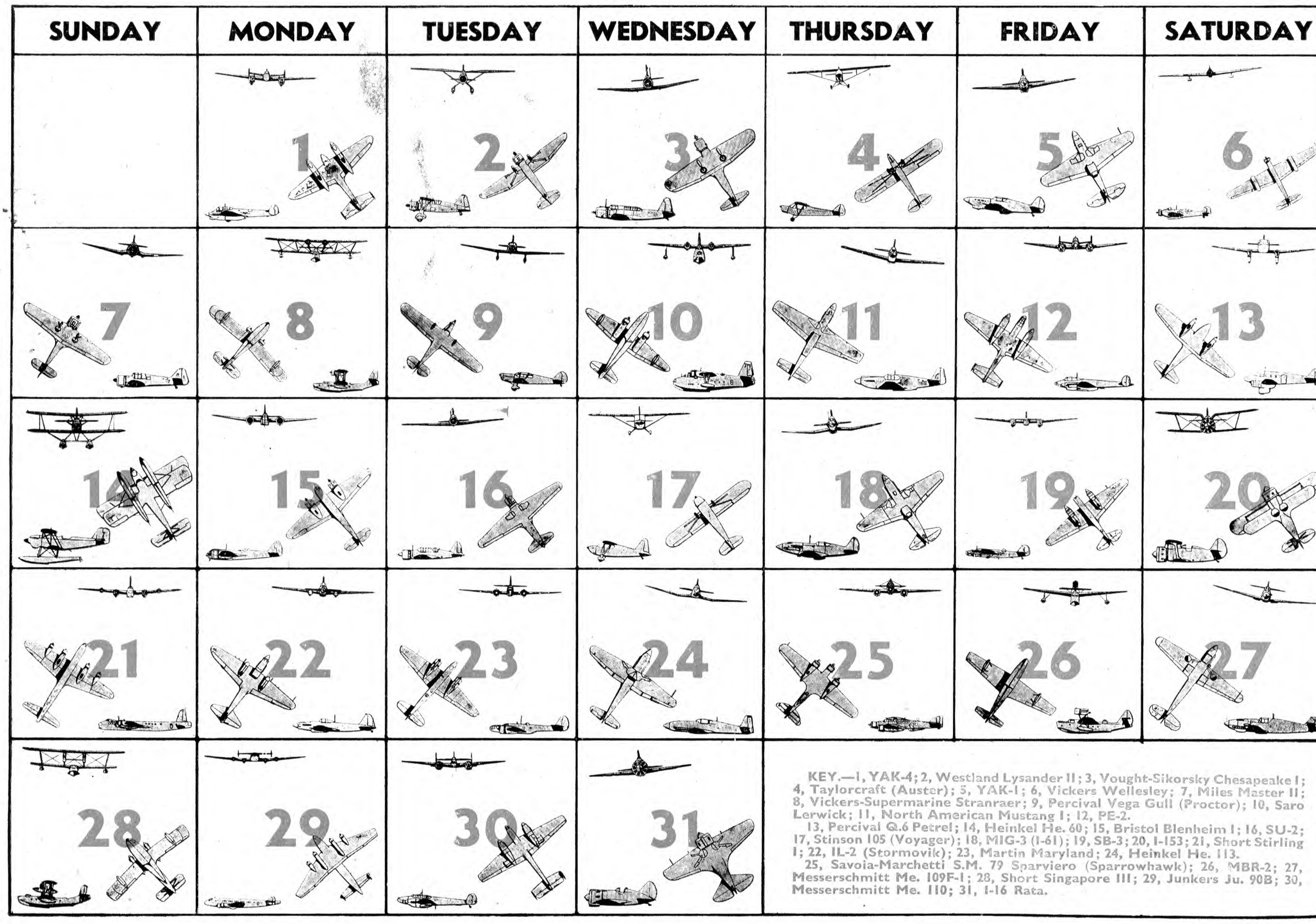
RECOGNITION AIR TRAINING CORPS GAZETTE CALENDAR

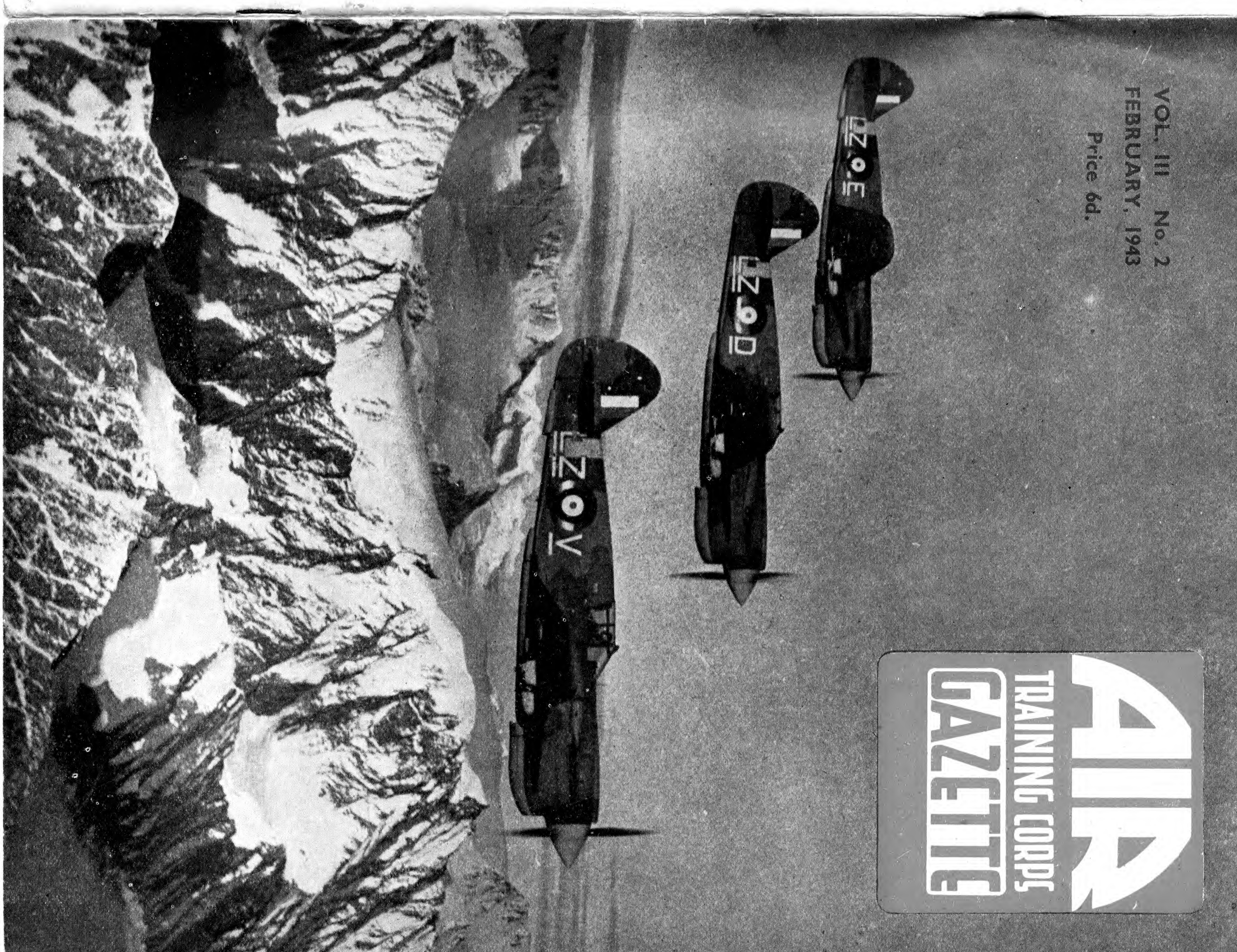
MARCH 1943

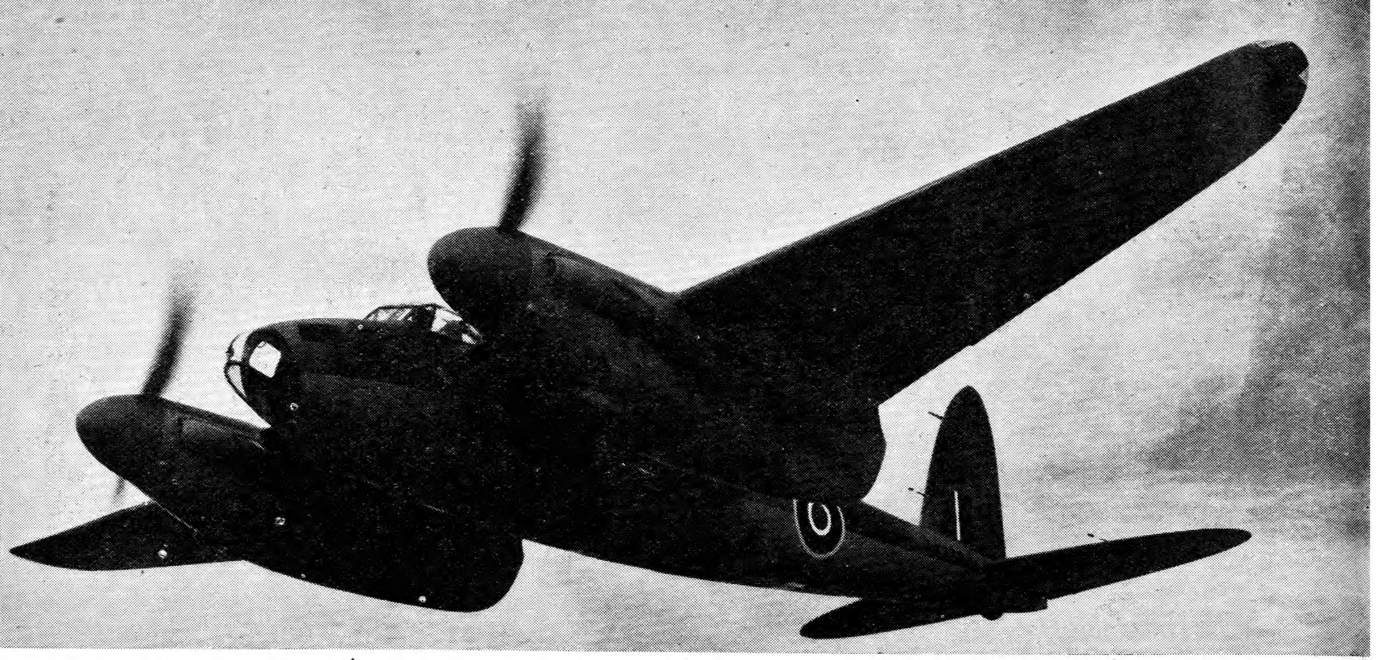


KEY.—1, YAK-4; 2, Westland Lysander II; 3, Vought-Sikorsky Chesapeake I; 4, Taylorcraft (Auster); 5, YAK-1; 6, Vickers Wellesley; 7, Miles Master II; 8, Vickers-Supermarine Stranraer; 9, Percival Vega Gull (Proctor); 10, Saro Lerwick; 11, North American Mustang I; 12, PE-2.

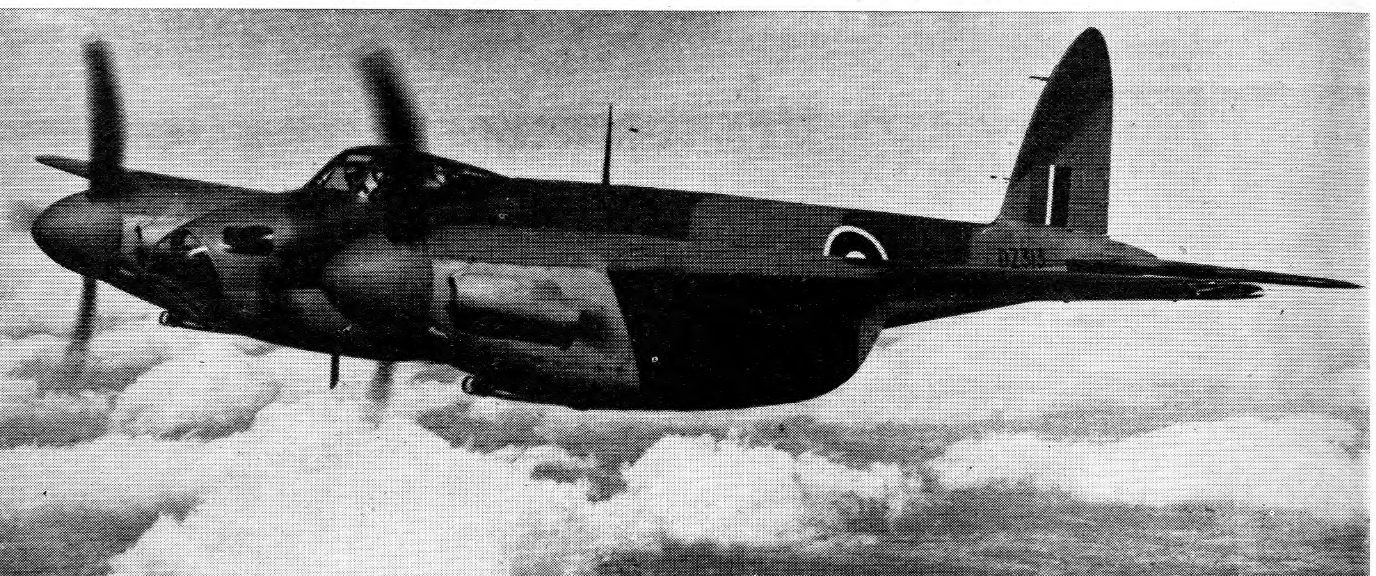
13, Percival Q.6 Petrel; 14, Heinkel He. 60; 15, Bristol Blenheim I; 16, SU-2; 17, Stinson 105 (Voyager); 18, MIG-3 (I-61); 19, SB-3; 20, I-153; 21, Short Stirling I; 22, IL-2 (Stormovik); 23, Martin Maryland; 24, Heinkel He. 113.

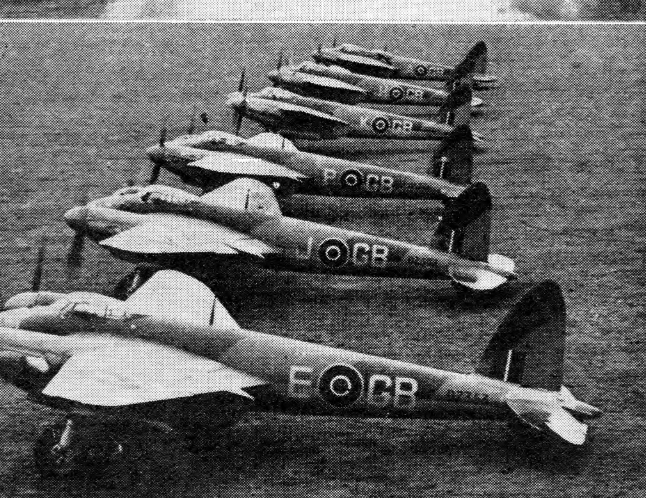
25, Savoia-Marchetti S.M. 79 Sparviero (Sparrowhawk); 26, MBR-2; 27, Messerschmitt Me. 109F-1; 28, Short Singapore III; 29, Junkers Ju. 90B; 30, Messerschmitt Me. 110; 31, I-16 Rata.

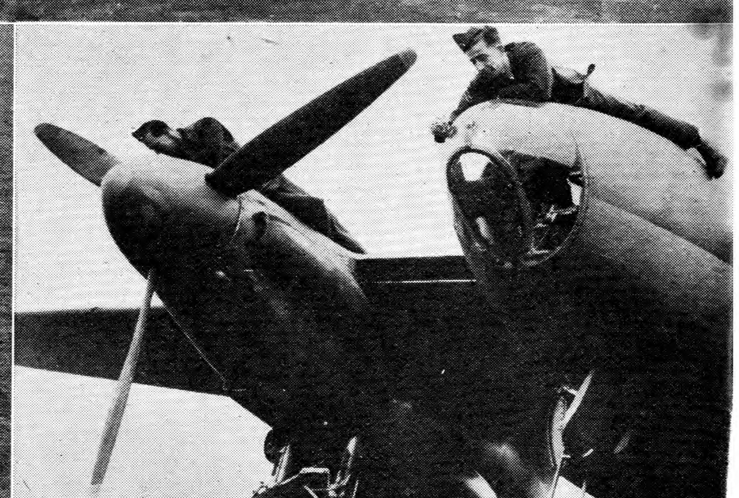




The de Havilland Mosquito high-speed bomber (span 54 ft. 2 in.) has already made its mark in the air war. It first came into the news through the raid on the Quisling headquarters at Oslo, and since then has taken part in several daylight operations over Germany and German-occupied territory.







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AIR TRAINING CORPS GAZETTE

Edited by Leonard Taylor

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1941 To—?

In two years of enthusiastic endeavour the Air Training Corps has proved its value to the Royal Air Force and has established itself firmly in the affection of the people of this country.

I am proud to have been closely associated with it throughout that time of many pleasant memories.

But it is to the future that we must look on these anniversaries, and not to the past. I am sure that the Corps can face the years to come with the confidence bred of its success, and that it will not allow the splendid vigour of its youth to decay.

I wish all of you all success.

J. A. Chamier

AIR COMMODORE
INSPECTOR, AIR TRAINING CORPS

Air Commodore A. D. Warrington-Morris, C.M.G., O.B.E., Deputy Director of the A.T.C., who was awarded the C.B. (Civil Division) in the New Year's Honours List.

Thanks from an Editor

On this, the second anniversary of the formation of the Corps, I feel I cannot do better than give to you extracts from two personal letters which I have recently received, the one from an Air Marshal, the other from an A.C.2.

This is what Air Marshal Sir Philip Babington, Commander-in-Chief of Flying Training Command, wrote to me:

"Everywhere I go I hear praise of the A.T.C. and the good effect it has on the youths who undergo that training. Those officers and instructors who give up so much of their time in making things go successfully deserve great credit for their work, and their reward must be in the knowledge of the good they are doing for the boys and the country rather than in any tangible rewards of another kind, but I am sure they must get a deal of satisfaction from the former."

Here is the letter from the A.C.2, who recently was the editor of one of our great national papers and has now just completed his Initial Training Wing course:

"I feel that I must write you a few lines to report on the excellent work which A.T.C. cadets are doing when once they join the ranks of the R.A.F.

"As you can imagine, being a newspaper editor—and also being 33—I am probably a little more observant than many of the youngsters who are at present training with me as A.C.2s for aircrew duties.

"I have now passed through my Initial Training Wing, and the help which ex-A.T.C. cadets were able to give to other men — both in studies and in general duties—was so marked that I felt that it should be brought to your attention.

"We have quite a number of them in our flight, and what has impressed me most of all has been the *spirit* of these men—the keenness and the enthusiasm with which they will undertake *any* job which comes their way. These ex-A.T.C. cadets are not in the R.A.F. just because they believe it to be their duty—they would be mortified if they were taken off the course and grounded, or if they were in any other branch of the Services. The ex-A.T.C. cadets stood out a mile in that respect—you could ask an airman if he had been in the A.T.C., and nine times out of ten you would know what the answer would be.

"As far as their preliminary studies are concerned, enough for me to think of the evenings on the side of my bed when a youngster of 20, who had been taught the rudiments of navigation in his A.T.C. classes, has given me a little private tuition. They know their stuff backwards, these young men, and though the tuition at the I.T.W. is excellent, it is quite obvious that they had a terrific advantage over men like myself, whose knowledge of maths. and kindred subjects was, to say the least of it, a trifle rusty.

"Many former A.T.C. cadets have helped me a great deal. I thought I should pass on my thanks to you."

We are very glad to see in the New Year's Honours List the name of Wing Commander H. Spence. Wing Commander Spence, who served in the R.A.F. in the last war with distinction, has many activities. In addition to being a business man running his own factory, he commands the North-East Area of the Air Training Corps in Scotland, and has a big responsibility in the Home Guard.

The two letters speak for themselves. They are tangible proofs of the great work done by the Air Training Corps during the past year. They will be a source of encouragement and inspiration to both officers and cadets to endure in the work which yet remains to be done before victory can be won.

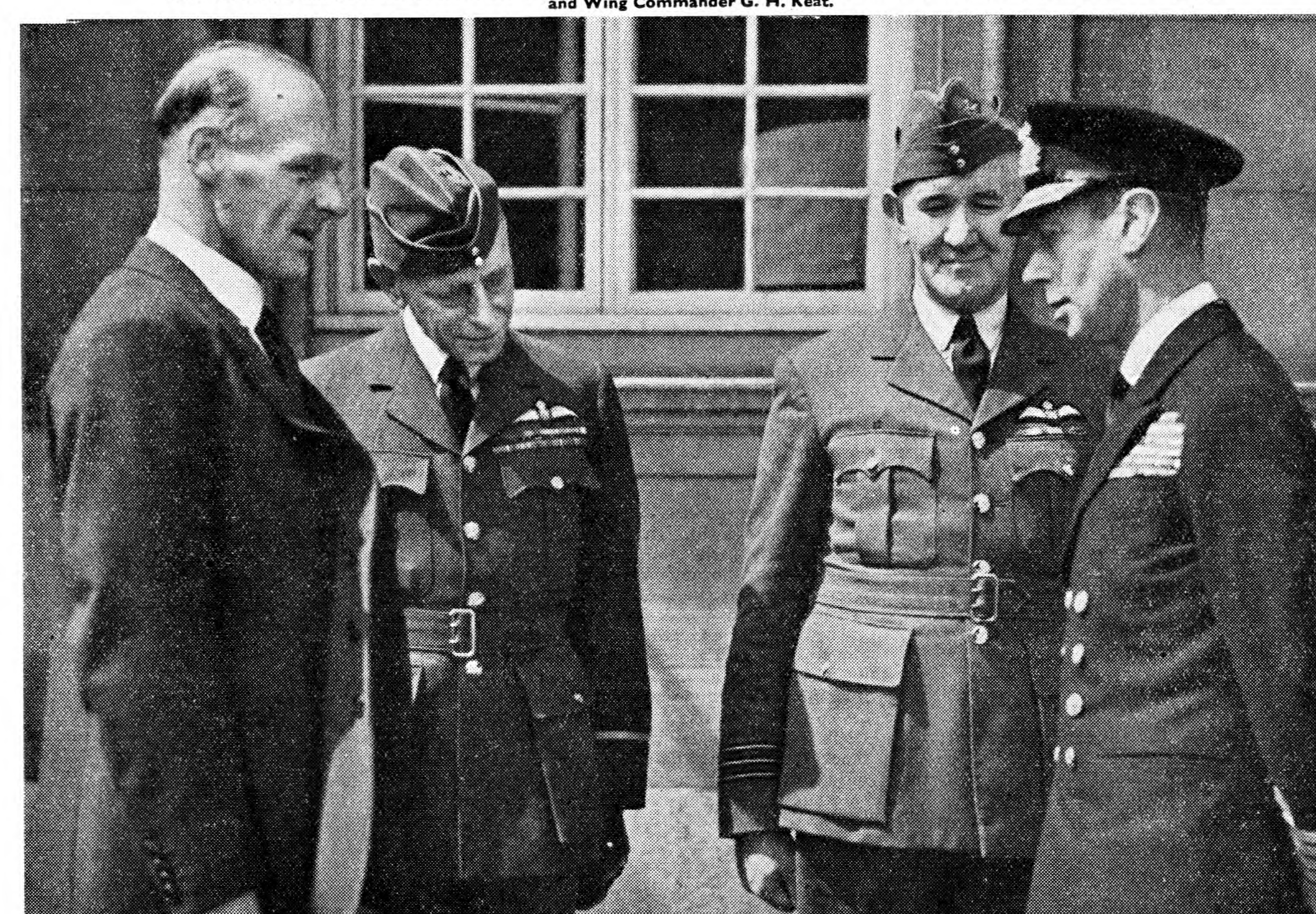
These two letters provide the answer for any who still may be wondering whether the work done in the Air Training Corps is worth while.

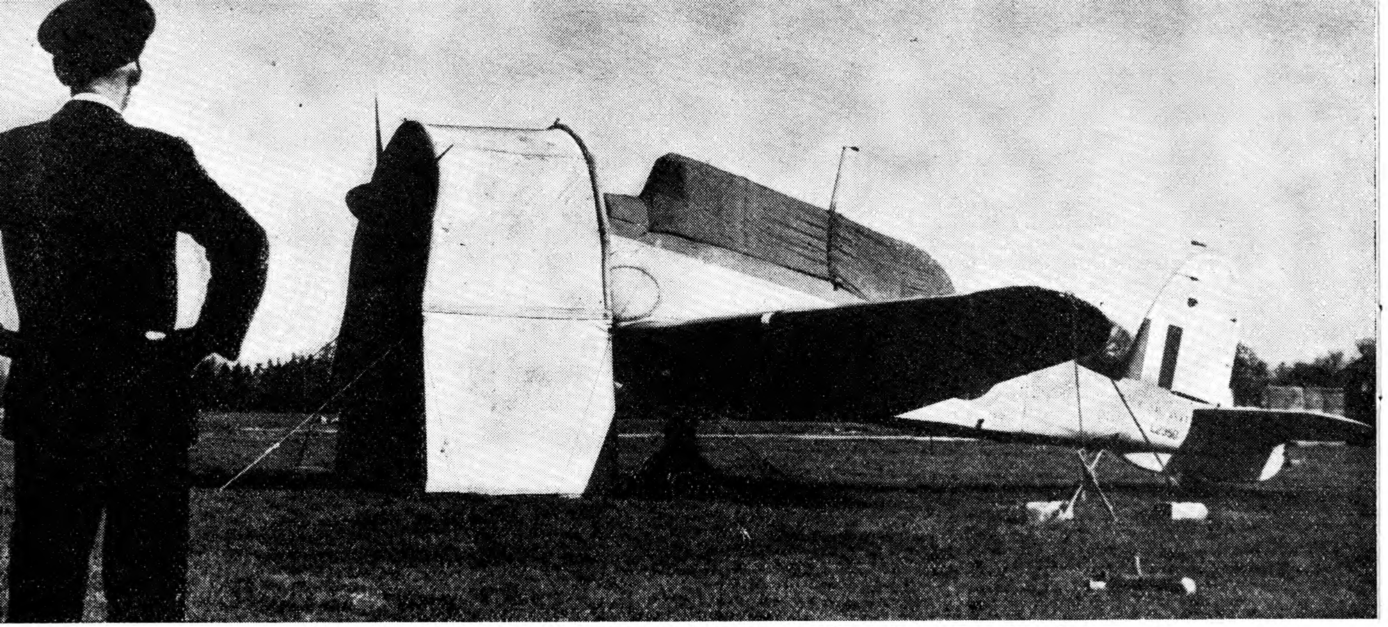
In recent weeks I have had hundreds of letters of appreciation from industry of the high value which management places on the work and training of the Air Training Corps. Parents of cadets may rest assured, therefore, that in the work and training done by their boys, in the evenings and at weekends, not only are they preparing themselves to serve their country in the immediate future, but they are also providing that basis of character and knowledge which is as valuable in peace as in war. So we can go forward in the third year of our existence in good heart; eager and confident in our ability to meet and beat all those difficulties of travelling, black-out and long hours of work which make training increasingly difficult but more important than ever in this fourth year of war.

W. W. Wakefield

DIRECTOR OF THE AIR TRAINING CORPS

H.M. the King talking to Mr. W. W. Wakefield, Director of the A.T.C., Air Commodore J. A. Chamier, Inspector of the A.T.C., and Wing Commander G. H. Keat.





SKUA SECURED. A Naval officer contemplates a Fleet Air Arm Blackburn Skua II (span 46 ft. 2 in.) securely picketed and with engine and cockpit covers in place.

Parking Your Aircraft

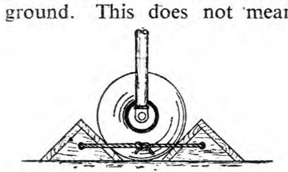
by P. W. BLANDFORD

DESPITE its great strength of construction in proportion to its weight, an aeroplane standing in an exposed position on the ground can be quite seriously damaged merely by the action of the wind. The precautions taken to prevent this damage occurring are grouped under the title "Parking."

Everyone whose work brings them into contact with aircraft should understand the principles of parking. This applies to aircrew as well as to ground crew, although parking on an airfield is usually done by ground crews. If a 'plane is forced-landed away from an airfield, it is the responsibility of the crew to make it safe for an overnight stop.

Parking can be broadly divided into three parts: making the machine itself safe, preventing the control surfaces from blowing about, and protecting the interior of the cockpit and engines from the effects of the weather.

Almost without exception it is the rule to park a 'plane head to wind. The machine is constructed to withstand the effect of meeting the airflow head-on in flight, so that is the best way for it to meet the wind when it is stationary on the ground. This does not mean that somebody has to stand by to shift the tail round every time the wind changes a few points, but it should face in the general direction of the wind.



(A) CHOCKS LASHED TOGETHER

To prevent the front wheels moving, they should have chocks placed in front and behind them, preferably lashed together (A). In an emergency chocks can be improvised from logs or stones. A shallow trench can be used for each wheel as an alternative to chocks. Each trench should be just wide enough to clear the tyres and about six inches deep.

It is not usual to chock the tail wheel, but it should be turned in line with the fuselage, so that any slight fore-and-aft movement cannot strain the wheel or leg.

To prevent wind rocking or lifting the wings or tail plane, picketing ropes are attached. Usually three ropes or pairs of ropes are used, one under each main plane and one at the tail. The main-plane picketing points are generally in the form of rings on the underside of the wing, attached to the front spar about two-thirds of the way out from the fuselage to the wing-tip. There may be a similar ring at the tail, or the rope may be attached to the tail-wheel leg.

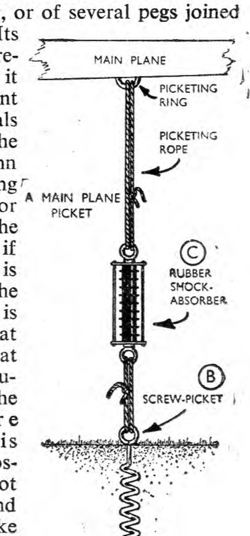
At the ground the ropes are attached to pickets, or rings permanently fixed to concrete blocks. The pickets used nowadays are screw-pickets, which look like giant corkscrews (B). They penetrate the ground fairly easily and have an enormous holding power. Various sizes of screw-pickets are used, each being specified by the load it is designed to take.

The ropes at the tail may be lashed directly between the picketing points and the pickets, but at the main planes it is preferable to include a shock-absorber device in the rope, so as to minimise the strain on the main-plane spars. The shock absorber may be in the form of a spring or an arrangement of rubber blocks in compression (C).

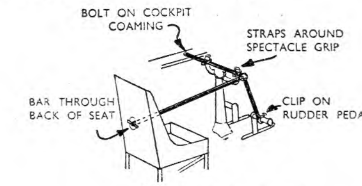
A control surface, i.e. rudder, aileron or elevator, can soon damage itself, or the control gear attached to it, if it is allowed to flap about in the wind. The rudder, in particular, if it is allowed to slam from side to side in gusty weather will soon damage itself, loosen its hinges and strain the control cables.

Damage to control surfaces is prevented in two ways—by locking the control column and rudder bar and toggling the control surfaces.

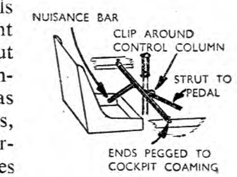
In the equipment of most aeroplanes there is a set of control-locking gear. This is not standard, as its design must vary with the differences in cockpit layout. It may consist of several tubes hinged together, or of several pegs joined by cables. Its essential requirements are that it should prevent the rudder pedals moving, and the control column from swinging fore and aft or sideways (or the wheel rotating if a spectacle grip is used). Usually the locking gear is arranged so that the pilot's seat cannot be occupied when the controls are locked. This makes it impossible for the pilot to start up and attempt to take off while the



controls are locked. One way of arranging this is to let one part of the locking gear pass through the seat. Alternatively, a separate bar, called a "nuisance bar," can be included in the gear and made to project across the seat (D).



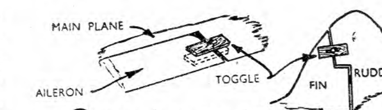
(D) TWO EXAMPLES OF CONTROL LOCKING GEAR



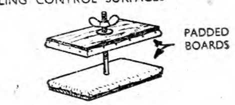
The locking of the controls may be sufficient protection, but in some circumstances, such as high, gusty winds, the control surfaces themselves may need to be locked by "toggling." This takes all strain off the control wires or rods. A toggle is a simple device consisting of two pieces of padded wood joined by a bolt and wing-nut. The toggle is fixed between the movable surface and a fixed part of the 'plane (E).

It is usual to disconnect or switch off the batteries of a parked aeroplane so that there can be no possibility of leakage. If there is no master switch for isolating the batteries, dummy terminals are fixed near each battery so that when the leads are disconnected they can be conveniently stowed out of the way. On a machine in which the engines are electrically started it may be most important when it is away from an airfield to safeguard the batteries in this way, so that a restart will be possible. On an airfield, although the precaution should still be observed, this is not quite so important, as an external battery can be plugged in for starting.

To protect the cabin and engines from the weather, special covers are provided, although they are not always carried in the aeroplane. A full set includes covers for cockpit, turret, engine and probably also propeller and wheels. The purpose of the wheel covers is not so much to protect the wheels from the weather as to prevent oil dripping from the engine on to the tyres and attacking the rubber. The various covers are held in place by straps and tapes. The propeller covers should be fitted so that those on the upper blades overlap those on the lower blades, preventing rain running inside. Metal blades do not need covering, but the variable-pitch mechanism inside the spinner should be covered.

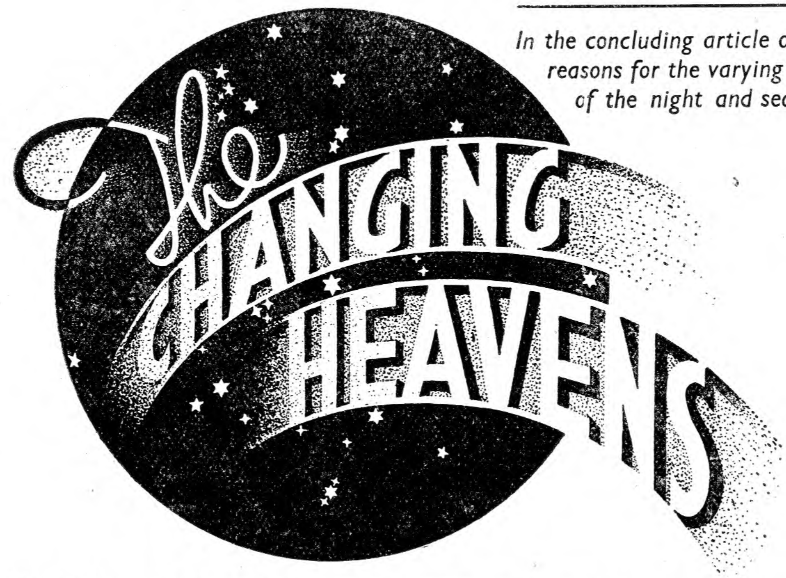


(E) TOGGLING CONTROL SURFACES



If the proper covers are not available, protection will have to be improvised. It may be sufficient to close all the hoods, windows, panels, etc., around the cockpit, then if a little water finds its way in it may cause discomfort to the pilot, but should not seriously affect the equipment. However, the engine should be covered in some way, and, bearing in mind the need for conserving rubber, a board or sack should be put over each wheel that is under an engine.

The Airspeed Oxford Mark II R.A.F. trainer below (span 53 ft. 4 in.) has two 375-h.p. Armstrong-Siddeley Cheetah X radial engines.



In the concluding article of this series **L. R. GLEGG** *explains the reasons for the varying positions of the stars at different times of the night and seasons of the year.* ★ ★ ★ ★ ★ ★ ★

IN a previous article we saw that owing to the apparent rotation of the Celestial Sphere many of the stars rise above and sink below an observer's horizon once in every revolution; and further, that since at certain seasons some of them are above the horizon only during the hours of daylight, they can be seen in the night sky during part of the year only. We have now to discover the reason for the changes in the times of rising and setting of such a star throughout the year.

The Solar Day

We keep time by the sun. The rotation of the earth on its axis causes the sun (apparently) to rise in the east and set in the west every day, and the moment the sun crosses our meridian (that is, when it is due south of us if we are in the northern part of the earth, due north if we are in the southern, or directly overhead if we are in the tropics) is called "noon." The interval of time between two successive noons is, of course, a day. Actually, for reasons we need not go into, this interval is not quite constant throughout the year, so the average is taken and is called a *Mean Solar Day*; it is divided into twenty-four equal periods which we know as hours.

Time reckoned on this basis is called *Mean Solar Time*, and is the sort of time which we keep by our clocks and watches and which we use in our everyday life. This "Sun Time," however, is not the only sort of time, as we shall soon see.

The Earth's Journey Round the Sun

Now, not only does the earth steadily revolve on its axis, but it also moves in an almost circular path round the sun, making one complete circuit in a year of just under 365¼ days. If we imagine ourselves transported to the Pole Star we shall see the earth below us turning on its axis in a counter-clockwise direction, whilst at the same time it follows its circular path (or "orbit") round the sun, also in a counter-clockwise direction.

Every day throughout the year it moves a small distance (roughly one degree) along the huge circle representing its track round the sun, but to make the following explanation more easy to understand we are going to imagine that it moves very much faster: no less than

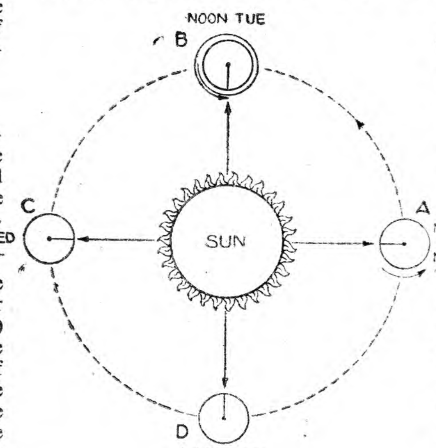


Fig. I.
An imaginary year of only four days.

ninety degrees per day. It will thus make the complete circuit in four of our Solar Days—in other words, we shall pretend that the year is just four days long.

Fig. 1 shows the position of the earth on each of these four days as we might see it from our imaginary perch on the Pole Star. In each case the dot in the centre is the North Pole, the little circle representing the earth will be its Equator and the line joining the North Pole to the Equator will be the northern half of a meridian which we will take to be the meridian of a certain observer. The earth is revolving on its axis in the direction of the arrow under A, and also travelling round the sun along the circular path shown by the dotted line, in the direction of the arrow on that line. (The earth's axis is not actually at right angles with the plane in which its orbit lies, but for the sake of simplicity this is ignored in the diagram.)

In position A the sun is just crossing the meridian of our observer, so that for him it is noon. Let us call the day Monday.

Position B shows noon on Tuesday, i.e. 24 hours later. The sun is again crossing the observer's meridian and the earth has made one-quarter of its journey round the sun, since it is a "four-day" year. But how many times has the earth revolved on its axis during this interval? Once at least, because a night has passed since noon on Monday, and the earth must therefore have revolved enough for the observer to have been on the side of it away from the sun, and you will see that for it to have turned sufficiently for his meridian to be again opposite the sun it will, in fact, have made exactly one and a quarter revolutions.

At position C (noon Wednesday) the earth has travelled another quarter of its circuit and made another one and a quarter revolutions on its axis; the same has happened again at position D (noon Thursday), and finally once again by noon Friday, when it is back at position A and our year is at an end. Therefore during the *four-day* year the earth has made a total of 4 × 1¼, or *five*, revolutions on its axis.

By precisely similar reasoning you will see that in a year of just under 365¼ days the earth will revolve just under 366¼ times on its axis. To perform this extra revolution in the course of a year it is clear that the earth must revolve on its axis once in rather less than our Mean Solar Day of 24 hours, or conversely in a Mean Solar Day the earth makes a little over one complete revolution. A little simple arithmetic will in fact show that the time taken for a revolution is approximately 23 hours 56 minutes.

"Star" Time

Now, the apparent rotation of the heavens (the Celestial Sphere) depends only on the rotation of the earth on its axis; the fact that for convenience we keep "Sun Time" (so that it is always midday at 12 o'clock and midnight at 12 o'clock—or 24.00 hours, if you like) does not make any difference to this fact. The stars, then, keep a sort of time of their own, which astronomers call *Sidereal Time*, the length of time taken for the heavens to make (apparently) or the earth (actually) one revolution being called a *Sidereal Day*, which is in fact equivalent to approximately 23 hours 56 minutes in our earthly way of measuring time.

If we set a clock to run fast we can make it keep Sidereal Time, though it will be of no use to us in our everyday life. It would have to be so regulated that it gained about four minutes a day, with the result that in a year it would have gained 24 hours—a complete day.

The sun, like the stars, seems to make a daily journey across the sky from east to west, but the stars evidently move a little faster than the sun. Imagine the sky as a great racetrack; if the sun and a certain star are regarded as starting together from "scratch," the star will slowly outpace the sun, and by the time the latter has done some 365¼ laps the star will have covered an extra lap and will overtake the sun, after which it will again draw ahead, and so on year after year. It is not the stars which put up an exceptional performance in this race: the sun is the laggard. The slower (apparent) speed of the latter is simply due to the fact that the earth makes a yearly circuit round the sun, whilst its position in space relative to the stars

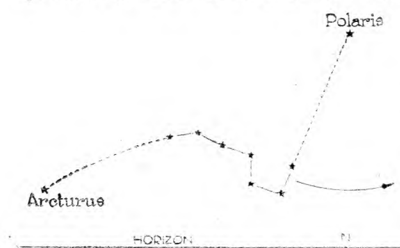


Fig. 2. Midnight, Aug. 1st.

remains for all practical purposes unchanged. (Even the nearest star is so immensely distant that the earth's movement in its orbit, vast though this is, makes no appreciable difference.)

How Star Time Affects Star-Gazers

What is the practical result of this difference between Solar and Sidereal Time to those of us who are primarily interested in studying the position in the sky of the various navigation stars?

Suppose that as seen from, say, London, a certain star is just rising above the eastern horizon at 7 p.m. on the evening of January 1st. It will travel across the sky, set in the west, and eventually rise again at the same point on the eastern horizon after one complete revolution of the Celestial Sphere—that is, in one Sidereal Day, or about 23 hours 56 minutes of our earthly (Mean Solar) time. On the evening of January 2nd, therefore, it will rise at about 6.56 p.m. The same thing will happen every day: the star will always rise some four minutes earlier than on the previous day. Eventually a time will come when it rises during the hours of daylight (in this particular case the coming of such a time will be hastened because the days are "drawing out" as spring approaches), and if our star happens to be one of those which are well removed from the Celestial Pole and which are therefore above the horizon for a comparatively short time only, it will in due course *both rise and set in daylight*. For a part of the year, then, this star will be above the horizon only during the day-time and we shall not be able to see it.

As the year grows older and the time of rising gets earlier and earlier, the star will at last appear before dawn; subsequently it will rise earlier still, until finally on January 1st of the next year it will once again rise at about 7 p.m.

So with all those stars which rise and set. Each one will do so about four minutes earlier each day, though each one will have its own particular time of rising and setting according to its position on the Celestial Sphere. Moreover, the position in the heavens of *any* visible star relative to a given observer is the same position as that which it occupied at a time some four minutes later on the *preceding* night, or that which it will occupy at a time some four minutes earlier on the *following* night. If we take a longer interval between the dates when we make our observations, since in the course of 12 months there is a total variation of 24 hours in the time at which a star is at a given point in the sky, a star which is in a certain position at a given date will be in that same position at a date three months later on, *but at a time six hours earlier*.

An Example

Fig. 2 shows (diagrammatically only) a part of the sky as seen from London at midnight (Greenwich Mean Time, *not* Summer Time) on August 1st. We see the familiar group of stars we know as *The Plough*, with an extension to its "handle" leading to the bright star *Arcturus*. We are looking roughly northwards, but the straight line in the diagram does not represent only the northern horizon; its left- and right-hand ends curve towards us, becoming the western and eastern horizons respectively—*Arcturus*, in fact, is seen low in the sky above the western horizon. We are in the northern hemisphere, so that the heavens appear to revolve in a counter-clockwise direction (as indicated by the arrow). all the stars in the diagram moving to our right, except, of course, *Polaris*, which remains almost stationary. *Polaris* revolves round the true Celestial Pole like all other stars, but is so close to it that its movement is imperceptible to an observer without instruments.

Fig. 3 shows where these stars will be six hours later (we shall not see them, because the sun is up at 6 a.m. in August)). *Arcturus* is below the horizon—it actually set in the west about 1½ hours after midnight. The stars in *The Plough* proper, however, have not set, and they never will, as seen from London, because they are comparatively near to *Polaris*. All these stars will have moved during the six hours through approximately one-quarter of a revolution, and as Star Time gains on our Sun Time at the rate of one Sidereal Day (one revolution of the heavens) per year, Fig. 3 shows also the approximate positions of the stars at *midnight* on November 1st. Both these diagrams, in fact, indicate the aspect of a part of the heavens on a large number of hours of the night (or day) and dates of the year; for example, Fig. 2 shows the position of the stars at 10 p.m. on September 1st, and Fig. 3 where they will be at 10 p.m. on December 1st.

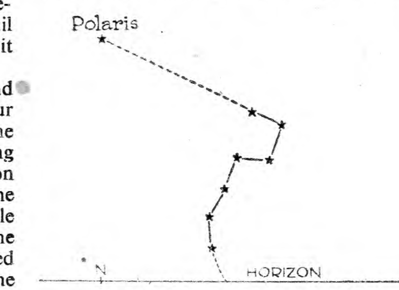
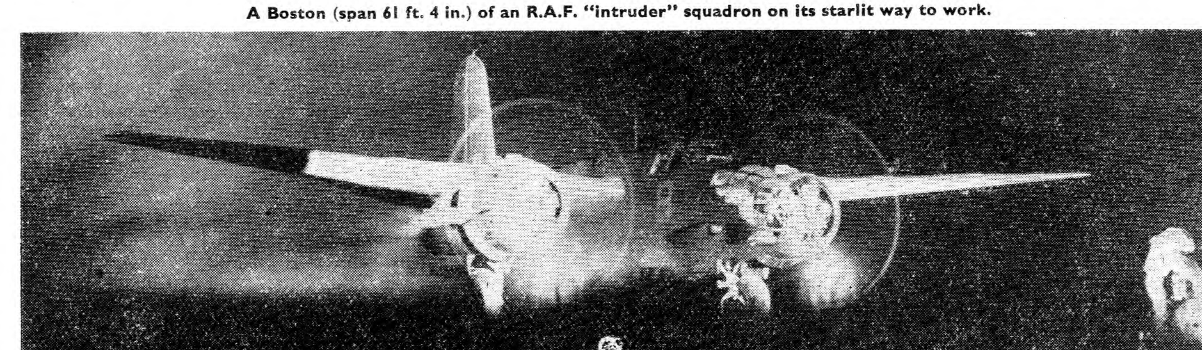


Fig. 3. Six hours later than Fig. 2

A Boston (span 61 ft. 4 in.) of an R.A.F. "intruder" squadron on its starlit way to work.



Pilot Navigation

by DONALD W. SEAGER

THE other day, upon asking a prospective pilot whether he had any knowledge of Navigation, I received the unexpected reply:

"I don't need any; I am going to be a pilot."

Remarks subsequently made by other fellows in the same position have convinced me that his was not an entirely isolated case.

If they could spend a few weeks in the adjutant's office at any E.F.T.S. their attitude would undergo a swift change. At frequent intervals during the course pupil-pilots ring up the aerodrome from some remote spot in a distant county with the request for transport back to base—their first cross-country flight a complete success except for one thing—they got lost. Many young pilots have been apt to treat navigation as a huge joke until a similar experience convinced them that flying an aircraft and navigating it are *both* indispensable to success. If you are lucky enough to have been forewarned of this danger by a pilot friend you are, no doubt, already convinced.

Differing Methods

Of course, there is navigation and navigation, or, more correctly, navigation and pilot navigation. Obviously, the pilot-navigator must use different methods from those employed in a heavy bomber. It is true that he can fly the aircraft without navigation for longer than he can navigate it without bothering about the controls, but the eventual consequences are equally disastrous. Fortunately the standard of navigation required by the pilot-navigator, who is generally flying an aircraft with limited endurance, is much less exacting than that required by a long-range bomber carrying a separate navigator.

An Exacting Task

Flying and navigating an aircraft for long distances is probably one of the most exacting tasks a pilot can be set, for while he dare not allow his concentration to wander from the controls for more than a few moments on end, at the same time he must keep a constant check on his position. Under these circumstances it is only to be expected that he does not normally make use of such aids as astro-sights and D/F wireless. His methods must be simple yet accurate, carried out as they are in intervals between scanning the sky for other aircraft, keeping an eye open for likely landing spots in the event of engine failure, snatching quick glances at the A.S.I. and compass and watching oil pressure and engine revs.

His specialised form of navigation is only part of the subject as we know it. It is called Pilot-Navigation—a relic from maritime phraseology, in which the terms "pilotage" and "navigation" are used to differentiate between finding one's way about in sight and out of sight of land respectively. As might be expected, pilot-navigation consists of navigating an aircraft within sight of the ground. Once the ground is obscured by fog or other causes and the pilot flies blind, using his compass to guide him through the overcast, he is employing D/R methods—elementary, perhaps, but nevertheless D/R.

Weather

The elements can be a far greater enemy to the solo navigator than to his counterpart in a larger aircraft, because any D/R position he calculates must, of necessity, be rough and ready. Generally speaking, if he encounters poor visibility he is well advised to try to fly round the affected area whenever possible. Provided that the weather is fit both at the take-off aerodrome and at the destination, the navigator of a heavy aircraft, on the other hand, need not worry overmuch about conditions along the route. He can navigate mainly by D/R, making secondary use of any other aids available, until the visibility improves and he can pinpoint his position by observation of the ground. The pilot-navigator, however, relies upon retaining sight of the ground during the greater part of the trip, and, if he runs into extensive bad weather, is forced to turn back. His greatest assets are skill at map-reading and the ability to interpret weather signs; in short, that quality known as "air-sense," which is developed mainly by experience.

Estimating the Wind

An accurate met. forecast must be consulted to determine whether the flight can be safely carried out, but the accuracy of the forecast wind is not of paramount importance, as this can always be checked by observing the direction of smoke drifting from factory or other chimneys. Unfortunately, the height at which he flies is predetermined by cloud conditions, and he may be forced to fly at a height where the wind direction is unfavourable.

Pilot-navigation alone is not to be recommended when it can be supplemented by other methods, because it does not enable the aircraft to be flown over the most direct route. Experienced pilots, however, can achieve a high standard of accuracy in conditions of good visibility when conscientious map-reading ensures that the position of the aircraft is never in doubt.

Preparation is Necessary

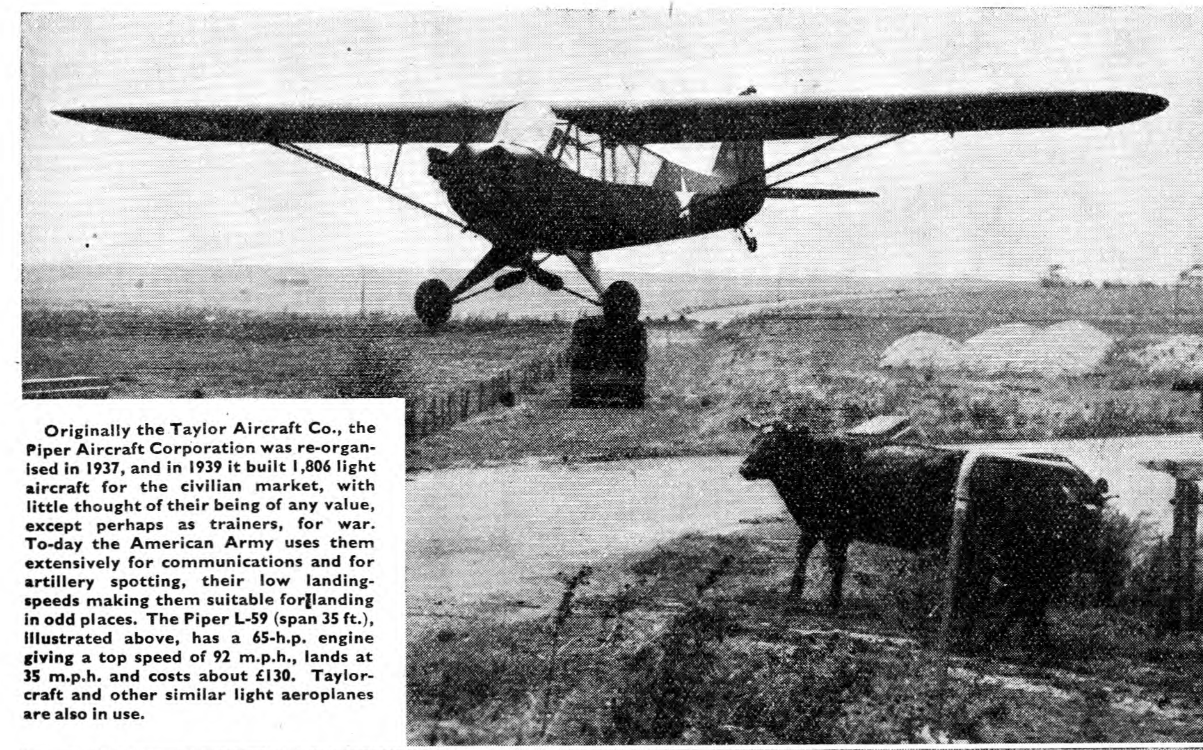
Any form of plotting in the air is impossible, and it is imperative to draw and measure your tracks before the take-off. A notebook strapped to the knee enables simple calculations such as E.T.A.s to be made, but complicated problems cannot be attempted. The importance of having youŕ maps folded correctly and stacked conveniently for use in the air can be readily appreciated when you imagine attempting to do this with one hand in an exposed cockpit. Many a good map has been torn from the harassed grip of a pilot attempting this feat.

One of the few jobs which can be carried out successfully is the observation of drift. This is made possible by the use of drift markings on the wings of the aircraft or by the installation of a floor-type drift sight, but most pilots appear to prefer altering course on the trial-and-error basis.

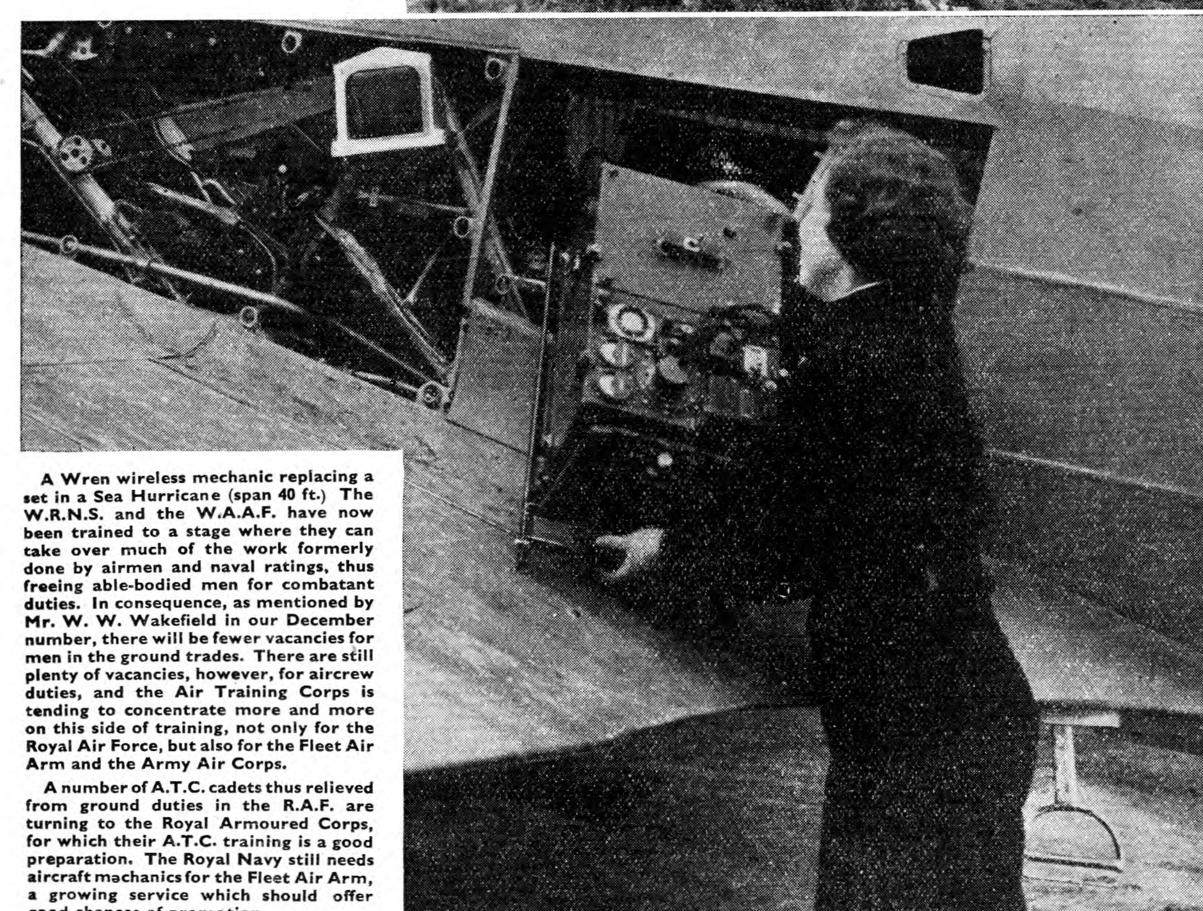
It is possible, too, for the wind speed and direction to be calculated not by plotting, but by the use of special tables. A convenient method of finding the wind direction only is to fly approximately upwind and to alter course until no drift is observed, when the compass reading gives the direction from which the wind is blowing. Variation and deviation must be applied to convert this direction to True.

The Pioneers

Some remarkable long-distance flights have been carried out successfully by pilots flying solo—witness the brilliant achievements of Bert Hinkler and Miss Amy Johnson—and there is no doubt that experience can bring this method of navigation to a high pitch of skill. As far as the pupil-pilot is concerned, pilot-navigation is not to be recommended for flights longer than two hundred miles at the most, although shorter trips can be attempted with perfect confidence if the visibility is good and landmarks plentiful.



Originally the Taylor Aircraft Co., the Piper Aircraft Corporation was re-organised in 1937, and in 1939 it built 1,806 light aircraft for the civilian market, with little thought of their being of any value, except perhaps as trainers, for war. To-day the American Army uses them extensively for communications and for artillery spotting, their low landing-speeds making them suitable for landing in odd places. The Piper L-59 (span 35 ft.), illustrated above, has a 65-h.p. engine giving a top speed of 92 m.p.h., lands at 35 m.p.h. and costs about £130. Taylorcraft and other similar light aeroplanes are also in use.



A Wren wireless mechanic replacing a set in a Sea Hurricane (span 40 ft.) The W.R.N.S. and the W.A.A.F. have now been trained to a stage where they can take over much of the work formerly done by airmen and naval ratings, thus freeing able-bodied men for combatant duties. In consequence, as mentioned by Mr. W. W. Wakefield in our December number, there will be fewer vacancies for men in the ground trades. There are still plenty of vacancies, however, for aircrew duties, and the Air Training Corps is tending to concentrate more and more on this side of training, not only for the Royal Air Force, but also for the Fleet Air Arm and the Army Air Corps.

A number of A.T.C. cadets thus relieved from ground duties in the R.A.F. are turning to the Royal Armoured Corps, for which their A.T.C. training is a good preparation. The Royal Navy still needs aircraft mechanicsfor the Fleet Air Arm, a growing service which should offer good chances of promotion.

Ocean Flying

The Curtiss Seagull (British name Seamew) (span 38 ft.), two-seat scout-observation monoplane now in production for both U.S. Navy and the Royal Navy. It is built either with floats or wheels and has a top speed of about 190 m.p.h.

by ***Captain Norman Macmillan,*** *M.C., A.F.C.*

ONCE sea fliers and seaplane aircrews were synonymous terms. That is so no longer. To-day more landplanes than seaplanes fly above the waters.

Sea flying is in some ways more difficult and in others more simple than overland flying. When out of sight of land, navigation must be effected without the aid of landmarks; changes of wind direction and strength are more difficult to observe (a fall in the air temperature when flying at the same height usually means a change of wind); a parachute descent is not such a sure way to safety; making a land-fall in fog is no joke, and a water landing in fog is, if anything, more difficult to pull off than one on land. But, on the other side of the balance sheet, except for waves (whose greatest height from trough to crest seldom exceeds 70 feet) and tides, the surface of the sea is level and constant. There are no mountains to trouble about when icing conditions are met, and it is thus possible to select an ice-free height with greater certainty and safety; bombers crossing the Alps to Northern Italy cannot do this.

In the ocean areas most likely to be flown over, the highest waves are most frequently found to the south of the Cape of Good Hope, and the greatest width between crest and crest in the North Atlantic. Sometimes a mile and a half may separate the high crests of North Atlantic waves, with, of course, subsidiary waves between. The shorter and higher waves off the Cape of Good Hope probably form a more difficult alighting problem than the longer, and consequently shallower gradient, waves of the Atlantic.

Alighting on the Waves

When Commander Towers (now a senior American Naval Air Corps officer) flew one of the four naval Curtiss flying-boats that set out to cross the Atlantic in 1919, he found that he could alight with comparative ease on the upslope of one of the great Atlantic mid-ocean waves. The subsidiary waves were not much rougher than an ordinary rough sea, and the average gradient remained constant long enough to enable him to touch down and lose speed before the crest was reached.

Now, this is important; if speed is not lost before the crest is reached, and there is still considerable way on the aircraft, the pilot will be faced with tricky combination of a stalled aircraft, poised one instant at a climbing angle on the crest of a wave and the next instant plunging down a nasty gradient out of control. So it is desirable to touch the water low enough on the rising wave to have time to lose all, or nearly all, forward speed before the crest is reached. This can be done only when long waves are found, otherwise the reversal of the gradient makes it impossible for the pilot to get right down into the trough before pulling back to alight.

Ditching

To-day, when so many of the over-ocean aircraft are landplanes, the technique of alighting on ocean waves is more important than ever, because the time factor for the launching of a dinghy is often slight.

With over-water air operations becoming every day more urgent, a knowledge of oceanography is an increasingly important part of an aircrew's mental stock-in-trade.

Oceanography

There are five oceans—the Atlantic, Pacific, Indian, Arctic and Antarctic; all have many subdivisions of lesser oceans, or seas; air war has waged over four of the great oceans, from higher than 70 degrees north latitude to nearly 40 degrees south latitude. The area covered by the war at sea is greater than that

Vought-Sikorsky Vindicators (British name Chesapeake) (span 42 ft.), two-seat dive bombers, circling round their carrier in the Pacific.

covered by the war on land. This is scarcely surprising when it is remembered that 71 per cent of the earth's surface, or just under 140,000,000 square miles, is covered by water. But this is not the only way to consider the water surface of the earth, especially from a military point of view.

The earth can be divided into different areas geographically. It can also be divided into distinctive areas geometrically.

One geographic system of division splits up the land surface into continents, which in turn are sub-divided into countries. Countries may represent either true geographical entities, as in the case of the British Isles, Australia, New Zealand and other land masses which are separated from adjacent land masses by natural divisions or ethnographic (race) divisions; in which case the frontiers may be political separation lines instead of lines of natural cleavage.

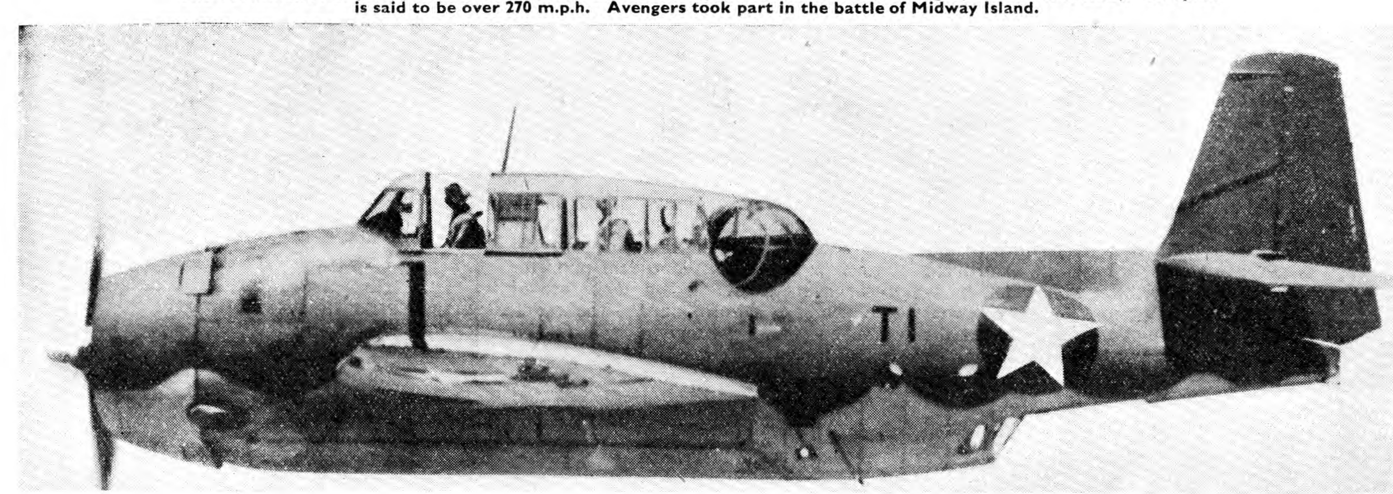
One geometric system divides the world into hemispheres—the north and south hemispheres, the east and west; these divisions are interesting navigationally, horologically, racially and climatically.

But another way is to divide the world into the so-called land and water hemispheres. This division is not properly either a geometric or a geographic one. It is an arbitrary cut through the centre of the globe along an oblique great circle, so that the greatest proportion of the land mass lies on one side of the globe and the greatest proportion of the water mass on the other. From the flying point of view this is the most interesting bicentral way of dividing the globe.

For most aircrews a study of the oceanography of the land hemisphere will suffice. Within it will be found the air routes interconnecting North and South America, Europe, Africa, Russia, India and China. Within it will be found great trade winds and many, but not quite all, of the tropical-storm zones, and most of the sea routes of the world. Once Japan is driven out of the Pacific islands area which she has overrun, it will contain all the war areas, including Japan.

For the prospective aircrews of the shore-based aircraft of Coastal Command, for the submarine-hunting aircrews of Bomber Command, for most of the Fleet Air Arm aircrews, whether they fly from carriers, battleships or cruisers, and for the catapilots of the Merchant Ship Catapult Unit of the R.A.F., the oceanography of the land hemisphere is the one with which they will become most familiar, for the majority will operate over that half of the globe. A study of its potentialities for flying will repay you if you come to do the actual job yourself.

The Grumman Avenger (span about 54 ft.) carries a 21-in. torpedo enclosed in the fuselage (or a ton of bombs). Its speed is said to be over 270 m.p.h. Avengers took part in the battle of Midway Island.



Basic Aircraft Recognition

(1942.) By C. H. Gibbs-Smith. *Country Life.* 5/-. 128 pages. $6\frac{1}{4}'' \times 9\frac{1}{2}''$.

The most complete recognition guide yet published, this five-shilling book contains over 200 three-view drawings of British, American, Russian, French, German, Italian and Japanese aircraft, all neatly classified by recognition features and well indexed. There is a section on camouflage and national markings, composite annotated drawings illustrating aircraft parts and a chapter on aircraft analysis for the purpose of recognition. The author acknowledges his debt to Mr. Peter Masefield of the *Aeroplane Spotter* and to the Ministry of Aircraft Production, and the book can be said to be of a high standard of accuracy.

Although different wording and different drawings are used, the chapter on aircraft analysis is produced on much the same lines as "A Guide to Aircraft Recognition" compiled by the Editor of the *A.T.C. Gazette* and Mr. James Hay Stevens nearly two years ago. Cut-up silhouettes are used, just as in that guide, and arranged in columns also just as in that guide, to illustrate the various arrangements of aircraft parts, though the author deals with wings first instead of engines. This order has been adopted in order that the word "weft" (Wings, Engines, Fuselage, Tail) can be used as a mnemonic. The value of this word "weft" has never been very clear to the reviewer. If a mnemonic is necessary, why not have one which includes "landing gear." But is it necessary? People who need such a mnemonic to recall that an aeroplane has wings, engines, fuselage and tail can hardly be expected to memorise the names and features of two or three hundred aircraft. However, that does not spoil the book.

It is reasonable to suggest that the Government, which has latterly gone in for publishing in a big way, might have assumed responsibility for a publication such as this. They have co-operated to some extent, through the Ministry of Aircraft Production, in its compilation, but as they do not assume responsibility, the Press, which often has to quote names, dimensions, etc., still has no official authority to go by, with the result that the bemused public is confronted in its several journals with pictures of the same aeroplanes bearing an assortment of names and credited with widely varying dimensions, performances and what not. This does not matter so far as the laymen are concerned, but the million or more of the public who read newspapers and have some duties in connection with aircraft recognition are not all in possession of official handbooks, and they may find themselves confusing the official figures, which they get only by hearsay, with the published figures, which they see in print, and vice versa, to the great joy of the King's enemies and of the examiners who are hoping to plough them in their recognition tests.

NOT BY AUTHORITY
of the Air Ministry. These books are reviewed by the Editor of the A.T.C. Gazette and the opinions expressed are not those of A.T.C. Headquarters.

Air Commentary

(1942.) By Group Captain W. Helmore, C.B.E., Ph.D., M.Sc., F.C.S., F.R.Ae.S. Allen & Unwin. 6/-. 90 pages. $7\frac{1}{4}'' \times 4\frac{1}{2}''$. 15 photographs.

In his introduction Group Captain Helmore expresses some doubts as to the wisdom of reproducing in book form words which were intended for broadcasting. His doubts are well justified. Group Captain Helmore is a good broadcaster, and many of us have enjoyed listening to him, but in print, lacking the expressiveness of his voice, his sentences appear tedious or overdrawn.

He does not help matters either by suggesting in his introduction that he envisages his listeners "confronted more often than not by a half-cleared meal, the contents of the kitchen sink, or a pile of unpaid bills." Group Captain Helmore's own friends may perhaps neglect their domestic duties in order to hear him broadcast, but, in the average British home, clearing up, washing up and paying up are seldom held up for any broadcaster less distinguished than Tommy Handley or Winston Churchill, and even the voices of these are sometimes drowned in the clatter of dishes.

Teach Yourself Electricity

(1942.) By C. W. Wilman, M.I.E.E. English Universities Press. 3/-. 184 pages. $7'' \times 4\frac{1}{2}''$.

A book which, as it says in the introduction, "has been written for the reader who seeks to learn something of electrical principles but who is dependent upon his own efforts to obtain and make use of the necessary information." The cadet, though having instruction, will find it useful too.

Elementary Electricity for Radio Students

(1942.) By W. E. Flood, M.A. Longmans. 1/-. 64 pages. $7\frac{1}{4}'' \times 4\frac{3}{4}''$.

A simple introduction to the study of electricity which should help the student in getting through the first difficult stages.

Parachutes in Peace and War

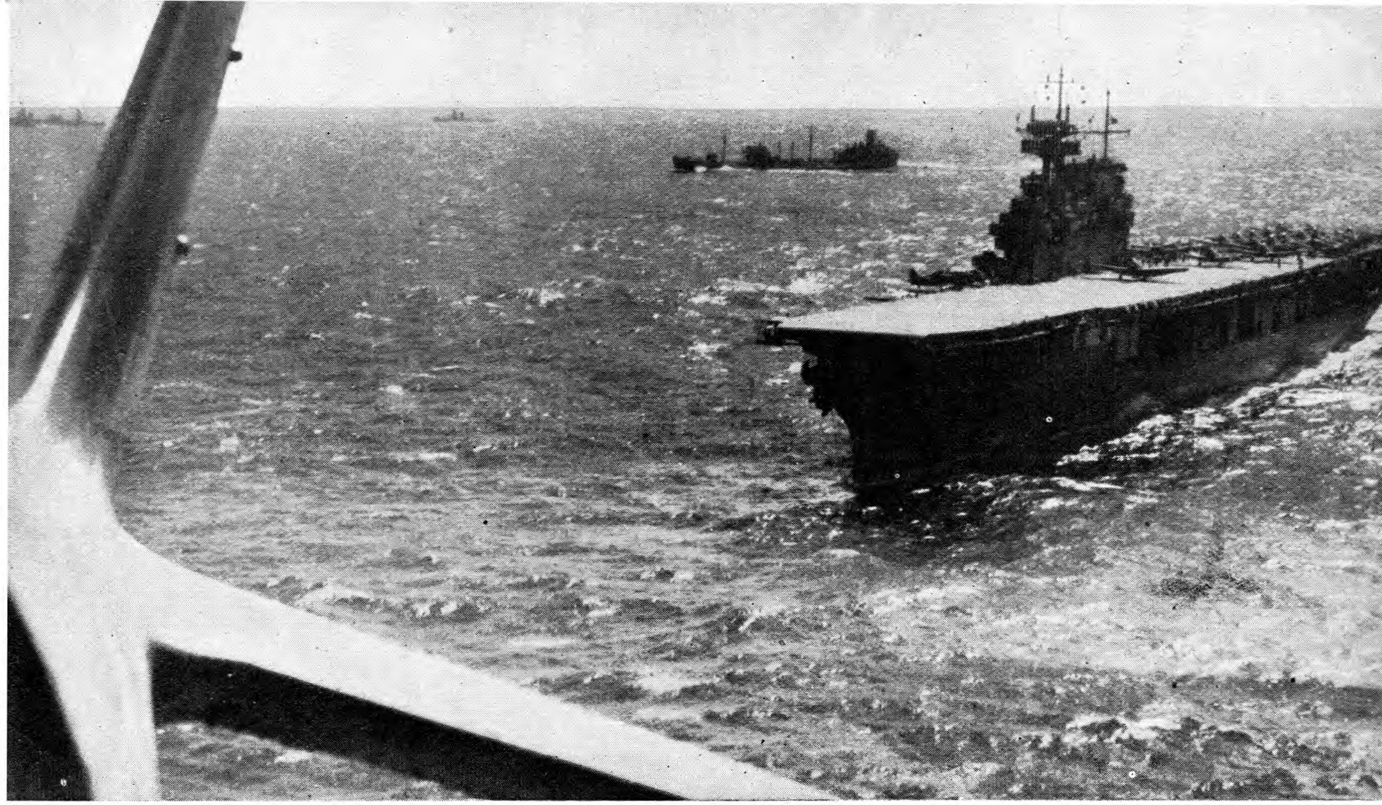
(1942.) By Professor A. M. Low. John Gifford. 2/6. 232 pages. $7\frac{1}{4}'' \times 4\frac{3}{4}''$.

It is some years since a book on parachutes was published. This one therefore fills a gap. It recounts the history of the parachute from its earliest days and deals with its use in war and peace.

Air Navigation
British Empire Edition

1942.) Second Edition. By P. V. H Weems. Revised and edited by Arthur J. Hughes, O.B.E., and P. F. Everitt, B.Sc., F.Inst.P. McGraw-Hill. 35/-. 519 pages. $8\frac{1}{2}'' \times 5\frac{1}{2}''$. Illustrated with photographs and diagrams.

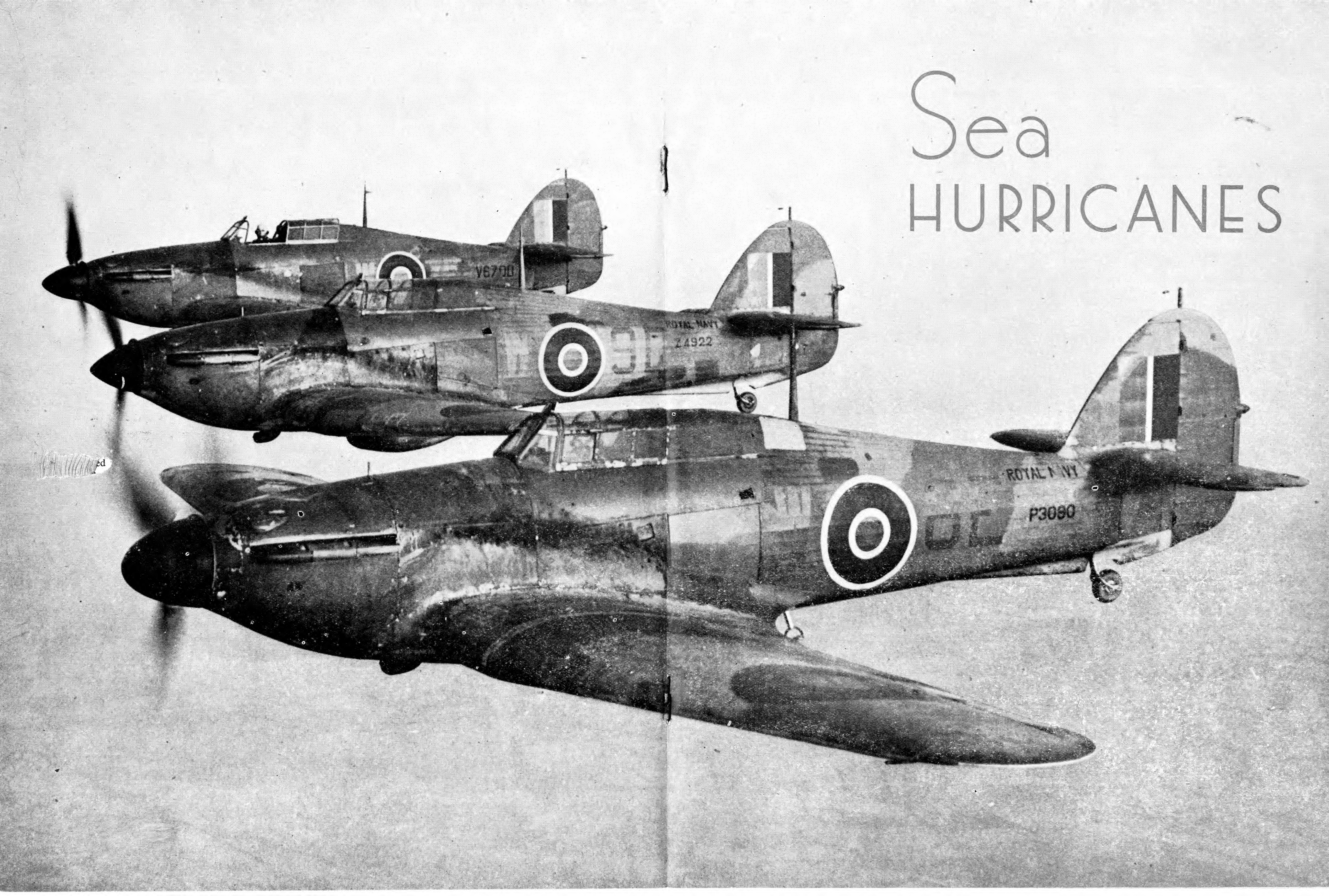
This book was produced in America before the war for the civil air navigator, and as an exhaustive treatise on the subject it has been held in deservedly high esteem, both in America and in this country. The present edition has been corrected up to 1941, so far as secrecy will permit, but the chapter on radio has been left in its original form. It is a handsomely produced book on good paper, and stands out strikingly among the many cheaper books which have recently been published on navigation.



With Wildcat fighters (span 38 ft.) and Dauntless (span 41 ft. 6 in.) and Devastator (span 50 ft.) bombers on her flight-deck, this American aircraft carrier makes an impressive picture as she steams along with her escort.

Men of the U.S. Army Eighth Air Force priming and "finning" American-built 1,000-lb. bombs before loading them into a Consolidated B-24 heavy bomber (span 110 ft.).

Sea HURRICANES



T. O. M. SOPWITH

Aerobiographies No. VIII
by C. G. GREY

The story of a rich boy who shunned delights and lived laborious days, and served his country well by doing so.

WHEN flying began in this country in 1909, Thomas Octavius Murdoch Sopwith—"Tommy" to all his friends and to many others—had more money than would have been good for most youngsters of his age. He had fast cars and racing motor-boats and everything he could wish. So, as he came of an old North-Country sporting family, he naturally took to flying.

In 1910 he flew a very dangerous single-seat monoplane at Brooklands; then he bought a tandem-seat Bleriot which he flew admirably. Also, he bought a Howard Wright biplane. And he took these to the United States late in 1910 to do an exhibition tour. His sister May went with him as business manager—most competent she was—and his machines were kept in order by Fred Sigrist, who had looked after his cars and boats.

Early in 1911 he came back, bringing with him a Wright biplane. At Brooklands he had the controls and tail of the Wright altered to a more practical arrangement. And then he had a tractor biplane built which had warping wings of the Wright type and a Gnôme engine. He and Fred Sigrist "doped out" the design, and Fred saw to the construction in the shed at Brooklands.

Admiralty Order

The biplane flew so well that the naval engineer officers and the pilots of the Air Department at the Admiralty advised Captain Sueter (now Sir Murray Sueter, M.P.) to order some for what was then the Naval Wing of the Royal Flying Corps—which in 1914 became the Royal Naval Air Service. So Tommy and his sister May formed the Sopwith Aviation Co., Ltd.

They leased the old skating-rink close to the station at Kingston-on-Thames. It is still there, behind the Regal Cinema, in the same street where the great Sopwith Works were built a few years later. And when they started to design new types they drew the plan views in chalk full size on the floor and the front and side elevations on the walls. More orthodox engineers laughed, but the Sopwith machines always flew well, and those of many other people did not. Tommy had a wonderful eye for form, and Fred Sigrist was one of the best mechanics I have known.

At the top of the page is a Sopwith 1½ Strutter taking off from a platform on a warship in the last war. A Fury, a Hart and a Henley (*Aeroplane* **photos**) **appear below. A Hurricane IIc occupies the centre of the picture, with a Hurricane I** (*Aeroplane* **photo**) **in a vertical bank to the left.**

At the bottom on the right, a Sopwith Camel is leaving the deck of a light barge towed by one of our then fastest destroyers. A Zeppelin was shot down by this method of attack. At the bottom left is a modification of the Fury, the Hawker P.V.3 (*Aeroplane* **photo**).

Scouts

At the skating-rink they produced the famous "Tabloid," a tiny single-seat biplane which, with a 50-h.p. Gnome, had a top speed of about 80 m.p.h. and landed at about 30 m.p.h. It was the forerunner of all single-seat fighters, but we called them "Scouts," because they were so much faster and more manœuvrable than were the big biplanes of the time that they were better able to go "look-see" and bring back news.

Gentleman's Agreement

When the firm got an order for a whole dozen aeroplanes Tommy Sopwith told Fred Sigrist, then dignified as works manager, that he would give him a bonus of so many pounds for each machine they built. And little more than a year later war broke out—in August 1914. The Sopwith Company was building only for the Navy—the Army's R.F.C. insisted on standardising the unhappy B.E.2c. But later the R.F.C. was forced to buy Sopwiths because of their performance, so their types were built by sub-contractors here and in France, and thousands were turned out. Tommy never varied the arrangement about the bonus, and at the end of the war Fred Sigrist was, deservedly, a very rich man. And so was Harry Hawker, a young Australian mechanic, who joined Sopwith's before the war, became the firm's head test-pilot, and likewise drew a bonus on every machine tested. Which is a good example of a "Gentleman's Agreement," of which we hear so often and meet so seldom.

In 1915 the Sopwith Company produced the famous "1½ Strutter" biplane, the first machine which, besides a gun in front firing through the airscrew, had another for the observer *behind* the pilot, on a gun-ring. It was a horrid surprise for the Germans, who were used to shooting down defenceless B.E.2cs as they pleased. The R.N.A.S. had so many "1½ Strutters" in 1916 that they were able to hand over enough to mount several squadrons of the R.F.C. and save the *moral* of the Army's aviators during the Battle of the Somme. Also, the R.N.A.S. lent three or four fighter squadrons in Camels to the R.F.C. That period in the air was about as critical as was the Battle of Britain in 1940.

The Camel

There is no room here to describe the Pup and the Camel and the Snipe, and the Dolphin, and the Salamander (our first armoured ground-strafer) and the Cuckoo (our first torpedo-dropper) and other original designs which helped to win the war.

When the war was over The Sopwith Aviation Co., Ltd., liquidated itself. Tommy Sopwith, Fred Sigrist, Harry Hawker and their friend Bill Eyres formed the H. G. Hawker Engineering Co., Ltd., to make motor-bicycles. A year or two later the firm began to make aeroplanes. Harry Hawker died in a crash—not in a Hawker machine—and medical evidence showed that he died before the crash. The other directors kept on his name as a memorial. Hence the famous line of Hawker aircraft.

Big Business

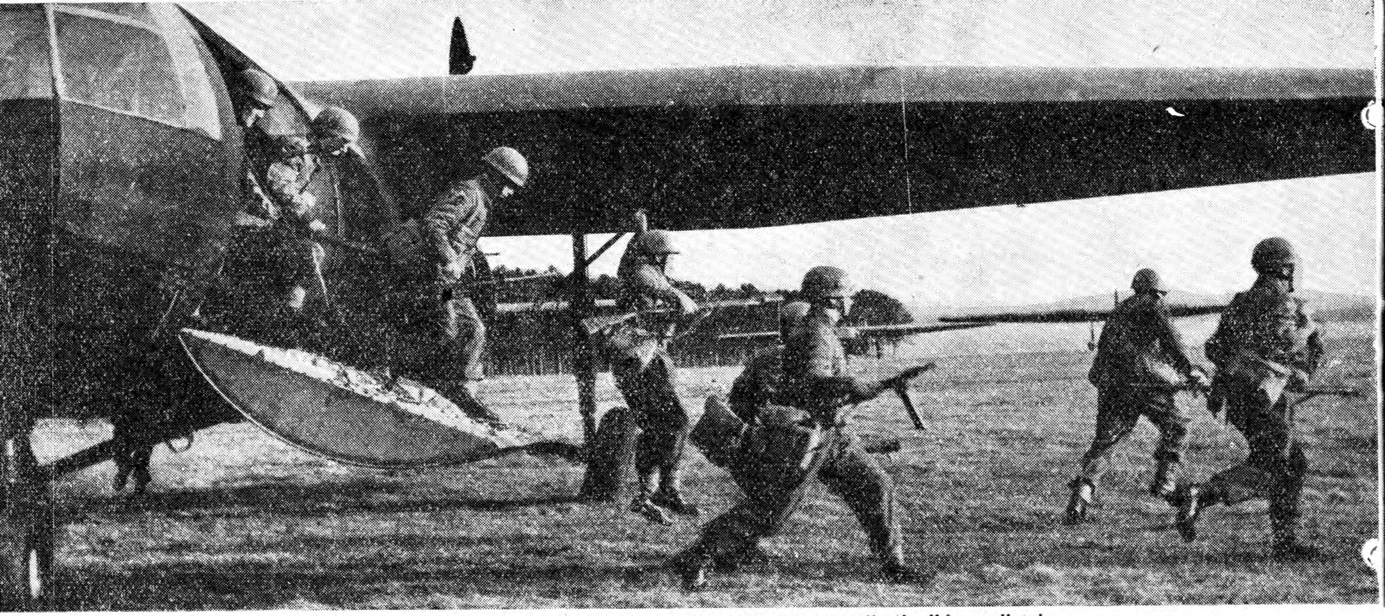
Among them the Hawker Hart and Fury may be regarded as the direct ancestors of the Hurricane and Typhoon, and their successors, of to-day. Between wars the Hawker Company acquired control of the Siddeley group, which included the Armstrong-Whitworth aircraft works and A. V. Roe & Co., Ltd., and the Gloster Company. Of all this Hawker-Siddeley group Tommy Sopwith is chairman.

He takes a very active interest in the production side of all the firms, and he flies constantly all over the country, piloting himself — though his co-directors insist that he shall, as he puts it, have his "nanny" with him, a good safe pilot to see that he does nothing rash.

Hurricanes Top the Score

Now here is a bit of history which has only recently been allowed out. Before the war, when the Air Ministry was dithering about whether it would order a couple of dozen Hurricanes or a couple of hundred, Tommy Sopwith, with the concurrence of his co-directors, signed an order to the works to put in hand one thousand Hurricanes. And that is why, in spite of yarns at the time, the R.A.F. was never short of fighters during the Battle of Britain—leaving out the fact that the fighter squadrons from the North of London to the North of Scotland were still in reserve.

As a further consequence, Hurricanes in the Battle of Britain shot down more enemy aircraft than did all other fighters, our own and enemy put together—Spitfires, Defiants, Messerschmitts, Heinkels, Junkers and all. And when one is told that there were five Hurricanes in the battle for every Spitfire, that, also, is something of which Tommy Sopwith may justifiably be proud. One often hears of the poor boy who makes good, but one seldom hears of the poor little rich boy who "shuns delights and lives laborious days" for love of a risky job, and serves his country notably by doing so.



Airborne troops de-planing from a Horsa glider and going into "action" immediately.

Airborne troops awaiting the signal to attack after de-planing from a Horsa glider.

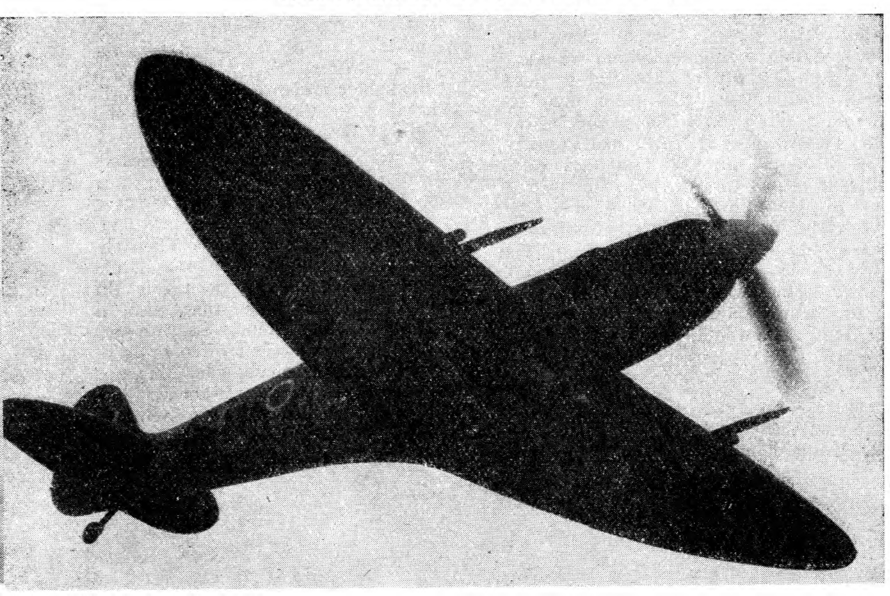
Airborne Assault

by V. E. R. BLUNT

LET us "gate-crash" a full-scale exercise of Airborne Troops in attacking and capturing an enemy strong point on the top of a hill which dominates an undulating plain.

It's a dull winter day, with low clouds down to 1,500 feet, and ideal for the purpose, as we shall no doubt realise when we get started. It's a bit cold when we sit down in the camouflaged hut to hear the "briefing" of the Royal Air Force pilots who are flying the "tugs" which tow the gliders of the Airborne Troops, and also themselves carry parachutists. They are told all about the aim and the plan of the operation. Then they are given the "met." forecast, their landmarks and the direction of approach to the "dropping zones," this latter information, of course, being guided by the lie of the land in relation to the enemy's ground and A.A. defences. The army officers, strangely dressed in "crash helmets," who have been listening to all this now get their instructions, and their plans are "tied up" with the whole scheme. The next item on the programme will surprise you—it's a good, sound, hearty meal! We realise, of course, later the reason why. Airborne and parachute troops are a *corps d'elite*, highly trained, very fit and well looked after. Every care is taken of them "at rest" and before operations. They are not allowed to go into action on empty stomachs, although they are accustomed to fight on for days on minimum rations, or no rations at all.

Spitfire preparing the way for airborne assault.



Take-Off

This being over, we join the staff officers, who are about to enter a glider. We watch first the Whitleys take off every few seconds, some alone, some towing large troop-carrying gliders. Our turn comes, and we clamber into a Horsa glider. We notice our pilot is a brigadier wearing the Army "wings," in which a lion rampant stands on the crown of the R.A.F. wings. Our Horsa is a long, roomy, comfortable craft, made of plastic plywood, and seems immensely strong. We hear the "drill" between our pilot and the "tug" pilot, which is transmitted by a telephone wire cunningly woven into the towing-cable. Then we begin to move. A few bumps, and we are airborne, though our tug is still trundling along the ground. What a different sensation taking-off in a glider is! No noise, no vibration: just a swish of air past the wings and fuselage and a grand floating feeling. Looking ahead over the pilot's shoulders, we see our "tug" just a little below us—we are above it, to keep out of its slipstream. The A.S.I. shows 126 knots and the altimeter 800 feet; the weather is getting worse. Visibility is down to 3,000 yards and cloud base to 900 feet. We are keeping just below it for fear of enemy fighters and to look out for our landmarks. Suddenly we see them and at the same time see the small white mushrooms of our parachutists descending into a hollow beside a wood. Others have landed before them, and over to the leeward of the wood and in the dead ground they have placed landing-signals and a smoke indicator. Immediately our pilot goes through his "casting-off" drill with the Whitley pilot, and we are floating free for a few seconds and then are diving at 45 degrees to the "deck." We level out at about 15 feet, touch down and come to rest in a very short distance. In action it would have been even less, because then skids are used instead of landing-wheels.

Under Fire

We become conscious of the clatter of machine-guns. Pitched battles seem to be going on all round us. The officers in our glider are out in a moment (its part of the drill), making themselves as inconspicuous as possible. We notice our brigadier in a ditch with a sergeant, who is carrying on his back a portable radio with antennæ. He is receiving information from parachutists who are already clearing the enemy out of the wood. We also shelter in the ditch, because machine-gun bullets are singing overhead from a gun at the corner of the wood. There's a burst of Bren-gun fire and the bullets stop. More parachutists arrive. We watch them sail down. Soon they have divested themselves of their parachutes and are collecting round their arms containers. Some are already attacking another machine-gun post in a ditch over beyond the wood in order to cover their comrades.

Supplies Arrive

From the clouds comes a regular swarm of gliders carrying not only troops but ammunition, mortars, radio sets and surgical units.

Thus reinforced, the wood is soon cleared of the "enemy," and prisoners begin to appear. There's gunfire over beyond the wood. Our brigadier leaves the ditch in which he took shelter and with a tommy-gun at the ready careers off to see what's happening. At the scene of action flashes of mortars and the enemy's guns show through the murk and smoke the positions of attackers and defenders. Enemy shrapnel rains from the sky, where puffs of A.A. shells explode at the cloud-base level. Mortar shells whizz overhead, to burst in the enemy strong-point which we can now see on the horizon a mile away. Alongside us Bren guns are spitting tracer shells at a copse just short of it. The firing is organised in "lanes," between which troops are moving to the attack. When they reach convenient cover they take up the job of providing a screen of machine fire, and let those they had left behind come forward and through them. Everything is done at the "double." Our brigadier is still dashing about. Smoke-screens are being laid by our aircraft and by mortar shells to "blind" the enemy. Fighter-bombers are making low-level attacks on the strong-point. The air is full of the roar of battle, the whine of shells and bullets. Casualties are so real that the brigadier is taken in and stops to help.

Final Assault

The copse is cleared, and the final assault begins on the strong-point—a formidable construction if it can take all the battering it has already had. It is strongly protected by barbed wire. The sappers go forward with their "Bangalore torpedoes" (used for destroying barbed-wire entanglements), whilst everything that can fire is concentrated on covering them. Through the gaps in the wire made by their explosions go the men with the secret weapons which do a lot of psychological harm to the remaining defenders, who offer no resistance to the final bayonet charge.

Physical Fitness

You and I remark on the physical fitness of the Airborne troops, who, although they have run a mile with heavy equipment, are not even puffed. They have that degree of physical fitness.

Well, that is the end of that battle, and you and I have both seen enough to make us want to join the Airborne forces, which is not easy. Even if a hundred of us pass the R.A.F. tests, only sixty would pass the Airborne forces test for physical well-being.

Airborne flying requires as much skilled flying as either bombing or air fighting. It requires good navigation, and an immediate understanding of military situations. It offers much greater scope for the intelligent and cool pilot of being able to influence a battle by an instant decision, a moment's glimpse of a position quickly and accurately reported and acted upon.

Airborne warfare is the new form of war which will require greater efforts, more training, more intelligence, than we have ever applied to any form of war before.

ARTIFICIAL HORIZON

A Lancaster (span 102 ft.) in a bank to port.

WHEN Alcock and Brown flew the treacherous North Atlantic, with its Alp-like clouds stretching several thousand feet above sea-level, they had no modern flying instruments, and the risk they took on that occasion would to-day be considered suicidal. In those days (1919) the only reference the pilot had for maintaining level flight was the natural horizon and crude lateral and fore-and-aft spirit-levels. In the North Atlantic the natural horizon is obscured for almost the entire journey in winter and quite the larger part even in summer, so Atlantic flyers in those days relied to a large extent on luck. Now the flying of the Atlantic is an everyday occurrence, thanks chiefly to modern flying instruments, not the least important of which is the Artificial Horizon Indicator.

This instrument provides a reference for fore-and-aft and lateral level flight; i.e., around the lateral (pitch) and fore-and-aft (roll) axes respectively. It therefore indicates whether the aircraft is banking, climbing or gliding. All these flying positions can be referred to the natural horizon in clear weather. Nevertheless, a pilot may be doing a very small angle glide and not be aware of it for some time. This liability to error increases with altitude. The Artificial Horizon Indicator, on the other hand, shows the slightest variation from fore-and-aft level flight. So it is not surprising that the pilot nowadays usually flies by the Artificial Horizon. The same applies to lateral level flight. Here again the natural horizon provides a reference in clear weather which becomes more unreliable as altitude increases. Again, the Artificial Horizon provides a more accurate reference at all altitudes by its rotating gyroscope.

There are two types of Artificial Horizon in use—the Mk. I and the Mk. II. (A) Fig. 1 shows the dial of the Mk. I, mounted on wings in the same relation (only exaggerated) to the wings of the aircraft in which it is fitted. It is reading craft to which it is attached) and the artificial horizon bar, which is governed by the gyro. (D) shows a 30-degree right bank; the pointer (P) indicates the amount of bank in degrees. The instrument scale is graduated into 10 degrees and numbered every 30, which is divided by 10, so 30 degrees reads three degrees and 60 degrees reads six degrees.

(B) and (C) Fig. 2 indicate a climbing attitude and a diving attitude respectively. It will be seen that the miniature aero-

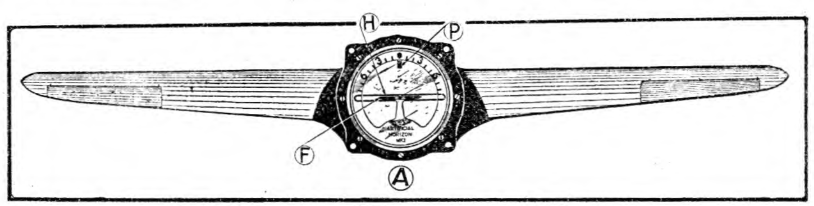


Fig. 1.

level flight with the miniature aeroplane (F) in the centre and level with the horizon bar (H). This bar is part of the gimbal and gyro system, and *it* therefore remains stationary in whatever attitude the aeroplane assumes. (E) Fig. 2 shows the indicator reading a 30-degree left bank. The miniature aeroplane and the numbered scale have now moved round the stationary horizon bar, and the flying attitude is indicated by the difference between the position of the miniature aeroplane (which represents the full-sized air- plane has moved above the horizon bar to indicate climb, and below the bar to indicate a glide or dive. In this way the Artificial Horizon provides the same reference as the natural horizon in clear weather. Unfortunately, the Mk. I will indicate angles up to only 90 degrees, left or right, so the Mk. II was needed to indicate all flying angles. Fig. 3 shows the dial of the Mk. II. It is shown indicating a left roll and dive. The miniature aeroplane (F) indicates the dive, the horizon bar (H) indicates the attitude of the

Short Sunderlands (span 112 ft. 10 in.), which do much cloud flying over the Atlantic, must rely to a large extent on their instruments.

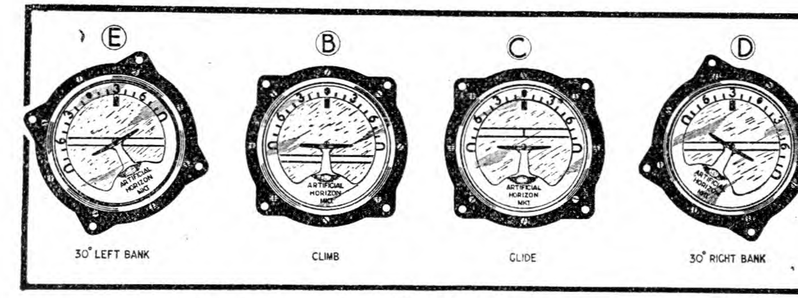


Fig. 2.

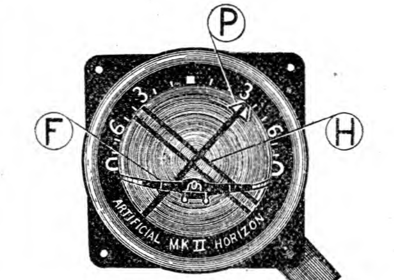


Fig. 3.

wings in relation to the miniature aircraft and the pointer (P) indicates the degree of bank. For level flight the pointer would be at zero, the horizon bar in the middle of the dial and the miniature aeroplane in the centre of the horizon bar. In fact, exactly as in the Mk. I at (A). For fully inverted flight the dial would read as for level flight, except the pointer (P) would be pointing vertically down. (G) is the pipe leading to the suction pump.

The great advantage of the Mk. II is its ability to indicate all flying attitudes, including a right or left roll, a roll and dive, banking, diving, climbing, 180-degrees roll, etc. This advantage is enormous in combat recovery, especially if the pilot takes cover in cloud or suddenly finds himself enveloped in cloud after breaking away. He has only to glance at his Artificial Horizon to know exactly his attitude horizontally and vertically. This enables a quick recovery and rapid manœuvre from cloud cover. The Mk. II will indicate climbing or diving angles up to 45 degrees, which is also an advantage in combat. Both instruments are luminous.

CROSSNUMBER SQUADRON

HERE is a puzzle to which the answers are numbers instead of words. The numbers all refer to details of an imaginary Air Force unit in Kent, as stated in the clues. In some cases two clues have been given.

First read through the clues, then go through them one by one, inserting an answer or part of an answer you can be sure of. The others can soon be worked out without much involved calculation. Those with a good knowledge of aviation, a quick memory and an eye for significant clues will complete the square in a few minutes. Others may take a few hours. It is not beyond the capacity of anyone with a knowledge of simple arithmetic.

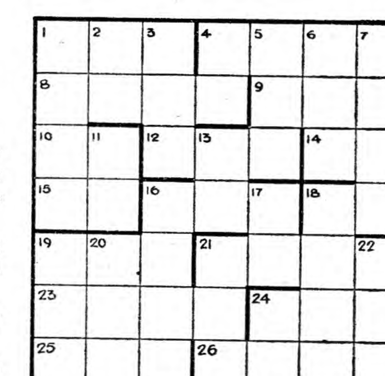
(*Solution on page* 26)

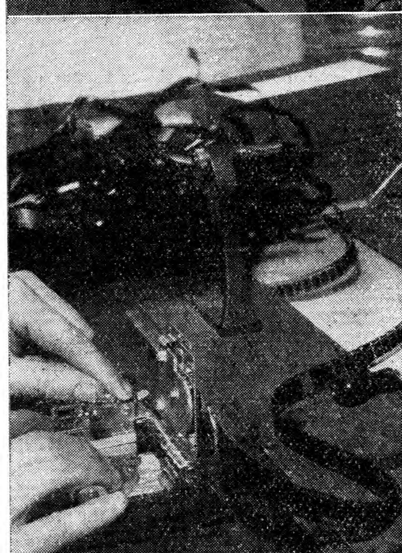
ACROSS

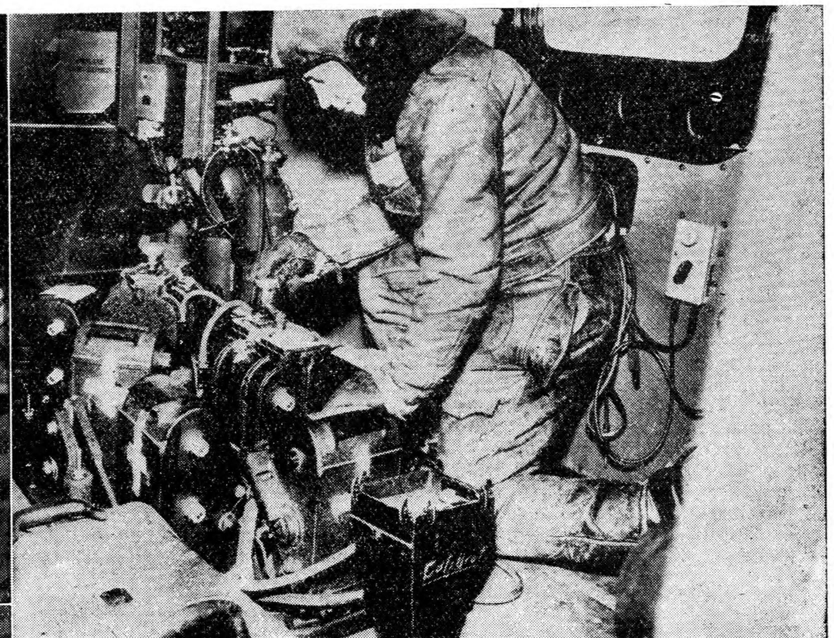
1. Longitude of the station.
4. Latitude of the station.
8. $5 \times 3 \times 2^6 \times 10$. (Total reputed rate of fire of guns of one aircraft.)
9. Number of airmen on the station.
10. Number of Dorniers destroyed.
12. Total number of officers and airmen on the station.
14. Total Messerschmitts destroyed.
15. Number of officers on the station.
16. Miles covered by Pilot Officer Brown in 33 mins. 10 secs. at 360 m.p.h.
18. Number of additional pence per fortnight received by L.A.C. Jones on being awarded a good-conduct badge.
19. Ten times the number of Dorniers destroyed.
21. Length of N-S runway in feet.
23. What the total strength would be if there were 20 airmen to every officer.
24. 12 times the number of Dorniers destroyed.
25. Length of N-S runway in yards.
26. Twice the number of airmen.

DOWN

1. Year of formation of squadron.
2. Number of Me. 110s brought down.
3. Half of *19* Down. Also type number of an Me. fighter of which 33 were destroyed.
4. Age of commanding officer on 31st December, 1942. Also half total number of aircraft destroyed.
5. This True course took a pilot a few miles east of Dieppe.
6. Five times the number of Me. 110s and Heinkels destroyed.
7. The year of birth of the commanding officer, who served through the last war.
11. Quarter the total number of aircraft destroyed.
13. Number of Heinkels destroyed.
16. Twice as many miles as Pilot Officer Smith covered in 90 mins. 10 secs. at 360 m.p.h.
17. Five times the number of Heinkels destroyed.
18. Five times the total number of officers and men.
19. Opposite 038°. Twice the type number of an Me. fighter.
20. Square root of 75,625 was the True course followed by pilot who went to Berks.
21. Square root of 63,001 was the True course followed by Jones when flying to N.W. Surrey
22. 34 times the number of Heinkels destroyed.
24. Half number of Heinkels and Me. 109s destroyed.







Above: A U.S. air photographer making adjustments to a fixed aircraft camera.

Left (top): R.A.F. photographer fitting a magazine to a standard air reconnaissance camera; (middle): Splicing a film from a cine camera gun; (lower): Washing the film after development.

AIR PHOTOGRAPHY

WHENEVER our aircraft set forth to carry out a sweep over the enemy's territory, or an attack on his shipping, they carry cameras which record in a fraction of a second and without possibility of error every detail of what is below.

The camera, short of a direct hit, is unaffected by bursting shells, tracer bullets or enemy fighters, and goes steadily on with its work while the attack is in progress.

In a high-level raid the long-focus lens and suitable filters overcome the difficulties of height and atmospheric haze, while in a mast-high attack a momentary operation of the shutter is sufficient to give an accurate and permanent record of the fall of the bombs and the damage resulting.

From the photographs the trained interpreter can extract by magnifying-glass and stereoscope far more detailed information than the crew could ever hope to see and remember.

In the peace of his office he can count the wagons in the railway siding, the ships in the harbour, and the aircraft on the enemy's landing-grounds.

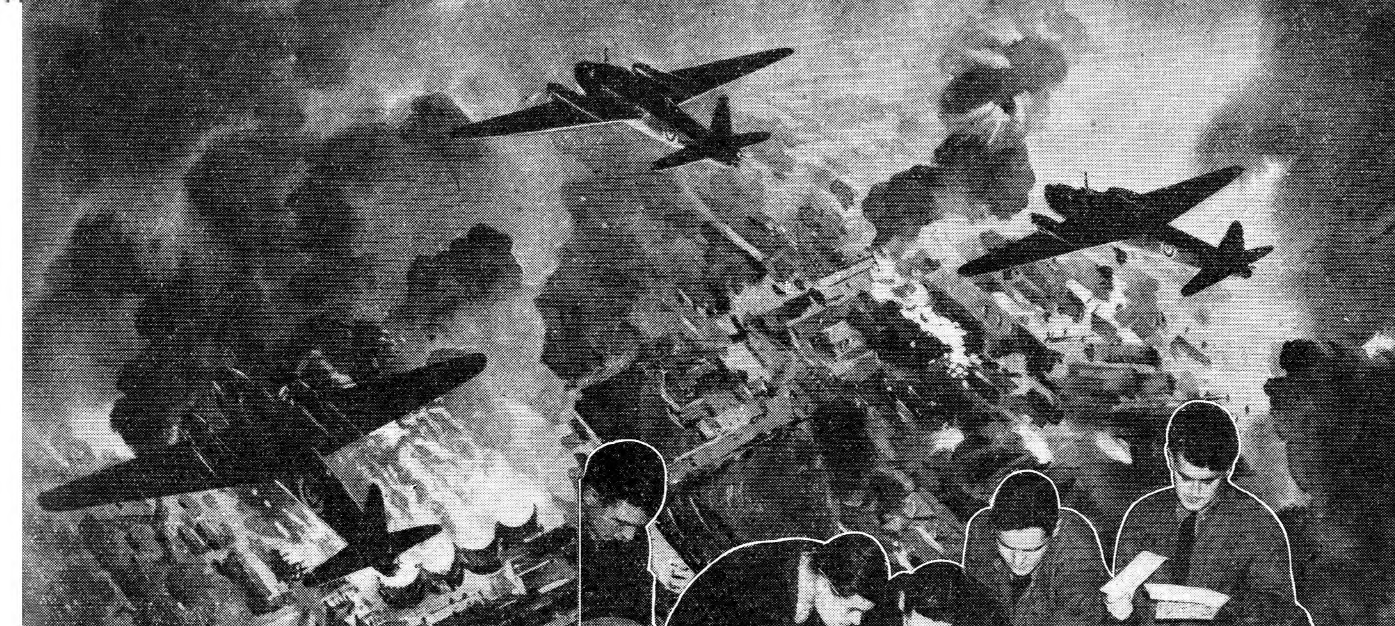
Photographs taken after previous bombing attacks on industrial plant, railway yards and harbours enable the interpreter to assess in detail the amount and nature of the damage done, and show whether further attacks are required.

Photography While You Bomb

Mr. Churchill has said that our bombing of Germany was now a good deal more accurate than it used to be. One reason for this is the great and recent development of night photography. Where in the past only a few photographs were taken on any raid—and they were apt to be regarded almost as curiosities—hundreds are now taken every night when Bomber Command is over Germany.

As an aircraft releases its bombs over the target, a photo-flash also is automatically dropped, and this explodes with a blinding light which lasts about one-tenth of a second. As this explodes, a camera with the shutter already open takes a photograph of the area lit up by the flash. This system is much the same as grandfather used years ago when he took a photograph in the dark by taking a cap off the camera, letting off a magnesium flash, and then replacing the cap. Only now in the place of grandfather a system of electrical controls is used.

Formerly ten or eleven operations were necessary for a crew to take a successful photograph of the area bombed, and that in the few crucial moments over the target area. Once a wireless operator, when blamed for spoiling the photograph by dropping the flash at the wrong moment, explained that it was not his fault. Just as he was preparing to drop his flash down the flare-chute, some machine-gun bullets came through the fuselage and put him off. But all that is needed now is for the pilot to hold the aircraft level for a few seconds when warned by an automatic light that the flash is about to explode.



Above: Artist's impression of a raid. The camera produces a less picturesque but more accurate impression. Right: Assembling air views to make a picture map.

As soon as the aircraft has reached its dispersal point, the camera magazines are fetched and developed in total darkness—for the films are very sensitive—fixed, rinsed and dried in methylated spirits, all at high speed without wasting an unnecessary second. Then the prints are hurried to the intelligence section of the station, to group headquarters and Bomber Command.

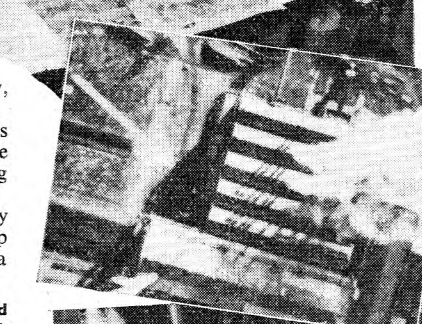
Thus navigation is helped and the Command is warned if Germany is trying out anything outstanding in the way of camouflaging or decoys. Fires are shown in these photographs, so that Command can judge the success of the raid, and, since the photographs are timed, of how it progressed. Only four fires are shown on an early photograph, but a few moments later these have swollen to twenty, and later still the whole target is seen to be ablaze.

The crews themselves take a great interest in these photographs. One of the first things crews begin to wonder about when the raid is over is what sort of photographs they have brought back with them. It is no uncommon thing for the captain of a crew to hang about intelligence after a raid is over to see if all is well with his photographs.

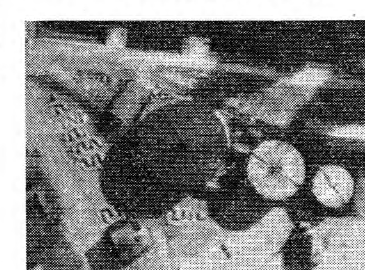
It might be thought that almost every aircraft would return with a satisfactory print, but there are many things that can go wrong. A pilot may have found a gap in the clouds to bomb through, but by the time the flash explodes all the camera may be recording is an artistic study of cloud formations. Or, just at the crucial moment, it may be impossible to hold the aircraft level, so that the camera will be pointing anywhere but at the area lit up by the flash.

Now throughout the Command there has been started a squadron ladder on which points are allotted for photographs which show either the target area or an area close to it. Every squadron hopes that it will be at the top of the ladder, and therefore clearly the squadron which has done the best for the month throughout the whole Command.

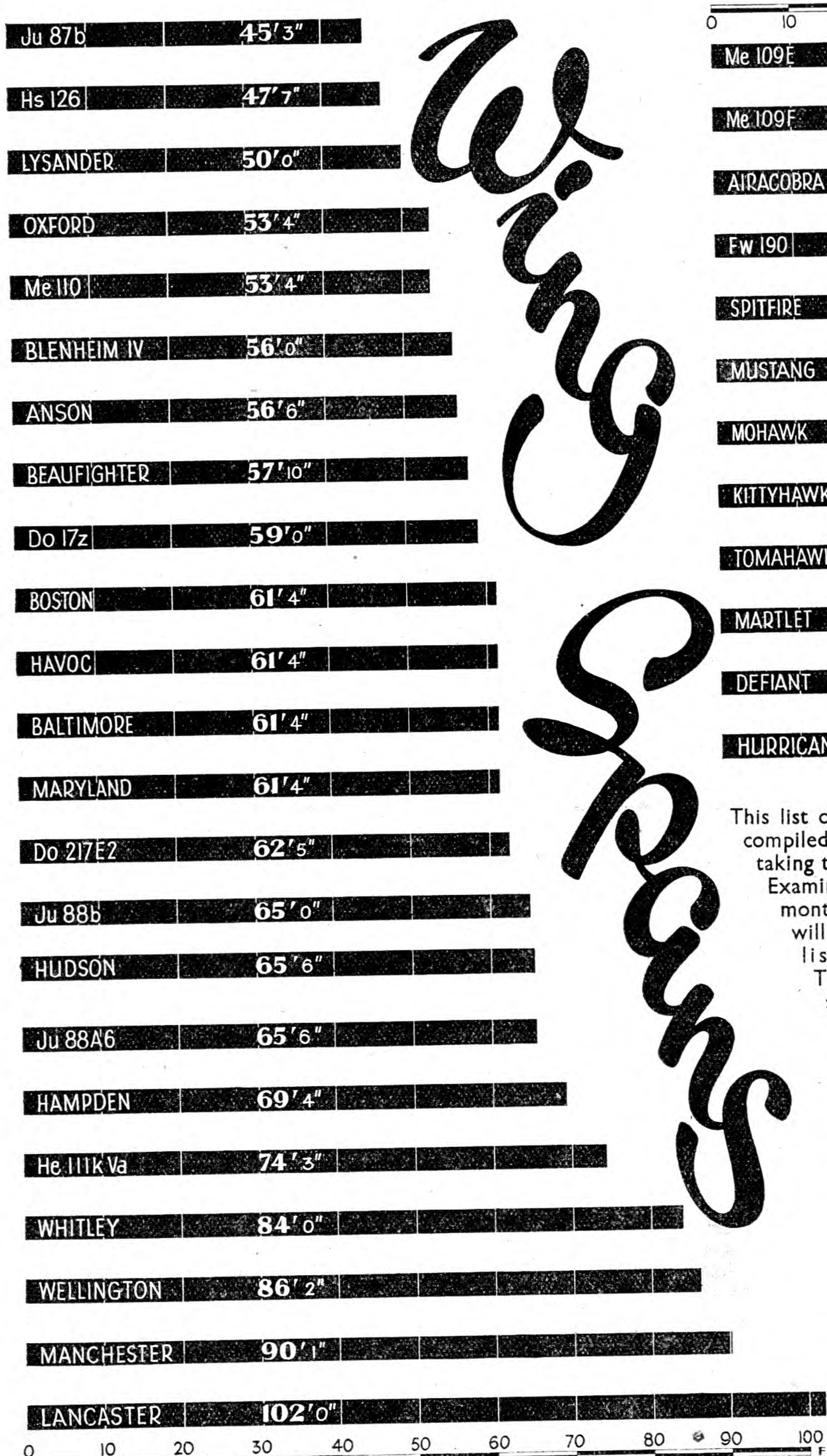
One group proudly boasted that for the month of July it held the first seven places in the squadron ladder. Other groups then decided that this was just luck, and next month would show what they could do.

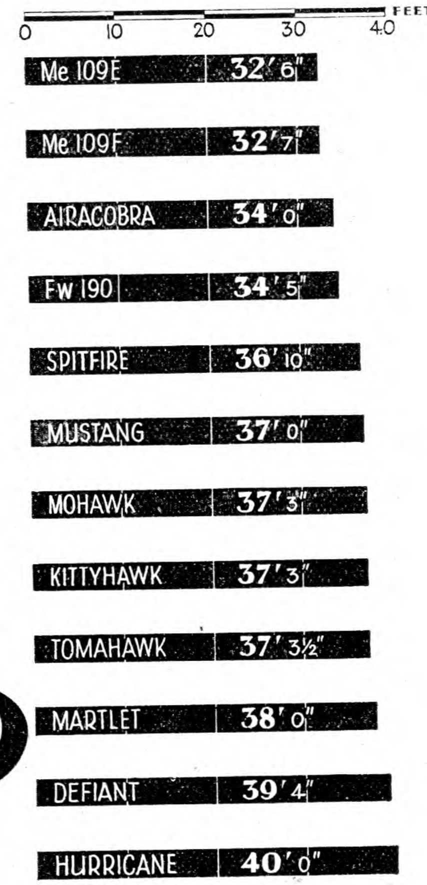


The four photographs on the right and below are of enemy-occupied territory. The upper one shows the effect of bombing during a daylight attack on the power station at Comines, the next reveals damage done to the Matford Motor Works at Poissy. This was taken after the raid, the night photographs having been spoilt by flames and smoke. In the corner an aircraft reconnaissance photograph reveals a camouflaged hangar at a German base which the eye might have missed or mistaken for something else. The photograph below was taken during a raid on the docks at Le Havre.



Wing Spans





This list of wing spans has been compiled to help those who are taking their Part II Proficiency Examination for aircrew this month. The examination will be on all the 35 aircraft listed here, plus the Typhoon, whose wing span we may not mention here. If you read through the list several times, visualising each aeroplane in all three aspects as you note its wing span, you should have little difficulty in passing the examination. The spans are quoted in feet and inches, but in the examination you are only required to answer to the nearest 3 feet.

LIGHT ALLOYS IN AIRCRAFT

*Information on materials used in the construction **of most** front-line aircraft and high-performance engines.*

by G. D. DUGUID, M.A.

THE performance of modern aircraft owes a great deal to the development of the light, high-strength alloys of which the alloys of aluminium with silicon, nickel, copper and magnesium, combining light weight with high strength, form a very important part.

Apart from magnesium, aluminium is one of the lightest of metals, the specific gravity in the rolled condition being about 2.68, that is, it is nearly one-third the weight of cast iron. Aluminium is relatively soft; it is ductile, that is, it can be drawn out; and it is malleable, that is, it can be beaten out without fracture. As it can be welded, it can be used for the shells of petrol and oil tanks. In the pure state it offers good resistance to corrosion; it can be machined, and also worked by such processes as rolling, spinning, stamping, drawing and forging.

Aluminium is relatively weak if it is subjected to a pull or tensile force, and in sheet form can be used for such parts as cowlings or fairings, but not for any parts which are subjected to stress. Aluminium sheet is obtainable in the soft, half-hard and hard conditions, the tensile strengths being five, seven and nine tons to the square inch respectively, which is very low compared with the high-strength alloys.

Casting Alloys

For castings, either aluminium-copper alloys or aluminium-silicon alloys such as "Alpax" can be used. The addition of silicon makes the alloy very fluid when in the molten state, and so more intricate castings can be made. They are also resistant to corrosion. Stressed components such as brackets and control levers can be produced by gravity die-casting, in which the molten metal is run into dies which have been shaped to the necessary contour.

High-strength casting alloys, particularly those which can be improved by heat treatment, have been used for stressed aircraft components. Class 1 castings of this type are produced under a rigid control in the foundry, and are subjected to X-ray and other careful inspection procedure. A series of alloys was developed in the Rolls-Royce laboratories, casting alloys being RR50, RR53, and RR53c, the series being known commercially as "Hiduminium."

Extruded Sections

For aircraft construction, members may be formed of sections of channel shape, or in the form of a T or Z, or others of a more intricate nature.

Sections such as this may be formed by a process known as extrusion, to which the light alloys lend themselves very well. The metal is heated until it becomes plastic, and is then forced through dies of the correct contour by means of a hydraulic press, which gives a uniformly dense structure to the material.

Sheet

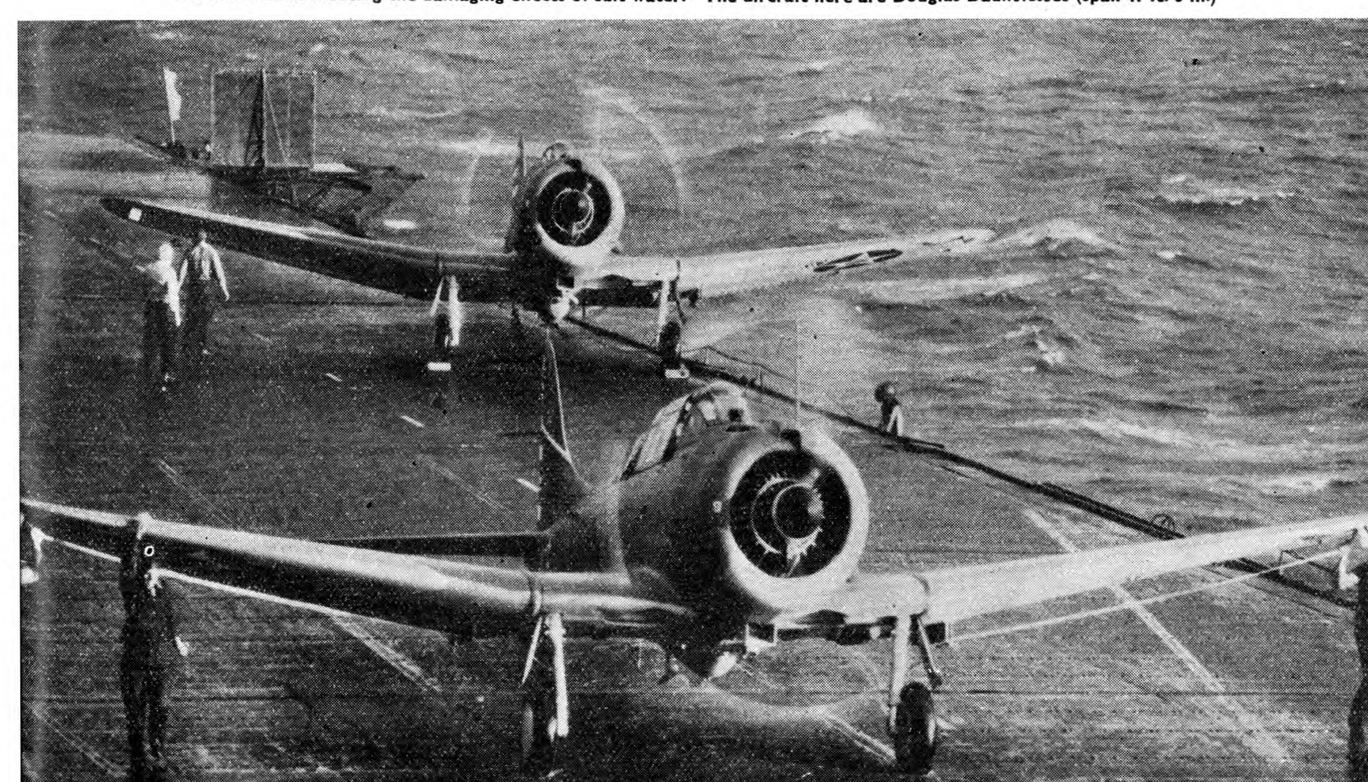
Light alloys in sheets form a very important part of the modern aircraft. duralumin sheet to specification 5L3 being a very good example. Duralumin, however, is subject to corrosion, particularly in salt-water spray, so that it is given an anodic treatment whereby a coating of aluminium oxide is formed on the surface as a protective coating.

A material known as "Alclad" has been produced in which the duralumin is surfaced on both sides with a coating of pure aluminium, which is resistant to corrosion, the aluminium being merged into the alloy sheet so that it cannot peel off

Magnesium Alloys

Pure magnesium is a very light metal, its specific gravity being only 1.74; when alloyed with small quantities of aluminium, manganese, zinc, copper and silicon an alloy is obtained of specific gravity 1.82, known commercially as Elektron. The alloy corrodes fairly easily, and so has to be given a protective coating by a process known as "chromating."

The anti-corrosive properties of metals are of great importance in the construction of aircraft designedf or operation from aircraft carriers and in meeting the damaging effects of salt water. The aircraft here are Douglas Dauntlesses (span 41 ft. 6 in.)



Radio Operating as a Career

By DEREK WHIPP

SHIPS of the Merchant Navy were compelled by Act of Parliament at the beginning of the last war to carry wireless installations and men to work them.

Such compulsion does not exist in the air yet, but radio equipment has proved so vital that an Act may become unnecessary. Even before the war, few liners left the ground without radio installations.

Aircraft radio operators for passenger 'planes had to qualify for an Air Ministry certificate before the war, satisfying the examiner of their proficiency in radio-telegraphy and radio-telephony.

Standards Required

Nowadays the provisional certificate is the only one available, and except in special circumstances examinations for this have been suspended. Standards are similar to those for the P.M.G. Special Certificate, which is available to budding seagoing radio operators.

Roughly, the standards for radio-telegraphy receiving are: 20 words a minute plain language, 16 words a minute code.

Not only operating efficiency is required, however. During the receiving tests, interference by half-strength Morse signals and motor generators are superimposed to simulate probable working conditions. Nothing terrifying in that. If the student has been able to concentrate to attain these speeds, he will have sufficient concentrative power to work through slight interference. Ability to handle the set with competence, to detect and rectify faults and to know the names and functions of principal parts of the set are other requirements.

A Written Paper

The general principles of electricity and magnetism and their use in radio will be the subject of a written paper, and to answer this the candidate is allowed three hours.

For information relating to the theoretical section, the Air Ministry recommends the Admiralty Handbook of Wireless Telegraphy. Another useful official publication is the "Q" Code, or A.P. 1529, as it is listed. Candidates will be expected to know the more frequent abbreviations used in aircraft communication. The Civil Aviation Communications Handbook is also helpful in outlining procedure.

Crossnumber Squadron

SOME HINTS ON SOLUTION

[1] 1	[2] 2	[3] 1	[4] 5	[5] 1	[6] 2	[7] 1
[8] 9	6	0	0	[9] 8	2	8
[10] 2	[11] 2	[12] 9	[13] 1	3	[14] 5	9
[15] 8	5	[16] 1	9	[17] 9	[18] 4	2
[19] 2	[20] 2	0	[21] 2	5	5	[22] 6
[23] 1	7	8	5	[24] 2	6	4
[25] 8	5	2	[26] 1	6	5	6

Across

4. First figure must be 5, or station would not be in England.

8. A figure ending in 5 is doubled 6 times and multiplied by 10. Without doing full calculation it is easy to see that last two figures must be 00.

16 An easy mental calculation —199.

Down

1. The year must begin with 19.

5. Must start with 1, or pilot would never reach France from Kent.

6. Must end in 0 or 5. Reference to *14* Across indicates that 5 is the answer.

Now continue on these lines, and your answer will be as on this square.

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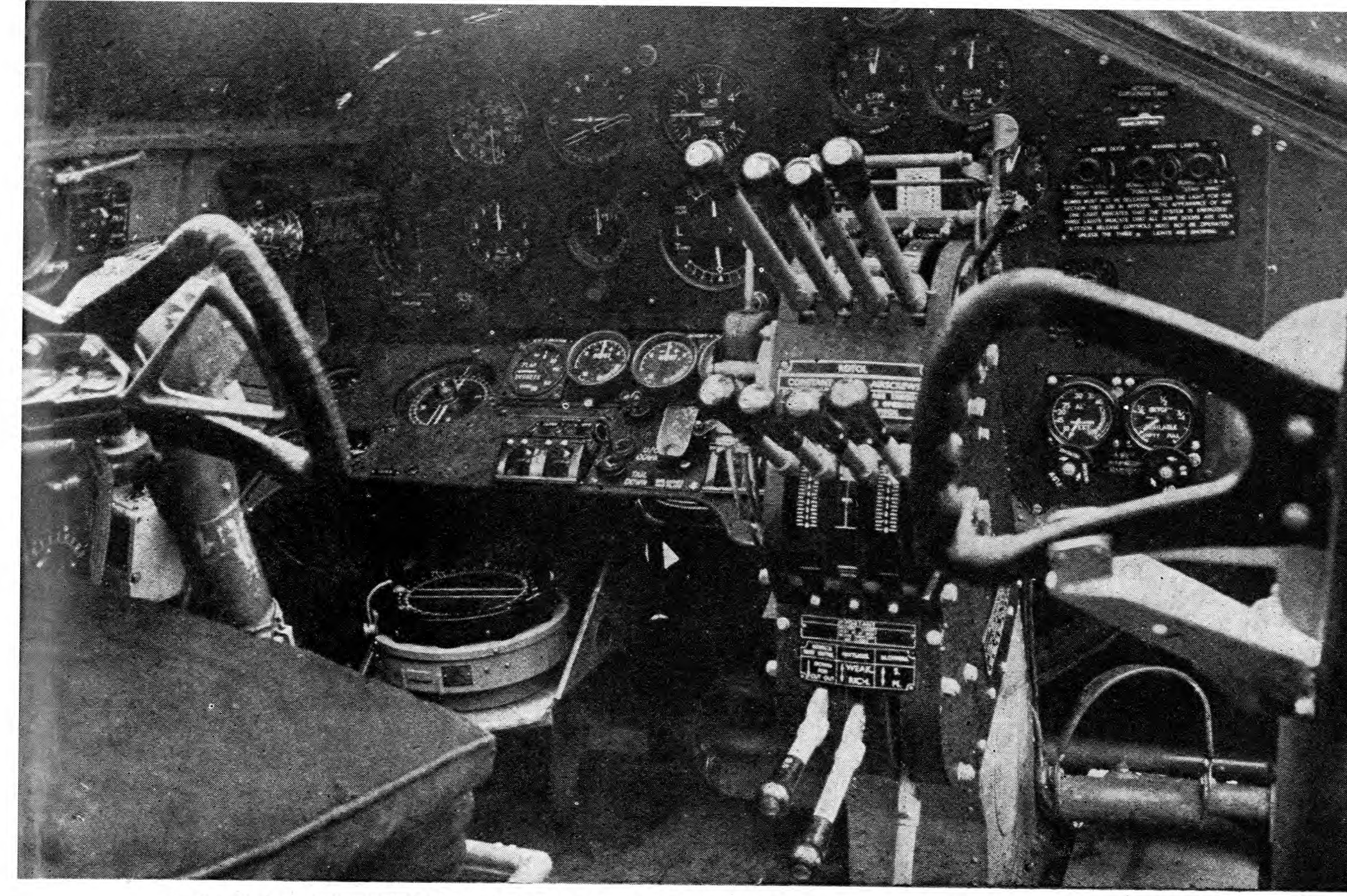

In the photos of the Halifax (above) and the Hudson instrument panels, some of the additional equipment carried by a four-motor aircraft as compared with a twin-motor machine is shown. In the larger aircraft, note the four throttle and the airscrew-pitch control levers; the pilot compass can be seen on the left.