	■	P	■
M	U	S	C	A	■	S	■	R	E	G	U	L	U	S
■	S	■	K	■	V	I	R	G	O	■	S	■	S	■



Gliding from Water

By W. W. Wakefield
Director of the A.T.C.

LAST year, in face of many difficulties, gliding was started in the Air Training Corps. Thanks to the keenness shown by officers, instructors and cadets, good progress was made, but if gliding is to play a major part in the activities of the Corps opportunity must be taken to use every facility that exists.

Last autumn I considered that there was a gap which needed filling. There were speed-boats available, and good stretches of water surrounded by hills which ought to provide good soaring conditions. Here, then, was a field for exploring. Accordingly, I arranged for a Falcon I single-seater glider to be sent to Windermere for modification by Major Cooper Pattinson, D.F.C., an old flying-boat pilot. He added two wing-tip floats, cut off the skid, put a ply hull with two steps on to the fuselage and made the fuselage watertight. The quick-release attachment was altered so that the pull came in the correct position for towing off water, and the air-speed indicator was placed into a position on the wing where the water would not splash into it.

On my first flight there was a steady northerly wind of 12 to 15 miles an hour blowing down Lake Windermere. About 300 feet of cable was let out from the speed-boat. Signalling was done by the hand. Wireless or some form of loudspeaker between glider and speed-boat is advisable. It is better that oral rather than visual means of inter-communication should be used. Voice transmitted by loudspeaker and compressed-air booster might be a suitable method.

On the first take-off I tried to pull the glider off the water too quickly, and instead of getting it up on to the step I got it right off the water, and as a result porpoised a bit. After taking the air, however, I quickly gained height, quick-released and made a satisfactory landing.

On the second take-off I got the glider up on to the step and it took off beautifully. Here again I only went up to about 200 or 300 feet, and then quick-released and landed in the roughest water I could find in the wash of the speed-boat. The glider behaved perfectly on alighting.

On the next occasion there was very little wind, with the result that the weight of the sagging cable tended to pull the glider underneath the water, and a series of waves came over the cockpit, giving me a good ducking. After a few seconds of this I quick-released before I was able to become airborne or, as seemed possible, being pulled to the bottom of the lake.

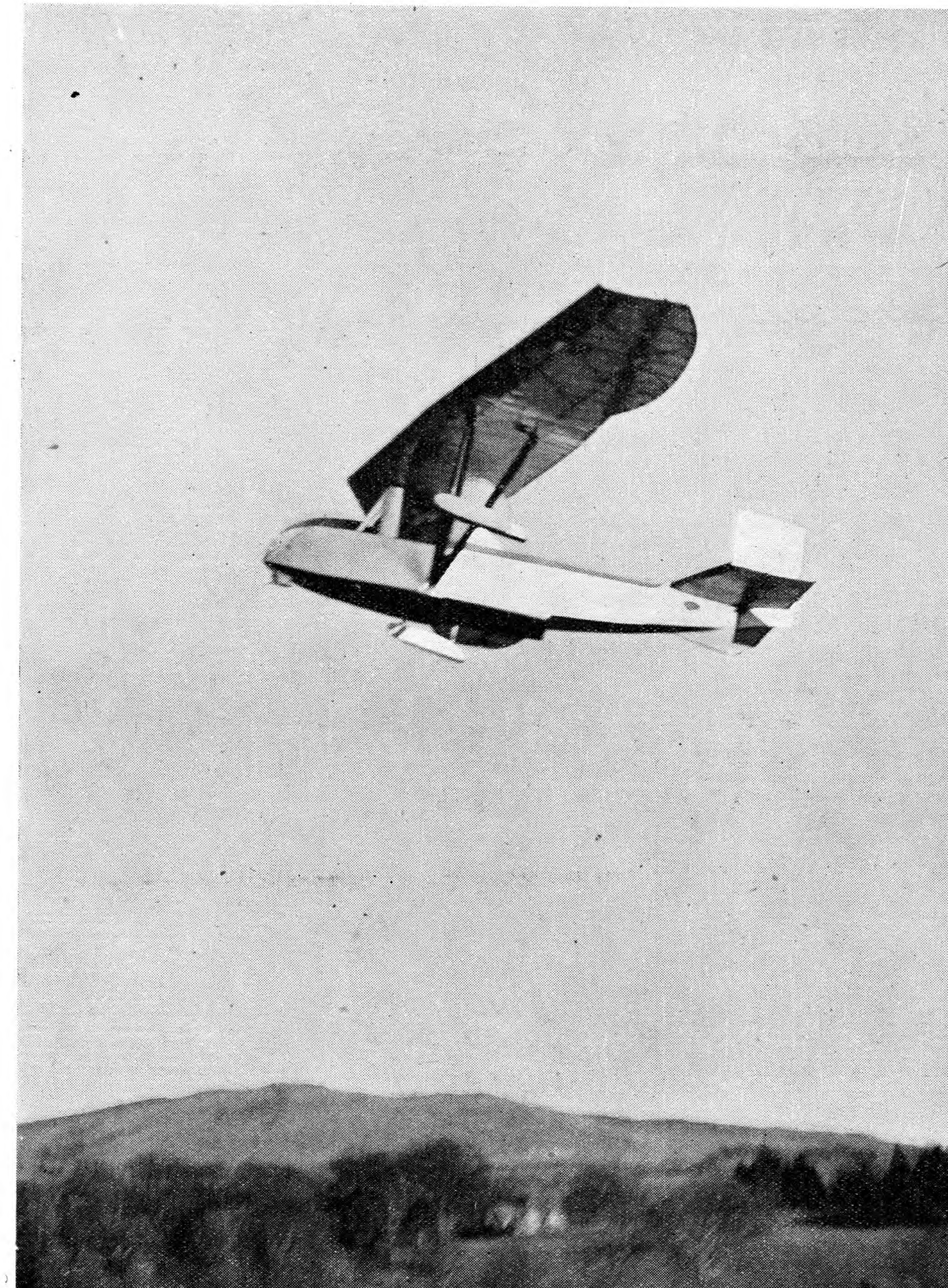
On the second run the cable was shortened to about 200 feet. This time I got off comfortably, and climbed to about 700 or 800 feet before quick-releasing over Bowness Bay, where I tried without much success to find an up-current. The glider again landed perfectly.

On the third run, again with longer cable, I got another ducking, and had to quick-release again without becoming airborne.

For the fourth run the cable was shortened once more and I got comfortably into the air. We ran down the lake, heading into what little wind there was, and the cable was let out to its full extent, so that I was soon flying at 1,200 feet. I was towed several miles down to the end of the lake at this height, where I quick-released. I made a hill which stuck out into the lake in another endeavour to do some soaring. But the wind was up and down the lake and was too light to provide enough up-current for me to remain long in the air. I was able to make another satisfactory landing.

The experience of these water-gliding tests shows that there is a lot of fun to be had out of gliding from water. I particularly look to two-seater gliders to provide the best form of instruction for A.T.C. cadets. Good up-currents should be obtained from the hills which invariably surround lakes or rivers. Valuable training could be given to Sea Cadets in seamanship in the speed-boats, while A.T.C. cadets receive air experience in the gliders.

Experiments and development work are continuing with other types of gliders. The details of the technical work done by Major Pattinson will be given to the Corps as a whole, so that others desiring to follow suit will have plans and specifications for making the necessary modifications to existing land gliders.



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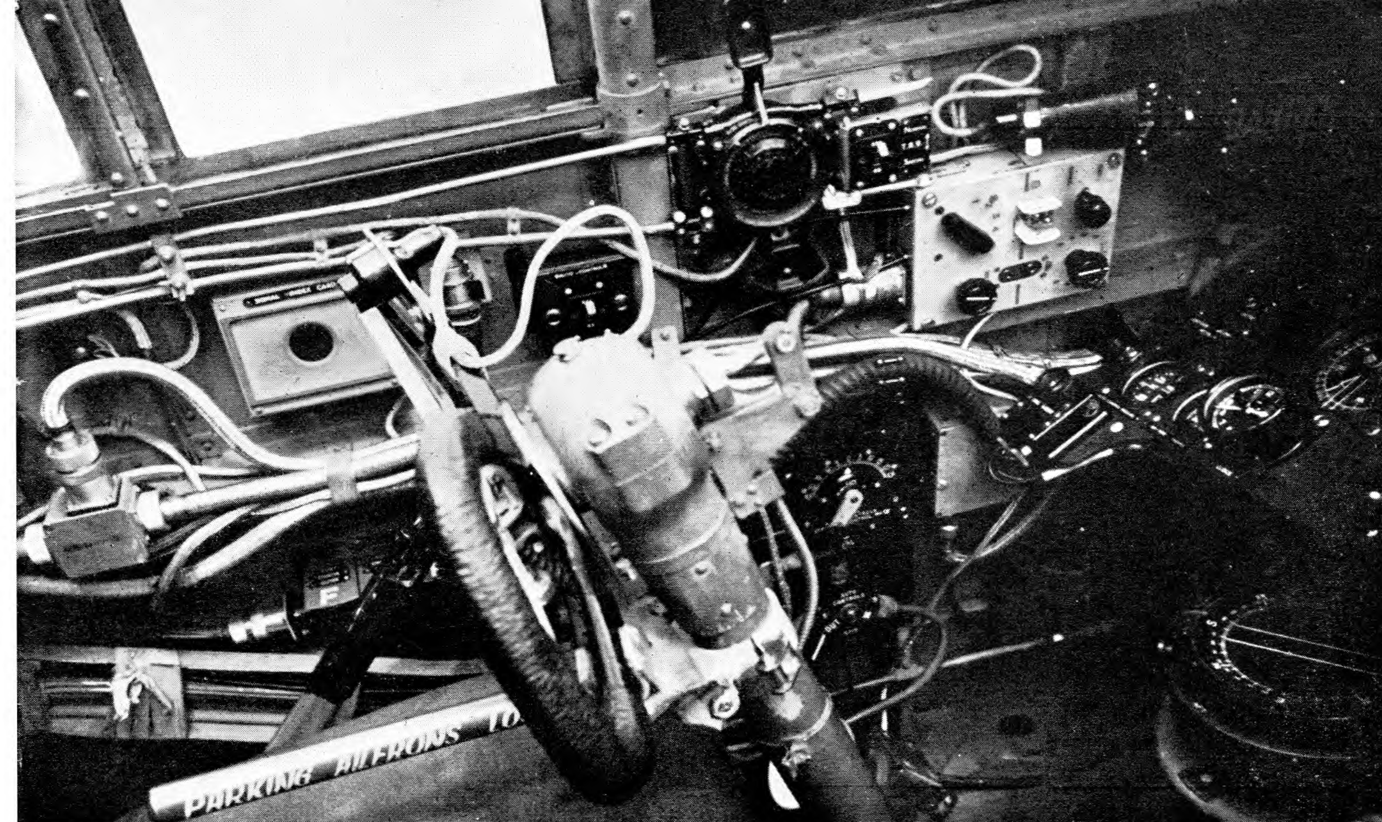

BIG STUFF

Few people realise the extent of the work done by the maintenance crews of the R.A.F. In the photo above of the "office" of the Handley Page Halifax heavy bomber, one gets an idea of the problems which confront mechanics. Note the number of leads, control cables, and instruments—all of which must be in perfect order.

Below are two pictures of mechanics working on the undercarriages of (left) the Halifax and (right) the Avro Lancaster. These wheels are regularly checked for tyre alignment, tyre pressure, lubrication, etc. Another duty of some of these men is to see that no stones or flints become bedded in the tyre. Note the different struts.