Penned Parts

(SEE PAGE 19)

1, Cessna Crane; 2, Lockheed P-38 Lightning; 3, Fairey Fulmar I; 4, Messerschmitt Me 109E; 5, Curtiss C-46 Commando; 6, Bell P-39 Airacobra; 7, North American O-47B; 8, Douglas A-20 Havoc; 9, Lockheed A-29 Hudson; 10, North American BT-14 Yale; 11, Bristol Beaufort II; 12, Vought OS2U-3 Kingfisher; 13, Handley-Page Halifax I; 14, Grumman JRF-5 Goose; 15, Lockheed P-38 Lightning; 16, Republic P-47 Thunderbolt; 17, Curtiss P-40E Warhawk; 18, North American P-51 Mustang.

Perfectly "Plane"

(SEE PAGE 23)

1, Nakajima Navy 97 Mk. III Kate; 2, Kawanishi Navy 97 Mavis; 3, Not positively identified — probably Jap. Mitsubishi Navy 96 Nell, photographed during an attack on Formosa; 4, Mitsubishi Navy I Mk. II Betty; 5, Focke-Wulf Fw 190; 6, MBR-2; 7, Lavochkin (development of LA-5); 8, Beechcraft AT-11 Kansas; 9, Ryan PT-22 Recruit; 10, Bell P-63 Kingcobra; 11, Nakajima Navy 97 Mk. III Kate; 12, Messerschmitt Me 109G; 13, Curtiss P-40F Warhawk; 14, Petlyakov PE-2s; 15, I-15; 16, Armstrong-Whitworth Albemarle I; 17, Piper Cub J-3 floatplane; 18, Junkers Ju 90; 19, Fairchild PT-19 Cornell; 20, Mitsubishi Navy 96 Nells; 21, Unidentified Jap torpedo-bomber; 22, Iliuchin DB-3F.

Published for the Proprietors, The Air League of the British Empire, Kinnaird House, 1a Pall Mall East, London, S.W.1, by the Rolls House Publishing Co., Ltd., Rolls House, Breams Buildings, London, E.C.4, and printed by the Stanhope Press Ltd., Rochester, Kent.

AIR *Training Corps* GAZETTE

PUBLISHED FOR THE AIR LEAGUE OF THE BRITISH EMPIRE, 1A PALL MALL EAST, S.W.1 (TELEPHONE ABBEY 5041)
BY THE ROLLS HOUSE PUBLISHING CO. LTD.

VOL. IV NO. 12 *Edited by Leonard Taylor* DECEMBER 1944

A Pattern to the World

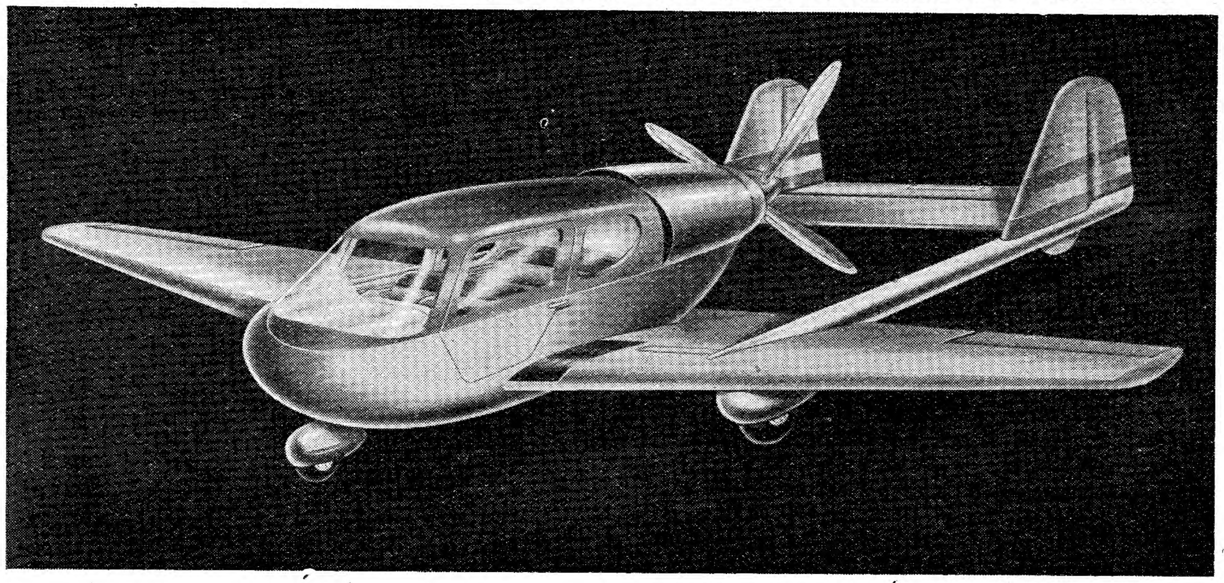
MANY distinguished visitors from Allied and friendly nations when visiting Britain ask to be shown something of the Air Training Corps. One of the most recent was General Nakhtchevan, Chief of the Persian Air Force, who saw two South London Squadrons—No. 343 (Camberwell) and No. 1351 (Clapham)—at their work. And, a few weeks ago, the United States invited the Air Training Corps to send a special mission to America to tell them something of the Corps' work and organisation. Two squadron leaders from the A.T.C. Directorate constituted this mission. Most of the great Dominions overseas—Canada, Australia, New Zealand, Southern Rhodesia, also India—hav[illegible]ir own Air Training Corps, and they have all de[illegible] their inspiration from and model their training on our own Corps in Britain.

All this interest in the A.T.C. is a great tribute to the work the Corps has been doing and a measure of the world-wide prestige the Corps has achieved in a little over three years. It is a tribute to the work of every A.T.C. cadet, instructor and officer who has done his part, in his own field, to make the Corps a success, and, in doing so, helping to bring victory to our arms. It is a constant gratification to me to see, as I do with increasing frequency nowadays, the stories of bravery and heroism under fire which are told in the gazettements of awards to ex-A.T.C. cadets. In two recent lists of D.F.C.s and D.F.M.s fourteen former cadets were named.

The preparation of young men to become aircrews has been the greatest single task of the A.T.C. during the war, and well has this task been done. The victory of the Royal Air Force over the Luftwaffe has indeed been a victory for the Air Training Corps as well; the contribution of the A.T.C. has been decisive. Let us remember, though, that the war is by no means over yet, and although the demands being made on the A.T.C. are not as heavy as they were, we must always be ready to meet the requirements of the R.A.F. when they occur, be they great or small. We must also be thinking ahead to our peace-time tasks, so that we can be ready for them when the time comes. We must, in fact, set out to show the world that free and voluntary youth training can do as much for our nation in peace-time as it has shewn it can do in war.

E. L. GOSSAGE, Air Marshal,
Chief Commandant and Director General,
Air Training Corps.

First prize in the American Popular Science Monthly's international personal-type aircraft design competition, "THE PLANE YOU'D LIKE TO OWN," professional class, went to Donald J. Wheeler, an engineer of Boeing Aircraft Co., Seattle U.S.A.



Vought Corsair

THE F4U Corsair was until recently the chief land-based fighter of the U.S. Navy and Marine Corps. This type is now believed to be reverting to carrier-borne operations for which it was originally designed, due, perhaps, to the Royal Navy's success with its own Fleet Air Arm Corsairs. American pilots preferred the Hellcat, which they said was slightly easier to deck-land. The Corsair also had a tendency to swing during take-off. This fault has now been corrected.

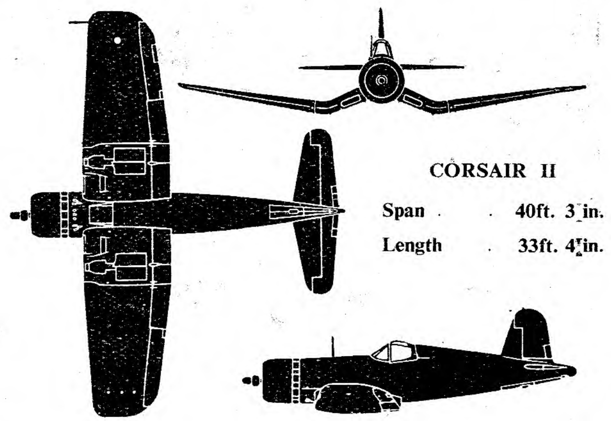
The prototype Corsair, the XF4U-1, appeared in 1940. The flight-testing took some time, and only towards the fall of 1941 were orders placed by the Navy Department. The first production model rolled off the assembly line in June 1942. Marine Fighter Squadron 124 (VMF-124), operating from Guadalcanal in the Solomons Group, was the first complete unit to be Corsair-equipped. From then on the Corsair's speed, firepower and range were used to full advantage as the Allies drove northward to Munda, Bougainville and Rabaul.

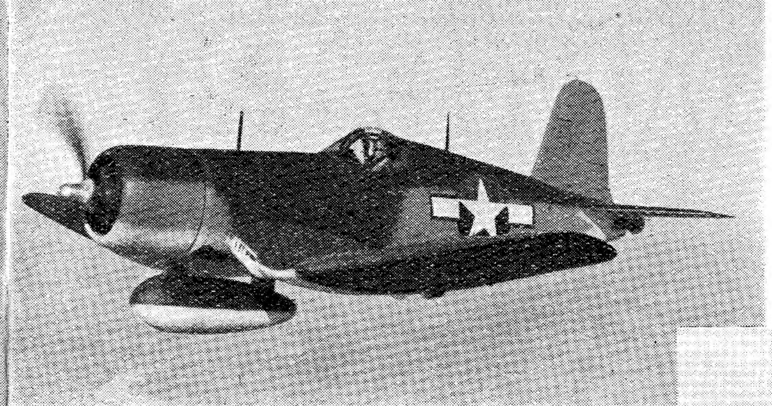
Conceived and developed by the Vought engineering staff, under Rex B. Beisel, the Corsair was intended to achieve a very big advance over contemporary naval fighter performance. The power plant decided upon was the Pratt & Whitney Double-Wasp R-2800 S1A4-G, giving 1,850 h.p. for take-off. Such a high-powered motor required a large-diameter airscrew, which meant a long, stalky undercarriage and resulting retraction difficulties if sufficient ground clearance for the blade tips was to be provided. Again, a rounded section front fuselage was chosen as giving the best aerodynamic form, and the ideal wing position would be mid-way, at right angles to the centre line of the fuselage, with still longer landing-gear. In the face of these problems it was decided to adopt a cranked inverted gull-wing, with the following advantages (see the three-view drawing):

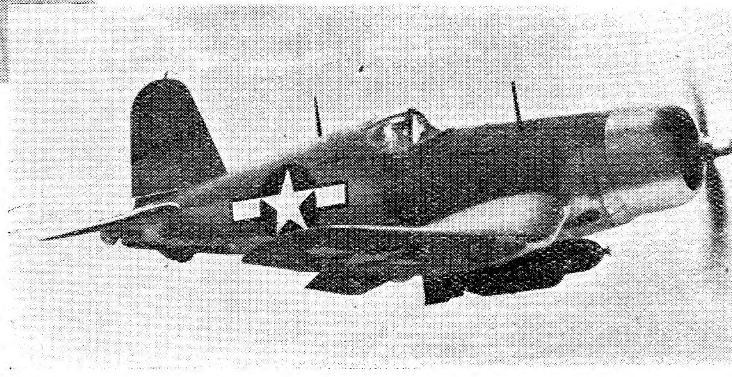
(i) The inboard and upward sweep of the centre section is aimed at the centre of the fuselage section, and meets the fuselage sides at right angles, minimising interference drag at the wing root and fuselage intersection. Wing-root fillets are non-existent on the Corsair.

(ii) The main landing-gear components are placed at the base of the shallow vee formed by each wing in the head-on view. Thus an even shorter undercarriage is used than would have been possible with the low-wing arrangement, and as a result the wheels and shock-absorber legs are able to retract backwards. The wheels are completely enclosed by doors in the wing when retracted.

(iii) The wing folds for stowage on carriers by lifting upwards on a simple hinge system until they nearly touch tips over the fuselage. The low hinge-point, just outboard of the crank in the wing, means that a lower overall height with wings folded is attained. Wing-folding, as on all the latest American types, is hydraulic, the operation being controlled by the pilot from the cockpit, without the help of deck parties. On British types deck parties swarm over the machine before and after flight, manhandling each wing into position. Pilot-controlled mechanical folding means smaller deck parties and less time taken in getting aircraft below or flying them off.







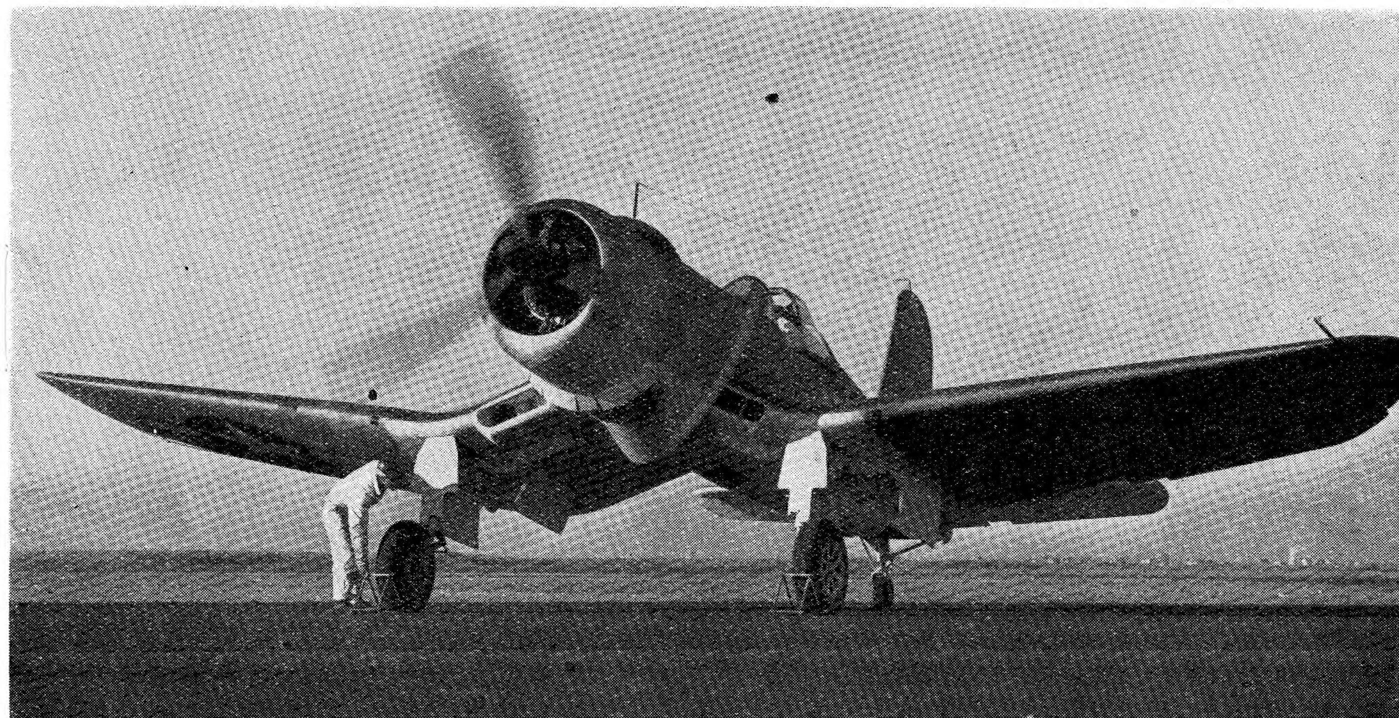
In its role as a long-range carrier-borne fighter the Corsair carries a streamlined drop tank slung under the belly (left). This may be exchanged for a bomb load (below). Both photographs are of the F4U-1D version similar to the F.A.A. Corsair II.

Still another advantage claimed for the Corsair's inverted gull-wing is that of improved view for the pilot forward and downward over the cranks in the wing. The prototype's cockpit was situated well forward over the wing to give all-important maximum view over the nose. Production versions have the cockpit placed further aft, possibly to give a reasonable view downwards and backwards over the trailing-edge. For view to the rear, the American method of scooping out the fuselage sides just aft of the sliding cover was adopted, and later a rear-view mirror in a transparent blister on the hood was added. Recently new bulged hoods have come into use. These enable the pilot to extend his range of vision rearwards, downwards and along the nose.

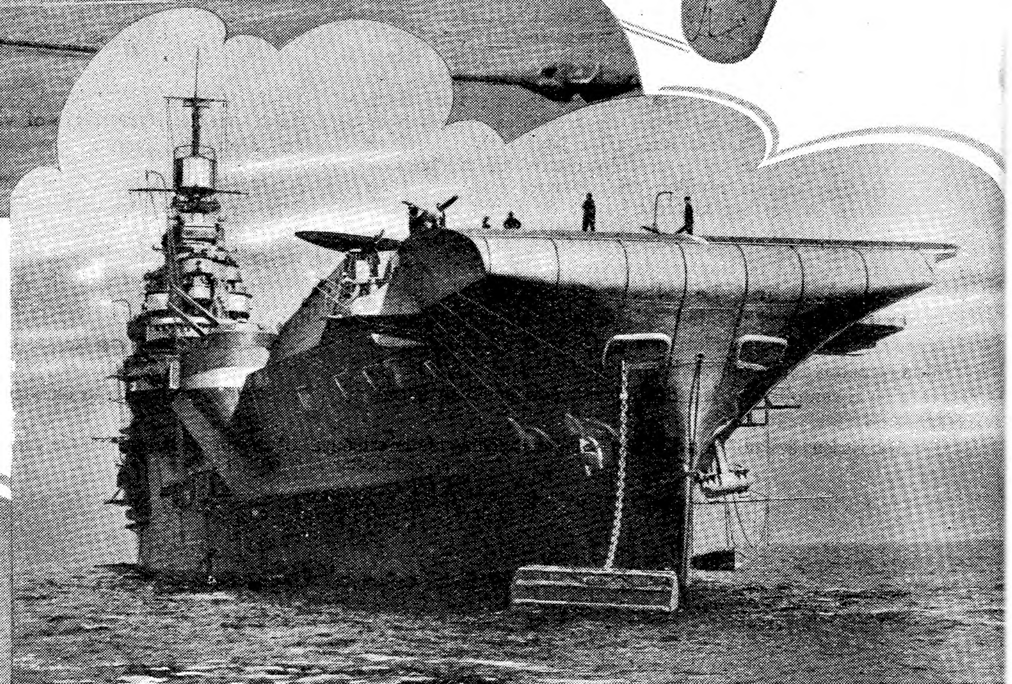
Construction of any shipboard machine must be extremely rugged to withstand heavy landing on heaving flight decks. The "backbone" of the Corsair is the main wing-spar, which absorbs the major part of landing and catapulting shocks as well as supporting the lower engine mounting and taking the full load of the wings.

The Double-Wasp motor has been stepped up to 2,000 h.p., and uses a two-stage, two-speed supercharger. The arrester gear is in the extreme tail.

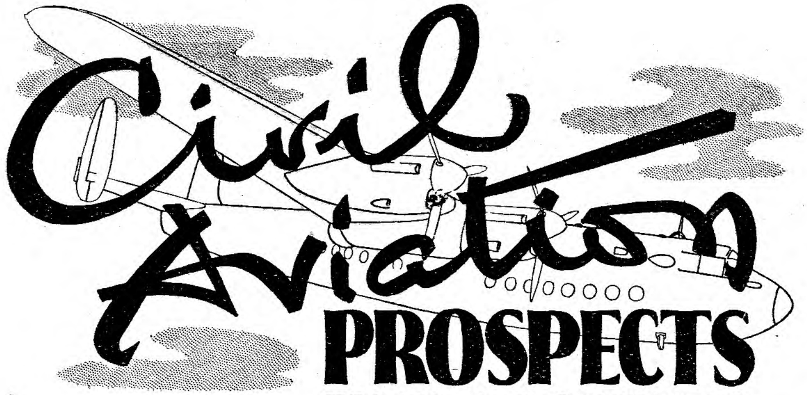
The various design features of the Corsair, including the inverted gull-wing, wing radiators and the undercarriage retraction arrangements are clearly seen in this view.



AIR POWER Afloat



Vast fleets of aircraft carriers and escort carriers, operated by the Royal and United States Navies, will figure largely in the Pacific War. On this page are the Albacore and Barracuda torpedo-bombers (top), the British carrier H.M.S. *Indomitable*, and a gun crew on the escort carrier H.M.S. *Battler*. Below, a U.S. Navy SBD-2 Dauntless is taking off.



Civil Aviation PROSPECTS

BY W. J. ROBERTS

MUCH speculation is taking place as to the organisation and control of civil aviation after the war, but whatever the outcome, the internal set-up of the civil airline will be somewhat on the lines indicated in the "family tree" at Fig. 1. In the diagram the various activities of a large airline are shown in progressive order, according to their degree of importance. At the head of the organisation is the general manager, below him the line divides into two sections, viz. office and airport. The cadet's interest will probably be centred on the latter section, although in actual practice the two work closely together and offer equally good prospects of a career.

Taking the airport side of the line, we find that it breaks again into the following sub-sections: flying staff, engineering staff, traffic department and administrative staff. Each of these sub-sections again breaks into smaller sections, such as flying staff into senior pilot, junior pilot, radio operators, etc. Engineering staff breaks down into ground engineers, technicians, station and aircraft radio engineers, instrument engineers, etc. This system may be carried on right down to the labourers and the office boys, but the "tree" would be much too large for the page if this were done, so we have stopped at the third division; if you care to, you may continue it yourself by re-drawing it. It would be a good way to familiarise yourself with the organisation and the categories into which duties fall.

Qualifications Required

Up to the outbreak of war the controlling authority for all aviation matters was the Air Ministry, and a definite system of examinations and certificates or licences was in use. This not only ensured the safety of passengers and crew, but it enabled an employer to know exactly the type of man he was employing and just how far that man could be trusted on his job. During the war civil flying has virtually stopped, and the issue of licences, except in special cases, has been suspended. With the return of peace, however, the original system, or possibly a modified system, will return, and this is the way in which most of the personnel will obtain positions.

To take a typical example, an A.T.C. cadet who is considering a career will decide which section he is best fitted for; a chat with his officers and instructors will give him a good idea of his prospects. Let us assume that our typical cadet is good on, say, engines and theory of flight and has an interest in instruments. He would decide that his best chances lay in the engineering section, and his first step would be to obtain a post in the workshops of an airline; in this his A.T.C. training would stand him in good stead. It proves to a prospective employer that his man is keen and has some basic training and a sense of discipline. Employers are fairly shrewd, and obviously a beginner of this type is better value for a given rate of pay than a raw newcomer, hence he has the best chance of a job.

The Licence System

From then on it is up to the cadet. His first aim would be his "C" licence, which permits him to certify engines as fit for flight. Then his "A" licence, which permits him to certify airframes; armed with these, he is classed as a G.E. (ground engineer), and he has acquired some standing. The next aim would be his "B" and "D" licences, which permit him to certify for flight engines and airframes which have been rebuilt or overhauled; after this comes his "X" licence, which covers instruments and other duties, and makes him a first-class G.E. who can pick and choose his job.

These licences are obtained by examination. There are no "school-tie" bars in the exams. and the means of study are available in every airport and in almost every public library. In the typical case outlined the engineering section was chosen; the same remarks and similar licensing arrangements apply to all other branches—navigators, radio men; even the pilot starts with his "A" licence and works his way up. The important thing to remember is that this is a new field which will expand rapidly; there will be ample opportunity for initiative and enthusiasm.

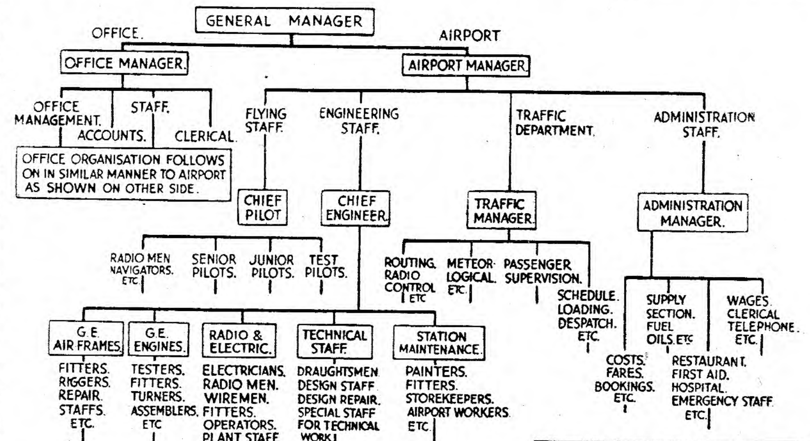
Manufacturers, Flying Schools, etc.

Two other avenues remain—the aircraft manufacturer and the private or public flying clubs and schools. The latter are, of course, either disbanded or on Service training at the present, but they will be back again with the return of peace.

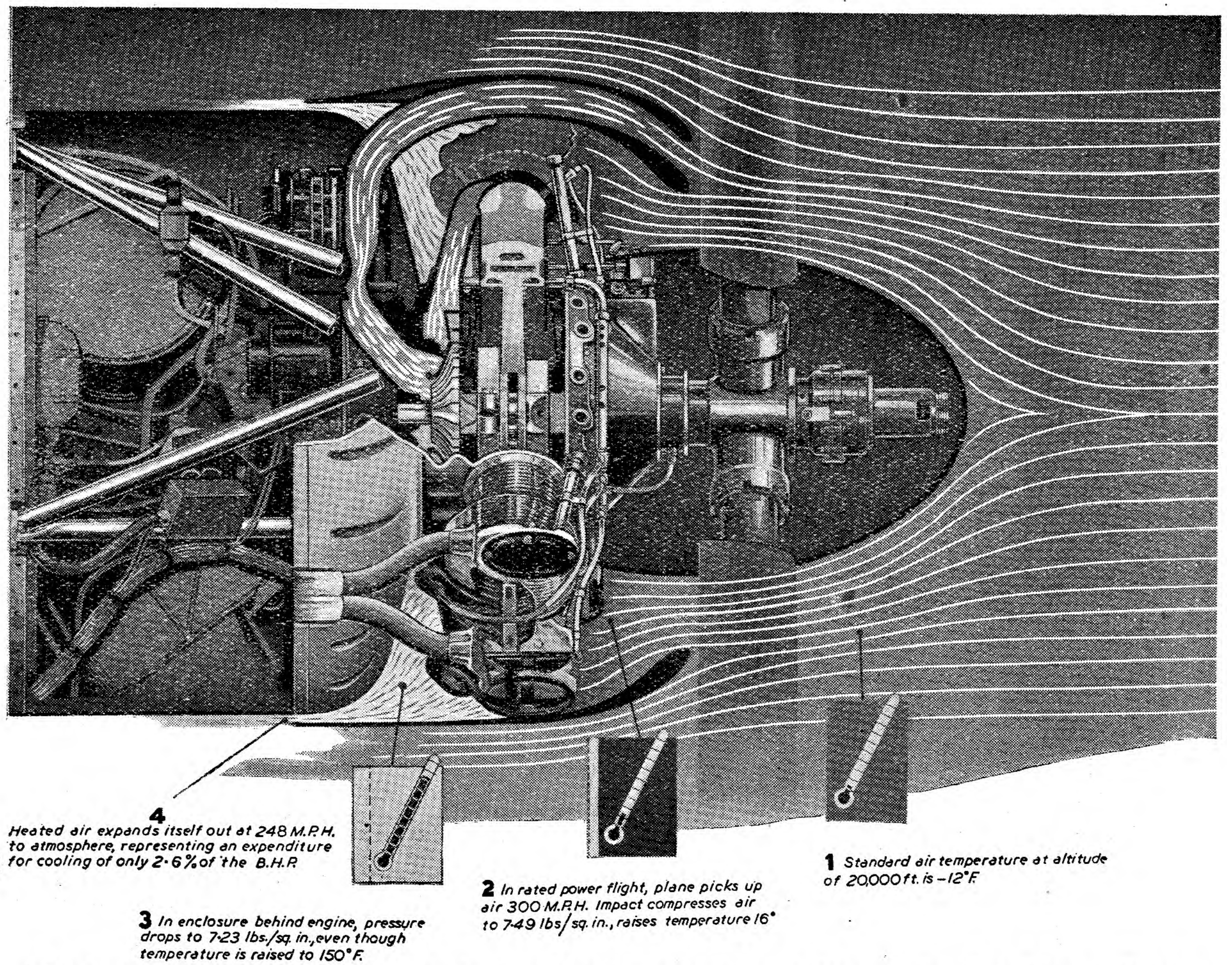
In the case of manufacturers it is usually possible to obtain an apprenticeship—in some cases an industrial apprenticeship without premium is possible—and, by study, the additional knowledge and experience for licence standard may be built up as the man gets on.

The flying clubs and schools frequently offer a way in through the "side-door," as a job in the workshops will give experience sufficient to make a start and additional experience will come later.

Always remember that, as an A.T.C. cadet, you have that little extra "something" that the average boy hasn't got: your instructors have worked hard to give it to you and you have earned a better chance by your own keenness.



CIVIL AIRLINE STAFF ORGANISATION.
Chart showing occupational groupings



This drawing shows in diagrammatic form what happens to the cooling air as it flows inside the cowling of a radial motor. The air is heated as it swirls round the cylinders, expands and forces its way out into the atmosphere via the cooling gills. Air for the supercharger is taken, in this particular example, from the mouth of the cowling. The illustration is redrawn by Roy Fielding from the original by courtesy of the Wright Aeronautical Corporation.

COOLING SYSTEMS

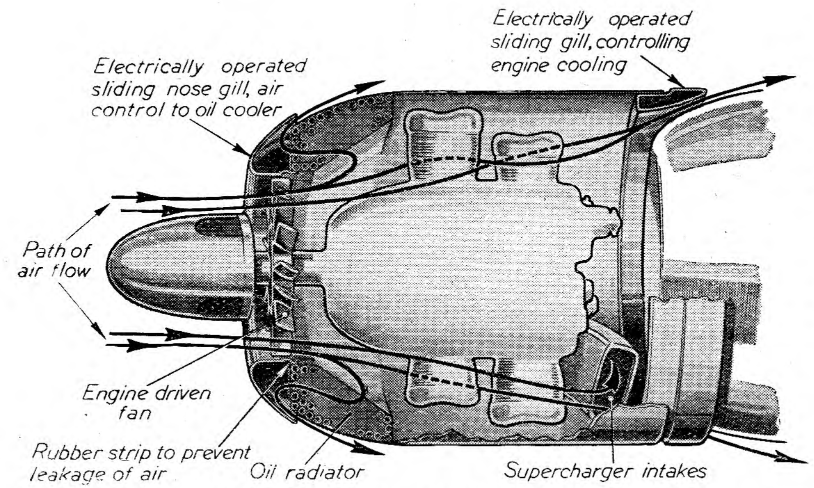
by Flight Lieutenant R. J. Packman

EARLY air-cooled engines had finned cylinders and cylinder heads which were entirely exposed to the air stream, so that the fronts of the cylinders were adequately cooled, but the backs were always much hotter; also the engine drag was considerable. The introduction of the Townend ring was the first real advance, for this device not only guided the airflow on to the cylinders, but it decreased the drag to about one-third of that of an uncowled engine. The Townend ring consisted of a circular ring of aerofoil section mounted round the cylinders, the aerofoil section being set at such an angle that the direction of the lift force on it was inclined forward, thus producing a negative drag force. The ring was usually hollow so that it could be used as an exhaust collector ring. It can still be seen in use on the Avro "Tutor."

The system used on present-day air-cooled engines is a combination of Townend ring and a long chord cowling, with the added refinement of controllable gills at the rear. With the aid of the temperature gauge in the cockpit and the gill control the pilot can maintain optimum engine temperature for all conditions of flight.

The latest development is the "windmill" airscrew, which has a fan attached to the airscrew shaft immediately behind the spinner to increase the airflow through the cowling.

Liquid cooling, which is used on most fighter engines, enables the cylinder walls and head to be kept at a uniform temperature, and can be designed to give very low drag, but has the disadvantage, compared with an air-cooling system, of the additional weight of the coolant and radiator. The cylinder walls and heads of liquid-cooled engines are surrounded by a carefully designed jacket. Coolant is pumped direct to the hottest parts of the head by a vane-type pump, and then led back through a header tank to the air-cooled radiator. A thermostatically controlled valve allows the coolant to by-pass the radiator when the engine is cold, thus accelerating the warming-up process.



The modern super-efficient cowling of the B.M.W. 801A motor with engine-driven cooling fan, sliding nose ring and sliding annular cooling exit ring.

The coolant most commonly used is a mixture of 70% water with 30% ethylene glycol, which has a higher boiling point than water, being in the region of 125° C. This allows an engine temperature of about 100° C. to be used without undue evaporation, with the advantages of better power output from the engine, and smaller radiator size made possible by the greater difference between the temperatures of the radiator and the cooling air.

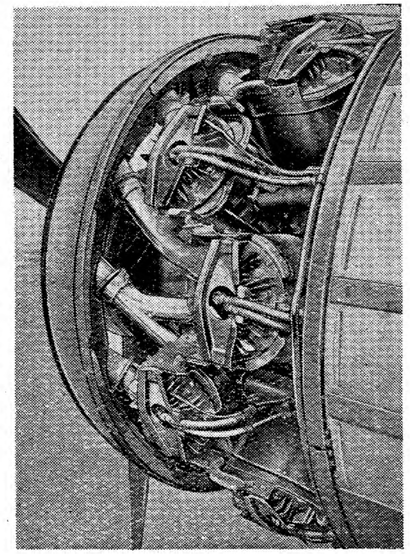
Some engines have a spring-loaded double-action relief valve in the header tank in place of the usual atmospheric vent. This system is known as "pressure cooling". It raises the boiling point of the water-glycol mixture and decreases the amount by which the boiling point falls at altitude, an important factor when operating fighters at 30,000 ft.

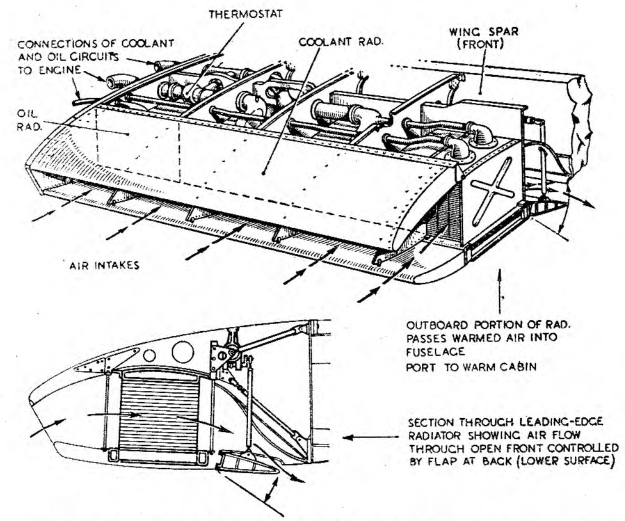
Early machines, such as the Hawker "Hart", had a radiator suspended directly in the airstream under the fuselage, the rate of cooling being controlled by varying the amount of radiator exposed, by a handwheel in the pilot's cockpit. This system would be very inefficient for high-speed aircraft because of the excessive drag. Radiators are now enclosed in a duct, either under the fuselage or engine nacelle, or built into the wing as in the De Havilland "Mosquito". The flow of cooling air is varied by a hydraulically operated shutter at the outlet from the duct. The cross section of the duct increases from the inlet to the radiator honeycomb and then decreases again towards the outlet, so that the airspeed through the honeycomb is comparatively low, but is increased to provide as little interference as possible at the outlet.

The overall drag of this system is very low, and at very high speeds can be negligible, due to the low speed of the air through the radiator, and to the propulsive effect of the outlet air. The latter effect is due to the fact that the heat given to the air as it passes through the radiator tends to expand it so that it is forced from the outlet with increased velocity.

The engine lubricating oil must also be cooled in order to keep it at its normal operating temperature of about 90° C. This is effected in most engines by a radiator with thermostatically controlled by-pass valve as with liquid-cooled engines.

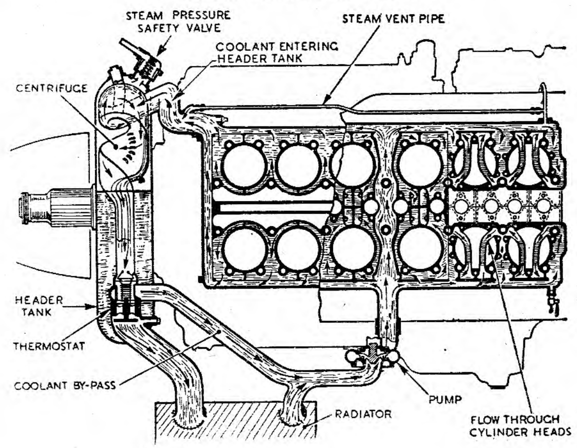
The simple cooling baffles of the Bristol Hercules two-row radial motor. The baffles direct the cooling air around the backs of the front row of cylinders and on to the rear cylinder bank, so that all surfaces are equally and adequately cooled.





Above: The wing radiator of the Mosquito shown in perspective and in section. The top drawing is redrawn from *The Aeroplane* and the lower from *Flight*.

Below: The cooling system of the Napier Sabre H-type in-line motor, redrawn from *Flight*.

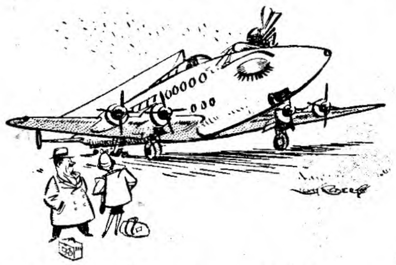


Aircraft MAKE THE Aircrew

by CAPTAIN NORMAN MACMILLAN, M.C. A.F.C.

WHEN I was driving round an aerodrome the other day my companion said: "I like the look of those aeroplanes that stand with their tails up." And it struck me that with the present growth of aviation we are approaching the time when public opinion will begin to play a part in deciding what types of aircraft are to be "fashionable."

Hitherto aeroplanes have been designed (except for the interior of luxury air-liners) with little attention to public opinion. Technical problems have been foremost in the mind of the designer, who has been too fully preoccupied with their most efficient solution to



What types of aircraft are to be fashionable.

trouble about what John Bull might think of the result. There were problems of stability, power and weight to be overcome. Then speed. Then more power. Both before and after the practical problems there were the theories of the mathematicians — Reynolds, Lanchester, Prandtl and many others. The result is the very efficient aeroplane of today.

Technical Variations

When the war ends the aeroplane designer will have to take a pointer from the architect, artist, composer, writer, all of whom, to be called successful and reap the benefits of success, must combine technical efficiency with an ability to please the public. Hitherto the aircraft designer has been satisfied (in the main) if he could attain to technical efficiency alone. That is the explanation of the still not inconsiderable number of aircraft of widely differing kind. Just think of the Lancaster, Fortress, Halifax and Liberator as four examples of approximately the same basic idea. Compare the Thunderbolt with the Spitfire, the Lightning with the Mosquito, the Ventura with the Wellington, the Catalina with the Sunderland, the Campini jet-plane with the V.1 flying bomb. There are many aeroplanes so alike as to cause confusion to spotters, but the really astonishing thing is that there are still so many different ones.

All these things affect the pilot and, to a lesser degree, all the other members of the aircrew. A pilot or a complete aircrew cannot be switched from one type of aircraft to another at a moment's notice. Differences are so great that a training period is necessary to become accustomed to the differences in flying characteristics and equipment. This is understandable when a personnel change is made from training aircraft to fighters, or from fighters to heavy bombers. But it should be reduced to the minimum when changing from one aircraft to another in the same class. It is reduced to the absolute minimum when changing from one class of operation to another with the same type of aircraft; which explains why the multi-purpose aircraft—like the Hurricane and the Mosquito—are so valuable in war, for then the change from fighter to fighter-bomber, reconnaissance aircraft, bomber, tank-buster or any other duty is

A personnel change is made from training aircraft to fighters.

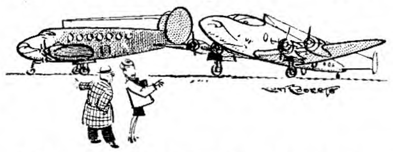
made in the aircraft, and the crew do not have to learn a new flying technique, but simply the technique of a new job.

The Public's Point of View

After the war, when flying becomes once more the popular form of travel it was before war restricted it to special travellers, the travel-by-air public is going to form some preferences in regard to the aircraft it travels in. And the airlines that provide them with the types of aircraft they like are going to carry the biggest trade. What we want is a cross-section of public opinion, a kind of Gallup Poll, to indicate the most popular-looking type of aircraft among the non-technical public. Do they like the tail-up or tail-down position on the ground? Do they like a high-wing or a low-wing monoplane? Do they fancy a jet or an airscrew? What size cabins do they prefer — private like the little end compartments in the Pullman coaches on French railways, or public like the interior of the pre-war Douglas DC-3?

The Pilot's Point of View

What has this got to do with readers of the *A.T.C. Gazette*? may ask the reader. A great deal. Among the

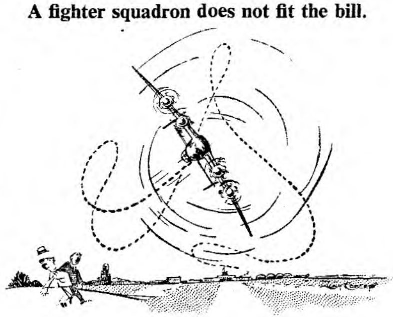


Do they like the tail up or tail down position on the ground?

readers of the *Gazette* are those who will aircrew the aircraft of the post-war period, both military and civil. Before the war R.A.F. pilots had a say in the final choice of aircraft, first at the experimental station and then at operational squadrons; but, of course, that was a choice between, perhaps, two or three aircraft already built, whose design could not be changed and which might all resemble one another fairly closely. In the earlier stages the preference was expressed mainly by technicians. If, after the war, means could be found to get the ordinary pilot's opinion on the broad outline of a new aircraft before the aircraft passed the paper stage, I believe that the operational efficiency of the types finally adopted would be even greater than they have proved to be in the past.

In civil aviation, however, it is the public's opinion that will count. Aircraft firms will have to commence a sound form of public relationship if they are to prosper in the civil field. Aircrews will have to learn to fly and operate not necessarily the kind of aircraft they would select, or the technicians commend, but the kind of aircraft the public will prefer to travel in. And

A fighter squadron does not fit the bill.



Helicopters such as the Sikorsky R-5, seen above, should find a place in commercial aviation after the war.

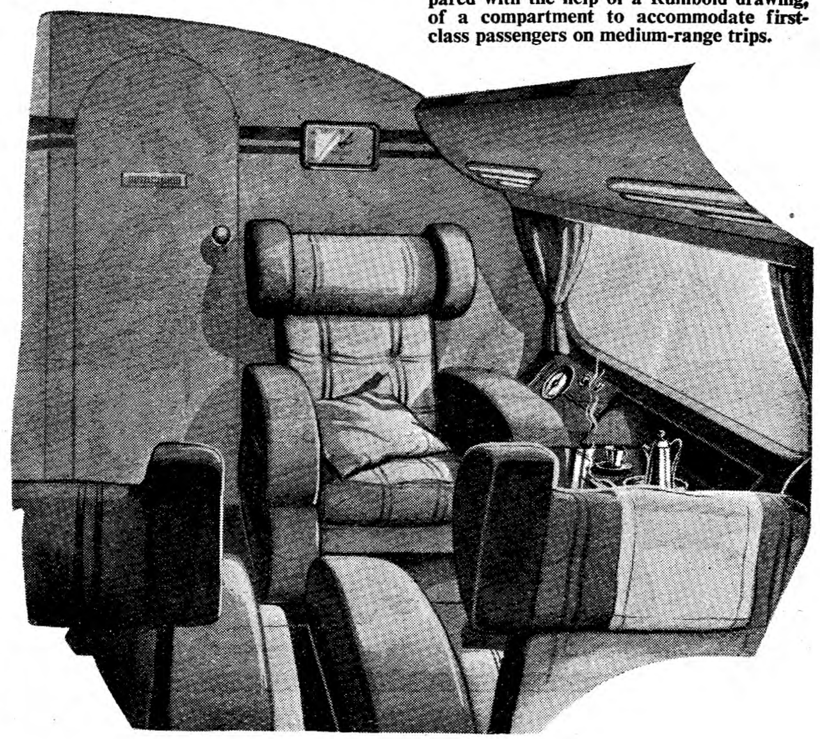
the post-war public will know far more about aircraft than the pre-war public, for it will be leavened with many tens of thousands of men (and women) who have served the Royal Air Force in war and who have learned to know more about aeroplanes than they ever knew about ships or railways. They are going to influence to some degree the trend of civil aircraft design.

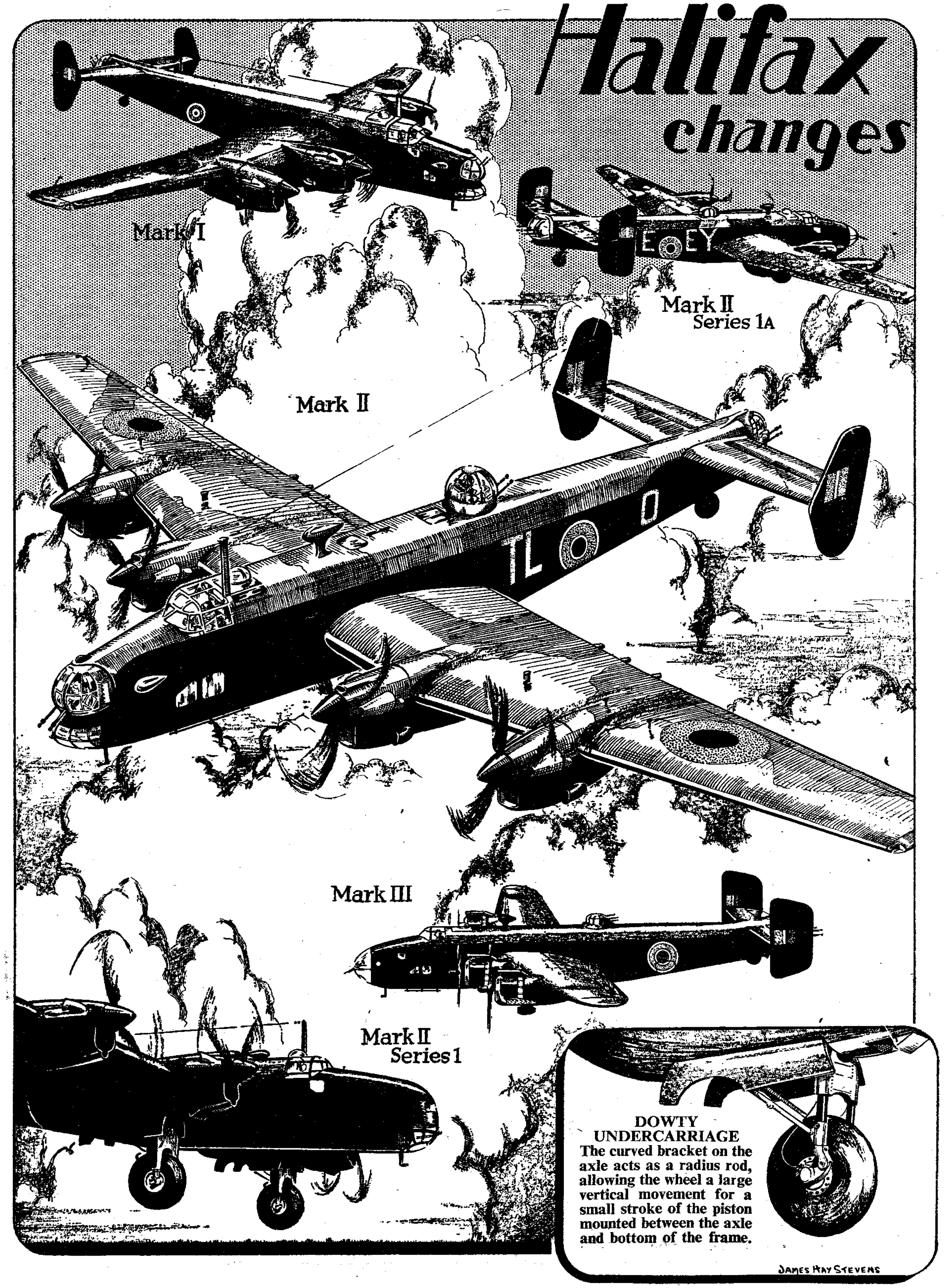
Be Prepared

For the pilot it is important. For the member of aircrew who has an eye on a post-war career in civil aviation it is still more important. Let him gauge the trend of post-war public opinion, and endeavour to learn to operate in an aircraft of a similar kind while the war continues, so that he will be as fully qualified as possible when the war is won. Most of the pilots who were the pioneers in the transport companies that started after the Great War were pilots who had flown the heavier types of aircraft in that war, either the twin-engined bombers, or the heavier single-engined types; many of them, like Jerry Shaw and Campbell-Orde, were in the first R.A.F. communications squadron that operated between London and Cologne and flew delegates to the Peace Conference in Paris.

Take a hint from the history of those men, and if you have an eye set on a career in post-war civil aviation use your present opportunities (which are golden) to further your future. If you believe that the public will like aircraft that sit with their tails up, then do all you can to learn the technique of their special take-off and landing. If you aspire to become the captain of a first-class transocean airliner, a fighter squadron does not fit the bill; work it out for yourself, and act accordingly within the framework of the efficiency of the Service that you serve today.

The tastes of passengers will have a major effect on airliner accommodation and decoration. Below is an impression, prepared with the help of a Rumbold drawing, of a compartment to accommodate first-class passengers on medium-range trips.





DOWTY UNDERCARRIAGE
The curved bracket on the axle acts as a radius rod, allowing the wheel a large vertical movement for a small stroke of the piston mounted between the axle and bottom of the frame.

HALIFAX CHANGES

by James Hay Stevens

In this short article the author sets out to show how the Halifax has been kept in front-line use for three years of war. The most interesting feature of the changes made to the aeroplane is the obvious fact that the research teams have spared no pains to examine every small feature in order to ensure that every possible detail that might improve the performance had attention.

THE Handley-Page Halifax was put into the Battle of Germany in 1941; it was the second four-engined heavy bomber to go into that battle—the first having been the Short Stirling—and the first to carry the 4,000-lb blast bombs. The design of the Halifax was begun, as part of the Royal Air Force policy of developing a really telling striking force, before the outbreak of war; but since it went into operational service many changes have been made to meet the altering needs of Bomber Command as the war advanced. It is some of these changes that form the subject of this article. Naturally, many alterations, such as improvements in equipment and other operational changes, cannot be mentioned at this stage.

The Halifax I went into service in the spring of 1941 with an armament consisting of a two-gun front turret, a four-gun tail turret and positions for beam guns just aft of the trailing-edge of the wing. This armament was soon considered to be insufficient, and a Hudson-type two-gun turret was added on top of the fuselage, so making the early Mark II.

It was this version of the Halifax (which is the centre-piece of the sketch on the opposite page) that was the main weapon of Bomber Command for the offensive against Germany in the winter of 1941-1942. With its three turrets, rear-view blisters, single radio mast and large flame dampers, it represented the compromise giving the performance then necessary for night operations and the escorted excursions against the *Scharnhorst* and *Gneisenau* at Brest and Lorient. Points such as the number of radio masts and the size of the exhaust shrouds may sound details, but they can have a very considerable effect on performance. On a large aeroplane, such as the Halifax, the complete removal of all these accessories may result in a gain in speed of some twenty miles an hour. The difference between a smooth, unpainted surface and a rough, camouflaged one may mean a difference of five to ten miles an hour—not to mention a considerable saving in weight.

The next change to the Halifax was the substitution of the characteristic Messier undercarriage by Dowty levered suspension units. This modification was effected only on some aeroplanes, and forms an interesting comparison in design. The Messier unit consists of a large magnesium alloy casting in which two conventional piston-type compression legs are mounted. In the Dowty unit the magnesium "frame" is replaced by a built-up member made from two vertical tubes with a riveted sheet-metal bracing portion at the top. At the bottom of this frame there are two levered compression units; these are knuckle-action brackets with a small high-pressure compression cylinder in the joint of each.

Another modification of a general nature was a change made to the power plants. On the Mark I and early Mark II the duct under each nacelle held two cylindrical radiator units and one cylindrical oil cooler. In order to simplify the manufacture and maintenance of the power plants these circular radiators were replaced by rectangular blocks in a simpler cowling rather similar to that on the Lancaster.

After about a year and a half of operational service the R.A.F. felt that a higher all-round performance was essential because of the increased skill of the German defences. Experiments were made in stripping some of the external protuberances in order to lighten and clean the aeroplane—always in search of the compromise best suited to the needs of the moment. The balance was struck between the comparatively rare use made of the top and front turrets and the gain to be had by their deletion. Careful tests were carried out on the effect of the removal of every external fitting that could possibly be considered as redundant or not absolutely essential to operational needs. The result of this work was the Mark II, Series 1; without front and top turrets, a faired "Roman" nose, no rear-view blisters at the navigator's station, and the shrouds removed from the eight saxophone exhaust pipes.

However, this version of the Mark II was only an interim one, as it was never intended to rely solely upon a single turret in the tail. The Mark II, Series IA, followed, and incorporated extra refinements. An entirely new nose (not unlike that on the Hampden) with a large moulded plastic panel and a free gun gave the bomb-aimer more commodious quarters and some armament with which to attack searchlights or defend himself. The Defiant-type four-gun Boulton-Paul turret was fitted snugly in the top of the fuselage to give a more powerful, though cleaner, weapon than the discarded Hudson turret. The solitary radio mast was removed and the aerial led to the fairing of the D.F. loop—an item that could not be removed. The most striking feature of this new version, however, was the new fin and rudder, features that are now appearing on all Halifaxes.

The original conception of a night bomber was that it should make a more or less majestic progress to its target and that only elementary evasive action should be necessary. However, the developments made during the war in radiolocation and the operation of night fighters, flak and searchlights have made it necessary for the night bomber (which cannot rely on the defensive crossfire of a formation) to adopt the most agile of defensive manœuvres. It was found that the rudder control of the Halifax was not suitable for violent manœuvres, and the result was the fitting of a large fin, which served partly to increase directional stability by the increase of side area and partly to improve rudder control by providing a smoother flow over the rudders.

The end of 1943 saw one of the most striking changes in the Halifax: the replacement of the 1,280-h.p. Rolls-Royce Merlin XX engines by the 1,650-h.p. Bristol Hercules radials. Although most British aeroplanes designed during the war have been adaptable for liquid-cooled or air-cooled engines, the problems connected with a changeover always give the design staffs some difficult questions to answer. In the case of the Halifax III the change has

CONTINUED ON PAGE 24

Principal Characteristics

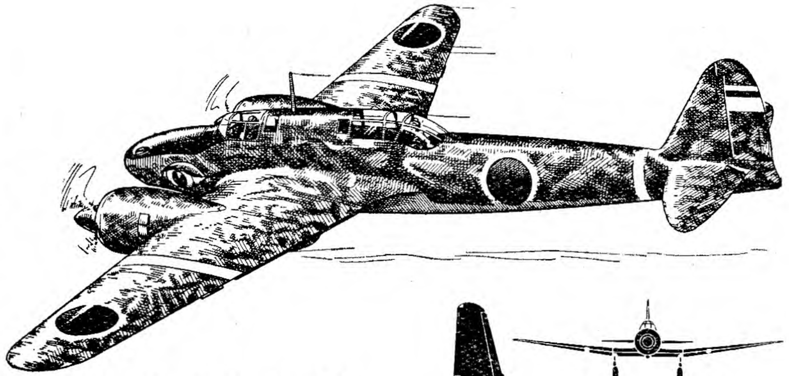
HALIFAX I	
Engines	4 X Merlin X
Span	99 ft.
Length	70 ft.
Height	22 ft.
Wing Area	1,250 sq. ft.
HALIFAX II	
Engines	4 X Merlin XX
Span	99 ft.
Length	71 ft. 7 in.
Height	21 ft. 7 in.
Wing Area	1,250 sq. ft.
HALIFAX III	
Engines	4 X Hercules XVI
Span (extended wingtips)	104 ft. 2 in.
Length	71 ft. 7 in.
Height	20 ft. 9 in.
Wing Area	1,275 sq. ft.

JAP TYPES

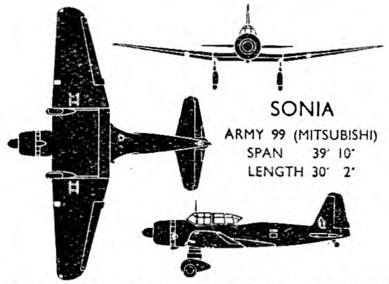
DURING recent months a certain amount of information has been released through official channels regarding Japanese war aircraft, including accurate silhouettes, some of which are reproduced on this page. The pen drawings are also from official silhouettes and photographs.

This acquisition of new facts is a direct result of the new Japanese speed-up in aircraft production and the development of fresh types in a bid to counter effectively the Allied air blows. Rapid advances by our troops have uncovered a large variety of aircraft left abandoned on captured airfields. Reconnaissance from the air, aerial photographs and combat films are other sources of information which are pooled to provide the data which is to be passed on to Allied air and ground forces. In addition, many Jap aircraft captured intact, or nearly so, are shipped to the U.S.A. or to Australia, where they are test-flown and examined in detail by our experts.

New Jap types are formidable regarding armament and equipment. The first powered turret appeared some time ago on the Sally (Army 97), and armour, radiolocation, leakproof fuel tanks and excellent wireless and radio devices are now standard on modern types.

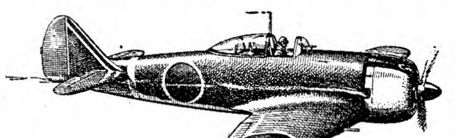


Above: The twin-engined fighter Nick (Kawasaki Army 2). The Nick is also used as a ground-strafer, and when it is undertaking this duty a large-bore cannon is mounted under the fuselage in addition to the usual armament. The dimensions are: span, 49 ft. 6 in.; length, 34 ft. 5 in.



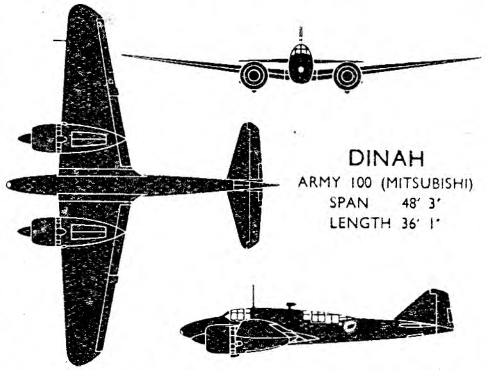
SONIA
ARMY 99 (MITSUBISHI)
SPAN 39' 10"
LENGTH 30' 2"

Right: The Sonia belongs to the old class of light bomber used so much in China. Although obsolescent, numbers are still in service. Power plant is a Nakajima Type 99 radial motor, and there is accommodation for a crew of two. Armament is believed to be one machine-gun mounted in each wing and a free-mounted gun in the observer's cockpit.

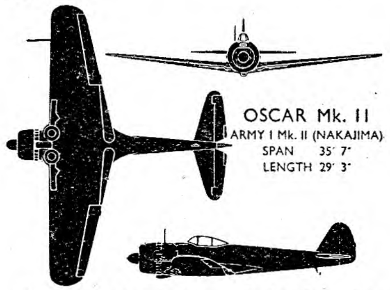


Above: The Nakajima Army 2 (Tojo) has a two-row radial engine developing about 1,450 h.p. and is probably equipped with self-sealing fuel tanks, protected oil tanks and armour protection for the pilot. American reports from the Pacific state that the Tojo is slightly faster than the Thunderbolt. Recent photographs show a new streamlined cockpit canopy, the pilot's section sliding back under the rear portion. The radio mast is re-positioned and is now on the cockpit hood as shown in the drawing. This version, the Mk. II, has a span of 31 ft. and a length of 29 ft. 3 in. The span is considerably less than that of contemporary Allied types, and makes for manoeuvrability.

The only modern Japanese specialised army reconnaissance aircraft, the Dinah, has two Mitsubishi Ha 112 radial engines which give a top speed in the region of 330 m.p.h. Mks. I and II (shown here) differ only in small details, but the Mk. III has more powerful engines with the nacelles extending beyond the trailing edge of the wing.



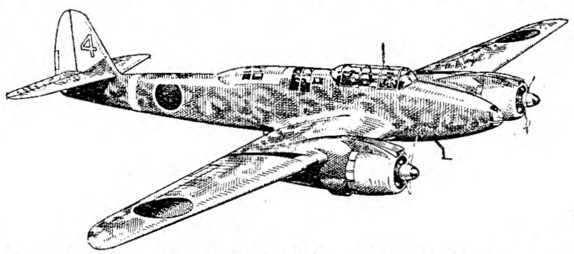
DINAH
ARMY 100 (MITSUBISHI)
SPAN 48' 3"
LENGTH 36' 1"



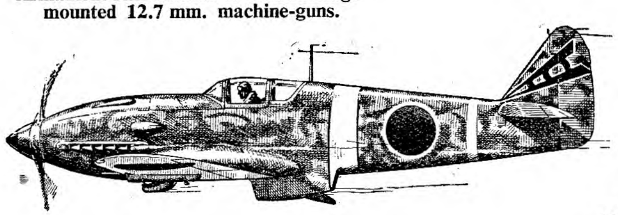
OSCAR Mk. II
ARMY I Mk. II (NAKAJIMA)
SPAN 35' 7"
LENGTH 29' 3"

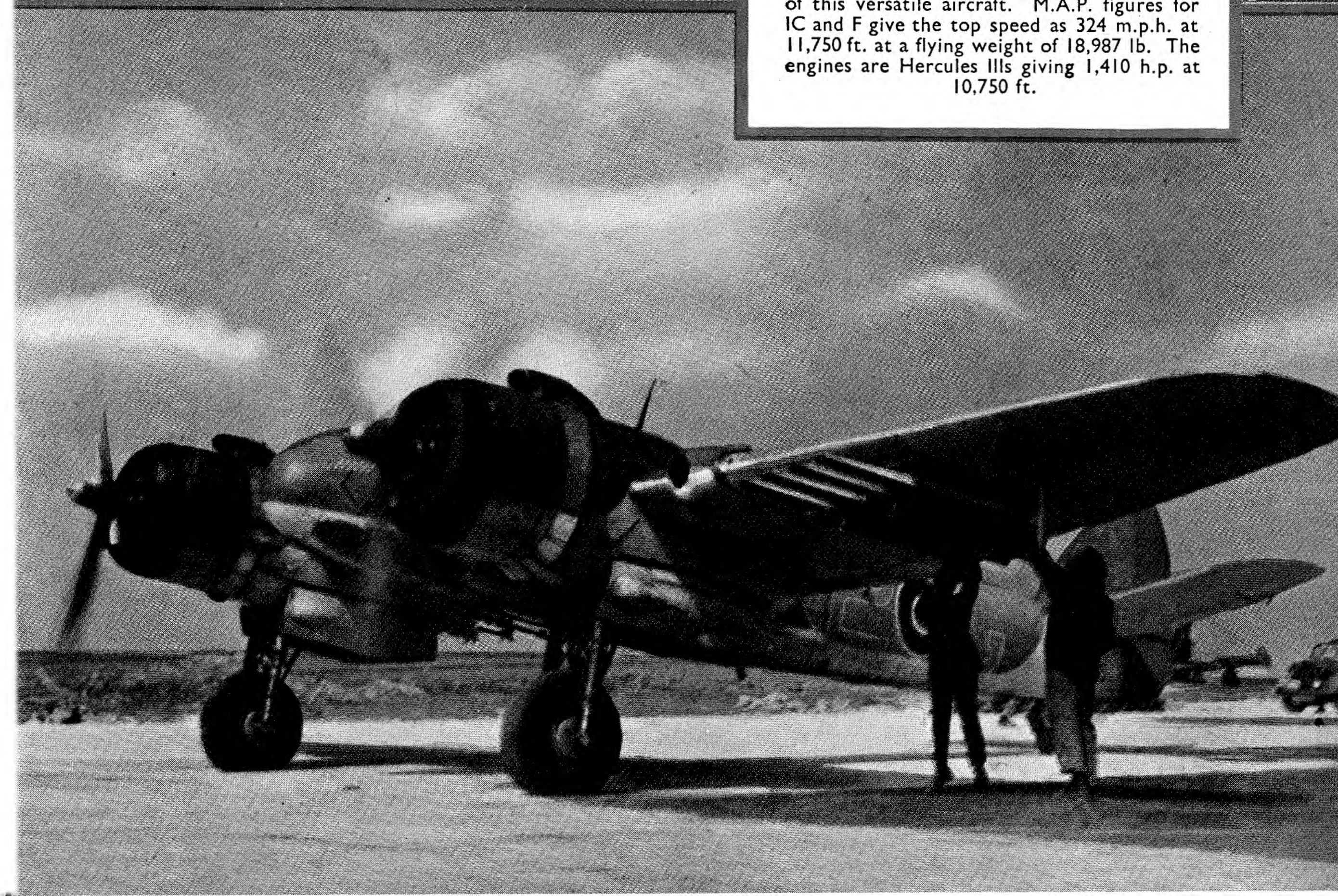
The early Army 1 was depicted in the Gazette for June, 1944. A more powerful motor has since been fitted and the air intake has been moved to the top of the engine cowling. Span has been reduced to 35 ft. 7 in. by fitting new tips to the wings, and the length is now 29 ft. 3 in. This model is known as the Mk. II, and is built by Nakajima. Armament still consists of twin fuselage-mounted 12.7 mm. machine-guns.

Bottom left: The Tony, or Kawasaki Army 3 has sustained changes in armament which, in the latest version, the Mk. II, consist of two 12.7 mm. machine-guns mounted on top of the engine, a 20 mm. cannon in each wing and provision for a 37 mm. cannon installed between the cylinder-banks of the motor and firing through the propeller boss. Bomb carriers are provided under the wings. Span 39 ft. 4 in., length 28 ft. 9 in.



Above: Little is known about the Irving, which has been seen only in small numbers. This reconnaissance fighter-bomber appears to seat a crew of three and has bomb-carriers beneath the wings. General layout is reminiscent of the French Potez 63, but the Japanese machine is of greater size. The motor cowlings are of advanced design, and probably house engines in the 1,500-h.p. class.

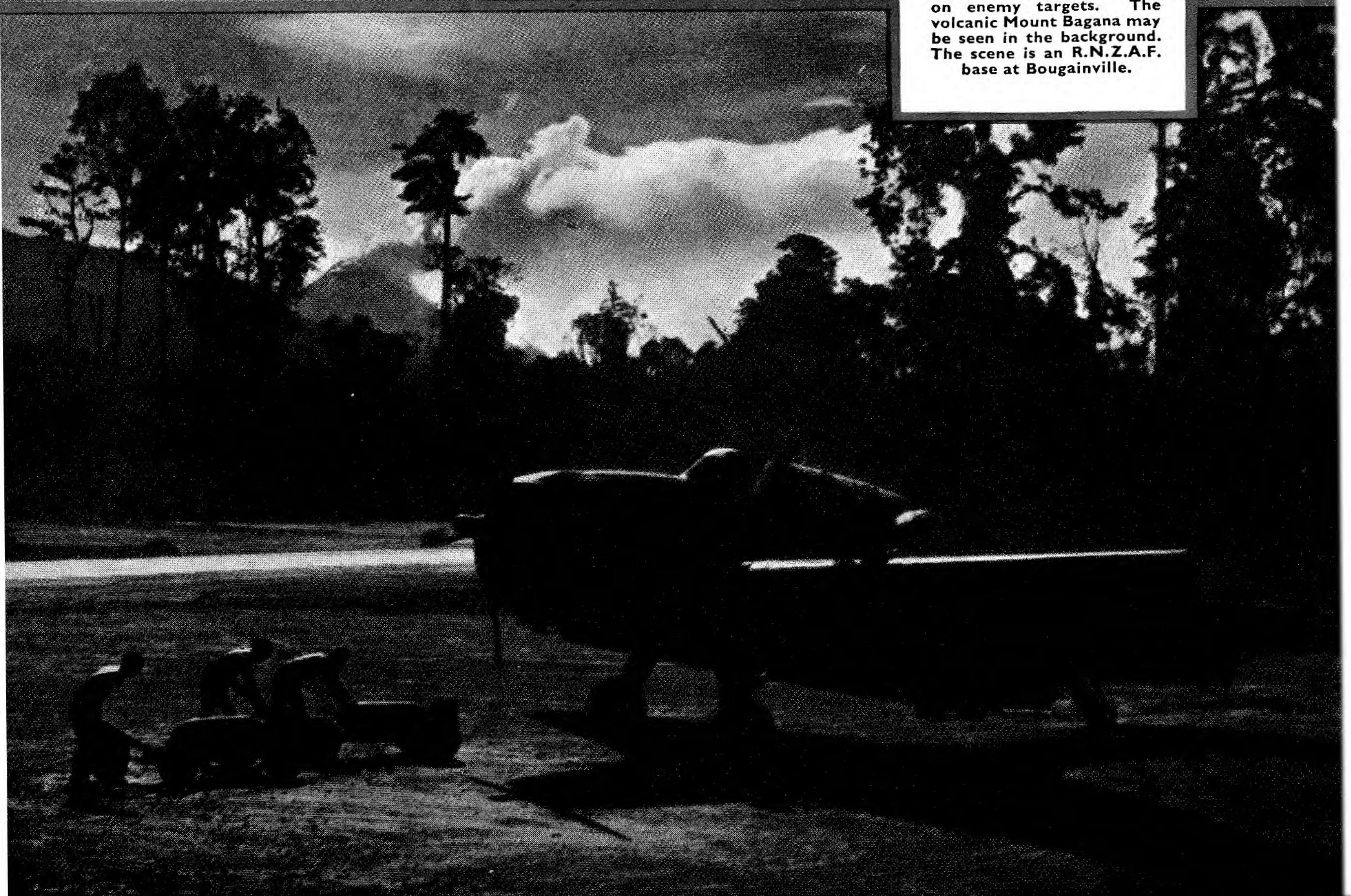




BEAUFIGHTER

The torpedo-bomber (top) and the rocket-firing version (below) are two recent versions of this versatile aircraft. M.A.P. figures for IC and F give the top speed as 324 m.p.h. at 11,750 ft. at a flying weight of 18,987 lb. The engines are Hercules IIIs giving 1,410 h.p. at 10,750 ft.

THE TEMPEST



ROYAL NEW ZEALAND AIR FORCE

(Above) A Warhawk of a New Zealand fighter squadron in flight over the country.

(Below) Armourers of a New Zealand servicing unit roll out the bombs to a waiting Avenger, which is being prepared for a strike on enemy targets. The volcanic Mount Bagana may be seen in the background. The scene is an R.N.Z.A.F. base at Bougainville.

FLYING IN NEW ZEALAND

An authoritative article on New Zealand's preparations for defence, its organisation of air training, and the part played by the New Zealand Air Training Corps.

TOO far removed from the Mother Country to expect immediate aid from that quarter, and with her own limited air forces devoted almost entirely to aircrew training, New Zealand, in the dark days that followed Pearl Harbour, found herself confronted with the threat of invasion as Japan's Pacific thrust struck swiftly southward.

Almost overnight the Dominion was placed on a new war footing, and preparations for defence were implemented with a minimum of delay.

During the first two years of the war the R.N.Z.A.F. had been primarily concerned with fulfilling the provisions of the British Commonwealth Air Training Plan and had built up a training organisation which was distributed over both Islands. The extent of the Air Force within the Dominion was nine flying training stations, a technical training school, and a stores erection and repair depot. In addition, three bomber reconnaissance squadrons were in process of formation. The only R.N.Z.A.F. unit outside New Zealand and under the direct control of the New Zealand Air Staff was a detachment of one of these squadrons stationed at Nandi, Fiji.

After the highly successful enemy attack on Pearl Harbour and Manila it was clear that drastic steps for the defence of New Zealand had to be introduced at once. The air resources of Great Britain were stretched to the limit; the United States air forces were not yet developed for island warfare. There was every reason for misgivings about the security of the country.

Forces Strengthened in Fiji

The strategic importance of Fiji had been recognised, and one of the first steps was to reinforce the small Air Force garrison there. At Nandi the bomber reconnaissance detachment became a new and complete squadron. In New Zealand reconnaissance squadrons were established in both the North and South Islands; fighter aircraft arrived—the country previously had none—new airfields appeared, particularly in the north, and the strength of the R.N.Z.A.F. in men and machines increased daily. Several stations previously given over to training were now on an "active service" footing, new operational stations were being developed with Army Co-operation squadrons, and thousands of airmen were being trained to keep pace with the demands of a rapidly expanding Air Force.

Simultaneous with the training of aircrew under the Empire Scheme, New Zealand was also training aircrews for squadrons concerned with the defence of New Zealand and the Pacific. Additional ground forces were required as a consequence, and, besides many thousands enlisted for ground duties, 7,000 aircrew aspirants free from Army obligations were called up by the Air Force for training as soldiers. These men were drafted into aerodrome defence units. Many elaborate defence plans were implemented and many coastal units manned.

The Japanese menace passed. The Americans seized Guadalcanal and their forces consolidated their hold in New Caledonia, the New Hebrides, Fiji and the Solomons. An enemy invasion of New Zealand was now highly improbable.

But the R.N.Z.A.F. still had an important role to fulfil in the Pacific, and while New Zealand airmen were waging a war of destruction against the enemy in Europe, others nearer home were helping to clear the Japs from the skies over the Solomons and Rabaul. This was virtually accomplished last March, New Zealand fighter pilots having accounted for approximately 100 enemy aircraft with a ratio of loss in their favour of roughly one to five.

The rapid growth of the R.N.Z.A.F. since the end of 1941 to meet her many commitments was never better shown than in the first half of 1944, when she had under her command in the Pacific squadrons of fast fighters, dive-bombers, torpedo-bombers, reconnaissance-bombers and flying-boats. Ground units in New Zealand had grown proportionately: large stores and repair depots had sprung up, operational training units for all types of aircraft, training stations for both aircrews and groundcrews, and administration groups and headquarters consistent with the needs of a fast-growing organisation.

Importance of the A.T.C.

So vast an organisation as the Air Force in New Zealand had become obviously required large reserves of manpower from which to draw from time to time. A continual stream of recruits for aircrews and for technical and administrative posts was essential. This was where the Air Training Corps came in.

Since its inception the A.T.C. has provided pre-entry training for potential pilots as an introduction to the more advanced R.N.Z.A.F. training, and special care has been taken to maintain a background conducive to the development of character and physical well-being. One of the principal advantages is that cadets receive instruction in certain subjects when they are at the most receptive age.

The Air Training Corps was formed in New Zealand in October 1941. The following year it had a membership of 4,223; in 1943 the figure had grown to 6,549, and in August last there were 9,300 cadets in the Dominion—double the strength for 1942.

Since June 1942 the A.T.C. has continued to provide an adequate flow of suitable and highly qualified men for aircrews and ground units, each thoroughly trained in specialised work according to his qualifications. To date over 3,000 cadets have passed into the Service, more than half of whom were aircrew. More than a thousand are filling important posts in technical trades, and many of these have served with maintenance forces in the Pacific.

Flying Conditions in New Zealand

The training of more than 11,000 airmen for flying duties was accomplished by the R.N.Z.A.F. without undue difficulty. Some of these were fully trained within the Dominion; more than half proceeded to Canada for further training under the Empire Training Scheme. For their instruction in New Zealand the most up-to-date equipment available was used, and this was replaced as new and improved training devices came to hand. Expert instruction and good flying conditions made easier what was quite a substantial task for a small country.

Many pilots who trained in New Zealand and subsequently flew in Great Britain have commented on the contrast between flying conditions in the two countries. Topographically and climatically they have little in common. While England is largely undulating country — gently rolling hills and green pastoral lands — the New Zealand terrain has a natural ruggedness. Rocky mountain ranges monopolising vast portions of both islands, isolated lofty peaks, and tall, bush-covered hills contribute to this ruggedness, which is relieved only by a few coastal strips and by the Canterbury Plains, on the east coast of the South Island, extending about 100 miles in length and 50 miles across. In many respects the country resembles Scotland; probably the main difference is that New Zealand's native bush is peculiar to herself.

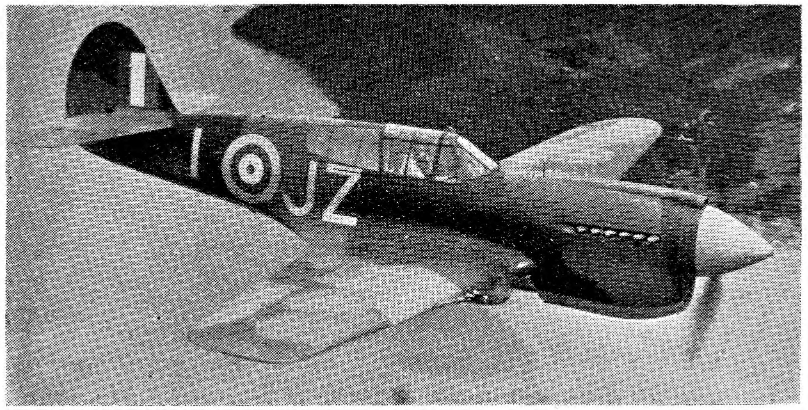
In climate, too, the two countries are markedly dissimilar. New Zealand has an island climate which is unaffected by her neighbour, Australia. England's proximity to Europe gives her a continental climate. Pilots who fly in England are accustomed to the frequent belts of fog, the result of the Gulf Stream. But in the Dominion fog is comparatively rare. When it is encountered the occurrence is invariably local. But high winds are not uncommon in New Zealand, especially during the spring equinox. In Wellington, the Dominion's capital, gales up to 80 miles an hour have frequently rendered the city's airport unusable.

The sea-level climate is generally very temperate in all parts of the country. In the South Island, obviously the colder, snow may fall four or five times a year, but no one remembers falls at sea-level in the North Island. Winter, however, sees the high ranges covered annually in both islands.

In good weather pilots in New Zealand are favoured with excellent visibility. From sea-level visibility may extend as far as 70 miles, while at normal flying altitudes a pilot can pick out landmarks over a hundred miles distant. When weather deteriorates, particularly in warm frontal conditions, visibility becomes restricted, and with ceilings lowering to a few hundreds of feet and with high winds flying can become very hazardous. To avoid the possibility of running into hills or mountains the pilot is forced to go either high, where he may encounter severe icing and unknown high upper winds, or coast-crawl, which can also be dangerous.

The proximity of hills to airfields also makes it difficult to assist pilots with radio aids for approaches in restricted visibilities, and so fairly severe weather limitations have to be imposed. Radio aids for route navigations are also limited because of the topography. Rapid local changes of weather further affect flying, but the excellent service given by the meteorological and flying-control organisations offsets this to a marked degree.

To obtain an accurate conception of flying conditions in New Zealand one must know of these difficulties. But that is not the whole picture, for the problems do not always present themselves, and one may fly for weeks without having to face any serious weather difficulties. Another point is that flying can often continue in an area though the weather may have "packed up" 20 miles away. Frequently weather disturbances are merely local.



A Warhawk fighter of an R.N.Z.A.F. squadron flies home over the rugged New Zealand coast. The same squadron later engaged the Japs in 1943 in the first combat in which N.Z. Pacific squadrons participated. Seven Zeros fell to the squadron in operations at Vella Lavella alone.

Because of the scenic attractions of the Dominion, flying is a pleasure in almost any district in both islands. From the air one obtains truly remarkable views: the snow-covered Alps on the west coast of the South Island, the glaciers and, further south, the Sounds; the beautiful Southern Lakes; the fiords at the tip of the South Island; in the North the mountainous ranges at National Park; the smooth lakes and thermal regions at Rotorua; and the wide bays and long, sandy beaches of North Auckland.

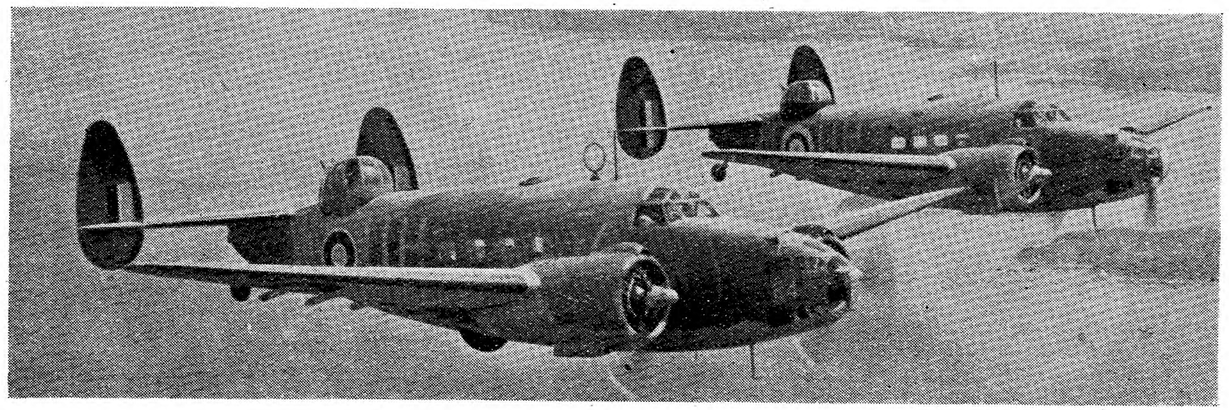
War Imposes Restrictions on Commercial Air Lines

The outbreak of hostilities with Japan, and the pressing need for machines which caused the R.N.Z.A.F. to draw on civil air lines in the Dominion, inevitably curtailed the operation of New Zealand's commercial airways. At the outbreak of war the country was covered by an extensive network of scheduled aircraft services. These routes were operated by three companies—Union Airways of N.Z. Ltd., Cook Strait Airways Ltd. and Air Travel (N.Z.) Ltd. Shortly after war began the whole of Cook Strait Airways' fleet and equipment was requisitioned for use by the R.N.Z.A.F. This service has since been operated by Union Airways and Air Travel together on a charter basis.

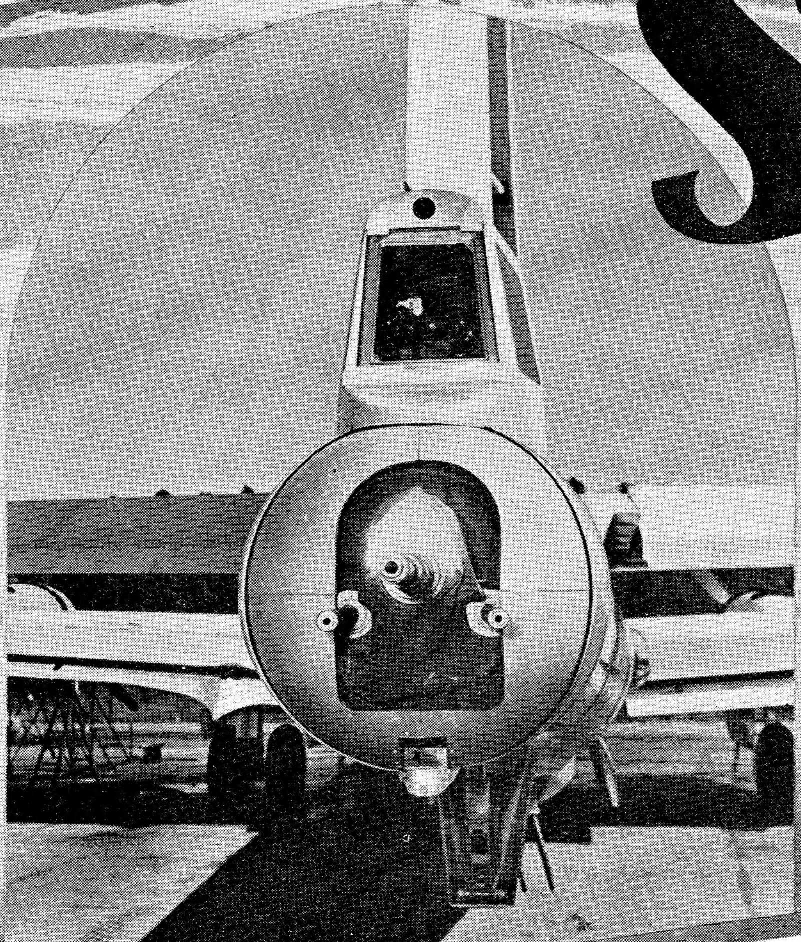
Bridging the 6,000 miles of ocean that separate Auckland from San Francisco, large Boeing flying-boats of Pan-American Airways Ltd. were before the war maintaining a regular service across the Pacific, intermediate calls being made at Honolulu, Canton Island, Fiji and Noumea. After the Japanese attack in December 1941 the service was suspended for the duration of the war.

A progressive speeding-up of the schedule operated by Tasman Empire Airways Ltd. has enabled the trans-Tasman air service which links Australia and New Zealand to cope with a much greater volume of traffic, both passenger and freight. It was first intended to make one return trip each week, but a tri-fortnightly schedule was in progress before long. Towards the middle of this year the company's Short Sunderland flying-boats were making four crossings of the Tasman—or two return trips to Auckland—each week; and more recently a third return trip was added.

R.N.Z.A.F. Hudson reconnaissance bombers of a South Island station return from a patrol along the New Zealand coast.

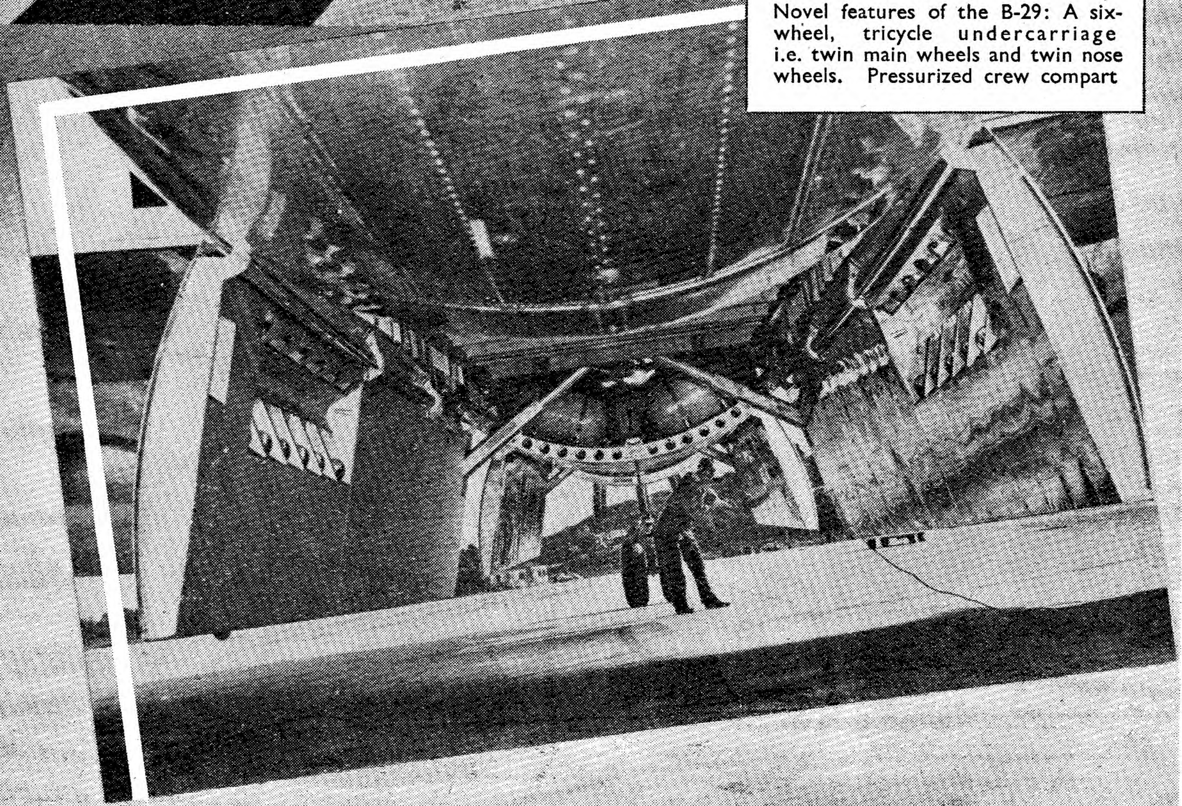


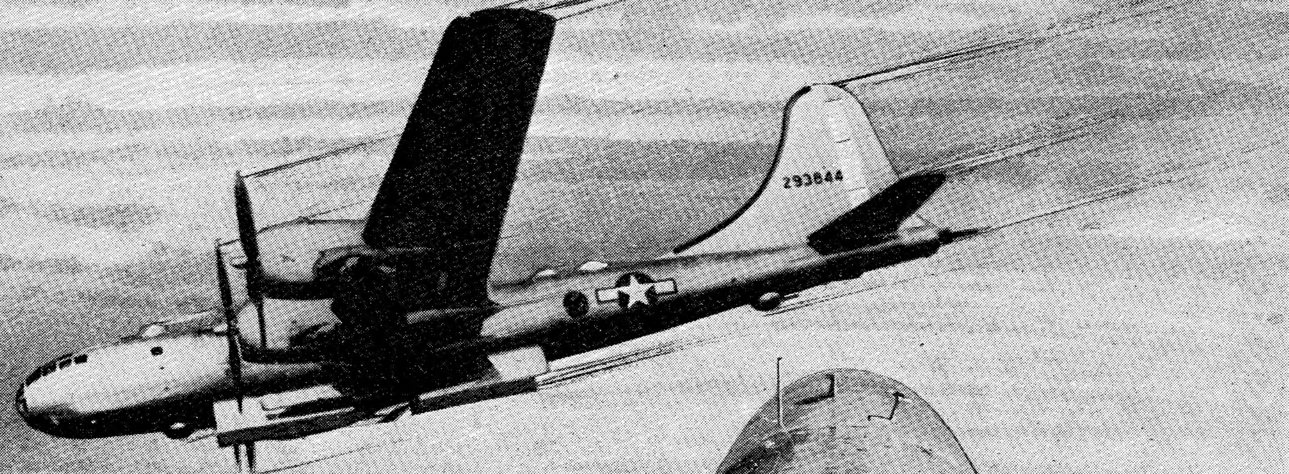
Superfortress

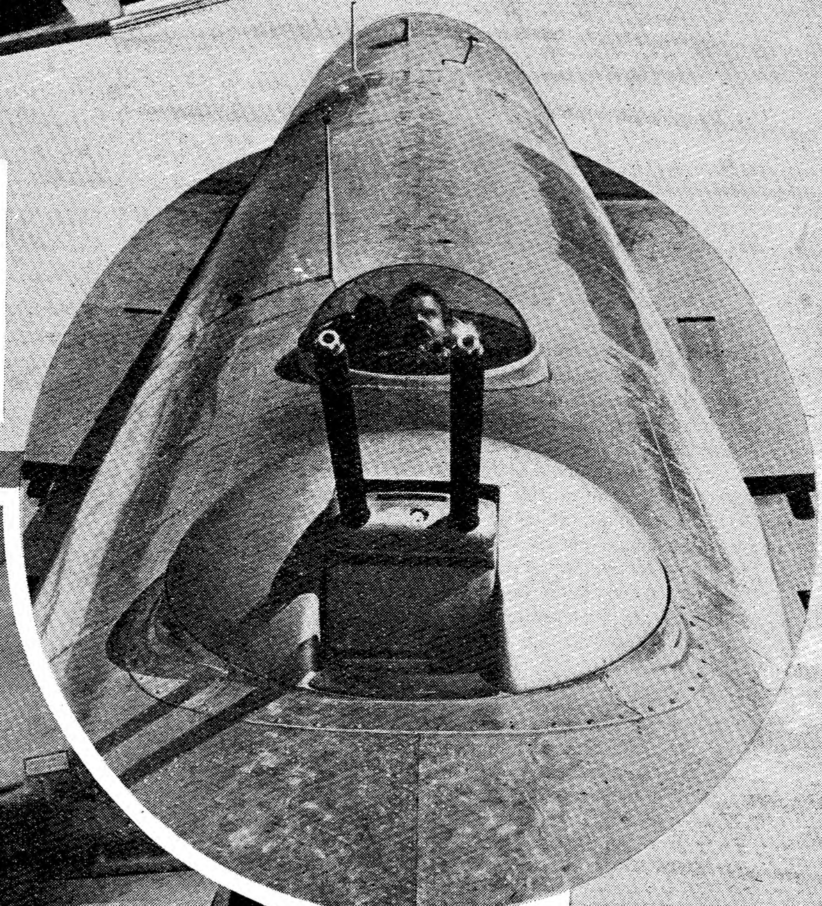


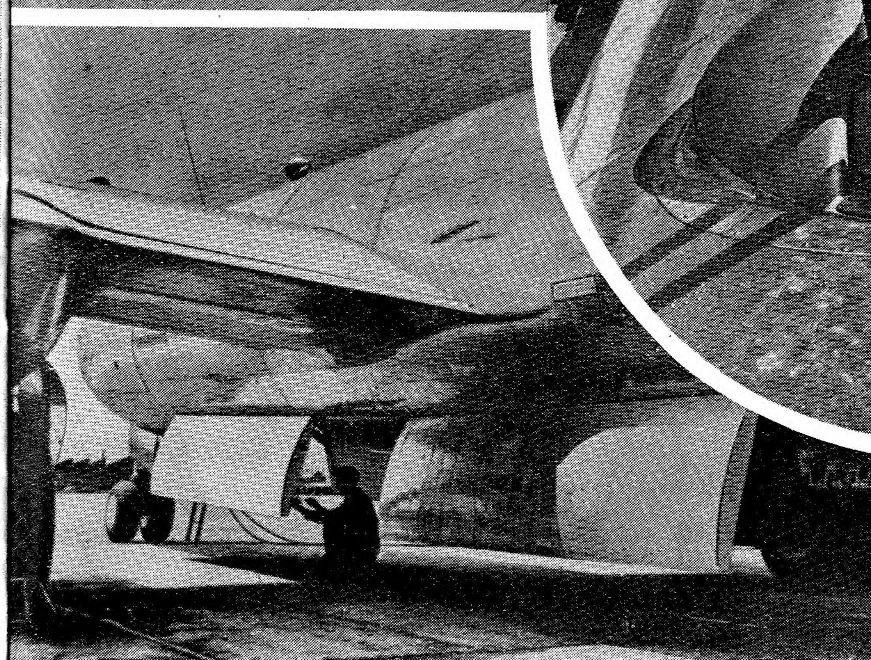
The biggest bomber in service with the United Nations is the Boeing B-29 Superfortress. This bomber built by Martin and Bell factories as well as Boeing's Wichita plant, and embodies the design, construction and tactical experience gained in the production of the Fortress, Stratoliner, and the venerable Boeing 247D. The cost of the first four XB-29's through their teething troubles was over £1,500,000. This included wooden mock-ups, wind-tunnel tests, and many design alterations. The first model, piloted by Boeing's chief test pilot, Eddie Allen, flew on September 14th, 1942.

Novel features of the B-29: A six-wheel, tricycle undercarriage i.e. twin main wheels and twin nose wheels. Pressurized crew compartments, remote controlled gun turrets and double bomb-bays. A small flat trolley is provided for crewmen to slide along the catwalks over the bomb-bays. Notable strikes of the B-29 have been: Japanese factories in Manchuria, factories in Kiushiu, Yokosuka naval base and Singapore dockyard.









Jet Propulsion of Aircraft

by A Naval Engineer Officer

SUPPOSING you are sitting on the tail of an aircraft with chocks under the wheels and the brakes on while the engine is being revved up. There is a mighty rush of air past you, and you only cling on with difficulty. If the chocks are now removed and the brakes taken off the aircraft moves rapidly ahead. What moves it?

The air is pushed aft because it is acted upon by a force, namely, the thrust of the propellers. Everyone knows the fundamental law of mechanics which states in popular language that action and reaction are equal and opposite. Thus the thrust of the propeller has an equal and opposite force, and it is this force which drives the aircraft ahead when unimpeded. It is exactly the same in a jet-propelled aircraft. A jet of mixed air and the products of combustion is discharged aft at a very high speed from a large nozzle in the tail of the aircraft or from nozzles in the wings, but to force the air back at this high speed there is a propulsion unit instead of the propeller.

The Propulsion Unit

This propulsion unit has four essential components: an air compressor, a combustion chamber in which the fuel is burnt, a gas turbine, and a nozzle-shaped orifice through which the products of combustion are discharged to the rear. A diagrammatic arrangement is shown in Fig. 1.

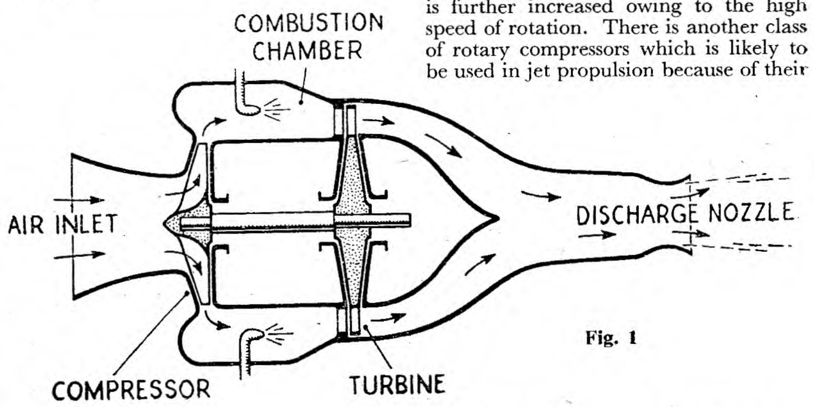


Fig. 1

The air compressor may be either rotary or reciprocating, but in general compressors are rotary like the supercharger of an aero engine or the circulating pump of a Merlin engine. They may have only one stage, or they may have several stages. In multi-stage air compressors the air is discharged from one stage to the inlet of the next. This second stage is similar to the first, and as the air passes through it the pressure is further increased owing to the high speed of rotation. There is another class of rotary compressors which is likely to be used in jet propulsion because of their superior performance. They have two intermeshing rotors like large screw threads. The air is admitted at one end, trapped between the threads, and com-

CONTINUED ON PAGE 24

Jet Propulsion

CONTINUED FROM PAGE 22

pressed as it is forced to flow in an axial direction. From the last stage of the compressor the air is discharged into the combustion chamber.

Fuel is sprayed into the combustion chamber in the form of a fine, continuous spray. When starting up the engine the fuel must be ignited by external means, such as a sparking plug, but once alight combustion continues without further assistance.

The Gas Turbine

The heat generated during combustion expands the air, and the mixture of air and the products of combustion are forced to escape by the only possible way, namely, through the turbine. The general features of the turbine are similar to those of a steam turbine.

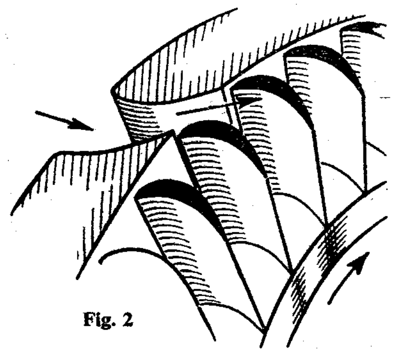


Fig. 2

In its simplest form the revolving or moving part is a wheel having specially shaped blades on its circumference. Nozzles fixed to the casing are arranged to direct the gases on to the blades. As the gases expand through the fixed nozzles, they attain a very high speed. They then strike the blades on the circumference of the wheel. The force of their impact causes the wheel to rotate. In addition, the blades are subject to a further force which helps to rotate the wheel, owing to the fact that the gases change direction while passing through the passage between them. Fig. 2 shows diagrammatically the passage of the gases through a fixed nozzle and through some of the blades of the turbine wheel.

The Jet

The turbine and compressor are at opposite ends of the same shaft, the sole duty of the turbine being to drive the compressor.

On leaving the turbine the gases expand further through a convergent nozzle, which converts some of the remaining heat energy into the high-speed jet which, as discussed in the second paragraph, produces the propulsive force of the aircraft.

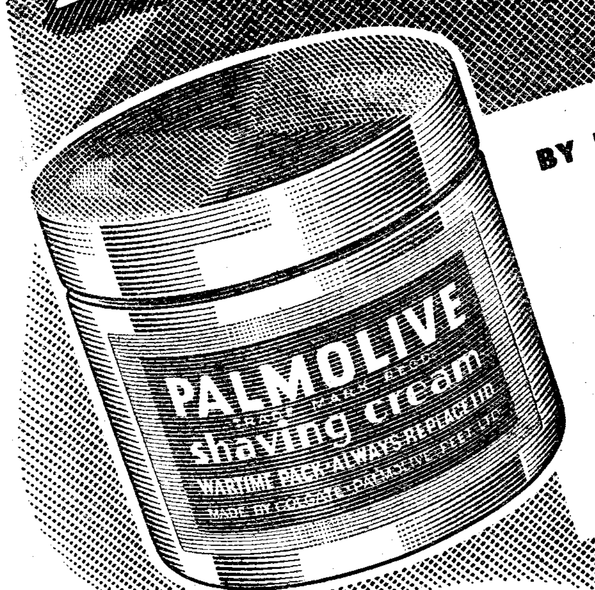
Halifax Changes

CONTINUED FROM PAGE 11

been eminently successful, and the increased power has brought the performance up to the latest requirements. The Mark III is essentially a Mark II, Series IA, airframe except for two additional modifications. In order to improve the performance at height, rounded wing tips are fitted to the later Mark IIIs. These wing tips help by slightly increasing the wing area, but their main function is to smooth the airflow at the wing tip and thereby improve lateral control at high altitude. The second new feature is a partially retractable tail wheel.

By such continual processes of refinement, by major changes, and often by very small ones, it is possible to keep the performance of an operational type up to date through three years of war.

"UNCONDITIONAL SURRENDER"



BY BILLIONS OF BRISTLES EVERY DAY

to the softening smoothing soothing lather of

PALMOLIVE SHAVING CREAM

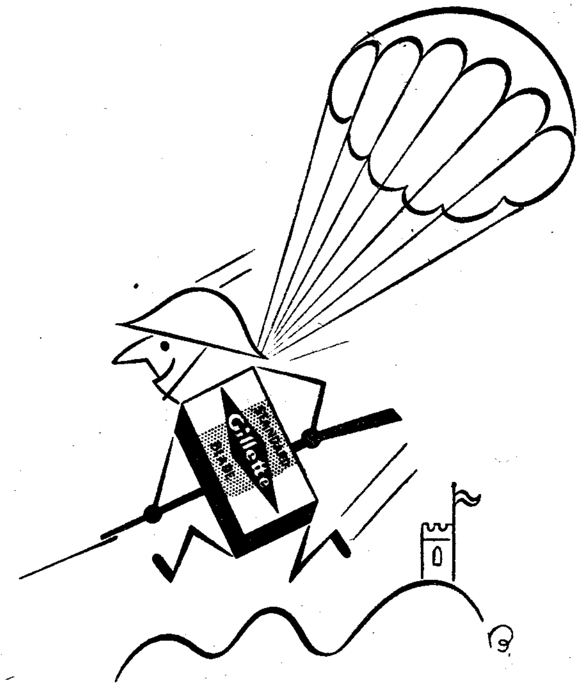
1/6 & 2/6 Including Tax

Do your teeth complete your charm?

the answer's on the tip of your tongue

Use Pepsodent. Then feel with your tongue how its super-cleansing Irium has flushed stain-collecting film clean away.

1/3 & 2/2. Also made in powder form.



Ground for Victory! And not only well and truly ground, but fine steel finely tempered. That's Gillette in battledress —the Gillette Standard Blades which have temporarily taken the place of the Blue Gillettes. They infiltrate tough beards. A bit elusive, perhaps—but well worth finding!

Gillette in battledress

Gillette "Standard" and **"Standard Thin"** Blades (plain steel) 2d each, including Purchase Tax. Fit all Gillette razers, old or new.

Sometimes difficult to get. Don't blame the dealer. Production still restricted.

The Forces' Favourite

Player's Please

MEDIUM OR MILD · PLAIN OR CORK TIPS

N.C.C.563A