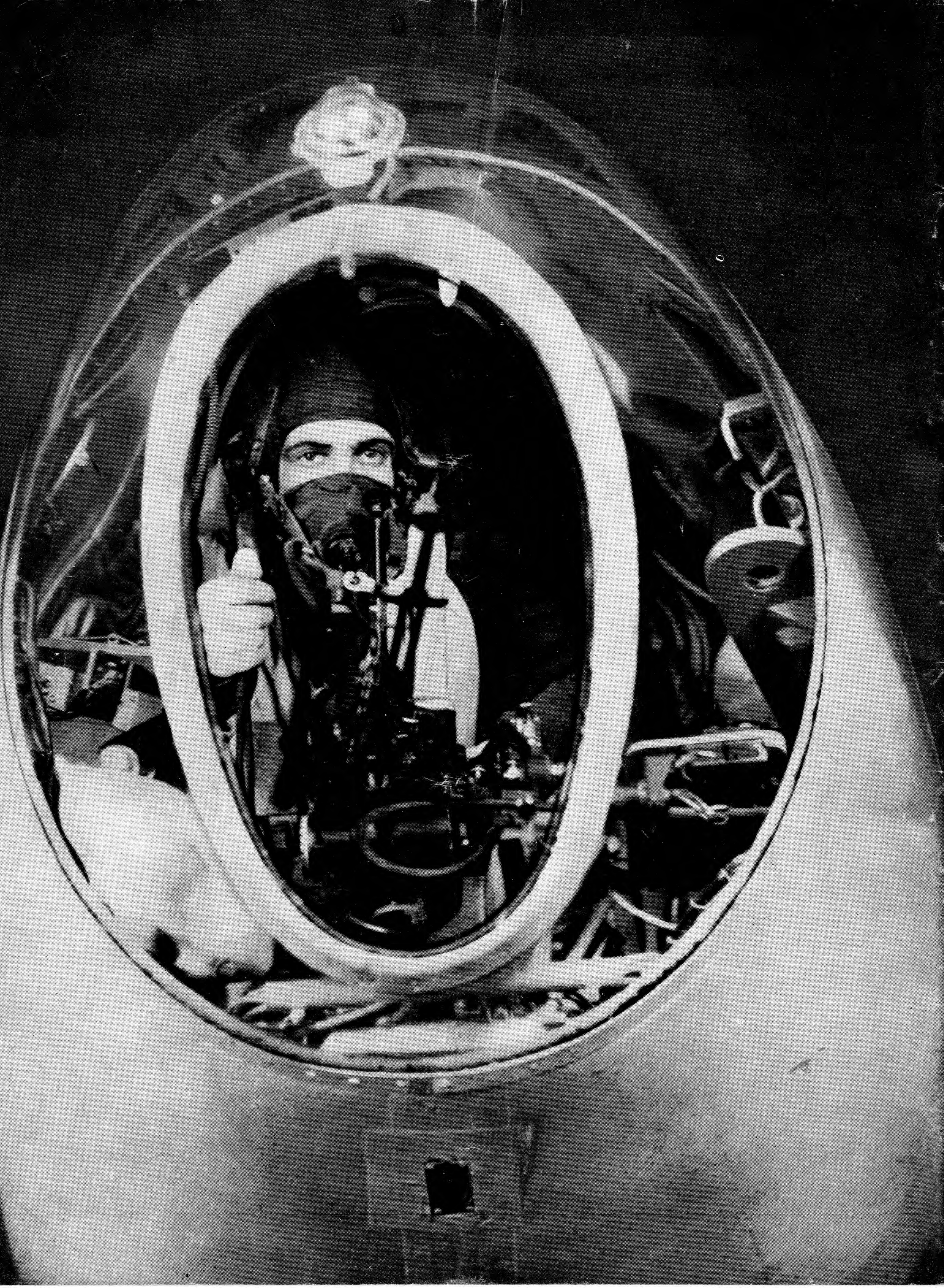

AIR TRAINING CORPS GAZETTE

VOL. III No. 6
JUNE, 194[illegible]

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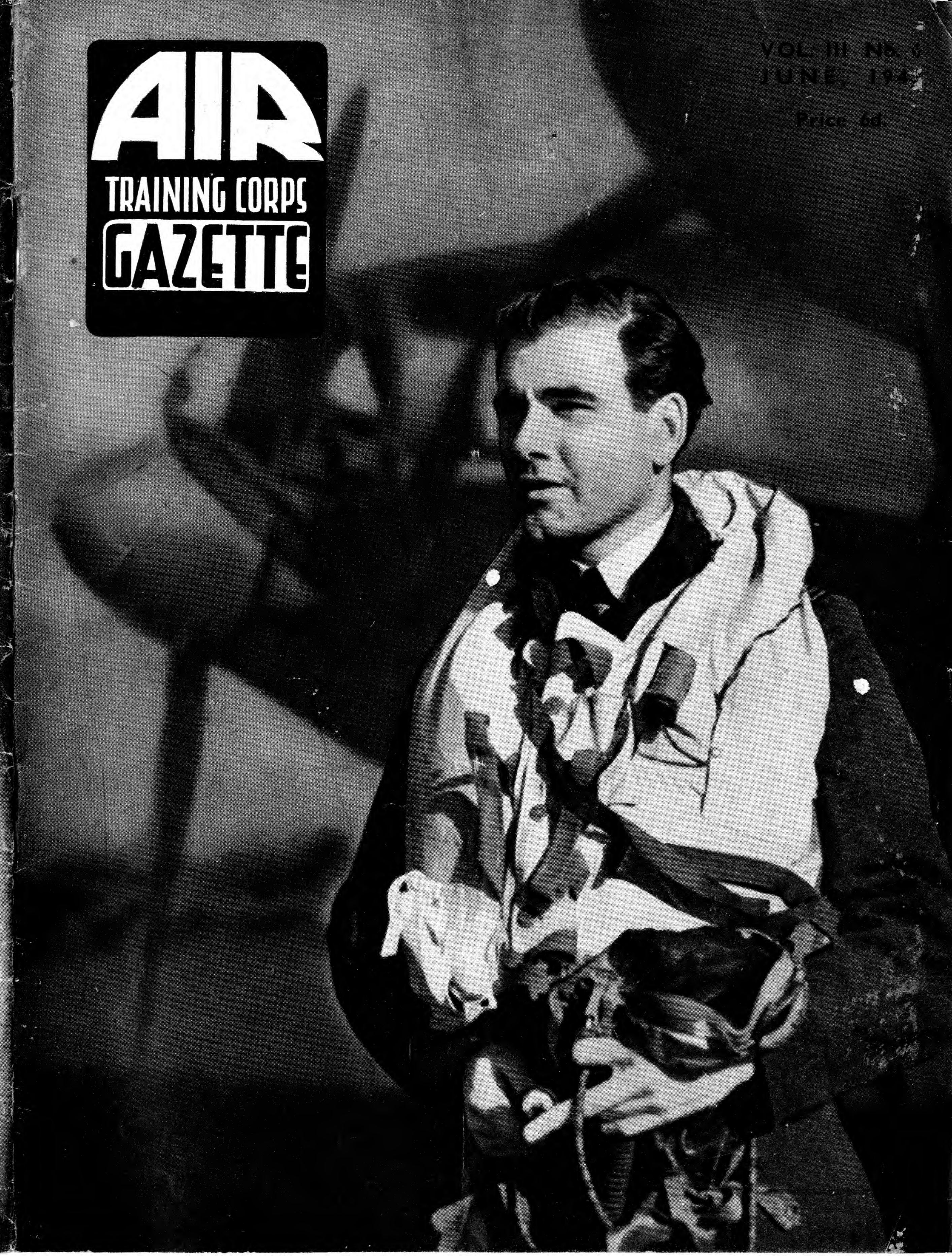
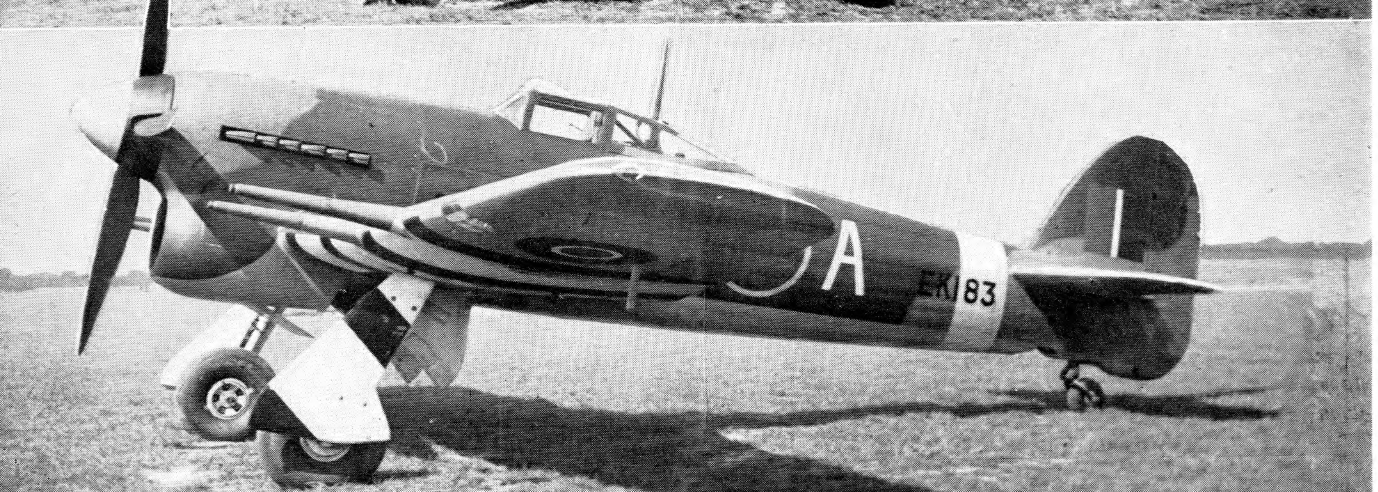


The Hawker Typhoon IB

The Typhoon IB has four 20mm. Hispano guns. It is fitted with a Napier Sabre engine of about 2,400 h.p., giving a top speed of about 400 m.p.h. The Typhoon IA has twelve machine-guns in the wings.



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AIR TRAINING CORPS GAZETTE

Edited by Leonard Taylor

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Post-Proficiency Training

THERE is now being issued a new syllabus for proficiency and post-proficiency training. The post-proficiency training takes the place of the Part II syllabus, and will be found to be more advantageous to cadets as well as being more convenient to units by reason of its flexibility.

The proficiency standard is the target at which all should aim to ensure a good start in their Air Force and Naval training. This training is both educational, i.e. English and calculations, and technical, i.e. electricity, wireless and mechanics.

For many who left school early to earn their own living the course is undoubtedly a stiff one, and to reach the proficiency standard in such circumstances is a very creditable achievement. For other young men, however, who have remained at school until a later age, the educational standards are more easily achieved, and in consequence more rapid progress can be made on the technical side, with the result that proficiency standard can generally be obtained by them at an earlier age. This fact provides the opportunity for additional training.

Instead of covering ground which can frequently be better undertaken by expert instructors of the Royal Air Force at an Initial Training Wing, the post-proficiency training now provides opportunity for planned training in subjects of special interest which in some cases can better be done in the Air Training Corps than in the Air Force or the Navy.

Advanced ("Post-Proficiency") training will have a wider scope to fit such young men for leadership and to enlarge their mental outlook. Instruction of this kind which the Air Training Corps can supply cannot be so readily given in the early months of Air Force and Naval training because of the need of concentration on technical studies. Instead of confining itself to subjects which are taught on entry into the Air Force or Navy, the Air Training Corps is providing a new service by giving leadership training before the cadet becomes immersed in his specialised life.

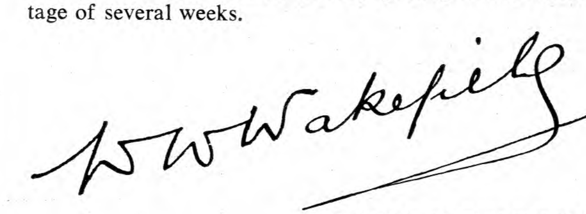
If this training is carried out with imagination the Air Force and Navy will benefit, and service in the Air Training Corps will be more interesting for the cadets and of greater value to them in after-life whether they be in the Service or in a civil occupation.

One of the main features of post-proficiency training is the opportunity it provides for proficient cadets to teach and lecture the less advanced cadets. In this way their own knowledge of the subject becomes surer, because, as I know from personal experience, there is no better way to find out one's own weak spots than by trying to teach others. In this way not only can confidence and the art of self-expression be obtained by cadets, but also a thorough revision of the proficiency subjects can be attained in an interesting way.

At the same time as undertaking this leadership training and study in special subjects, further study in work to be undertaken at the Initial Training Wings can also be profitably pursued where time and facilities permit.

The results achieved in leadership training or an advanced technical study will be noted on a cadet's certificate of service, and will assist him in his future career. Post-proficiency training will enable cadets the better to absorb their Air Force and Naval training, and in consequence will minimise the chances of failure. It should also improve the opportunity of being chosen for commission on completing aircrew training.

Finally, where cadets reach a satisfactory standard in post-proficiency training they will be re-interviewed by the Aviation Candidates Selection Board, and if considered to be up to the required standard will receive priority of call-up. Their records will be specially marked when they go to the Initial Training Wing or to the University Air Squadron, and in the case of the Initial Training Wing they will be able to take the final examination half-way through the course, and if they succeed they will pass out earlier, thereby gaining a time advantage of several weeks.

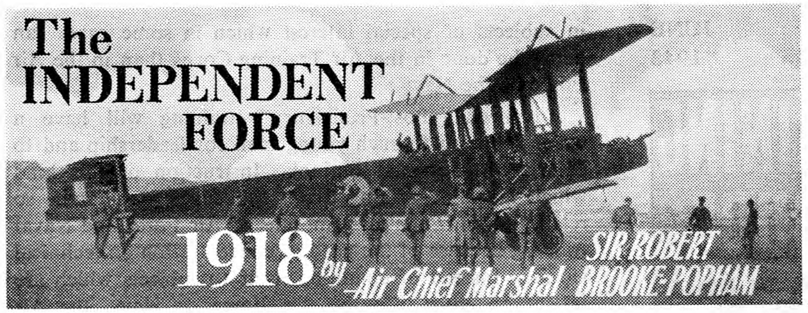


DIRECTOR, AIR TRAINING CORPS

This month's front cover shows Group Captain Hughie Idwal Edwards, V.C., D.S.O., D.F.C., 28-year-old Australian, who was awarded the Victoria Cross for leading a low level daylight attack on Bremen in July, 1941.

The INDEPENDENT FORCE 1918

by Air Chief Marshal SIR ROBERT BROOKE-POPHAM



The caption to this photograph (which we cannot verify) says that it is of the present King (then known as Prince Albert) leaving for France in a Handley Page bomber. The fact that senior officers are saluting indicates that it is more than an ordinary occasion.

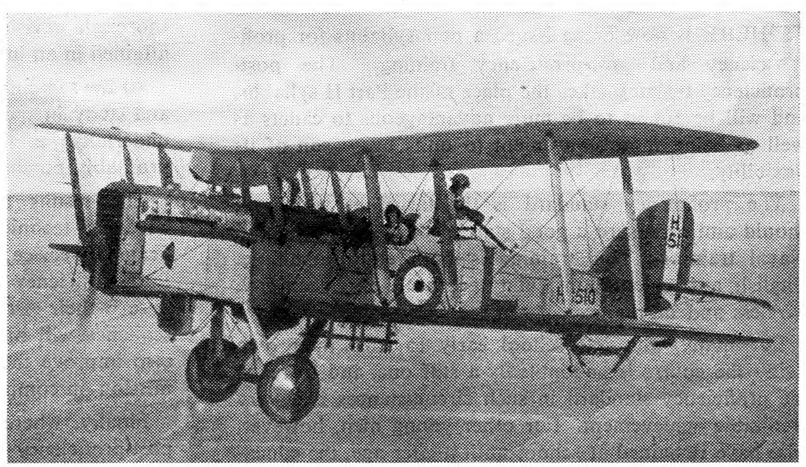
THE Independent Force was formed on 6th June, 1918, its object being offensive air action against important centres in Germany. It was under the command of Major-General Sir Hugh Trenchard (now Marshal of the Royal Air Force, and a Viscount). Judged by present-day standards, the work carried out by this Force may appear small. For instance, in one of the raids on Essen carried out during the month of March, 1943, aircraft of Bomber Command dropped in one night just double the total weight of bombs that the Independent Force dropped during the whole five months of its existence. And again, the most distant target of the Independent Force was Cologne—distant 160 miles from the British lines, it was attacked only three times, and the total weight of bombs dropped on it was under $2\frac{1}{4}$ tons; now we constantly read of our aircraft dropping hundreds of tons on objectives 600 and 700 miles away. But the correct attitude is not to belittle the work of the Independent Force, but to realise first the great development of air power, a development which is still continuing; and, secondly, what can be accomplished with small resources by drive and determination.

The Independent Force was located in the neighbourhood of Nancy, in the French area of operations, the reason being that owing to the small radius of action of aircraft of those days, targets in Germany could hardly be reached from the British area. From Nancy the distance was much less. As early as October 1917 a wing of three squadrons had been sent there under the command of Lieut.-Colonel Newall, who was Chief of the Air Staff 1937 to 1940, and is now Governor-General of New Zealand. The three original squadrons were Nos. 55, 100 and 16 Naval, the first commanded by Major Baldwin, who, as an Air Vice Marshal, commanded a bomber group during this war, and is now serving with the R.A.F. in India. In February 1918 this wing was raised to the status of a brigade, and when it was absorbed by the Independent Force had reached a strength of three day-bomber squadrons and two night-bomber squadrons. At the Armistice 11th November, the Independent Force had grown to four day-bomber squadrons each of eighteen aircraft, five night-bomber squadrons each of ten aircraft, and one single-seater fighter squadron with fourteen aircraft. It was still far below its projected strength of forty squadrons in all.

Equipment

Of the first day-bomber squadrons, one was equipped with the D.H.4 and two with the D.H.9. Both these were two-seater biplanes, the observer behind the pilot being armed with one or sometimes two Lewis guns. The D.H.9 had a speed of about 100 m.p.h. at 10,000 ft., a ceiling of 14,000 ft. and normally carried two hundredweight of bombs. It had been realised before June 1918 that the D.H.9 with its 230-h.p. Puma engine was an inefficient bomber, but owing to shortage of higher-powered engines it was the only type available at the time. The D.H.4 was rather faster and had a bigger radius of action. Later on one squadron of D.H.9As arrived, and by November 1918 the D.H.9 was in process of being replaced by the D.H.9A, which had a 400-h.p. Liberty engine and was an all-round improvement. The principal night bomber was the Handley Page, a twin-engine biplane having a normal bomb load of 12 cwt. and a maximum speed of 80 m.p.h. There were no parachutes or self-sealing tanks, cloud-flying instruments were practically non-existent and the bomb sights rudimentary. Aircraft were used to the utmost limit of their range, and sometimes petrol would be exhausted as our front lines were reached, pilots then having to glide to an aerodrome with their engines stopped. The bombs principally used were the 112-lb. and the 230-lb., both H.E. Sixty-four 550-lb. bombs were also dropped, and eleven of a 1,650-lb. bomb.

The original squadrons were sent to the Nancy area to attack targets in Germany as a reprisal for the air raids on England. The object of forming an Independent Force was quite different: it was to attack important centres in Germany, not by way of retaliation, but as a definite step towards reducing the resisting power of the German nation. The G.O.C. Independent Force worked directly under the Air Council and received orders from it, not from the Commander-in-Chief of the British Armies in the field. This, however, did not prevent co-operation with land forces when required, and in fact the G.O.C. helped attacks by the French and American Armies in September and October by bombing railways used by the Germans. A further development projected, but never carried out, was the formation of an Inter-Allied Independent Air Force, of which Major-General Sir Hugh Trenchard was to be the Commander-in-Chief, receiving directives on policy from Marshal Foch.



The D.H.9A, which had a 400-h.p. Liberty engine and was an all-round improvement on existing single-engined bombers.

No Protection

The fighter squadron never came into effective use, so the bomber squadrons had no escort or other assistance from fighters. During the first two or three months the day bombers were attacked most of their way into the target as well as on their return journey; it was during the latter that the heaviest casualties occurred, probably due to the fact that the observers ran out of ammunition. It soon became evident that some steps must be taken against enemy aircraft, and, after opposition on the part of the French had been overcome, a systematic plan of bombing enemy aerodromes was carried out. The object was twofold: first, to prevent the enemy attacking our aerodromes by night; secondly, to reduce the effectiveness of his attacks on our day bombers. Forty per cent of the total weight of bombs dropped by the Independent Force were in attacks on enemy aerodromes; the proportion was reduced after August, because these attacks had produced a good deal of effect. Anti-aircraft fire by day was not so serious a factor as enemy fighters.

The squadron losses were heavy at times. On July 31st nine D.H.9s of 99 Squadron crossed the lines to bomb Saarbrucken; four were shot down before reaching the target and three on the return journey. The Squadron was re-equipped, trained up inexperienced pilots, and carried out an attack on a German aerodrome on August 15th. On August 22nd twelve D.H.9s of 104 Squadron set out to attack Mannheim; two were shot down on their way to the target and five on the way back, but the squadron was soon ready for work again. One aeroplane in each day-bomber flight carried a camera; these photographic machines generally suffered heavy casualties, because the photographer had to get down into the fuselage to take his photographs, and therefore there was no one left to work the Lewis gun.

The Causes of Success

The material damage inflicted by the Independent Force may seem small, but its activities caused the diversion of many fighter aircraft, A.A. guns and searchlights from the front line to the protection of industrial centres, and the expenditure of much labour and material on defence schemes. And according to a German writer "the indirect effect, namely, falling off in production of war industries and breaking down of the moral resistance of the nation, cannot be too seriously estimated." Many lessons learnt from the the achievements of the Independent Force, small though it was and with many of its aircraft of poor performance, prove that then and now the main causes of success are skill, courage, good leadership and the offensive spirit.

OTHER JUNE ANNIVERSARIES

The Hon. C. S. Rolls (co-founder of Rolls-Royce Ltd.) made, in 1910, first non-stop return flight England to France and back, in a Short-built Wright biplane.

Flight Sub-Lieutenant R. A. J. Warneford, first to destroy a Zeppelin, awarded V.C. He climbed above it, bombed it. The explosion threw his aircraft over and fractured a fuel pipe. Landing in enemy territory, he repaired it, took off and returned to an Allied aerodrome. This was in 1915.

Alcock and Brown, in a Vickers Vimy, made first non-stop crossing of North Atlantic by air in 1919. The Vimy in which they flew is normally at the Science Museum.

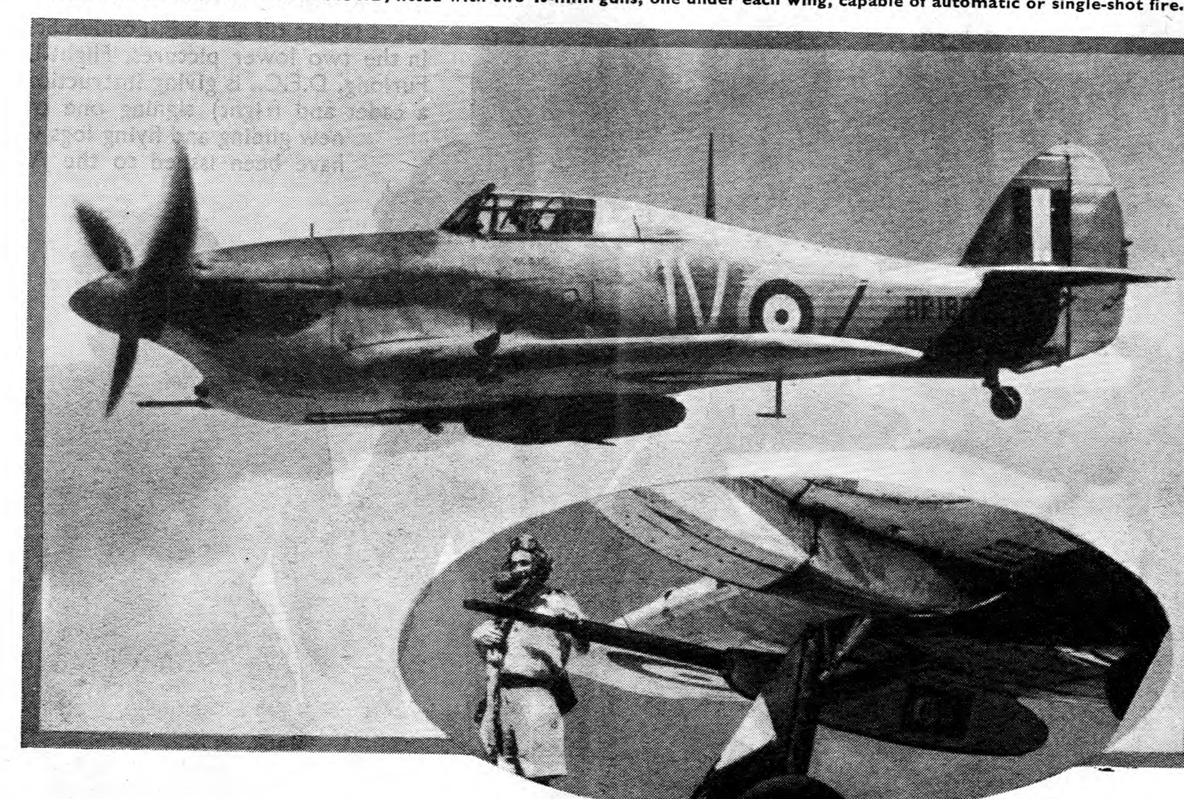
June 1935 was spent almost entirely in the air by Fred and Al Keys, of Meridian, Miss., U.S.A. They set a refuelling endurance record by staying in the air 27 days, 5 hours and 34 minutes.

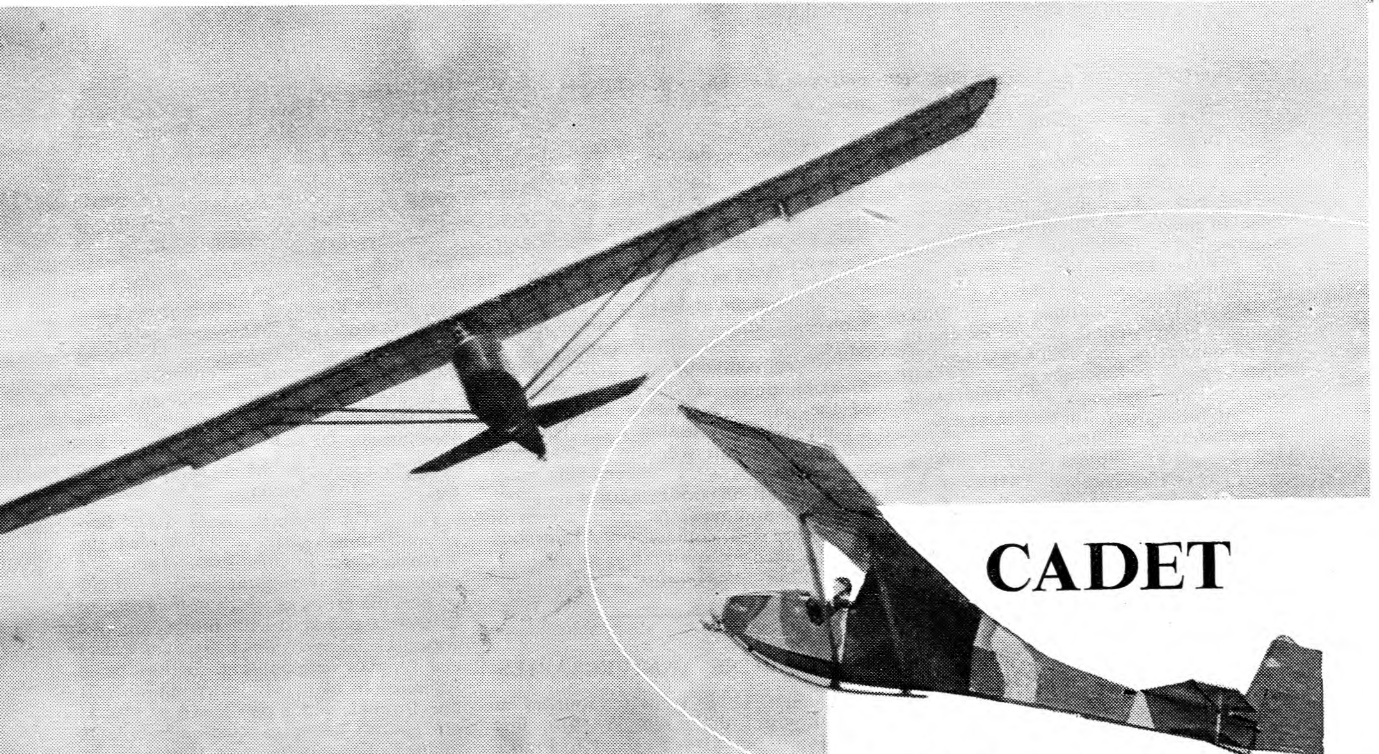
In June 1936 the Hurricane and Spitfire were first shown to the public, at Hendon Air Display.

Flight Lieutenant M. J. Adam in 1937 put up altitude record to 53,937 feet.

Flying Officer D. E. Garland and Sergeant Thomas Gray were awarded the Victoria Cross in June 1940. They were pilot and observer of the leading aircraft of five, the crews of which volunteered to destroy the Maastricht bridge on the Albert Canal, over which German troops and supplies were pouring. Besides being subjected to extremely heavy anti-aircraft fire, through which they dived to attack, our aircraft were also attacked by a large number of enemy fighters. Only one aircraft came back. Flying Officer Garland and Sergeant Gray did not return, but thanks to their leadership the whole formation were able to attack the target, and the bridge was blown up.

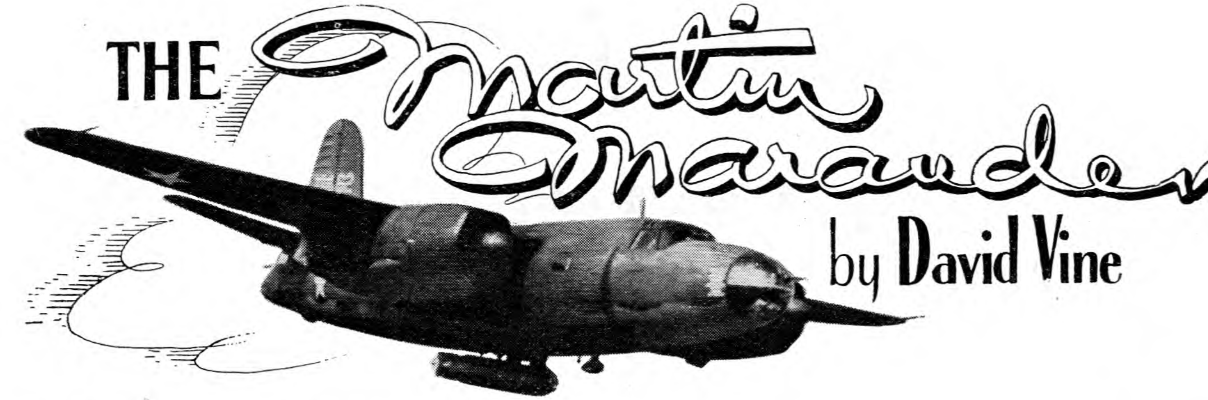
What they needed. The Hurricane IID, fitted with two 40-mm. guns, one under each wing, capable of automatic or single-shot fire.





CADET GLIDING

Anglo-Irish composite picture. The top picture was taken at Bangor, Northern Ireland. The one on the right is of a cadet taking off at a S.E. London School. In the two lower pictures, Flight-Lieut. Furlong, D.F.C., is giving instructions to a cadet and (right) signing one o' the new gliding and flying logs which have been issued to the A.T.C.



THE Martin Marauder

by David Vine

THE Martin Marauder, with its handsome streamline form, is another star in the galaxy of American light attack bombers which did such good work knocking the Nazis out of North Africa. It possesses an almost ideal streamline form, and in profile is rather like the graceful outline of our own Wellington.

Like all American aircraft, it inclines to sumptuousness in the interior, with comfortable seats and many modern comforts for the crew. The interior is more roomy than the Baltimore or the Maryland, both designed by the same firm, namely, the Martin Aircraft Co., of Baltimore, Maryland, U.S.A.

High Wing Loading

The "futuristic" appearance of the Marauder is due partly to the cylindrical fuselage and the gradual taper both in profile and plan. The wings are noticeably small in area, even for a nose-wheel aircraft, giving the wing a loading of about 51 lb. per square foot. Like the Boston and Beaufighter, the tailplane of the Marauder has a dihedral angle of 10 degrees. The underslung engines leave an undisturbed upper-wing surface, which has been found to be an aerodynamic advantage. The landing-speed of the Marauder is more than 100 m.p.h., but despite this, and its high wing loading, it is not difficult to handle at the touchdown, though it certainly is not a novice's aeroplane. The Marauder I has two Pratt & Whitney Double-Row Wasp engines giving nearly 4,000 h.p. altogether. Four-bladed electrically operated Curtiss propellers are used, and these, with a diameter of 13 ft. 6 in., are fully-feathering, constant speed and are fitted with cuffs to increase engine-cooling efficiency and power translation.

Interior

As in the Baltimore, the nose fairing is made of moulded plexiglass and provides a clear view for the front gunner. A single gun of .5-in. calibre is mounted in the upper portion of the nose. There is also provision for emergency control should the pilot be injured. Externally the Marauder shows no family resemblance either to the Baltimore or Maryland, but on closer inspection, especially inside, a likeness is noticed. The cockpit is similarly laid out and the arrangement of the radio equipment is similar to that in the Baltimore, with more room added. It will be noticed that the fuselage widens out in plan at the centre section and gives more elbow room for the crew.

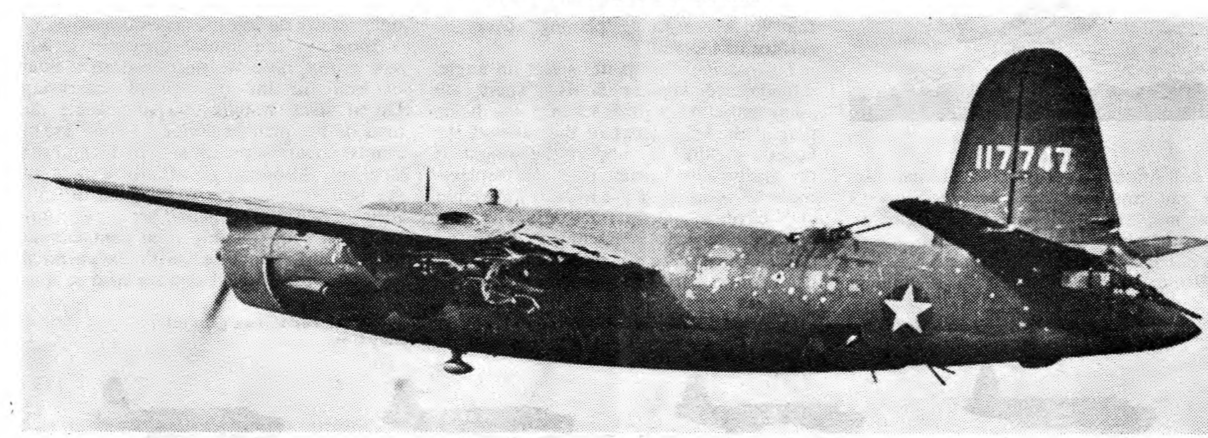
The tail protection is interesting. Two .5-in. machine-guns are universally mounted behind a transparent enclosure right in the tail. The two guns have a wide arc of fire and upward traverse, and are very effective owing to their heavy calibre and high rate of fire. The Marauder was designed to operate without fighter escort, therefore it is heavily armoured.

Unlike that of the Baltimore, the rear of the Marauder fuselage interior is rather dark. The crew are five in number. The front gunner bomb aimer is seated in the nose; the radio operator-navigator is immediately behind the pilot; the mid upper gunner, who is also the photographer, resides under the upper turret, while the rear gunner sits in the tail. All can directly communicate with each other if necessary.

Undercarriage

The main wheels retract forward, while the nose wheel comes up backwards. Hydraulic operation is used for retraction as well as for the flaps, bomb doors, engine-cooling gills, and brakes. The brakes are powerful, with two separate brakes fitted to each wheel, one on the inside of each wheel and one on the outside. Only nose-wheel aeroplanes can use such powerful brakes. The hydraulic system follows modern American practice where a hydraulic accumulator is used in which air pressure energises the oil. This allows for damage due to enemy action by providing an effective emergency operation.

Marauder mauled. This Marauder, her left wing and engine nacelle riddled by flak, flew home to a safe belly landing after a bombing raid in Tunisia.

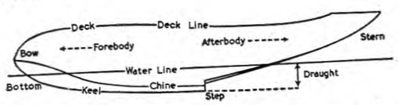


Marine Aircraft Terms

by A. M. COLBRIDGE

MARINE aircraft have a language of their own, much of it being drawn directly from that of the sailor.

Afterbody of a float or hull. That part between the step and the stern, the stern being used to define the extreme rear or aft portion of the body, just as *bow* is used for the extreme forward portion.



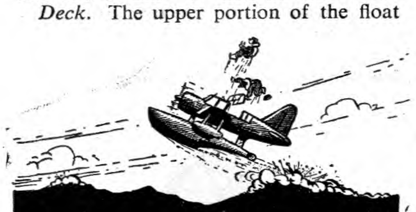
Buoyancy is defined as the amount of sea-water (in lbs.) displaced by the float or hull. This varies, of course, with the depth to which the float or hull is submerged, which, in turn, varies with the load carried. Thus in defining buoyancy a specific water-line is given and the corresponding buoyancy found when the hull or float is submerged to this line.

Excess buoyancy is the difference (expressed in pounds of sea-water) between the displacement under normal load conditions, i.e. to normal-load water-line, and the displacement when the hull or float is totally submerged. For convenience the excess buoyancy is often given as a percentage of the normal displacement.

The line formed by the intersection of the bottom of the hull or float with the sides or deck is called the *Chine*.

Dead rise is measured as the angle between the bottom of the hull and the horizontal on each side. Hull bottoms are usually in the form of an open "V"—the dead rise thus being the angle between one arm of this "V" and the horizontal.

Deck. The upper portion of the float



Porpoising.

or hull joining the two sides. If the sides are not apparent, i.e. the deck curves over in a smooth line to meet the chine, then the whole of the upper surface above the chine is classed as the deck.

Displacement is the weight in pounds of sea-water displaced by the hull or float under given conditions, that is, submerged to a specified water-line or carrying a given load.

Draught. The maximum projection of any part of the submerged hull or float below the surface of the water and measured perpendicularly to the surface. It can also be taken as the depth of water required for floatation with the lowermost part of the body just grounding.

Forebody. That part of the hull or float between the step and the bow.

Keel. Longitudinal structural member running from bow to stern along the bottom centre line (interrupted, of course, by the step or steps). To this is often added a form of "capping strip" on the outside over the keel proper to protect it against accidental damage. This is known as the *false keel*.

Hump speed is that speed during take-off when the resistance of the water is at its maximum. When the aircraft starts to accelerate from rest both the forebody and afterbody of the floats are partially submerged. Firstly a bow wake breaks and the nose of the float starts to rise. This wave moves farther and farther back against the step as more speed is gained, until the "hump" is reached. At this point the water resistance is its greatest, but once past it the bow wave disappears completely, the water breaks in a fine spray just in front of the step and there is a marked increase in acceleration, as the floats are now "planing" over the surface of the water.

Hydrofoils. Flat plates set at an angle, intended to replace floats. There are many objections to this scheme, one being that at the initial part of the take-off the necessary "lift" to support the weight of the machine must come from the displacement of water, and the hydrofoils are not very effective until a fair speed has been reached. Several ingenious hydrofoil systems have been suggested, and a number of model tests have been carried out. There does not, however, appear to be much chance of their replacing the normal float-type seaplane.

Hydrofoils: (a) hydroplaning, (b) at rest.

Metacentre. This is an imaginary point through which the buoyancy force (due to the displaced water) passes for all small lateral displacements of the float or hull. This means simply that if the float or hull is "rocked" slightly the buoyancy force will always pass through the same point, i.e. the metacentre.

Metacentric height. The vertical distance of the metacentre above the centre of gravity. For stability in a single float or hull this must be positive, i.e. the metacentre above the centre of gravity, otherwise a roll will be accentuated until the body capsizes; but where this is not possible, such as in twin-float seaplanes, water stability is obtained by other means, such as given by an adequate "track."

Porpoising is a pronounced pitching movement, that is, a bouncing up and down, which may occur when a seaplane or flying-boat is moving over the water. Under certain conditions it tends to build up, increasing the longitudinal rocking until a float digs in. It was a particularly common fault with the early seaplanes fitted with "scow" or flat-bottomed floats, often without steps of any description.

Even with the best float designs, porpoising may occur under bad weather conditions, e.g. a heavy swell, and the only cure is then to slow up and start again. Fortunately, porpoising generally only occurs during the take-off.

Sponsons are lateral projections, like low aspect ratio wings, added to a float or hull for the purpose of increasing lateral water stability and increasing the area of the planing surface. Their use is almost invariably confined to flying-boat designs. Although essentially a part of the hull, they can be so designed to fulfil their stabilising duties and yet present low drag in flight, possibly even contributing lift. A machine fitted with exaggerated sponsons has the appearance of a sesqui-plane, that is, a biplane in which the lower wing is of much smaller area than the upper.

Spray strips take the form of triangular "laths" fixed to the outside of the hull or flat along the chine. Their purpose is to deflect spray away from the hull which might otherwise cause inconvenience. Spray thrown on to airscrew blades pits them and reduces the length of their useful life. A similar or even better cure is given by so designing the bottom of the hull that the surface in the immediate neighbourhood of the chine is "hooked," and so controlling the spray in this manner.

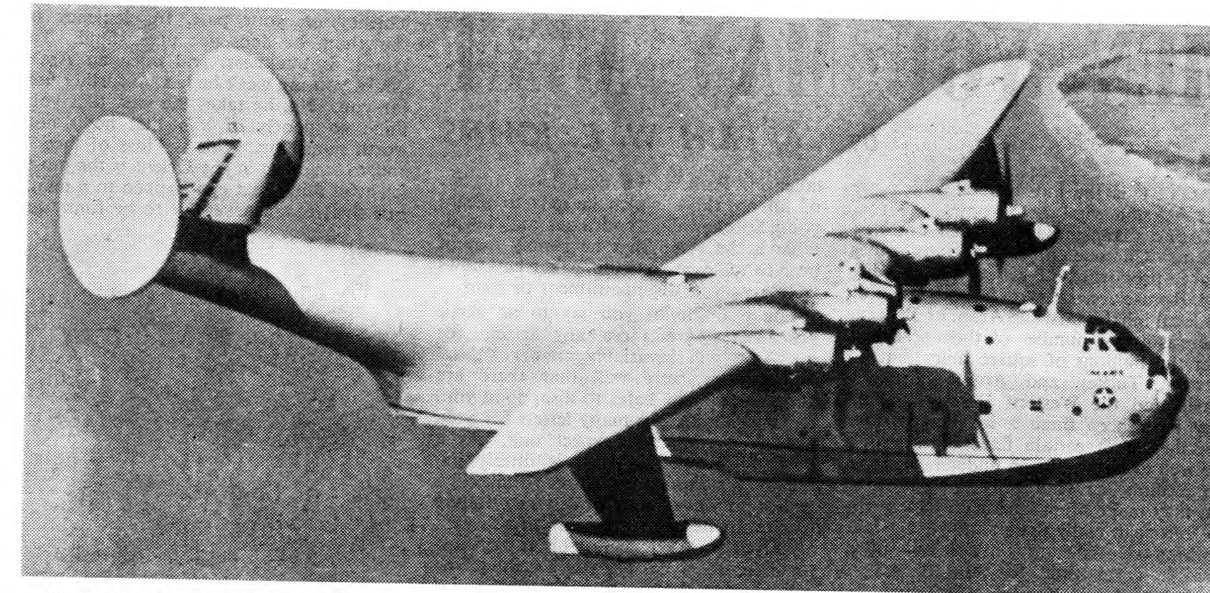
A step is a break in the bottom surface of the float or hull; there may be one or more steps, in various positions, depending upon the type of aircraft and the design. The position of the step or steps is of great importance, good design resulting in better control and ease of take-off. The object of the step is to "unstick" the afterbody, and thus help the hull or float over the "hump," leaving the machine supported by the forebody planing over the surface of the water.

To assist this action, and especially with low-powered aircraft and/or deep steps, the step is sometimes "ventilated." This is done by fitting a small air scoop to the top surface of the float, which leads the air through the float and discharges it immediately aft of the step itself. The pressure of this air greatly assists the float to pass over the hump speed, thus giving a quicker take-off. Such ventilated steps have been employed on light seaplanes, but the modern designer, with the highly efficient float and hull designs evolved to-day, has little need to resort to such tricks.

When it has been used, however, provision is generally made to retract the air scoop once airborne, so that it gives no drag.

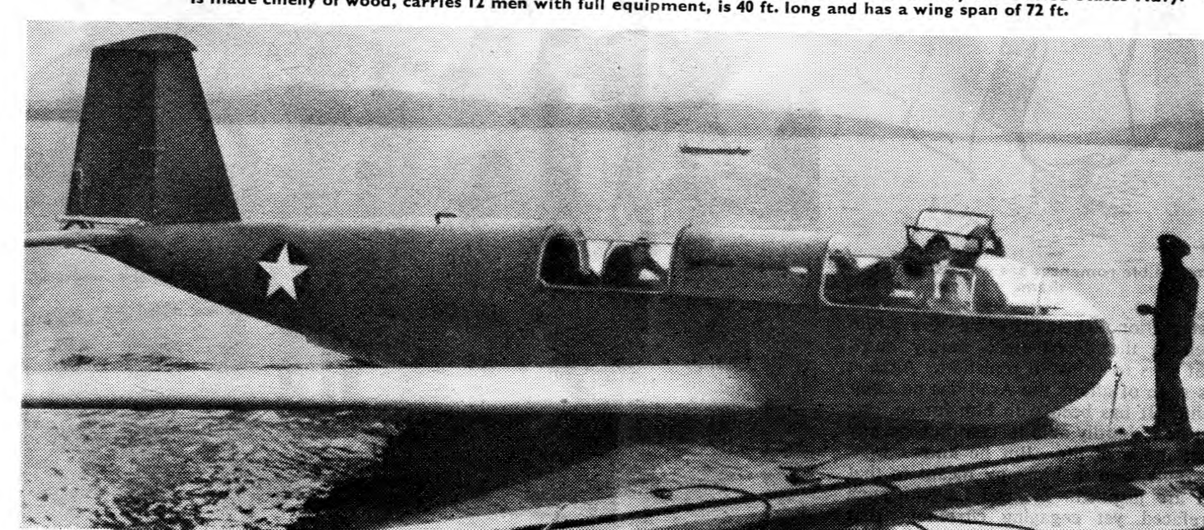
The depth of the step is not critical, but has a definite influence on the performance of the float or hull. The *position* of the step, on the other hand, is most critical. A shallow step improves conditions up to the hump speed, but above this is not so good. A deep step improves the planing properties above the hump speed, so generally a compromise is reached in the design.

Four stages in take-off: (a) at rest, (b) accelerating—bow wave formed, (c) at hump, water resistance greatest, (d) past hump—boat hydroplaning, immediate increase in acceleration.



The Martin 170, Mars (United States Navy XPB2M-1), has a wing span of about 200 feet. The beam is 13 ft. 6in., maximum draught 5 ft., and its gross displacement is 995,000 lbs. There are two full decks throughout the hull.

Marine Glider. Said to be the first military amphibious glider in the world this Bristol XLQ-1 is used by the United States Navy. It is made chiefly of wood, carries 12 men with full equipment, is 40 ft. long and has a wing span of 72 ft.



MEN YOU MAY MEET

by **CAPTAIN W. E. JOHNS**

EGYPT is the hub around which are set the vital aerodromes of Iraq, Palestine, Transjordania, Aden and the Sudan. On one of these aerodromes a large proportion of cadets will one day find themselves, so now let us glance at the local inhabitants, the Arab, or Beduin. There is a vast number of them scattered over the millions of square miles that lie between Turkey and Arabia, between Persia and the Western Desert; and as they have been there a lot longer than we, they have certain fixed ideas which are well to know, for an understanding of the Beduin may not only save trouble, but may make life a lot easier. Of course, no European really understands the subtle working of the Arab mind, but it is possible from time to time to get a glimpse of it.

Probably more hooey has been written about the Arabs than any other race on earth. Incredible romances have been woven about the sheikhs of the desert. The first thing to do is to forget that. The next thing in trying to understand the Arab is to discard European standards of judgment. What is a sin in London may be a virtue in Baghdad.

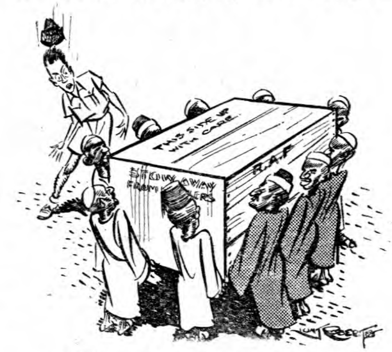
First of all, the Arab is a realist. He has to be, for to him life is, and always has been, a grim business. Quite a number of Arabs live perpetually on the verge

Incredible romances are written about them.

of starvation. There are some—those who dwell in the desert—who hardly know what it is to drink to repletion. Against this state of affairs the Arab has no complaint. It has been with him for so long that he is hardly able to comprehend any other mode of life. But he knows what he wants, and to him any means to that end are justified. He will lie with such barefaced yet engaging effrontery that against one's better judgment one is often taken in. Perhaps the most shattering lies of all are those which he tells to please you. So charming, courteous and hospitable is the Arab that he simply cannot bear to tell you something that he knows will cause you disappointment or pain.

For example, if you say to an Arab postman: "Are there any letters for me?" he will invariably answer "Yes," knowing perfectly well that there are none, because he hates to disappoint you. If he says there are many letters for you, you can reasonably expect one. As a guide, the average Arab is utterly unreliable for this same reason. Admittedly, he has no idea of time or distance. Rarely having anyhere in particular to go, with all his life to get there, this is not surprising. But if he sees you are thirsty he will shorten the distance to the nearest water rather than see you downcast by being told the bitter truth. Thus if he says there is a water-hole one hour's march away, you would be wise to reckon that it is at least six hours.

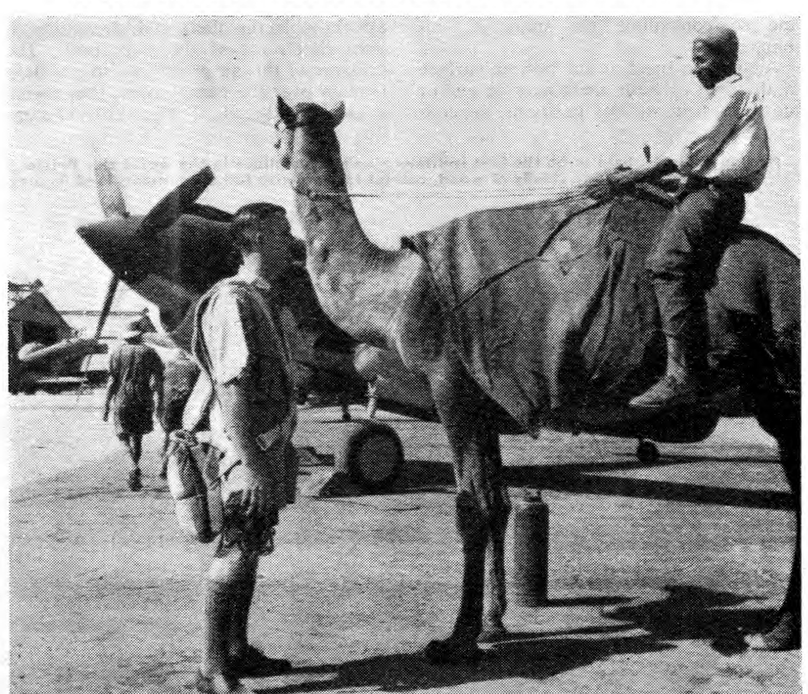
The next important thing to remember is: an Arab will take any amount of punishment without a murmur. If he knows the punishment is deserved he will expect it, and bear no malice; in fact, hard though it is to believe, if he does not receive the punishment he knows is warranted he may feel insulted, and hate you for it. He does not regard this as leniency on your part, for leniency is something he does not understand. To him it is weakness, and once an Arab thinks you are weak he has no further use for you. No, he takes the view that you think so poorly of him that he is not worth punishing. This is "loss of face," and to lose face in the Orient is the most frightful thing that can happen to a man. For this reason never try to be funny at



Will have performed a miracle.

the expense of an Arab. Above all things, never hold one up to ridicule. Hit him if you will, and he will get up smiling; but to make an Arab look foolish in front of his people is to make a deadly enemy. The next point is manual labour. The true Arab has a rooted objection to anything in the nature of work. Arabs who work as cultivators of the soil or fishermen, for example, are looked upon as the scum of the earth by the desert Arabs, who consider that the only honourable calling in life (apart from fighting) is the breeding of camels. They even regard breeders of goats and sheep as people far down the social scale. Work is a low and degrading business, for the Arab cannot conceive of anybody working unless compelled to do so by utter poverty. In the Middle East a white man who carries his own bag or digs his own garden at once loses face. He sinks at once to the very dregs, and is treated accordingly. No Arab could believe that a man goes for a walk, or digs in his garden, because he likes that sort of thing.

A Tomahawk pilot in the Middle East takes a look at a camel and its rider.



Nevertheless, the Arab can be a very lovable character. I once had a batman who was a liar, a thief and a rogue; a

A white man who carries his bag loses face at once.

more plausible rascal never lived, yet I couldn't help liking him. Arabs affect you like that. We need not say much about religion. The Arab has his own religion; he takes it very seriously, and expects you to respect it. It would be in the worst possible taste not to respect it.

In my experience a white man has nothing to fear from any Arab wherever he may meet him. If you have a forced landing, or are stuck somewhere in a car, you will find his behaviour exemplary. He will be polite, and do his utmost to help you. This is the ancient law of the wilderness, where help and hospitality are offered automatically. In such circumstances an Arab will rarely steal anything. He might "borrow" something out of your tent because he knows it will not seriously inconvenience you; but he would not take anything if he found you in a bad way, stranded somewhere. Nor does a desert Arab expect a tip for his assistance. The town Arab is different.

The town Arab is different.

As a worker the Arab is a failure, often a fool. It may take ten Arabs to lift a case that two white men could handle, because Arabs have no idea of team-work. Each man lifts when he feels like it. The white man who one day persuades ten Arabs to lift together will have performed a miracle.

STRESSED-SKIN CONSTRUCTION

by **J. T. HENSHAW**

THE metal stressed-skin airframe is to-day the most popular type of airframe in use for both civil and military aircraft. Designers throughout the world have adopted this method of construction for almost all classes of aircraft, even for machines as different in design as the Spitfire and Lancaster.

Compared with the tubular-wire-braced airframe, the advance in technique is, of course, revolutionary, a fact which will be obvious if we compare the spacious interior of the modern stressed-skin bomber with the maze of tubes and bracing wires which comprised the airframe of not so very long ago.

The first point which occurs to us when making this comparison is the apparent frailty of the modern form of construction. Why, we may ask, can machines as heavy as the modern bomber be free from bracing while even light aircraft of a few years ago were of such complex construction? The answer lies in the use which the designer now makes of the skin covering.

In the old fabric-covered airframe the covering was not intended to assist the structure to carry flight loads. Its purpose was to cover the skeleton airframe and provide a streamlined surface, any loads which came upon the fabric being transferred to the structure to which the covering was attached.

Fabric is still used for control surfaces in many aircraft. This is the Liberator's tail, the rudder of which is fabric covered.

In stressed-skin construction, however, this situation is reversed, the metal skin or covering being, as the title suggests, "stressed," i.e. carrying a load.

This is achieved by substituting for the braced, girder-like framework a structure which in many respects resembles a thin-walled tube. This analogy will be obvious if we consider only the fuselage. The mainplanes will be discussed later.

If we take a thin-walled tube and try to bend and twist it, as would the loads imposed during flight, the tube will, of course, oppose our efforts; or, to be more accurate, we should say that the thin wall or skin will offer the resistance. We should also find that if we increased the diameter of the tube, the opposition to our bending and twisting would become greater as the diameter increased, until, when we reached a diameter equal to that of the fuselage of the modern bomber, we would have a tube of immense strength capable of carrying very heavy loads.

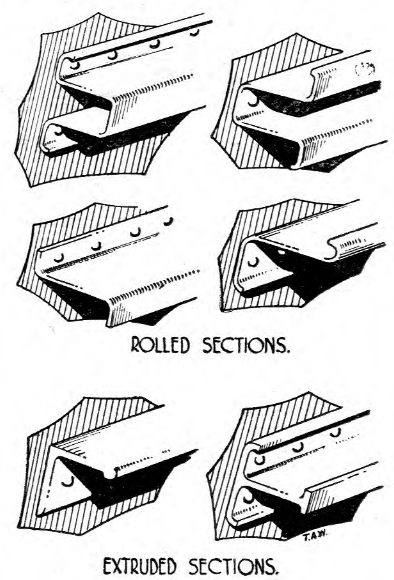


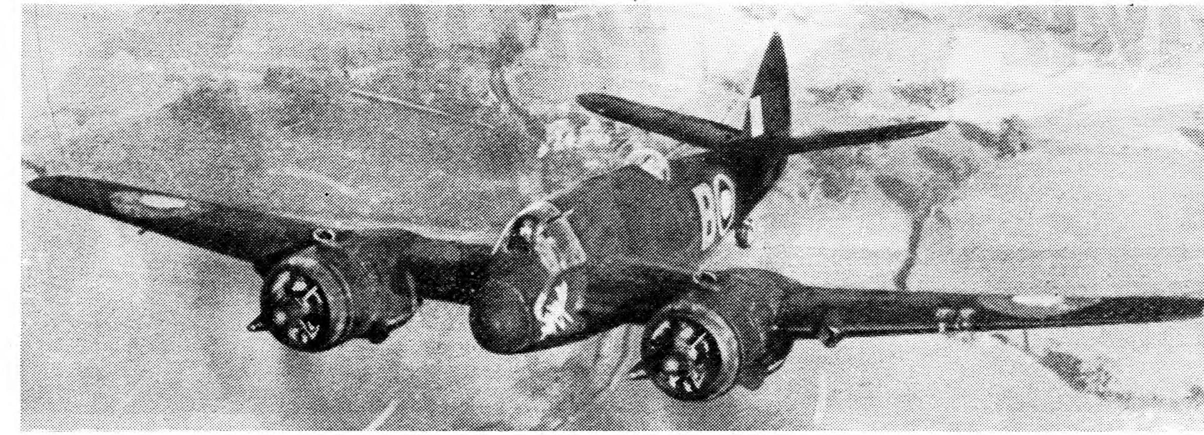
Fig. 1.

Here, then, in the thin-walled tube we have the principle of stressed-skin construction.

In practice, however, the design is not so simple. The chief difficulty is that if failure due to buckling is to be prevented, the thickness of the skin or wall of the tube must increase as the diameter increases. The thickness of skin which would then be required for an aeroplane fuselage would be considerable, and, as weight economy will not allow this, it is necessary for the designer to find some means of preventing the skin buckling under the load, or at least to improve the resistance to buckling as much as possible. It is to fulfil this requirement that stringers are introduced.

Stringers

Fig. 1 shows cross-sections of stringers in common use. The idea of the apparently "fancy" sections is to form the metal into such a shape that it will make a stable member, i.e. a member which will not readily buckle when loaded. These stringers are securely riveted to the skin panels, as shown in Fig. 2, and by this means it is possible to stabilise thin panels which, if unsupported, would readily buckle. This enables us to use very thin skins with a corresponding saving in weight.



The Bristol Beaufighter.

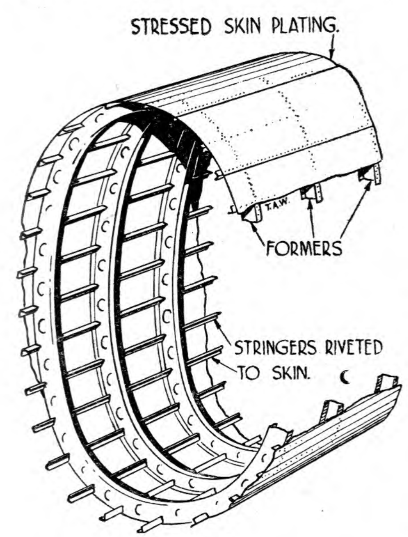


Fig. 2.

Unfortunately, in heavily loaded regions, such as the fuselage centre section, even stabilised skins would require to be very thick, and in order to save weight it is usually desirable to reinforce the stressed-skin shell by fitting longitudinal beams known as longerons, instead of increasing the skin thickness. These longerons are tapered to finish at a point where the shell is able to carry the load unaided.

Formers

It is true, of course, that fuselage formers or frames are also important parts of the airframe structure. Heavily loaded formers such as those supporting the concentrated loads from mainplane spars or gun turrets are specially built up to withstand the heavy loads imposed.

The majority of the formers, however, are not required to carry such heavy loads, and their main duty, as suggested by their name, is to form the contour of the fuselage shell and to help it to retain its shape when loaded.

The work of the formers may be more clearly understood if we consider the analogy of a bundle of straight wires bound together at fairly close intervals by string bands, each band representing a former. If we grasp the wires at the ends and try to bend them they will tend to spread and distort as they resist the bending. The string bands surrounding them will, however, with little effort prevent this and will keep the wires in shape. In just the same way the formers in the fuselage hold the loaded skin and stringers in shape while they themselves are only lightly loaded.

The Mainplanes

The principle of construction of the stressed-skin wing is very similar to that of the fuselage. The shape required by the aerofoil section is, of course, different, but the stringer-skin combination behaves in exactly the same way as it does in the fuselage structure.

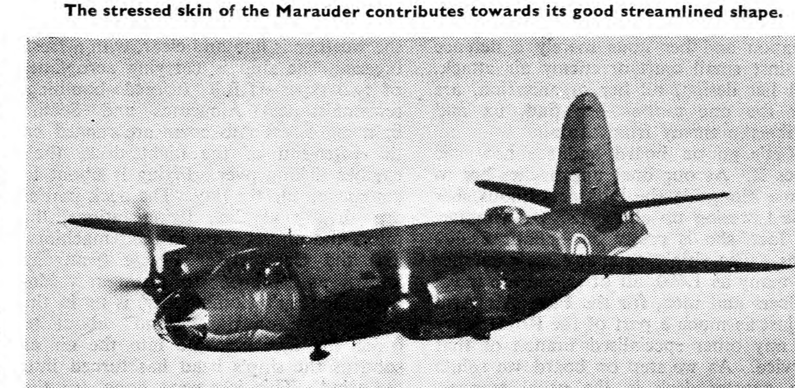
In wing construction, however, it is not practicable to make the stringers and skin strong enough to carry more than a comparatively small proportion of the load imposed on the wing. This makes necessary the introduction of the spar or spars always found in the mainplane structure.

We find, therefore, that all stressed-skin wings consist of the main spar, or spars, which are required to carry the major portion of the load, together with the load-carrying skin which, as in the case of the fuselage, is stabilised by the specially shaped stringers.

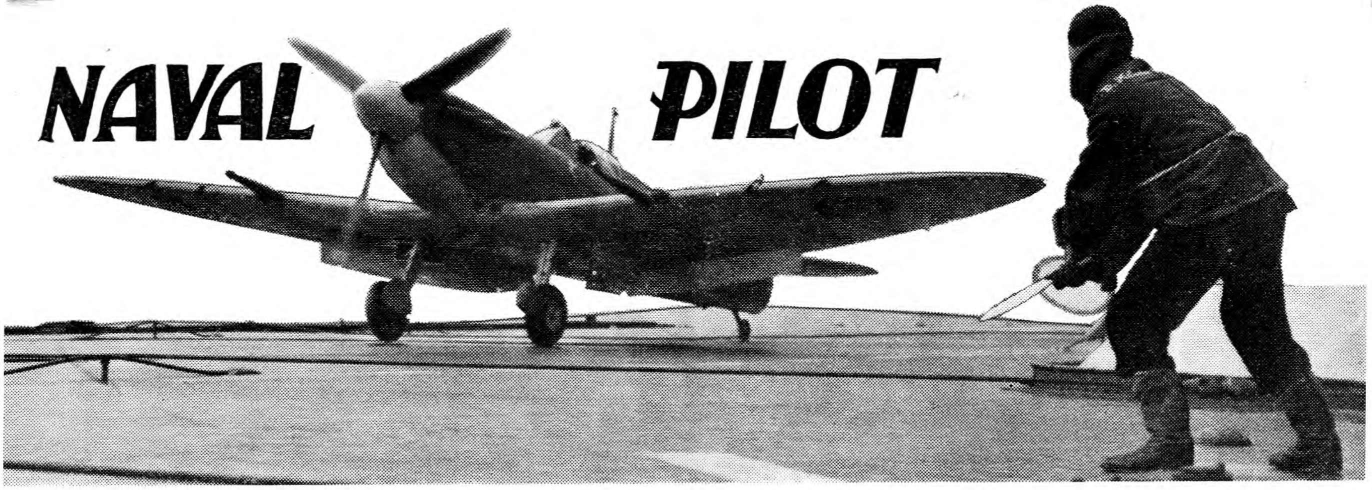
The formers which, as we have seen previously, are required to keep the fuselage in shape are, in the case of the wing, replaced by the shaped ribs, which perform exactly the same function. As is the case with the fuselage formers, the heavily loaded wing ribs such as those supporting the engines or fuel tanks are strongly built, while their more lightly loaded counterparts, whose main duty is to give shape to the skin, are usually of light construction.

We see, then, that in both wings and fuselage the principle of stressed-skin construction is the same, the skin being a working member which does far more than "keep out the wind." In all cases the combination of skin and stringers is vital, and if at any time we must modify or repair these members we must treat them with the care which such highly important components deserve.

The stressed skin of the Marauder contributes towards its good streamlined shape.



NAVAL PILOT



A Seafire landing on the deck of H.M.S. Indomitable.

ENGRAVED on the front of Dartmouth College is an old saying which can be traced back for over four hundred years—"It is upon the Navy, under the good providence of God, that the wealth, safety and strength of the Kingdom do chiefly depend." Of all His Majesty's ships with the Senior Service none is more novel, either in her appearance or in her duties, than the aircraft carrier. To the eye of the sailor her lines are anything but beautiful, for with her flat flying-deck high out of the water and her bridges, mast and funnel clustered together in the "island" on her starboard side, she breaks all the rules of how a ship ought to look. But her appearance is certainly businesslike, and in fact the modern carrier is one of the most remarkable craft to sail the seas.

The battleship is designed to strike with her guns. She has to be fast enough to maintain the pace of a modern sea-fight and strong enough to withstand the shock of action. She must be able to deal damaging blows on the enemy while her armour wards off any hits she may receive.

The carrier is built to strike with her aircraft. She, too, must be fast. But in a fleet action she has no place in the line of battle, for there she would stand no chance. Besides, there is no point in her being there. From a safe position thirty miles away—only a few minutes' flying distance—she can join in the fight just as decisively. Her aircraft are her main weapon and her guns merely a defence against small craft or enemy air attack. All her design, all her organisation, are for the one purpose—to find, fix and strike the enemy from the air.

Let's go on board and see how she does it. As our boat approaches her to come alongside she looks enormous, her side towering up above us. As a matter of fact, she is pretty big—about 23,000 tons. The ship's company may number as many as 1,600, all of whom are naval officers and men, for the Fleet Air Arm is just as much a part of the Royal Navy as any other specialised branch of that service. As we step on board we salute the quarter deck in the usual manner, although a carrier's quarter deck bears very little resemblance to that of any other ship. Having reported ourselves we are free to look around.

Impressive Size

In spite of the fact that we are prepared for the great expanse of the flight deck and the echoing size of the hangar, we can't help being impressed by the spaciousness of the ship—whether in the wardroom for the officers or the recreation space for the crew. There seem to be miles of passages, scores of ladders and a dozen different decks. All the same, every inch, every corner, appear to be used for some purpose and everyone we meet is busy. From time to time the shrill pipe of a bo'sun, a bugle call, or an order sounds over the loud-speakers which are placed everywhere. One of these days, when the ship is in action, these same loud-speakers may from time to time bring us news of how things are going—very cheering to those whose action stations are far below and out of sight. You, as a pilot, will probably be in the thick of it and having the time of your life, but those of us who aren't so lucky will be glad to hear how the fight goes.

Into Action

That night, accompanied by destroyers, we put to sea to meet our battle fleet. Flying and gunnery exercises are to be carried out on the way. Next morning the weather is fine and clear, with a fresh breeze. The ship is carrying aeroplanes of two types—T.B.R. (torpedo-bombing-reconnaissance) Albacores and Seafire fighters. Eight Albacores are ranged on the after-end of the flight deck, their engines ticking over. Flying is about to commence for the day. The deck parties are already at their flying-stations, the pilots and aircrews are in their machines, and the Commander Flying (generally known as "Wings" to distinguish him from the ship's Commander) is up in the flying-bridge on the "island" about to order the first machine into the air as soon as the ship's head has turned into the wind. This is always done, for the faster the wind over the deck the quicker the take-off and the slower the landing.

Aircraft Off

Round she comes, until the steam-jet at the forward end of the flight deck blows directly fore and aft; the signal is given, and the flight-deck control officer sends off the Albacores in quick succession. Once in the air, they form up into formation and set off on their exercise.

The deck now seems strangely quiet and empty, but not for long, for five Seafires—one of them yours—are coming up in the lifts and being towed aft by the miniature motors (called "Dodg'ems"), which are so like those little cars which crash about in fun fairs and amusement parks. The engines are warmed up, and you and the other four fighter pilots leave the game of cards which you were playing in the pilots' rest room and climb into your aircraft. One after another you are sent off, and you form a tight V-formation headed by your squadron commander. He, by the way, is known in the Service as a tough proposition, as his D.S.O. and D.S.C. ribbons prove, and you are lucky to find yourself behind an old hand with such a fine fighting record.

Whose side are you on?

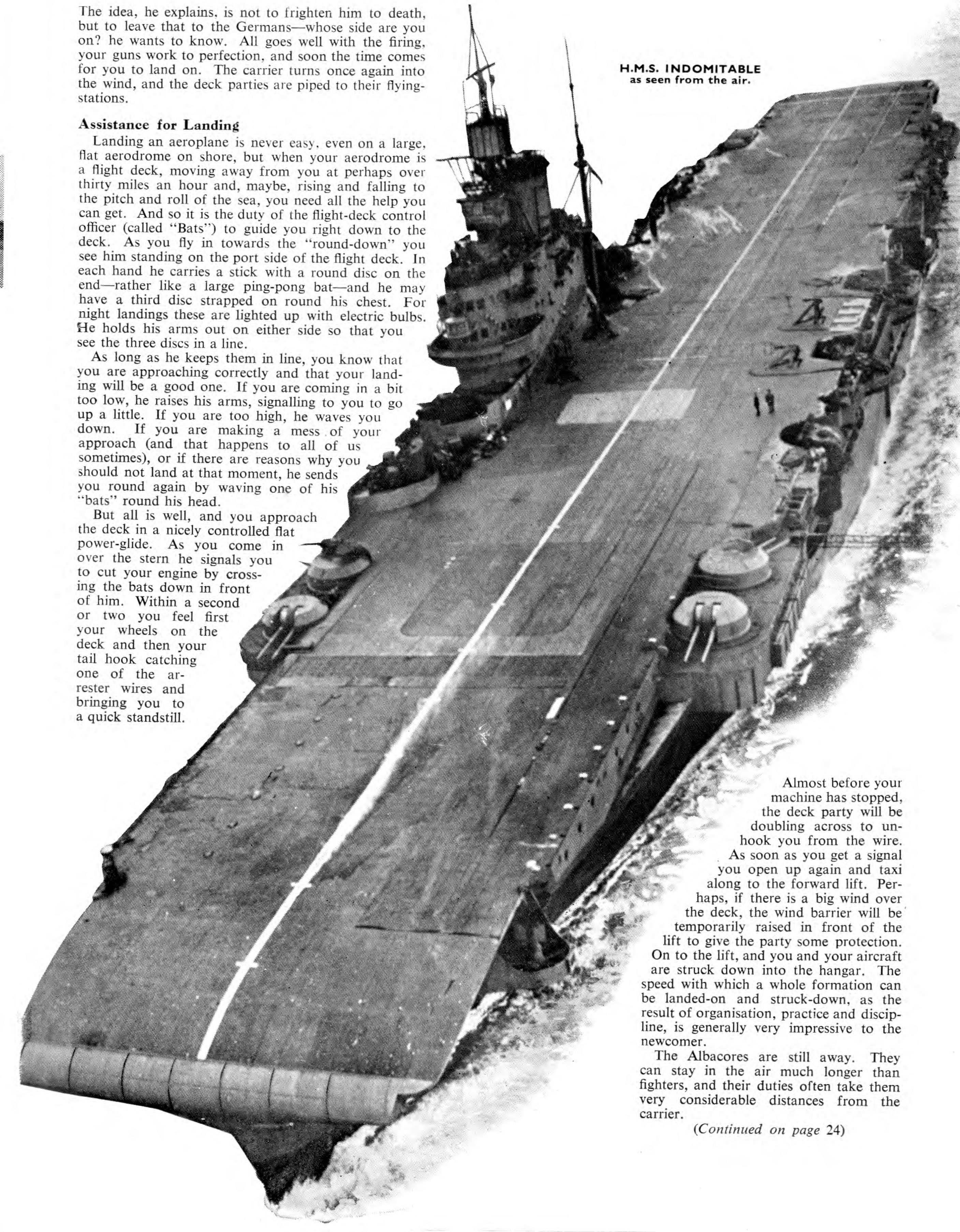
As has been so often drilled into you during your training, the job of a carrier's fighters is a double one—to protect from enemy machines our T.B.R. aircraft which need as clear a run as possible and to shoot out of the sky any of the enemy who may try with bomb or torpedo to attack our ships. Both these duties demand good gunnery, and it is gunnery you are going to practise now. One or two big gas-filled balloons are to be released from the ship, and you are to shoot them down, which is quite a lot of fun and good practice as well. Your thoughts wander, and apparently your flying does too, for you are brought to with a jerk by hearing over the wireless a polite but pointed enquiry from your squadron commander, who wonders if you would oblige him by trying to fly in slightly better formation. The idea, he explains, is not to frighten him to death, but to leave that to the Germans—whose side are you on? he wants to know. All goes well with the firing, your guns work to perfection, and soon the time comes for you to land on. The carrier turns once again into the wind, and the deck parties are piped to their flying-stations.

Assistance for Landing

Landing an aeroplane is never easy, even on a large, flat aerodrome on shore, but when your aerodrome is a flight deck, moving away from you at perhaps over thirty miles an hour and, maybe, rising and falling to the pitch and roll of the sea, you need all the help you can get. And so it is the duty of the flight-deck control officer (called "Bats") to guide you right down to the deck. As you fly in towards the "round-down" you see him standing on the port side of the flight deck. In each hand he carries a stick with a round disc on the end—rather like a large ping-pong bat—and he may have a third disc strapped on round his chest. For night landings these are lighted up with electric bulbs. He holds his arms out on either side so that you see the three discs in a line.

As long as he keeps them in line, you know that you are approaching correctly and that your landing will be a good one. If you are coming in a bit too low, he raises his arms, signalling to you to go up a little. If you are too high, he waves you down. If you are making a mess of your approach (and that happens to all of us sometimes), or if there are reasons why you should not land at that moment, he sends you round again by waving one of his "bats" round his head.

But all is well, and you approach the deck in a nicely controlled flat power-glide. As you come in over the stern he signals you to cut your engine by crossing the bats down in front of him. Within a second or two you feel first your wheels on the deck and then your tail hook catching one of the arrester wires and bringing you to a quick standstill.



H.M.S. INDOMITABLE as seen from the air.

Almost before your machine has stopped, the deck party will be doubling across to unhook you from the wire. As soon as you get a signal you open up again and taxi along to the forward lift. Perhaps, if there is a big wind over the deck, the wind barrier will be temporarily raised in front of the lift to give the party some protection. On to the lift, and you and your aircraft are struck down into the hangar. The speed with which a whole formation can be landed-on and struck-down, as the result of organisation, practice and discipline, is generally very impressive to the newcomer.

The Albacores are still away. They can stay in the air much longer than fighters, and their duties often take them very considerable distances from the carrier.

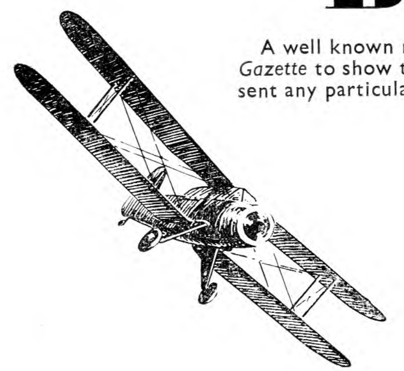
(*Continued on page* 24)

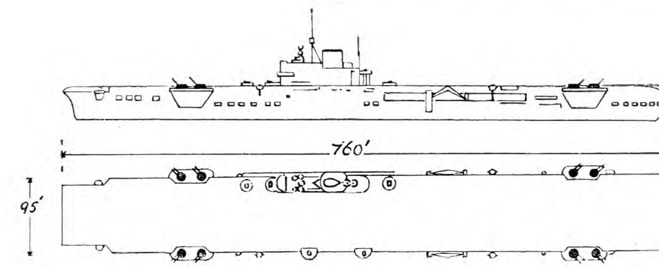
British Aircraft Carriers

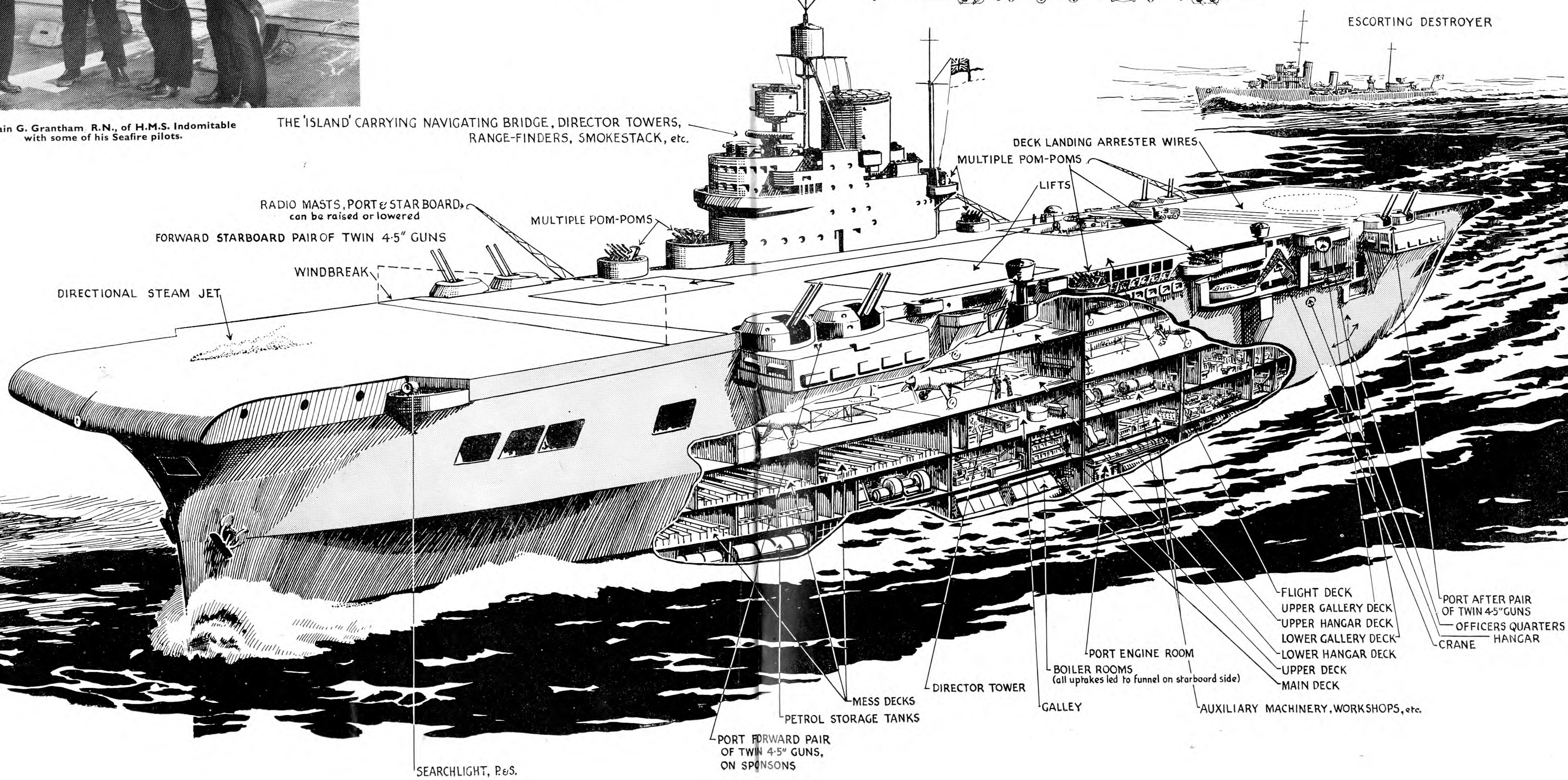
Captain G. Grantham R.N., of H.M.S. Indomitable with some of his Seafire pilots.

A well known naval artist has produced this drawing specially for the *A.T.C. Gazette* to show the general lay-out of carriers. The drawing does not represent any particular ship.

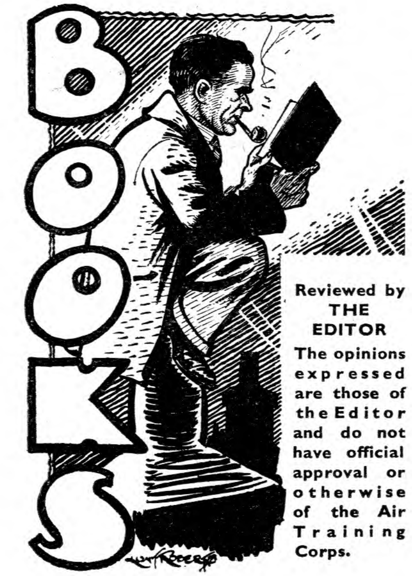
The latest classes of large British Carriers have a maximum speed of 31-32 knots, obtained from Parsons' geared turbines. The *Ark Royal* was designed to carry 60 aircraft, but no information on this point has been released about later ships.







The pictures opposite are of the Vultee Vanguard, 10-gun, long-range American fighter. Span 36 ft., speed 350 m.p.h. Below is a flight of PBY's, the U.S. Navy's Catalina flying boats, patrolling over the Alaskan shore.



Reviewed by THE EDITOR

The opinions expressed are those of the Editor and do not have official approval or otherwise of the Air Training Corps.

Elementary Flying Training

(April 1943.) Issued by the Air Ministry. From His Majesty's Stationery Office. Air Publication 1979A. 9d. net. 121 pages. 4½″ × 6⅞″. Many diagrams.

Introduced primarily for R.A.F. cadets, this book has been placed on public sale so that A.T.C. cadets and others can study it and learn something about flying. The opening chapters, dealing with the theory of flight, are a little more involved than those of most primers on the subject, but they deal with the subject more thoroughly, and the intelligent reader should not find them difficult. Having mastered these the reader will find no difficulty with the rest of the book, in which the whole sequence of elementary flying training is explained clearly and fully.

A study of the book will enable a cadet, when he does start his flying training, to get the last ounce out of every minute of instruction. Those who are not going into the R.A.F. would do well to have a copy, since it can give them a wider view of the specialised jobs, and in any case they may have a chance of learning to fly as civilians after the war. Ninepence for 120 pages is quite cheap, even for plain paper, and this is full of expert and authoritative information.

The Log of a Merchant Airman

By Captain John Lock and John Creasey. Stanley Paul & Co. Ltd. 15/- net. 228 pages. 5¼″ × 8¼″. 36 illustrations.

Known to many for a long time as a first-class air-liner pilot, Captain John Lock is here revealed to be as good a publicity agent for British aviation as ever sat in dignified state in Imperial Airways offices. After learning to fly in the R.A.F., he joined Hillman's Airways, a small but lively concern founded and run by E. H. Hillman—a plain-spoken, vigorous owner of a fleet of buses in East London. After that Captain Lock joined Imperial Airways and flew over most of the Empire routes, which he describes in detail, with sympathy and understanding of the problems of international and imperial relations. Though loyal to the larger firm, he expresses his greatest admiration for the smaller but more enterprising firm of Hillman. By no means a literary masterpiece, this is still a good book, likely to inspire the young man, and the older man, too, with a sense of the responsibility of Empire, a realisation of the possibilities of aviation, and the yearning for travel and adventure.

Combat Report

(THE STORY OF A FIGHTER PILOT.) (April 1943.) By Hector Bolitho. B. T. Batsford, Ltd., 8/6 net. 138 pages. 4⅜″ × 8½″. 12 illustrations.

If you can get through the parts in which the author establishes his bona fides, i.e. that he travels the world in the right style (first class), belongs to the right club (Athenæum), writes about the right people (Royalty), becomes an officer in the right Service (R.A.F.) at the outbreak of war, etc., you will find herein an intimate and interesting record of the progress of a young friend of his named John, who, after a false start in Australia, joins the R.A.F. before the war, fights in the Battle of Britain, gets the D.F.C. and rises to the eminence of squadron leader.

Aircraft Identification

(SERVICE TYPES AND THEIR CHARACTERISTICS.) Reprinted from *Flight*. Flight Publishing Co. 3/6. 72 pages. 10¾″ × 8¼″. Illustrated.

Four-view drawings, photographs and printed descriptions of 72 British, American, German and Italian Service types—one type to a page—taken from the pages of *Flight*. Those who have seen them in that journal will know that they are worth having in book form.

Flight and Airframes

(May 1943.) D. O. Bishop, B.Sc.(Eng.), A.M.I.E.E., and P. S. Bosanquet, B.Sc. Sir Isaac Pitman & Sons, Ltd. 10/6 net. 192 pages. 5½″ × 5⅜″. 24 photographs and many diagrams.

A good explanation of elementary aerodynamics, with chapters on frameworks, structures, hydraulics, materials and the reading of blueprints. Illustrated with technical diagrams, photographs of well-known aeroplanes and sectional drawings from *The Aeroplane* and *Flight* of seven aircraft. The book explains and illustrates things clearly.

Pocket Planisphere

By Francis Chichester. Allen & Unwin. 2/6. 5½″ × 5″.

Shows how the stars appear at any time of night or year. Prepared for navigation students by an expert navigator.

Aero-Engine Theory

(1943.) D. R. W. Archer, B.Sc., and A. C. Ree, B.Sc. Sir Isaac Pitman & Sons Ltd. 10/6 net. 200 pages. 5½″ × 8¾″. Many diagrams.

A little beyond the average cadet, this book deals fully with aero-engine theory. It should be of value to those who are making a close study of the subject and useful for reference to others.

Explosives

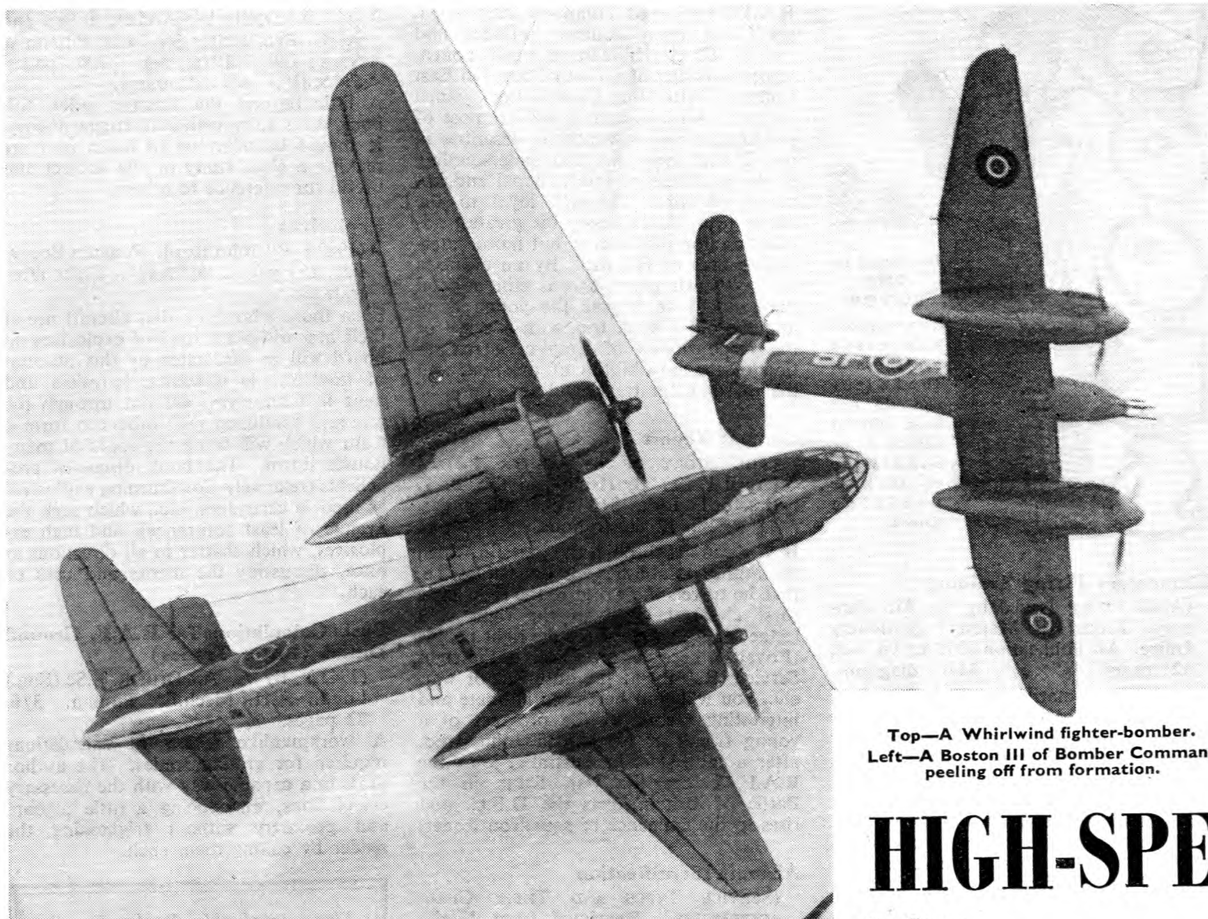
(1942.) By John Read. Penguin Books. 9d. 159 pages. 6⅝″ × 4⅜″. Eight illustrations.

Even those who think that aircraft are at their best without a load of explosives on board will be fascinated by this account of how simple elements, harmless and inert in themselves, are put through the mill and combined with others to form a team which will bring the roofs of many houses down. The book discusses propellents (relatively slow-burning explosives as used in cartridges, etc., which seek the avenue of least resistance), and high explosives, which shatter in all directions at once, discussing the merits and uses of each.

Basic Calculations for R.A.F. Ground Duties (Fitter Trades)

(1943.) By A. A. Druett, B.Sc.(Eng.) Lond., A.H.I.Mech.E. Pitman. 3/6. 72 pages. 7¼″ × 4⅞″.

A workmanlike review of calculations required for ground trades. The author deals in a capable way with the necessary calculations, introducing a little algebra and geometry without frightening the reader by calling them such.



Top—A Whirlwind fighter-bomber.
Left—A Boston III of Bomber Command peeling off from formation.

Top—The Mosquito has to do some fast turns at times.
Right—The Lockheed Lightning in action.

HIGH-SPEED STALL

By **Capt. Norman Macmillan,** M.C., A.F.C.

Its Cause

THE high-speed stall is a function of three characteristics of an aeroplane—its speed range, its inertia and its power of manœuvre. For that reason it cannot occur during straight flight, whether on the level or on the climb. It is discoverable only when manœuvring about the looping axis, that is to say, when making fast turns or when pulling out of a dive.

Speed Range Improves

Early aeroplanes had a speed-range ratio of about 1 to 2, which, expressed in miles per hour, means that for a minimum speed of about 40 m.p.h. they had a top speed of about 60 m.p.h. Their range of flying speed—some 20 m.p.h.—gave them little power of manœuvre, and it was necessary to put the nose down to gain speed before making even a gentle turn. The low-speed stall was their headache.

Aeroplanes of the Great War improved to a speed-range ratio of about 2 to 1, that is, some had a maximum level-flight speed of about 120 m.p.h. for a minimum speed of about 40 m.p.h. Their weights and wing loadings were still extremely low compared to present-day figures, and even when turning their stalling speed was not much faster than when flying level. So, while it was known that it was easier to stall on turns, and, in unstable machines like the Camel, to spin off such stalls, there was not enough difference between that type of stall and any other stall to suggest that there was a distinction to be drawn between a low-speed and a high-speed stall.

Leaving out special cases, modern aircraft have a speed-range ratio which may fall anywhere between $2\frac{1}{2}:1$ and $4:1$. Their weight and wing loading have soared. Their minimum flying speed has risen far above 40 m.p.h. Their slowest manœuvring speeds have also risen—even more remarkably. In consequence, inertia forces, which are the product of their mass (weight), velocity and rate of change of direction, are much greater, even though the rate of change of direction has remained much the same.

How It Happens

Now, let us have a look at the theory of the high-speed stall.

When flying at its minimum level speed in still air, an aircraft's lift and weight are equal and its wings attack the airflow at the angle of their maximum lift co-efficient.

Now, suppose the aircraft to be flying at maximum speed, with the wings at or near their minimum lift co-efficient. Then imagine the weight of the aircraft to be instantly increased. It would be necessary instantly to increase the wing angle to a higher lift co-efficient value to generate the lift required to support the additional weight.

Entry at high speed into a steeply banked turn (or the pull-out from a dive) reproduces this condition every time. The load produced by the inertia of the aircraft may be as high as four, six or eight times the normal weight of the aircraft. When executing the turn the pilot automatically increases the wing angle in relation to the airflow. Resistance simultaneously increases. Speed falls. Stability in the turn is then dependent upon the interrelationship of wing angle, speed, and rate of turn.

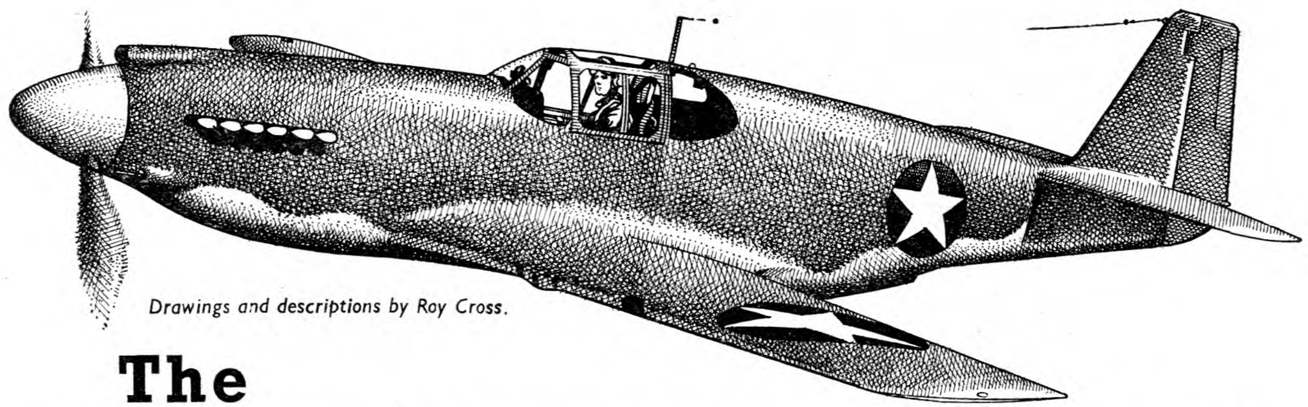
In combat it is instinctive to tighten the turn. But a point may be reached when the wings reach their maximum lift co-efficient. Then any attempt to tighten the turn still further will stall the aircraft.

Because the load is exerted along the axis of the yawing plane through the fore and aft centre of gravity the aircraft will stall outwards in the turn. But gravitation will tend to cause the nose of the aircraft to fall.

The controls are in the position for a spin, and the modern high wing-loaded aircraft may flick over and fall a long way in a dive or spin before the pilot can recover. If the aircraft is too near the surface it may go right in, although, according to all the laws of normal stalling, its speed was never near the danger mark.

So remember, when turning fast, that you are not flying a normal aircraft, but an aircraft laden to many times its normal weight. Your wing loading may be as high as 200 lb. sq. ft., and your speed range of $4:1$ for normal flight may have fallen to $2:1$, or even less during highly stressed manœuvres. At present only experience can teach when the high-speed stall is imminent. But, as it is the resultant of manœuvre loading, and can occur only at a peak load, it should be easy to test each type of aircraft for its high-speed stall loading and then fit an accelerometer (with the peak load marked thereon) on each instrument board, so that the Service pilot could get the maximum manœuvre out of his aircraft without the risk of stalling it at high speed and thereby losing his Hun, if indeed he fares no worse.

An affair of gravity both for ship and aircraft. This is an artist's impression of an attack by a Whirlwind.



Drawings and descriptions by Roy Cross.

The NORTH AMERICAN MUSTANG

The Mustang, a low-altitude, high-speed fighter-reconnaissance monoplane flying with Army Co-operation Command, is doing extremely well. High speed, heavy armament, excellent manœuvrability and instant response to controls near the ground make it a match for most German fighters it is likely to meet.

Here is a summary of the characteristics, specifications and performance of the Mustang I:

Makers: North American Aviation, Inc., Los Angeles Municipal Airport, Inglewood, California. Maker's name: N.A. 73 Apache. U.S. Army designation: P-51 Mustang.

Engine: One Allison V-1710-39-F3R 12-cylinder V motor, glycol cooled, and giving 1,150 h.p. /12,000 ft./3,000 r.p.m. Weight: 1,320 lb. approx. Reports indicate that the Packard Rolls-Royce Merlin XXI is fitted to later models, the result being, in the words of Lord Beaverbrook, "a very good aeroplane, one of the best in the world." A Curtiss Electric constant-speed airscrew is standard.

Armament: Eight Browning machine-guns including two of 0.5 calibre, reflector sight, bullet-proof panel in windscreen, large armoured bulkhead behind pilot, rear-view mirror. The U.S. Army have a dive-bomber version of the Mustang.

Performance: Maximum speed 370 m.p.h. at 13,000 ft., and 320 m.p.h. at 1,000 ft. Range: 510 miles at 310 m.p.h. Landing speed with flaps down 90-100 m.p.h. Take-off run is fairly long, even with flaps depressed through 10 degrees.

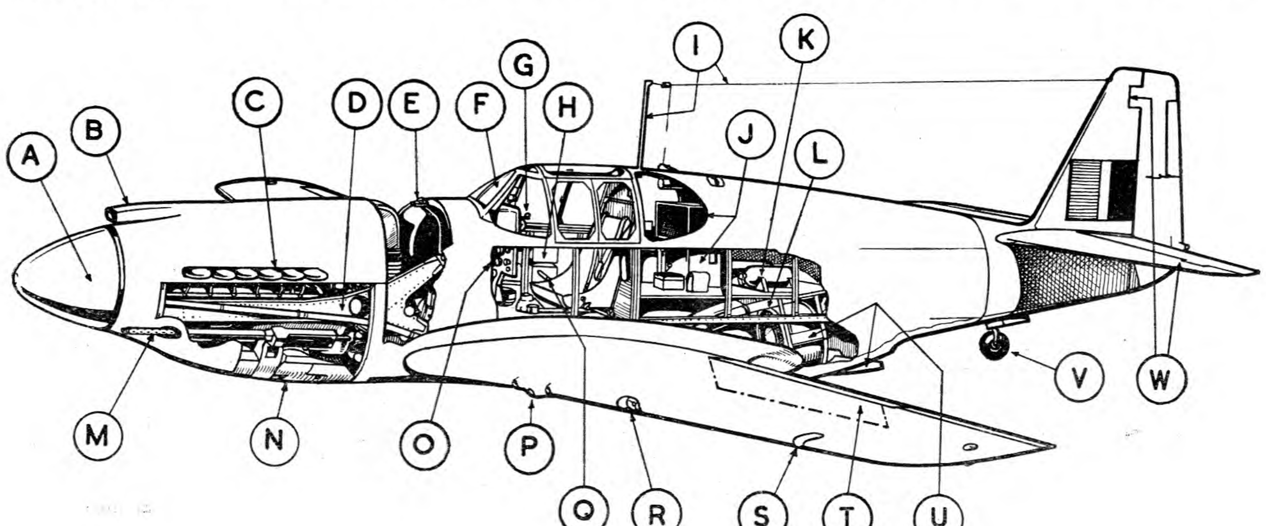
Weight: Empty, 5,990 lbs.; loaded, about 7,708 lbs.

Fuel Capacity: 141 gals. Oil: 10.1 gals.

Dimensions: Span 37 ft. $0\frac{5}{16}$ in.; length 32 ft. $2\frac{5}{8}$ in., height 8 ft. 8 in., wing area 235.75 sq. ft., aspect ratio 5.84, track 11 ft. 10 in.

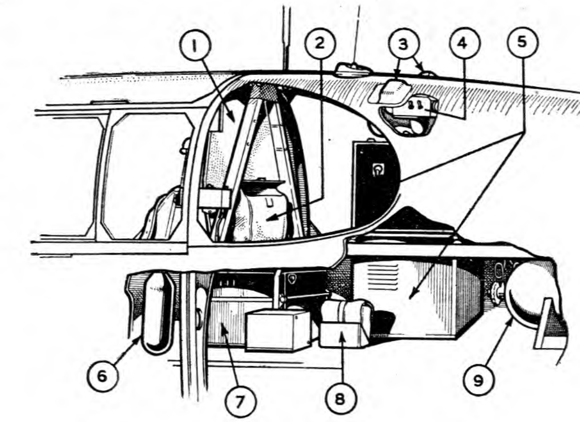
Army Co-operation Command was formed towards the end of 1940, when lack of air support for ground forces largely contributed to our defeats in Greece and Crete. Pilots of the tactical reconnaissance squadrons undergo special training at Army Co-operation Schools in elementary reconnaissance, air photography, Morse signalling, artillery spotting and advanced reconnaissance, ground straffing and close support of ground forces.

Below: A part-sectioned Mustang, showing details of its equipment and armament. A, Curtiss electric, three-bladed, constant-speed airscrew; B, carburettor air intake; C, flame-damping exhausts; D, engine-bearer; E, oil tank, 10.1 gals.; F, bullet-proof glass panel; G, Morse tapper; H, radio and oxygen remote controls; I, radio mast and aerial; J, radio sets; K, two oxygen bottles; L, hot-air pipe to cockpit; M, 0.5 cal. Browning m.g.; N, ammunition boxes and spent cartridge chute; O, instrument panel; P, three Browning m.g. in either wing (free-firing: the two fuselage guns are synchronised to fire through the airscrew); Q, hand-pump (hydraulics); R, landing lamp; S, camera gun; T, flap; U, radiator unit, set far back under fuselage, providing clean entry for fuselage: airflow through the special oil-glycol radiator is controlled by the usual adjustable rear flap; V, retracting tail wheel; W, rudder and elevator mass balances.

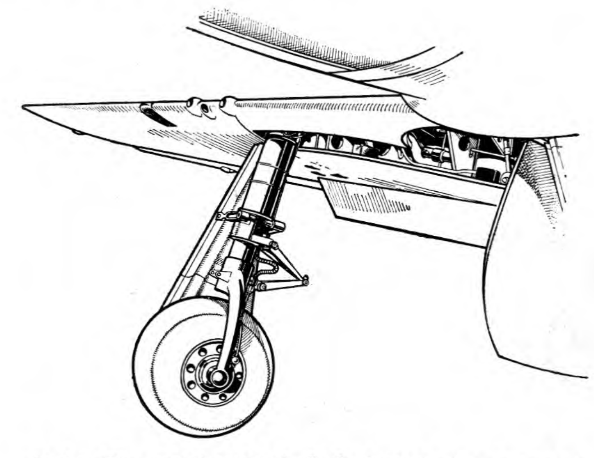


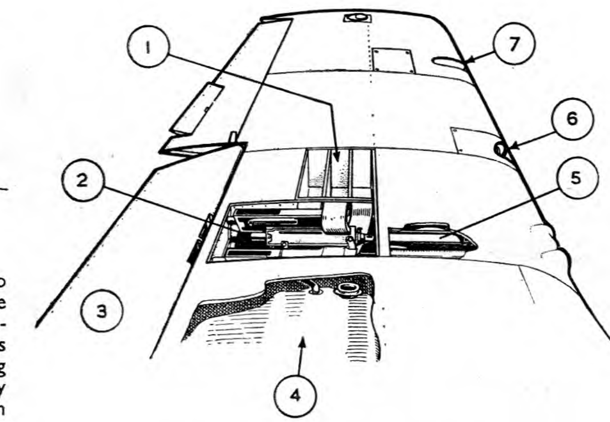
MUSTANG DETAILS

Equipment to the rear of the pilot's cockpit is shown in the sketch on the right: 1, a sheet of armour-plate, completely protecting the pilot's head and back from the rear; 2, mesh first-aid bag between crash pylons; 3, ventilators; 4, ground radio switches; 5, radio sets; 6, extinguisher bottle; 7, battery; 8, emergency rations; and 9, port oxygen bottle. The gun-firing relay mechanism is on the starboard side just aft of the battery.

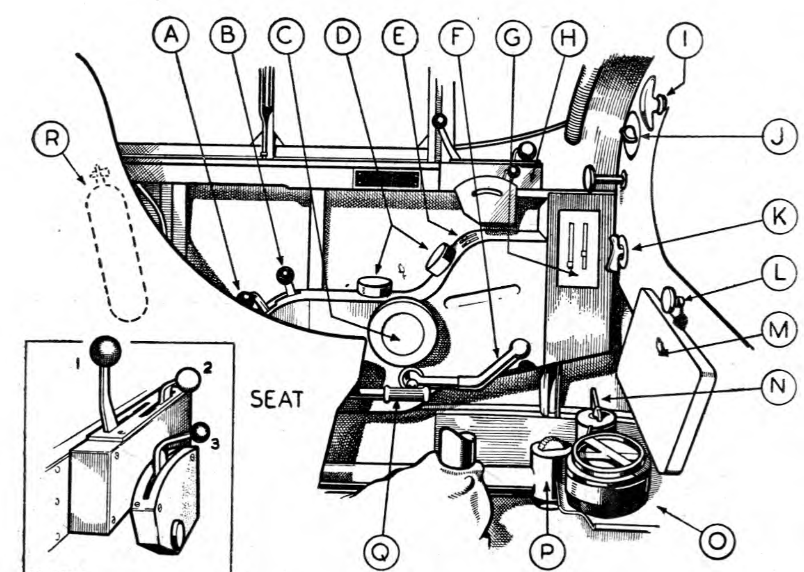


Below: The starboard wing and undercarriage leg. All three landing-gear components, flaps and radiators are operated hydraulically, together with the differential and parking brakes. Air-oil shock-absorbers are used for undercarriage damping.





Right: The metal-covered, flush-riveted wing is in two halves which bolt together on the centre-line, the centre section thus forming the cockpit floor. Wing-tips are detachable. Equipment in the wing includes: 1, ammunition boxes for three Browning guns (2); 4, port $70\frac{1}{2}$-gallon, self-sealing fuel tank; 5, gun blast-tubes; 6, landing light, skewed slightly outboard (in either wing); 7, camera gun. Adjustable trim tabs on ailerons, and slotted flaps (3) are other features.



Left: The cockpit is roomy, yet compact, and an excellent view is obtained through the Plexiglass hooding, owing to the low sides. All the following are mounted on a shroud on the port side: A, flap lever; B, radiator control; C, elevator trim; D, rudder and aileron trims; E, landing gear position indicator; F, undercarriage operating lever; G, flaps and radiator indicators; H, engine-control quadrant (see inset), I, cocking handle for port fuselage gun; J, gun-selector switch; K, gun-heater control; L, parking brake; M, switch panel (ignition, cockpit floodlight, starter, etc.); N, fuel cock; O, compass; P, cockpit-cooling pipe; Q, tail-wheel locking lever; R, fire extinguisher bottle (side of seat). Inset: 1, throttle; 2, mixture lever; 3, airscrew-pitch control. An independently-sprung panel with fourteen instruments is set into the main dashboard. Gear on the starboard side includes spare-lamp stowage (for gun-sight, etc.), hood jettison lever, hydraulic hand pump, map-case and cockpit-drill data plate. Seat and rudder pedals similar to those of the Curtiss Tomahawk are standard.

Aerobiographies XI—by C. G. GREY

The Bristol Aeroplane Co., Ltd.

Sir George White.

IN 1910 Sir George White, Bart., registered The British and Colonial Aeroplane Co. Ltd. After the war of 1914-18 its name was changed to The Bristol Aeroplane Co. Ltd.—a wise move, because the new name identified it still more closely with the city of Bristol, and also because after the war the word "Colonial" became unpopular in the British Dominions. It was the first aircraft company in this country to be formed with Big Money behind it. The few aircraft ventures which came into being earlier were more or less one-man shows with small capital.

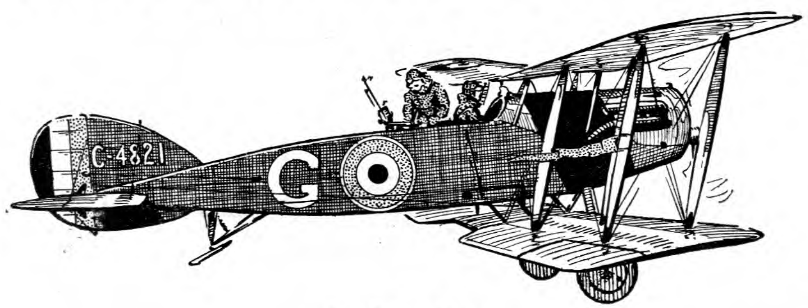
Sir George White was in the direct succession of the historic Bristol Merchant Venturers of past centuries. We who knew him could always picture him as the owner-admiral of a fleet, trading where it could and raiding where it could not. By 1910 he was already the Tramway King of Great Britain. He had bought up decrepit horse-drawn tramways, electrified them and made fortunes out of them for himself and his lucky shareholders.

The same foresight which led him to specialise on tramways showed him the future of air transport And he did things in a big way as usual. He persuaded the War Office to let him build sheds on Lark Hill, near Amesbury on Salisbury Plain, where some enterprising Army pioneers had already started in a small way on their own. He engaged four or five of the best French pilots (France was ahead of us by a year) to teach British aviators how to fly and how to teach others. The two most notable were Henri Jullerot, now in the Free French Air Service, and Paul Prier. And the first Bristol pilot was Sydney Smith, Sir George White's nephew, later lieut.-colonel in the R.F.C., and now a director of the Bristol Co. He took his aviator's certificate, No. 33, in November 1910.

By 1911 the Bristol Co. had flying-schools in full blast at Brooklands and at Lark Hill, and the works at Bristol had turned out pusher biplanes of their own design, as beautifully built then as are modern Bristols. Nowhere has pride of workmanship been higher than right through the history of Bristol aeroplanes.

For the Military Aeroplane Competition of 1912 Bristols produced, besides biplanes, a couple of monoplanes, designed by a Rumanian, Sam Coanda, which were amazingly modern in outline and flew very well.

And then came the man who put Bristol aeroplane design right in the front—Frank Barnwell. He and his brother Harold, trained as engineers on Clydeside, had been experimenting and crashing aeroplanes in Scotland. His first success, in 1913, was the Bristol Bullet, a reply to the Sopwith Tabloid. It was so good that many of the type were used as scouts in 1914-15. Barnwell himself, as a captain in the R.F.C. Reserve, was hauled off to France to fly one of his own Bullets. But in 1915 he was fetched back to design more aeroplanes. And his experience in war gave him a great advantage.



The Bristol Fighter.

The result was the historic Bristol Fighter, with a Rolls-Royce Falcon of 250 h.p. (about). With pilot and gunner close back to back, and twin guns fore and aft, it was one of the most formidable aircraft of the war. And its weapon-value was high, for it was fast and manœuvrable and carried a very big load.

Another of Barnwell's wartime successes was his little monoplane, which many pilots swore was the best single-seat fighter of the war. A ham-handed senior officer said that it was dangerous in landing, so it was never built in large numbers. But its pilots loved it.

Sir George White died in 1916, and was succeeded by his son Stanley, who is to-day managing director. On Sir George's death, his brother Mr Sam White became chairman, and carried on the old tradition. The firm was kept well to the fore in official circles by Mr. Harry White-Smith, Colonel Sydney Smith's brother, who was first chairman of the Society of British Aircraft Constructors.

Another of the founders of the Bristol firm was Mr. Herbert Thomas, now assistant managing director, a nephew of Lady (George) White. At 18 years of age, when he took his aviator's certificate, in January 1911, he was the youngest British pilot. Soon afterwards he was injured by an airscrew which started too soon, and in spite of repeated tries the R.F.C. would not have him in 1914-18. So he has devoted himself to producing aircraft—at which he has been more useful than he could have been as a pilot. He also has been chairman of the S.B.A.C. (1933-35).

After Mr. Sam White died he was succeeded as chairman by Mr. W. G. Verdon Smith, another brother of Sydney and Henry Smith's, who was, and is, head of the Bristol tramway and taxi organisation.

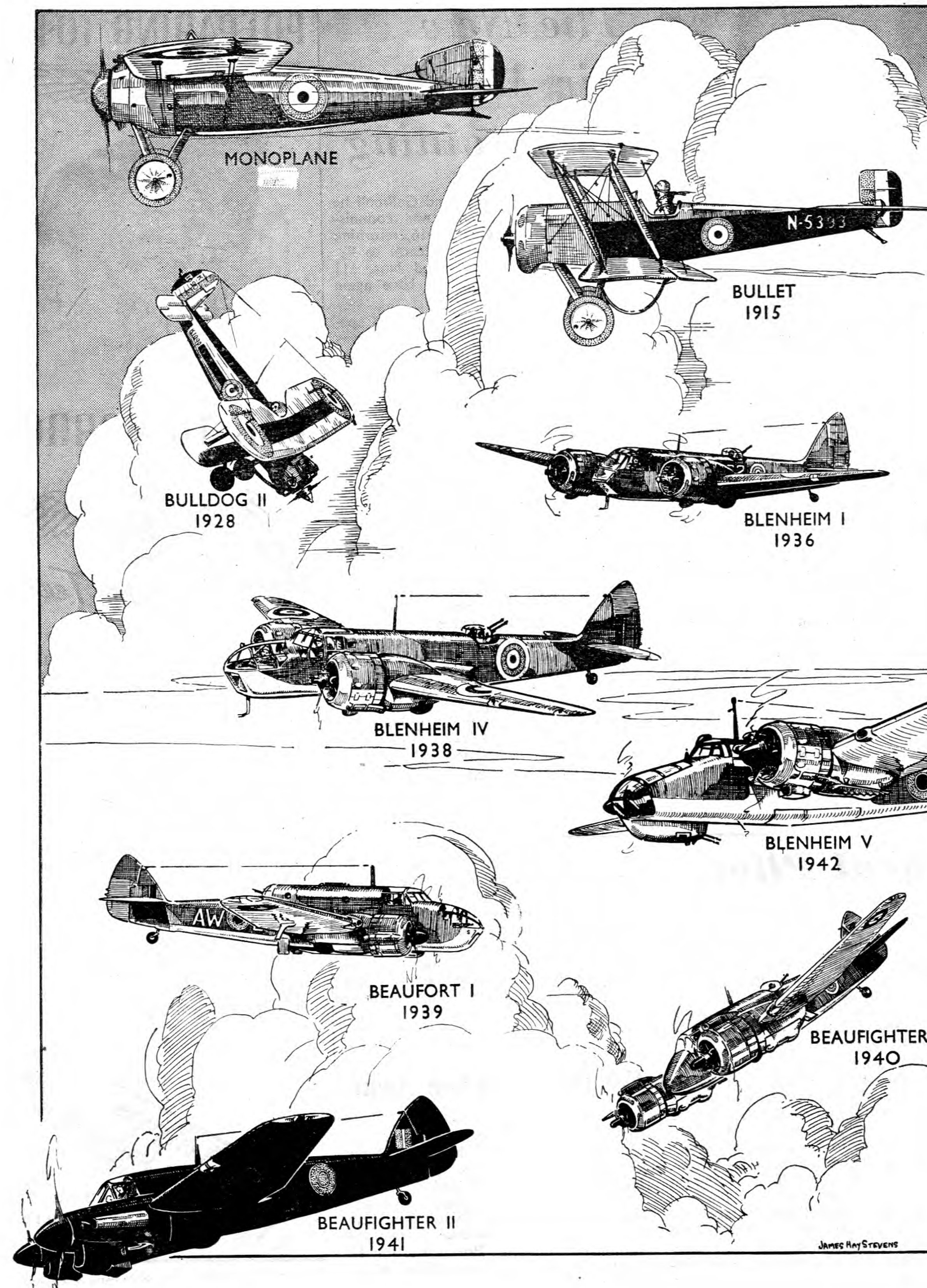
After 1918 the Bristol Co. spent huge sums, for those days, on experimental types. Also, they took over the Jupiter Cosmos radial air-cooled engine designed and made by a young man named Roy Fedden. But that branch of the business must be subject for a later article. It is too big to treat here.

A Bristol machine which did well in the R.A.F. was the Bristol Bulldog, a fast and manœuvrable single-seat fighter. But the firm's great success came in 1936 with the Blenheim, our first all-metal, stressed-skin, twin-engined bomber-fighter to reach really high speeds. Three years ago, after a little experimental modification, one of them was worked up to 300 m.p.h.

In the early days of the war the Blenheim did fine work. As a fighting scout round the Norwegian coast, as a bomber of the German Fleet off the mouth of the Kiel Canal, as a dive-bomber in the French downfall, as an anti-submarine weapon—it has done everything well. It is a monument to Frank Barnwell, who was killed in an accident to a silly little light aeroplane which he had built.

His work has been carried on worthily by L. G. Frise and H. S. Pollard, who worked with him for years. They have given us the Beaufort, a noteworthy torpedo-bomber, and the Beaufighter.

Lately the Board has been strengthened by electing as directors N. Rowbottom, who, after some years in Paris teaching Gnôme-Rhône how to make a static radial motor came back to take over engine production, and Captain K. J. G. Bartlett, who represented Bristols on the Continent for years, and knows all foreigners inside out. Bristols certainly have a fine team.



The New Air Member for Training

Air Marshal R. M. Drummond, C.B., D.S.O., O.B.E., M.C., after six years in the Middle East, first as Senior Air Staff Officer and later as Deputy Air Officer Commanding-in-Chief, has been appointed Air Member for Training, in which position he is responsible for all R.A.F. training, including that of the Air Training Corps. He takes the place of Air Marshal A. G. R. Garrod, C.B., O.B.E., M.C., D.F.C., who is to be Deputy Air Officer Commanding-in-Chief, Royal Air Force, India.

Although because of his absence abroad he has seen nothing of the A.T.C., Air Marshal Drummond told a representative of the *Gazette* that he had followed its progress with interest and had heard good reports of ex-cadets under his command.

Air Marshal Drummond is an Australian, aged 48. He saw an aeroplane for the first time at the age of 20, when, as a private in the First Australian Expeditionary Force, he was passing through the Suez Canal in 1914.

After service in Egypt and Gallipoli he was wounded, and then was commissioned in the R.F.C. in 1916, returning to Palestine when he had learnt to fly. Subsequently he commanded Nos. 111 and 145 Squadrons, which have again made history in this war.

He helped to survey the Cairo-Capetown air route in 1919. In 1920 he was in command of an expedition in South-Western Soudan, and subsequently served on the staff of Lord Trenchard. He attended the first R.A.F. Staff College Course and later the Imperial Staff College. From 1925 to 1929 he was lent to the Australian Air Board, and served as Deputy Chief of the Air Staff during the building up of the Royal Australian Air Force. He was posted to the Middle East in 1937 as Senior Air Staff Officer, and has therefore had much to do with preparing for as well as achieving our great victories there.

One forms the impression from a glance at Air Marshal Drummond's weather-beaten face and lean figure that he is a man of action who would prefer to be back in the fighting in Africa. His speeches are likely to be short, his inspections thorough and his comments to the point. He clearly sees the value of the A.T.C. as a means of training for war and peace, and looks forward to becoming fully acquainted with it.

Both he and Air Marshal Garrod in their new appointments will have the best wishes of the Air Training Corps.

Naval Pilot

(*continued from page* 13)

If wireless can be used it is easy for them to "ring up" the carrier and find out her exact position, which makes it a simple matter to get home. But if wireless silence has to be kept so that the enemy is not given any idea of the ship's whereabouts, the observer has a very big responsibility. Before he took off he will have been given a forecast of the ship's speed and course, and ever since he has been in the air he has been plotting the aircraft's course and speed, after making the necessary wind allowance. When the moment comes to turn homewards, the observer must give the pilot his course, which, if all has gone well, should hit off the carrier. If the weather is fine and visibility good, navigational mistakes can be ignored to some extent, for the ship will probably be seen though she's miles away. But in low cloud and poor visibility the observer generally heaves a private sigh of relief when the familiar shape of the carrier duly appears just where he said it would be.

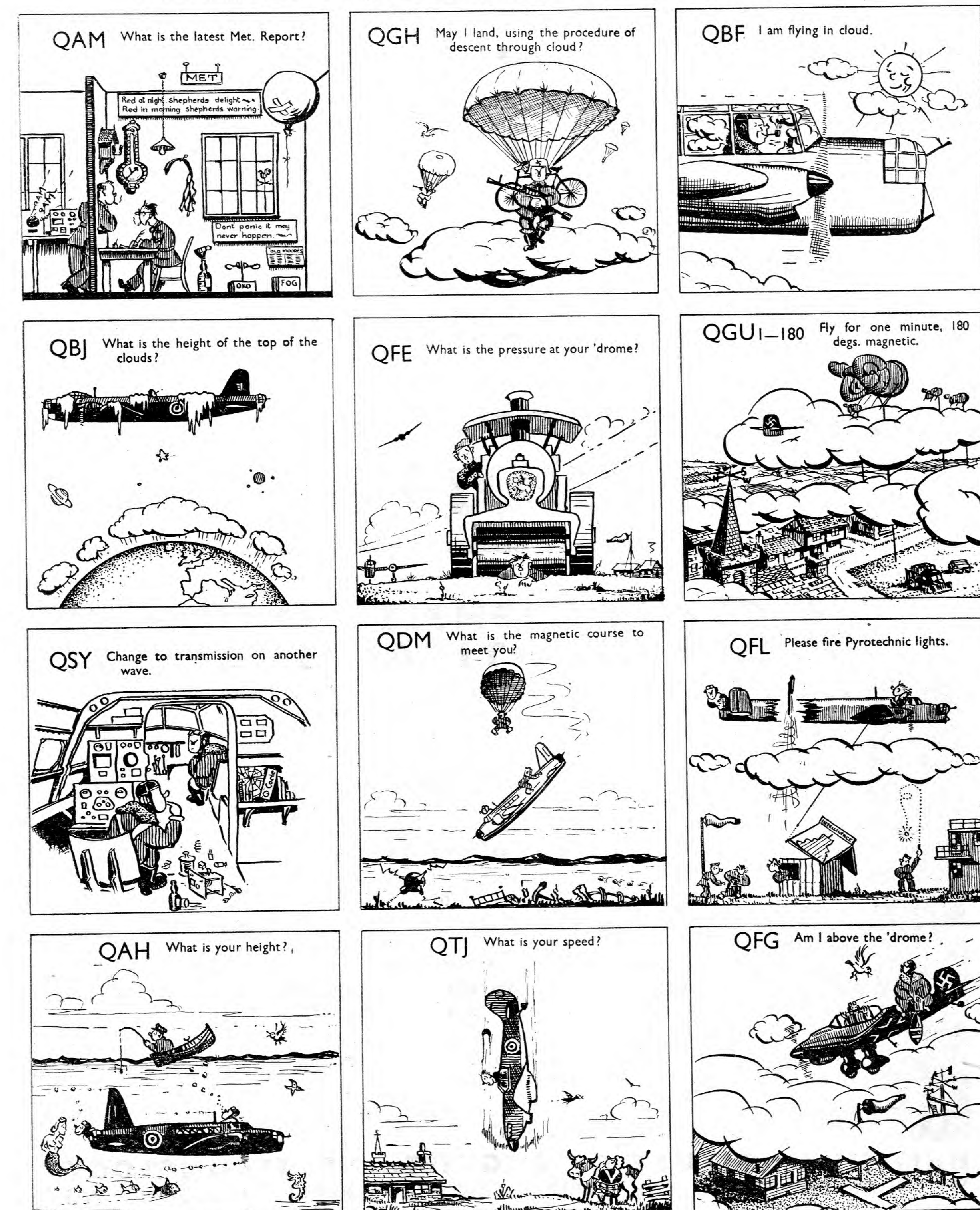
Here come the Albacores to land-on. They form line ahead and circle us; then, backing each other up perfectly, they touch down, taxi to the forward lift, and disappear into the care of the fitters and mechanics in the hangar. We go down to the ward room for luncheon.

Key to 'As You See Them'

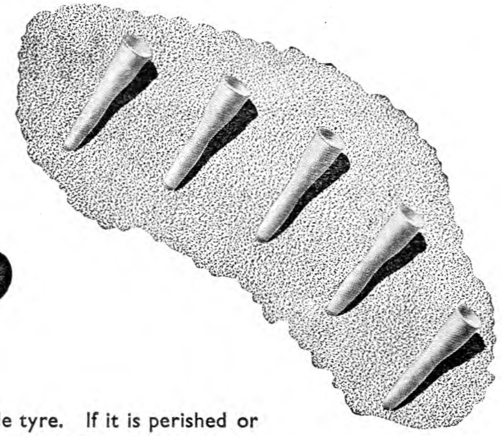
Reading from left to right—1st line: Martin Baltimores and Consolidated Liberators. 2nd line: Nakajima Navy G-97-2 and Spitfire IXs. 3rd line: de Havilland Mosquito II and Bell Airacobra I. 4th line: Grumman J2F-4 and Miles M-28. 5th line: North American Mitchell Is, Short Stirling I, Douglas Boston III. 6th line: Boeing Fortress II, Beechcraft F-2 and a Miles M-18, Magister II.

THE Q CODE

Although cadets are not required to learn it, the Q code, both in civil and service aviation, is part of the language of flying. Here an R.A.F. artist, W. Megoran, has illustrated some of the more frequently-used signals.



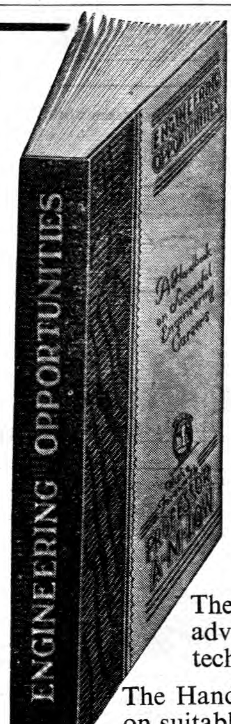
MILEAGE GUARDIANS...
or thieves ?



A valve-rubber can make all the difference to the life of a cycle tyre. If it is perished or badly fitted, it will permit air to escape, *and that must not happen*. Cycle tyres *must* be kept hard if they are to give maximum mileage and the present critical rubber situation demands the longest possible life from *every* tyre. You should, therefore, inspect your cycle valve-rubbers frequently and renew them immediately you suspect leakage. Pump your tyres hard—keep them airtight—and you'll keep them longer!

Treasure those
DUNLOP CYCLE TYRES

3H/305



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Let's get Lost; Why don't you fall in love with Me — FB 2921

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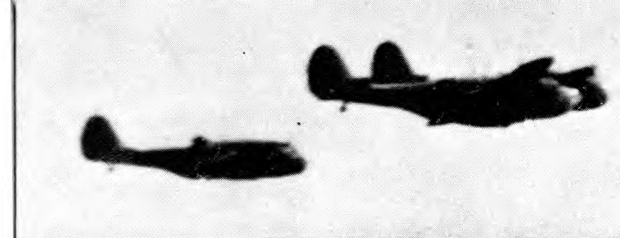


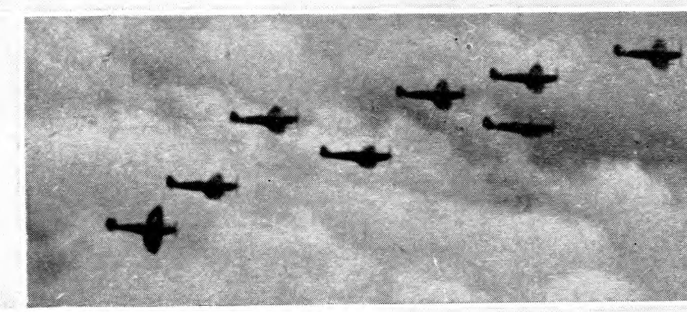


AS YOU SEE THEM

Photographs of British, American and Japanese aircraft.

For key see page 24.