PUT A TAG ON THESE
(See *page* 23)

1, Bristol Blenheim IV; 2, Boeing B-17E Fortress; 3, Douglas DB-7 Boston III; 4, Messerschmitt Me 109G; 5, Short Stirling IV; 6, Messerschmitt Me 410; 7, General Aircraft Hamilcar; 8, Consolidated B-24D Liberator; 9, Douglas A-20 Havoc; 10, North American BT-14 Yale; 11, Fairey Firefly I; 12, Grumman TBF-1 Avenger; 13, Boeing B-17G Fortress; 14, Brewster F2A-2 Buffalo; 15, Douglas DB-7 Boston III; 16, North American B-25 Mitchell; 17, Martin B-26 Marauder; 18, Curtiss SB2C Helldiver; 19, Grumman Wildcat; 20, Boeing B-29 Super-Fortress; 21, Iliuchin IL-2; 22, Fairey Barracuda II.

DISCERNIBLE DETAILS
(See *page* 22)

1, Republic P-47 Thunderbolt; 2, Vought-Sikorsky OS2U-3 Kingfisher; 3, Martin B-26 Marauder; 4, North American B-25 Mitchell; 5, Waco CG-4A Hadrian; 6, Consolidated B-24 Liberator; 7, Taylorcraft Auster IV; 8, Supermarine Spitfire F.XII; 9, Hawker Typhoon Ib; 10, Avro Lancaster I; 11, Avro York; 12, Douglas A-26 Invader; 13, Northrop P-61 Black Widow; 14, Fairey Barracuda; 15, Messerschmitt Me. 410; 16, Junkers Ju 87; 17, Toupolev TB-7; 18, MBR-2; 19, Mitsubishi OB-01 Betty.

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AIR Training Corps GAZETTE

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1945

A MESSAGE FROM THE CHIEF COMMANDANT, AIR MARSHAL SIR E. L. GOSSAGE, K.C.B., C.V.O., D.S.O., M.C.

As midnight 31st December, 1944/1st January, 1945, struck we crossed the threshold of a new year, a year of great prospect of ultimate victory. May I wish one and all—officers, instructors and cadets—the best of good luck and success in the months which lie ahead in 1945. This year may hold out for us some of the greatest days our Empire has ever known, and we shall all be glad to have lived in these times and to have made a contribution towards the successes for which we have worked so hard.

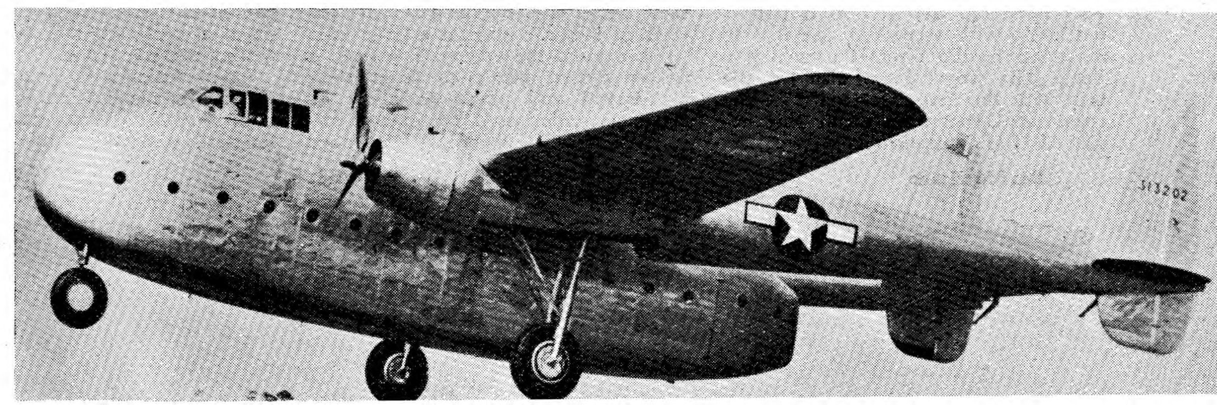
As we all know, the Air Training Corps has passed through a most difficult period during 1944 through the transfer of cadets to the Army. We recall the circumstances, namely, our sufficiency of aircrews due to our striking victory over the Luftwaffe having been gained at a much lighter cost than we had expected. Although inability to serve with the R.A.F. has naturally been a keen disappointment to those who had hoped and trained for it, we can only be thankful that we have not had to face once more the dire results of unpreparedness which were our lot in 1940. All good luck to those who have joined the Army from the A.T.C.; they are already making their mark through the superiority of their alertness, their training and their sense of discipline.

The younger cadets who are with us have first-rate prospects of service with the peace-time R.A.F. Transfer to the Army is not likely to come their way unless much changed circumstances arise.

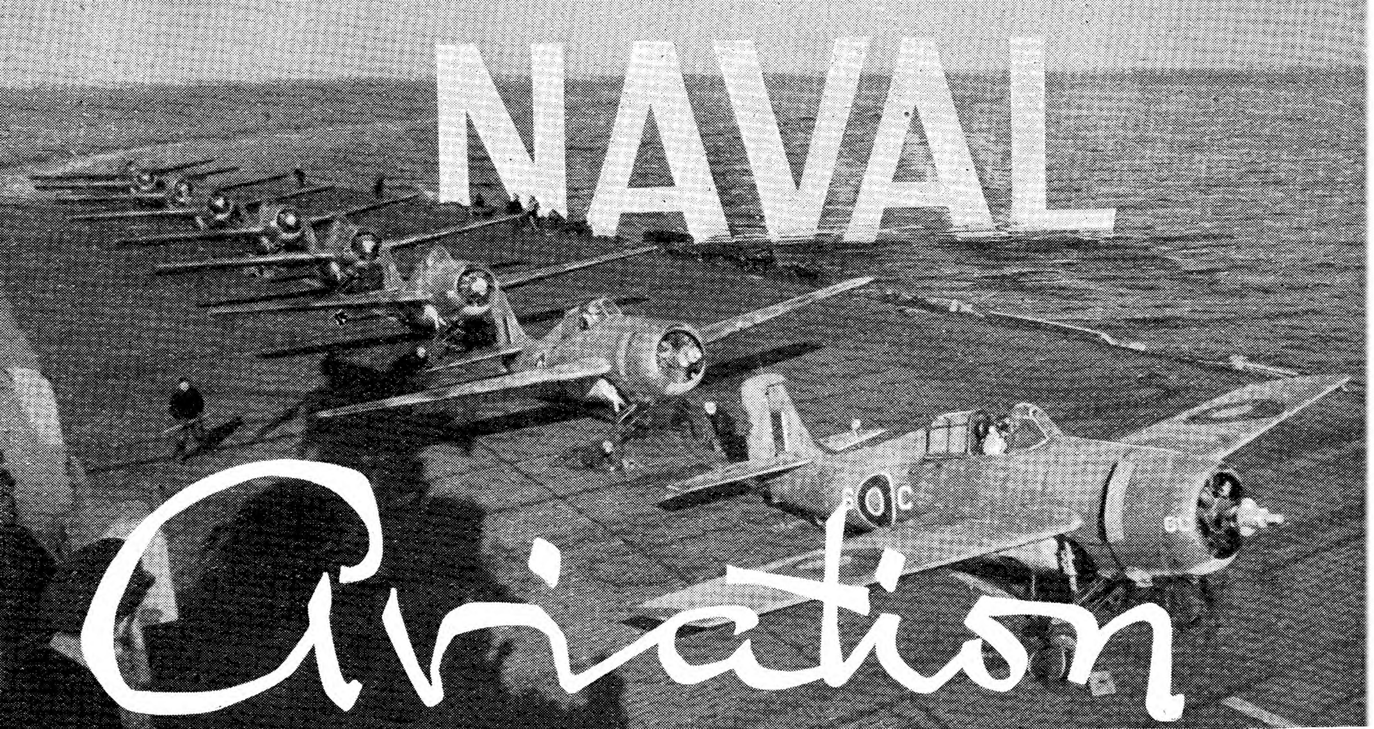
The original aim of the A.T.C. remains the same, namely, the training and production of the best recruits for the R.A.F. and F.A.A., both of which will probably have to be kept in being in considerable strength for some time after actual hostilities have ceased. This, then, is the reason for our existence, and we have to concentrate as before on the work it entails.

I thank officers, instructors and cadets for the zealous, self-sacrificing, voluntary work which all have put in during the past year, in spite of our many difficulties. Conscious of our aim and of our responsibility to the future we shall go forward with the tasks that lie before us. The Royal Air Force relies upon us to carry out these tasks thoroughly.

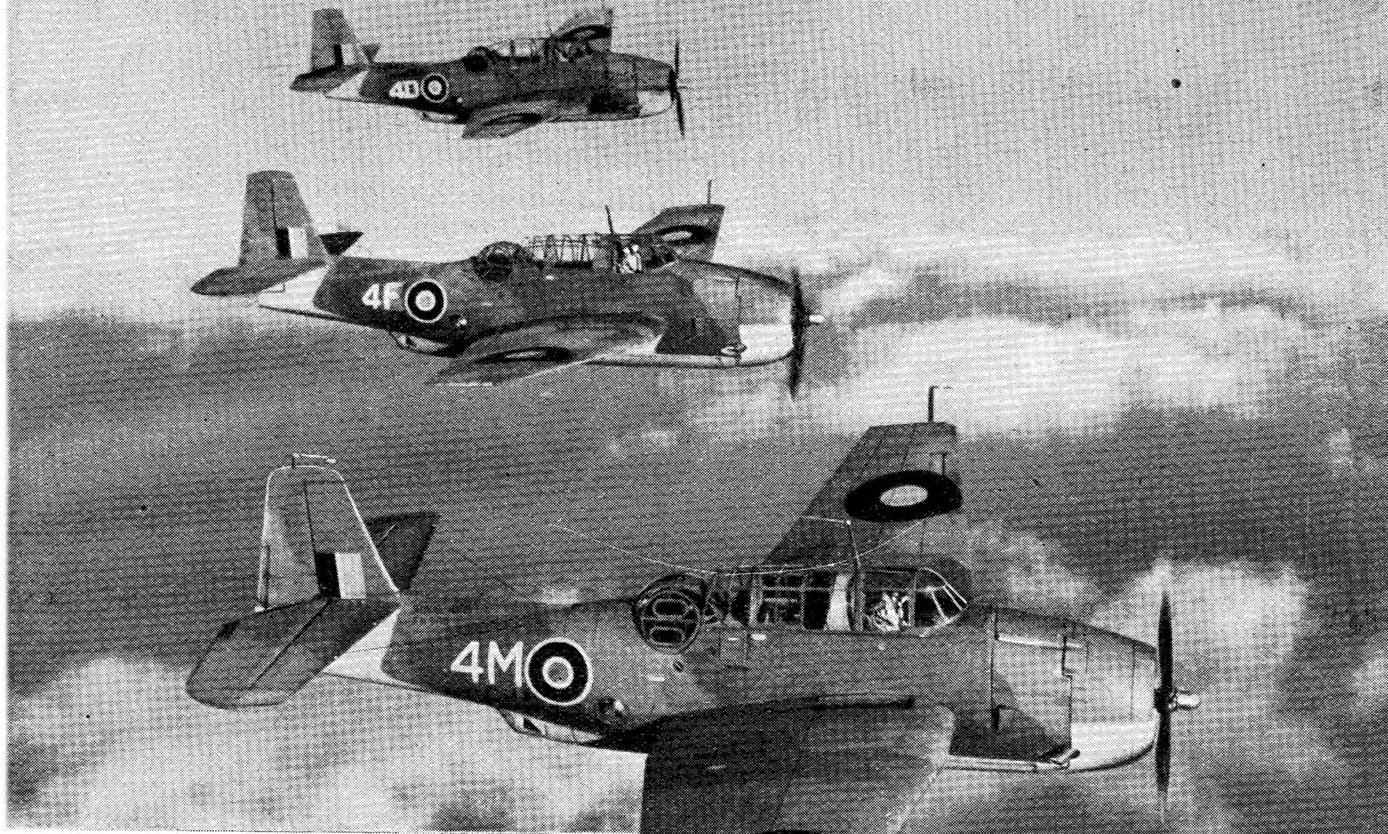
E. L. GOSSAGE, *Air Marshal,*
Chief Commandant and Director-General,
Air Training Corps.



The new American "utility" transport, the C-82, built by Fairchild. Tricycle undercarriage ensures that aircraft is level when on ground to facilitate loading, etc.



NAVAL Aviation



The photographs on these pages are of Royal Navy Grumman Wildcat single-seat fighters and Avenger torpedo bombers.

An article specially written for the A.T.C. GAZETTE by VICE-ADMIRAL D. W. BOYD, C.B., C.B.E., D.S.C., Fifth Sea Lord and Chief of Naval Air Equipment

ATTACKS on ships, assaults on the land, and defence—these are the primary functions of naval aviation. In all three spheres of activity naval aircraft have this advantage—that they can be brought close to the scene of action; and the ease with which carriers can be switched from one area to another is an important factor in any form of operation.

During the war years technical development has been so rapid that shipborne aircraft are now as effective in battle as any other aircraft of comparable size.

Achievements

The air strength of the Navy, which started so modestly, is still expanding, but it has during these five terrific years built up an impressive record. Its aircraft have attacked German and Italian warships both at sea and in strongly defended harbours; they have sent to the bottom over half a million tons of merchant shipping; they were the first in history to sink a warship by dive bombing, the first to cripple a battleship with torpedoes, the first to drive off hostile aircraft attacking a fleet. The Royal Navy also led the way with the first escort carrier—the captured German merchant ship renamed *H.M.S. Audacity*.

The story began one day in 1917 when Squadron-Commander Dunning succeeded in landing a Sopwith Pup on the flight deck of the converted cruiser, *H.M.S. Furious*, only to be killed in making a second attempt. It is well to remember the significance of the work of this gallant pioneer, and the great strides made by his successors owe much to his courage and enterprise.

Function

The chief function of naval air power is to provide the fleet with long-range striking power. It enables surprise attack to be made on distant objectives, and it can also bring about gun action by crippling units of the opposing fleet, allowing the hunters to close with the hunted, as in the Battle of Matapan and the chase of the *Bismarck*. There are other forms of attack which sea-air power can achieve, but those are the two most vital, and they are carried out by torpedo-carrying and bomber aircraft. But these, being single-engined aircraft, are weak in defence, and for a large-scale strike against the enemy they need a fighter escort, partly to cover their withdrawal and partly to allow an approach unharassed by enemy aircraft. The Royal Navy uses long-range Corsairs, Hellcats and Wildcats for this work, and they have proved highly successful. The recent strikes against the *Tirpitz*, which have now been crowned with success, and against shipping in Norwegian waters have shown the effectiveness of this form of escorted attack. An important addition to the Navy for this type of work is the Firefly, a long-range heavily armed reconnaissance fighter, with the advantage of a high cruising speed.

Organisation and Co-operation

The organisation of naval aviation is such that this sort of strike can be launched from any single fleet carrier. The aircraft complement of these carriers is so designed that each ship is a self-contained unit, with a sufficient number of fighters not only to escort the bombers but also to provide the ship herself with protection. Escort carriers are not generally self-contained and they operate in groups.

The days of Taranto, Matapan and the other great victories achieved by gallant but pathetically small forces of naval aircraft are now past. We are getting into our stride.

Co-operation with the army is a new activity for naval aviation, but it is the natural outcome of the development of long-range assault and the Navy's ability to operate suitable types of aircraft. There can be no doubt that naval aircraft played a major role in the attacks on North Africa, Italy, Greece and the South of France. The last-named attack afforded an outstanding example of the importance of carrier-borne aircraft in assault operations. It was an opportunity for which Admiral Troubridge's escort carrier group had been waiting, and they performed the task magnificently. The Supreme Command found that it had at its disposal a self-contained air force which could be brought into action at short notice and at any spot along the assault coast or hinterland. The enemy must have been enraged to find single-engined fighter-bombers playing havoc with his supply columns when he knew that there were as yet no operational airfields established in the assault area and that the nearest Allied bases were far away in Corsica.

That attack gave naval aviation the opportunity to perfect its technique of co-operation, paving the way for similar assault operations which will undoubtedly provide most of its work in the Pacific theatre of war.

In such operations the Royal Navy, by means of "all-purpose" squadrons based in carriers, provides aircraft not only for normal fighter protection, but also for artillery spotting both for naval and land guns, photographic and tactical reconnaissance and fighter-bombing, including rocket-firing. In all these branches of warfare the pilots of the Corsairs, Seafires, Hellcats and Wildcats undergo special training in conjunction with Army officers, who perform liaison duties in the carriers themselves.

Thus naval aviation plays a part in these long-range assaults which could not be achieved by any other means.

Defence

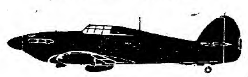
The task of air defence is the only one which has remained consistently the same throughout the war. The protection of the Fleet and of our convoys from both air and submarine attack is a vital job and one from which there is no rest. All day and every day naval aircraft have to maintain their vigil. There are always ships at sea, and there are always submarines and aircraft to attack them. The outstanding example of carrier air defence was the cover provided for the Malta convoys. Attacks reached their greatest intensity in the last convoy to get through, and in this battle the aircraft of *H.M.S. Eagle, Indomitable* and *Victorious* engaged more than 250 enemy aircraft, accounting for over 70 of them.

Escort Carriers

It was for this particular sphere of activity that the escort carrier was designed, and the story of how these small ships have helped to close the Atlantic "gap" and maintain the lifeline to Russia has been told often enough; yet it is impossible to overemphasise the successes achieved by naval aircrews. In the Russian convoy during which *H.M.S. Chaser, Fencer, Vindex* and *Striker* scored outstanding victories, pilots and observers flew in freezing skies in open Swordfish cockpits, and sometimes they had to be lifted out of their aircraft after landing on the flight deck. Their reward, and the reward of the aircrews of other ships with Russian convoys to their credit, lies in the fact that the merchant ships got through and the U-boats were sunk.

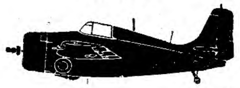
I should like to record that the first operational success of the rocket pro-

Sea Hurricane



Seafire

Wildcat



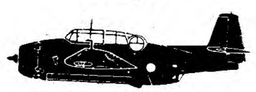
Hellcat

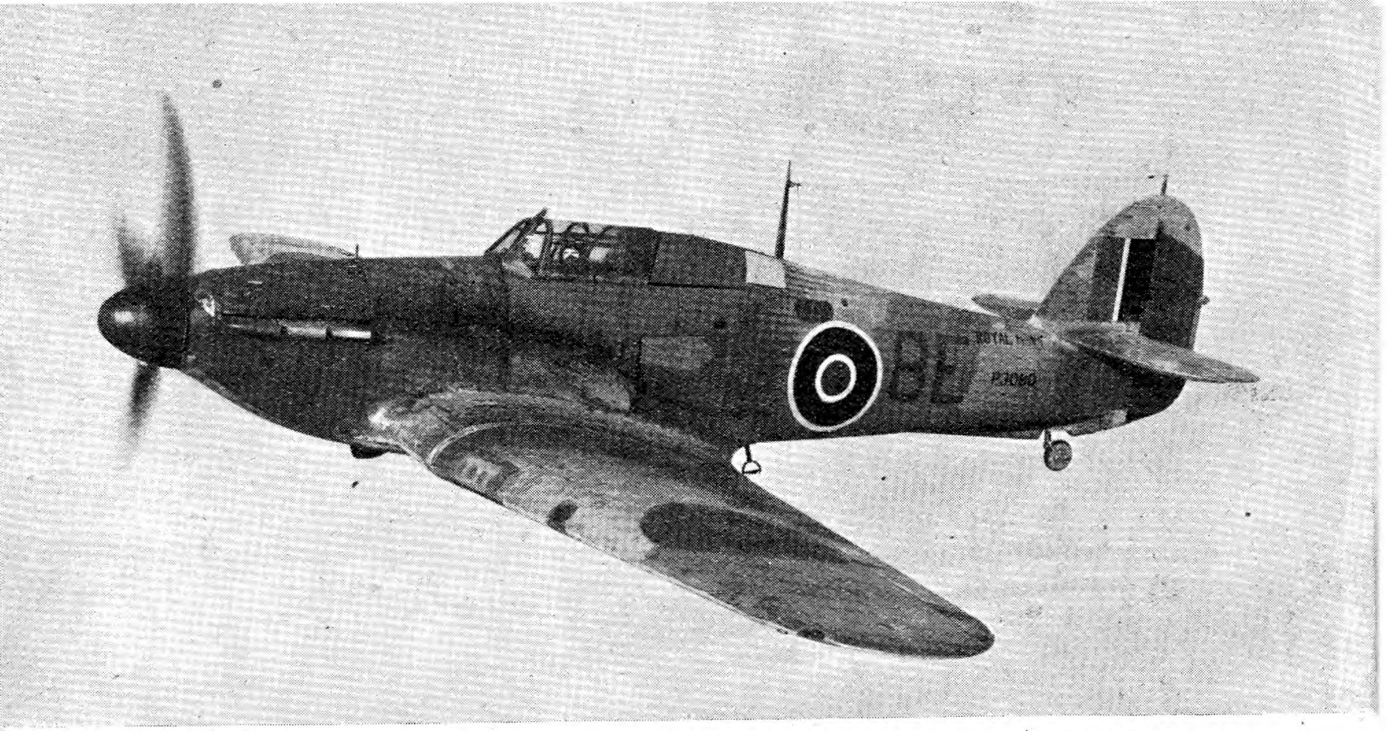
Corsair

Swordfish

Barracuda

Avenger





The Sea Hurricane, which particularly distinguished itself in the Malta convoys of June and August, 1942. During one Malta convoy at least 39 enemy aircraft were shot down by Fleet fighters for a loss of eight.

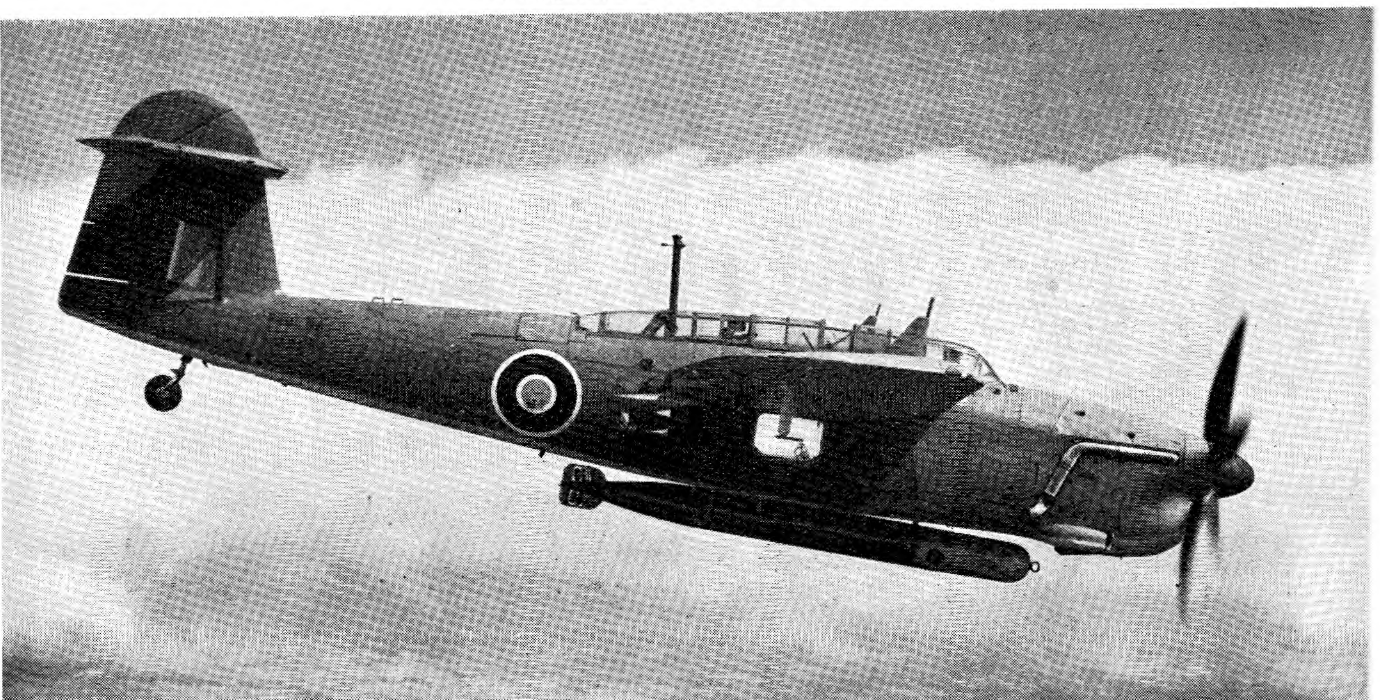
jectile was achieved by naval aircraft from the escort carrier *H.M.S. Archer,* and that naval aviation played a large part in the development of this new weapon, which has been a considerable factor in the defeats inflicted on the enemy on sea and on land.

The small number of warships sunk by hostile aircraft or submarines when carrier-borne aircraft have been present for protection is a sufficient testimony to the efficacy of naval aircraft from the Gladiator to the Seafire and the Swordfish to the Avenger.

I must also pay tribute to the great work done by naval aviation in the United States Fleet. In the words of Admiral King, U.S.N., "the uniform success which has characterised our naval air operations is unmistakably the result of an organisation which was based on the conviction that air operations should be planned, directed and executed by naval officers who are naval aviators. . . ."

Naval airmen must indeed, if they are to achieve success, be seamen. They must be accustomed to ship life, to its smells and noises and to its constant discomfort. To be airmen is not enough. They are part and parcel and a quite natural development of our seagoing heritage, and indeed they form the very spearhead of the striking power of the great service to which they have the honour to belong.

The Fairey Barracuda is replacing the Albacore and Swordfish as the Royal Navy's standard torpedo-carrier. An article dealing with this aircraft appears on page 8.



THROUGH the Royal Canadian Air Force and the British Commonwealth Air Training Plan — the latter conceived just 23 days after Britain declared war, and put into operation three months later—Canada is playing a major role in the defeat of Germany.

The Dominion has sent to the United Kingdom and to other parts of the world thousands of well-trained aircrew and groundcrew personnel. Never a day passes when Canadian boys are not in the thick of things aloft, or working hard servicing the Lancasters and Halifaxes, or the Spitfires, Mosquitos and Typhoons which are among the many types of aircraft Canadians fly.

In 1943 about 39,000 aircrew were trained under the B.C.A.T.P. Last year 41,000 aircrew were trained to be added to the 100,000 already produced in Canada. Enough men will be available, fully trained, to man bomber squadrons in 1945, and if necessary in 1946.

A Good Training Ground

The Dominion, with its varied climatic and geographical features, and its thousands of square miles of fine flying territory, provides every condition needed to produce good aircrew.

There are mountains, the mighty Rockies, which can be used to simulate the Himalayas, over which trainees as aircrew may one day have to fly. There is snow and ice in abundance in the wintertime, providing conditions which may be encountered in Russia or the Aleutians. The great expanses of prairie land, where farmers go to bed early and no light shows after nightfall, are ideal for teaching night flying, instrument flying and blind navigation. For men who will one day join Coastal Command, the shore-lines of Canada provide a variety of conditions such as are found in many parts of the world. Except for extreme tropical temperatures, there are few climatic conditions of the globe not found in the Dominion.

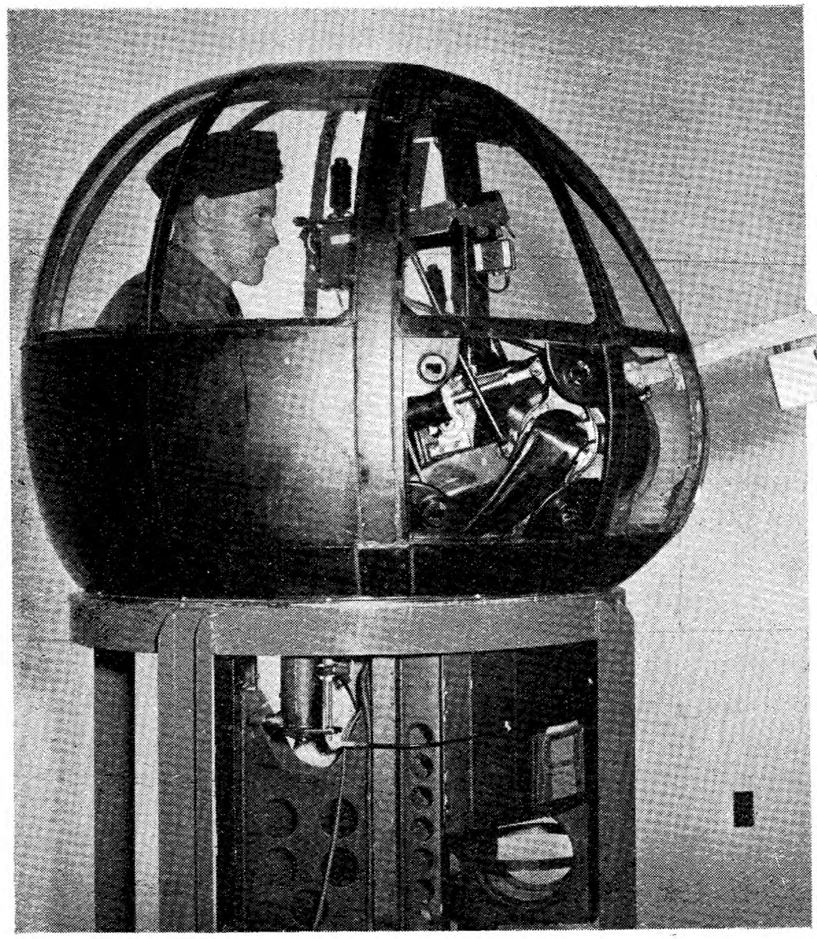
Most important of all, perhaps, is Canada's geographical position in the world. It makes her an ideal place for training fliers. Three thousand miles away from enemy bombers, the Dominion has provided the comparatively normal conditions so essential for the uninterrupted functioning of the plan.

In Canada men are trained to fill every position in aircrew. In the early days of the war, when aircraft had not reached the size of the great bombers of today, a man was trained to fill, all at once, the positions of navigator, air gunner and bomb-aimer, under the inclusive title of "observer." Now, with space in the huge aircraft available for a separate specialist in each position, the B.C.A.T.P. trains men to become individual navigators, air gunners and bomb-aimers.

B.C.A.T.P. trainees attend a number of different schools for their instruction. For instance, future pilots go to flying schools; trainees aspiring to be air gunners or bomb-aimers go to bombing and gunnery schools; potential wireless operators are trained at wireless schools; and would-be navigators attend air observers' schools. Flight engineers go to technical training schools.

How You Become a Pilot

At Initial Training school (I.T.W. in Britain), through which all branches of aircrew pass first, trainees make their first "flight" in a Link Trainer. They also go through decompression chambers, in which atmospheric conditions at 25,000 feet and higher, with or without oxygen, are simulated. Through these important tests experts



An air gunner-to-be operates a gun turret trainer at a bombing and gunnery school.

can determine the exact physical reaction to stratospheric conditions of every man training as a pilot.

Elementary Flying Training School is the next step up the would-be pilot's ladder, and, incidentally, it brings an increase in pay. Here the student is issued with goggles, helmet, flying suit, boots and gauntlets, and now begins not only to look like an aviator, but to feel like one. Instruction in the manipulation of a parachute is given, and at last the student is taken up to see how the instructor flies the aircraft.

After between eight and twelve hours' dual instruction the magic "Try it yourself" comes to the student.

From E.F.T.S. he goes to a Service Flying Training School, where his early flying is also done with an instructor in a more advanced type of aircraft. The already familiar routine of take-off, circle the airfield and land, learnt at E.F.T.S., is resumed, but at a different speed. As the flying training increases classroom studies become harder.

They include navigation, engines, airframes, airmanship, meteorology, armament, wireless and aerial photography.

The day at S.F.T.S. can start even at two a.m., for here pilots learn night flying and are taught to be all-weather airmen. At the end of about ten weeks stiff tests are given, and when these are passed the student receives his "wings" at a presentation ceremony called a Wings Parade. At this moment the student automatically becomes a sergeant pilot, with a still further pay increase.

Air Gunners and Bomb-aimers

Bomb-aimers and air gunners are sent to bombing and gunnery schools for their training. At these, while the gunners are learning how to handle machine-guns, or are studying range estimation and deflection shooting, the bomb-aimers are busy learning all they can about the intricacies of good bombing. Their courses are not long, but are intensive.

During operational flights the bomb-aimer is one of the busiest men aboard the aircraft. He understudies and assists all members of the crew. As pilot's mate he can help the skipper in take-off and landing, and relieve him in the air at the controls in an emergency or if the pilot becomes overtired.

As second navigator he map-reads and takes astro shots of the stars with his sextant while the navigator plots and times the shots for the fixes. He also works complicated and all-important navigational precision equipment, and imparts to the navigator the information required.

The bomb-aimer understudies the flight engineer, with whose instrument panel and duties he must be conversant in an emergency. A keen bomb-aimer usually knows lots about the wireless operator's equipment, too, while in aircraft with guns in the nose he should be able to take over a gun. Furthermore, the bomb-aimer is also the photographic expert, taking all photos from his position.

Wireless Operators

The wireless operator on a bomber has been called "the forgotten man" of aircrew. Forgotten he may often be, amid the more glamorous pursuits of piloting, bombing and aerial combat, but much of the entire crew's welfare, and their lives, depend upon him, and he is one of the most vital cogs in the whole human wheel that makes a bomber function.

Wireless-operator students go to B.C.A.T.P. wireless schools, where they are given the last word in radio training.

For the first several weeks the trainees do classroom work, practising the Morse code as part of their curriculum. Then they are taken up to learn to perform their tasks under any conditions which may be encountered. At the end of the course the wireless operator is permitted to put up "sparks" on his sleeves, emblematic of a qualified wireless operator.

The instruction of a "wop" includes a short spell at bombing and gunnery school, where aircraft recognition and pyrotechnic signals among other things are studied. In addition, the "wop" acquires a knowledge of gunnery and ammunition, in case on operations he should be required in an emergency to take over from an air gunner.

The Navigator

The navigator, once a Jack-of-all-trades in a bomber, with the title of observer, now has his own specific job to do. When he graduates from his navigational course under the B.C.A.T.P. he wears the letter "N" on his breast.

Maps, charts and navigational computers are the tools he works with. He must be able to read maps and charts, must know how to correct compasses and work intricate navigational apparatus.

With the advent of heavy four-engined bombers a new position was created in aircrew—that of flight engineer.

Seated beside the pilot during the take-off or landing, it is his job to assist in handling throttles and under-carriage and flaps, and general control of the engines, until the aircraft is airborne or stationary.

Flight Engineer's Duties

When the aircraft is in flight the flight engineer works before the instrument panel, busily watching the gauges which indicate the working of his aero-engines. Fuel gauges, meters indicating oil pressure and temperature, and even gauges recording the propellers' revolutions per minute fall under his expert eye.

The creation of this position in aircrew brought an opportunity for many excellent groundcrew mechanics to remuster to aircrew. Earlier in the war, due to the shortage of Canadian groundcrew in Britain, R.A.F. airmen formed the bulk of these remustered flight engineers. Gradually Canadian groundcrew overseas remustered into this trade. Now provision has been made under the B.C.A.T.P. whereby Canadians are trained as flight engineers for overseas service.

Training for groundcrew is equally intensive, and the men in the air owe everything to the thoroughness with which the boys in the greasy overalls of this less glamorous but all-important branch of the Air Force are trained.

The Cost

What is this great project costing the Empire countries who are a party to it—the United Kingdom, Canada, Australia and New Zealand? Here are some figures.

When the plan was conceived first, as a three-year project, its cost was estimated at about £120,000,000 (reckoning five dollars to the pound sterling), but early in the summer of 1941 the Minister for Air estimated the joint expenditure of all countries up to March 31st, 1943 (the date the agreement on the plan was to be renewed) at about £164,800,000, plus about £5,600,000 for the completion of training pupils then in advanced schools. A rough breakdown of the later estimate showed this division:

United Kingdom contributions in kind (aircraft, engines and spares)	£38,800,000
Canada alone—being cost of recruiting and manning depots, initial training and elementary training of Canadian pupils	24,000,000
Costs shared by Canada, Australia and New Zealand (of advanced training)	102,000,000
Total	£164,800,000

The £102,000,000 to be spent by Canada, Australia and New Zealand was divided into percentages of 81, 11 and 8; or: Canada £82,200,000, Australia £11,600,000 and New Zealand £8,200,000.

The cost of training a pilot is about £5,000 alone.

Canada's Air Effort in Figures

The following facts may help you to realise the magnitude of the B.C.A.T.P. and appreciate its work better:

Canada has sent over 50,000 aircrew and groundcrew personnel overseas.

For every Canadian member of aircrew in a Canadian squadron overseas there are ten in R.A.F. squadrons.

Canadian Bomber Group today provides about one-fifth of the aircraft sent on the great attacks made on Germany and enemy-occupied territory.

Decorated B.C.A.T.P. personnel are numbered in hundreds, and their awards range from the Victoria Cross to Mentioned in Despatches.

There are over 16,000 women in the R.C.A.F.'s Women's Division.

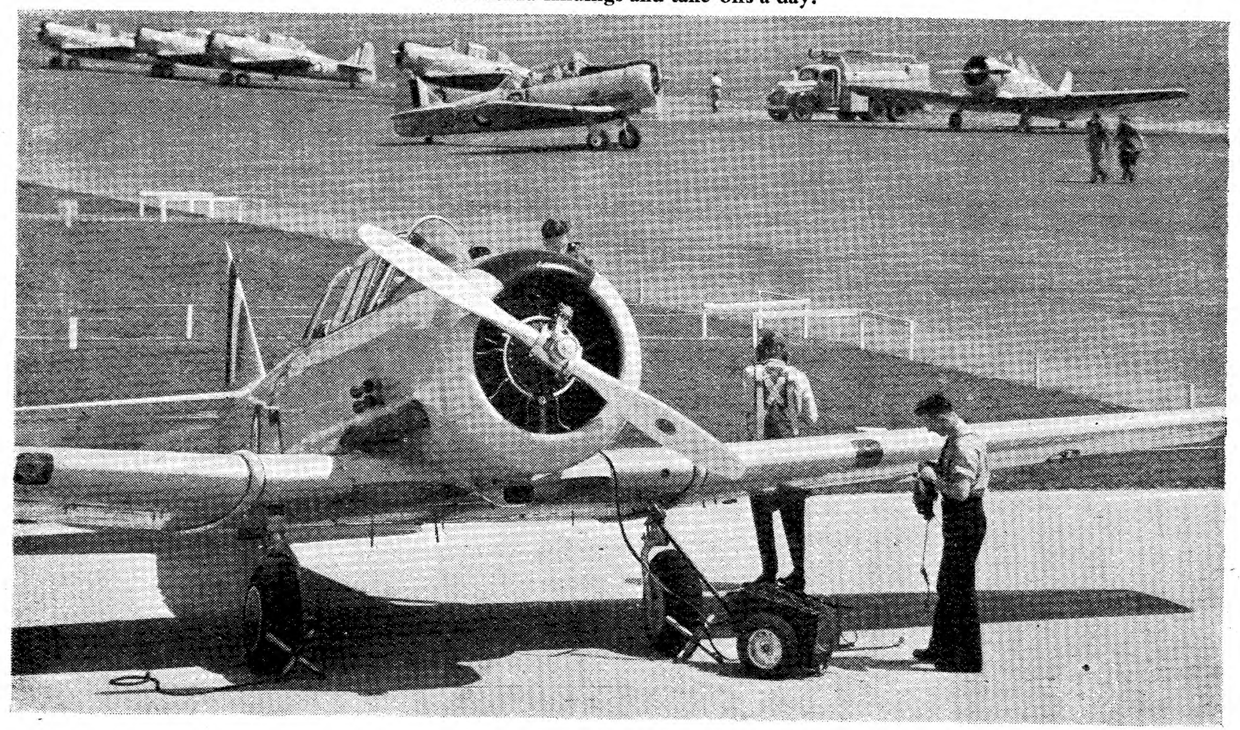
The R.C.A.F. began the war with only about 4,000 personnel. Through the B.C.A.T.P. the Air Force strength today exceeds 200,000.

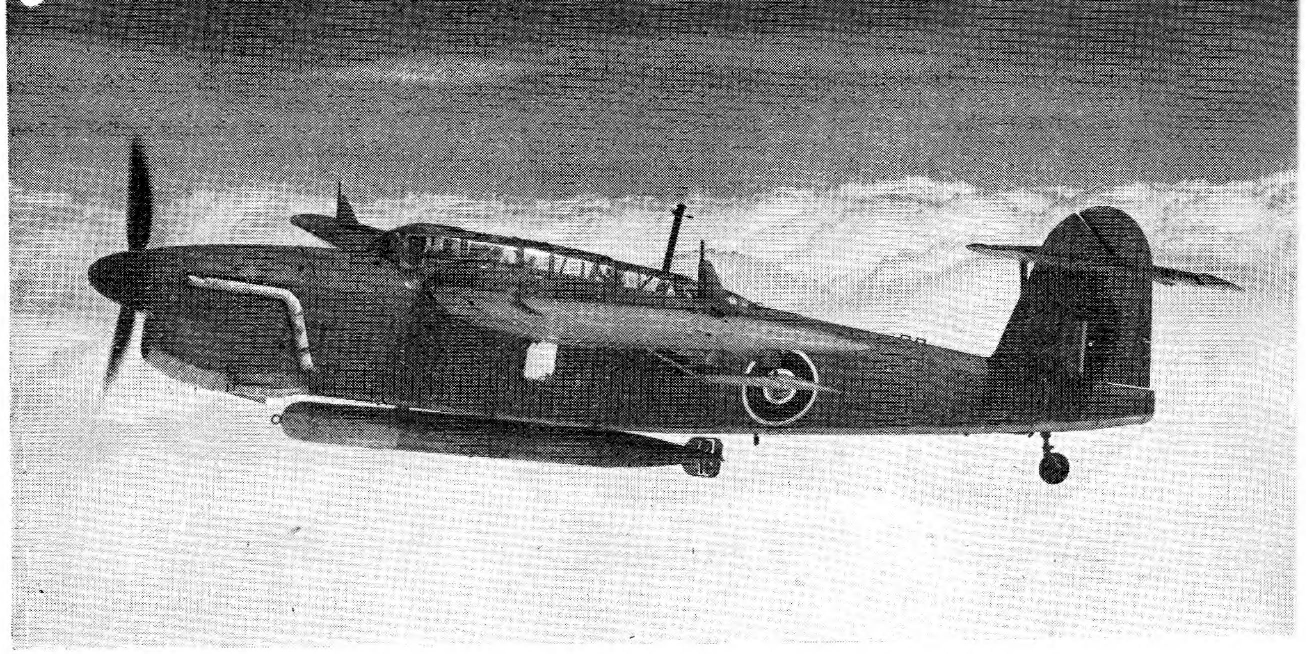
More than 100,000 groundcrew men have been graduated to date.

R.C.A.F. overseas aircrew personnel total 45 per cent and groundcrew 55 per cent of the 55,000 sent abroad.

There are over 40 Canadian squadrons overseas.

A scene at Uplands, near Ottawa, one of Canada's largest R.C.A.F. advanced training schools, which boasts more than a thousand landings and take-offs a day.





Fairey Barracuda

by Roy Cross

FROM its earliest days the Fairey Aviation Co. Ltd. has shown a particularly appreciative understanding of the design requirements peculiar to naval aircraft, and has interpreted them to the satisfaction of the contract-awarding authorities. Such names as Campania, 111F, Flycatcher, Swordfish, Albacore and Fulmar are lastingly inscribed in the annals of the Fleet Air Arm. It is not surprising, therefore, that the latest T.S.R. aeroplane to enter service with the Fleet is a Fairey product.

The Fairey Barracuda was designed to a most difficult Admiralty specification for a three-seater shipborne dive and precision bomber/torpedo-carrier/mine-layer/reconnaissance monoplane, and, as was to be expected, some time had to elapse before all the design and production "bugs" were eliminated. Apart from these perfectly natural delays, other factors, such as removal of priority on certain essential materials and supplies during the crucial 1940 period, hindered the start of quantity production. Large numbers are now with the Fleet, and production at several factories throughout the country is on the increase.

Power

The original intention of the manufacturers' design staff to power the Barracuda with a new X-type Rolls-Royce motor was not carried out. Rolls Royce compromised with an engine specially suited to naval aircraft, the Merlin 32, the fitting of which made necessary the re-drawing of the front fuselage lines. Later some trouble was experienced with the exhaust system. Severe burning of the ducts leading the hot gases away from the exhaust ports resulted in several experimental installations. Service machines now have ejector-type exhaust stubs, one to each cylinder.

To carry a crew of three, a heavy military load, plus the mass of equipment and special construction features demanded by carrier-borne operations, requires firstly a large, weighty aircraft, and secondly, in natural sequence, a motor sufficiently powerful to get the aircraft safely off the deck. The Barracuda's Merlin 32 was developed specially for F.A.A. use to maintain high power at low to medium altitudes and to give full output for take-off from the restricted flight deck of a carrier. The capacity of the motor remains unchanged from earlier Merlins, although by strengthening certain engine parts a much-increased horsepower is available at sea-level. The dry weight of the Merlin 32 has not greatly increased, and its power/weight ratio must be even more impressive than that of the Merlin 20.

The tailplane was originally set low down on the fuselage, where controllability proved to be seriously affected by turbulence of the airflow caused by the operation of the flaps and their position in relation to the wing. Consequently the tailplane was lifted out of the disturbed airflow and now rides high on the fin, strut-braced to the fuselage.

All metal construction is employed throughout the Barracuda, except for the control surfaces, which have fabric covering. The usual special care has been taken to prevent corrosion through contact with sea-water and the salt atmosphere, and the whole aircraft has a special under-coat of protective paint.

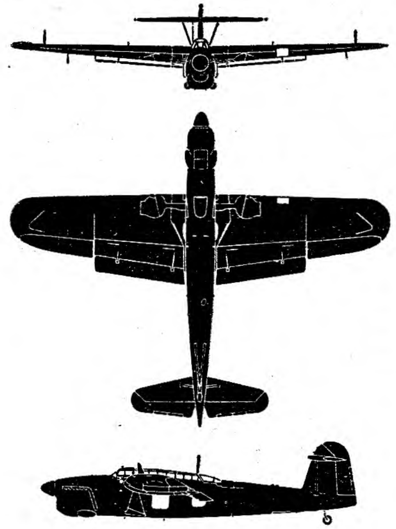
Accommodation

An essential of aircraft design, and particularly important on carrier-borne types, is good visibility for the crew. A good deal of thought was given to this requirement, and it greatly influenced the decision to adopt a high wing position for the Barracuda. The pilot enjoys an excellent view from a position just forward of the leading-edge of the wing, while the transparent top hooding and the large observation windows in the fuselage under the wing provide the navigator and wireless-operator with perhaps a better field of vision than on any other shipborne type. The rear compartment—really two separate cockpits—is well lighted, and accommodates, besides the crew, an amazing amount of gear, radio, navigational facilities and equipment, pyrotechnics, etc., without cramping.

Catapult spools for assisted take-off and a standard V-frame arrester hook for deck landing are placed at specially strengthened portions of the fuselage.

The high monoplane wing carries the Fairey-Youngman flaps, a highspot of the Barracuda design. The flaps, on either side, are outrigged below and behind the trailing-edge of the wing, and have the advantage of leaving the

Below: The official silhouette of the Barracuda II. The Barracuda I had a Merlin 30 with three-bladed airscrew, and is shown in the accompanying photographs by Charles E. Brown. Dimensions are: Span 49 ft. 2 in., length 40 ft. 6 in., height 15 ft. 5 in.



trim of the aircraft unaltered when they are in use. Four flap positions are available—fully depressed for landing, intermediate position for take-off, neutral for normal flying and a negative angle of incidence in which the flaps act as efficient dive brakes.

Folding

For wing folding the portion of the trailing-edge carrying the flaps hinges upward and over, coming to rest in the inverted position on buffers. This action is automatic and controlled from the cockpit. The outer wings are then folded back manually to lie alongside the fuselage, in which position they may be attached to catches in the outer tailplane. For deck-handling during this operation V-shaped rails in the wing undersurface near the tips extend automatically as the undercarriage folds down for landing-on, or alternatively may be released manually by pressing push buttons in the wing undersurface after landing.

Detachable screens just inboard of the ailerons beneath the wing are fitted when the aircraft is carrying bombs on the wing racks. They serve to isolate the ailerons from the turbulence caused by the air flowing over these excrescences, so that full aileron efficiency is maintained.

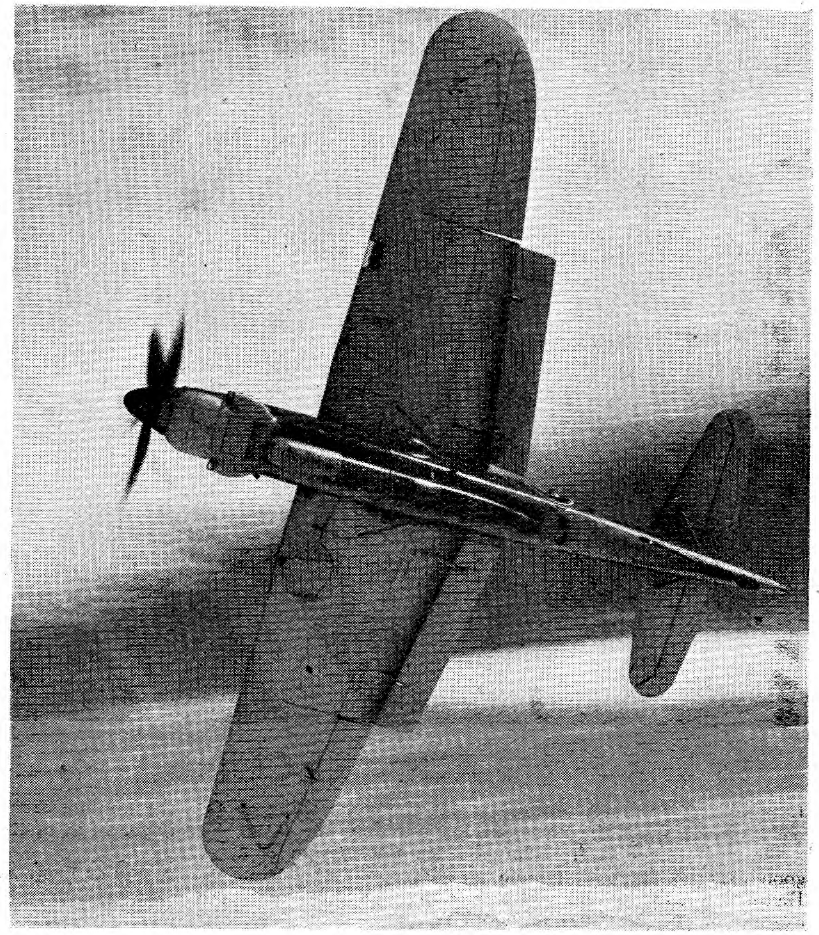
Undercarriage Retraction

The high wing arrangement, while ensuring good visibility from the cockpits, presented some knotty problems regarding undercarriage retraction and accommodation. Normal wing retraction would be difficult owing to the length of the undercarriage leg required. Various ways of getting over this, such as retracting the wheels into the fuselage, were finally rejected in favour of the ingenious system described here. Each main landing-gear component incorporates a horizontal torsion box hinged at its inboard end to the bottom of the fuselage, and a shock-absorber strut at right angles to the box at its outer end. The link strut between the torsion box and the centre section serves to brace the component. The box folds into a well in the fuselage side, and the shock absorber unit and wheel recess into the wing. A wit has suggested that so intrigued were the Fairey engineers at the unorthodox method of retraction they decided to design an aircraft—the Barracuda—around it, rather than the more usual reverse procedure. At any rate, the undercarriage folds neatly away and is totally enclosed by fairing strips and hinged fairing flaps. Operation of the latter upon landing releases the deck-handling rails mentioned above. The oleo-pneumatic legs are specially designed in an attempt to eliminate bounce caused by heavy landings.

Powerful wheel brakes, as well as the landing-gear, hinged trailing-edge and flaps, are operated hydraulically. Full sets of navigation, identification, formation and deck-approach lights are provided. The port wing carries a powerful landing-light.

The advent of the Barracuda marks the beginning of a new phase of Fleet Air Arm operational history. Not only is it the first British shipborne T.S.R. monoplane to enter service with the Royal Navy, but it heralds the re-arming of the F.A.A. with new and up-to-date types. The model attack on the German battleship *Tirpitz* in Alten Fiord, in which Barracudas and their Seafire, Wildcat, Hellcat and Corsair escorts took part, symbolises the ever-increasing potency of the Navy's strength in the air. The Royal Navy is now receiving the best aeroplanes that Allied engineers can devise and produce—the best naval aeroplanes in the world.

The excellent manoeuvrability of the Barracuda, even with a heavy torpedo slung beneath the fuselage, is graphically illustrated here. The recesses for the deck hook and the wing-handling rails are visible in the fuselage and wing undersurfaces. The air outlet from the radiator is seen in front of the warhead of the torpedo.



AIR RECONNAISSANCE

Looking out from an aircraft is not the same thing as seeing things from the air. The camera does the latter better, and this R.A.F. reconnaissance photograph is a good example. It is of Damm airfield, south of Berlin. Damm is a grass airfield laid out in 1934-5. It is a good example of the pear-shaped layout of this type of home base. Apart from the painting of dummy roads across the landing area little attempt has been made at camouflage. Most of the aircraft visible are trainers.

NOTES ON INTERPRETATION

A. Use of Light and Shade.

Due to colour tones and light return, the camera records variations of light and shade not visible to the naked eye, of which the interpreter makes full use.

CONTINUED ON PAGE 26)

The Spitfire VIII. This mark is similar to the Spitfire IX, but has a pointed and wide chord rudder and a retractable tail wheel. It is used chiefly in the Mediterranean area, and has a redesigned, better streamlined air-intake filter beneath the nose.

FLIGHT TEST

by STRINGBAG

Flight testing an aircraft after overhaul is an official duty that can provide quite a lot of unofficial pleasure. "Stringbag", now serving at a naval air station describes such a test.

"C FOR CHARLIE is ready for test . . . will you deal with it?"

The pilot nods his head and bends over the flight-authorisation book, where his name has already been filled in against the number of the aircraft. Under the heading of "duration of flight" the words "as required" have been entered, and next to this appears the squadron commander's initials. Now the pilot scratches his own initials in the next column, acknowledging that he understands what is required of him.

Do *you* understand?

This is not a test pilot's job, for the aircraft has only completed an ordinary periodical inspection. There are to be no terminal velocity dives or "flat out" tests such as were necessary when the prototype of "C for Charlie" first took the air. But just the same, there is a routine to go through which every pilot has to understand. The aircraft is to go on test with perhaps the most junior member of the squadron, but he will be bound as rigidly as the most experienced wizard of a hush-hush experimental unit.

Now, it happened that on the afternoon of writing these words that it was my job to flight-test a Fleet fighter, and the routine which I went through an hour or two ago will serve very well to illustrate what happens. The only reservation concerns the figures. The fighter happens to be one of our latest, and I cannot therefore give away everything to the enemy. It is sufficient to say that it has everything the best type of fighter possesses, including an engine of upwards of 2,000 horsepower.

First of all comes examination of the Form 700 which is laid out on a desk close to the entrance to the hangar. Everybody seems to have signed up — rigger, fitter, electrician, radio mechanic, armourer, the crew who have just made something like 1,000 individual inspections. It only awaits my own signature, and that doesn't take long. In another couple of minutes I am being strapped into the cockpit, and as I fish for the straps my eyes are beginning to wander over a score of dials and about a hundred knobs, taps switches, handles and whatnots surrounding me. The layman would collect a sick headache at the thought of checking such a formidable array, but familiarity helps one to sort out all the gadgets into groups, and, as with the face of an old friend, one can detect by the "expression" on the cockpit's face if anything is wrong.

As nothing catches my eye as out of place, the vital details are attended to individually. By withdrawing the bar which guards the magneto switches, the electrics come on. This means that the undercarriage lights twinkle a bright green (to show that the undercarriage is down), that the fuel pressure gauges, the contents gauges of the various tanks, the position of the flaps, are all shown up instantly, either by a light or by a reading on a dial. They are so clear and easy to read that they are disposed of as being O.K. within five seconds.

While I am doing this I move the control column around to feel that it is free, and a second later I am doing a quick run-over the trimming tabs — the little handwheels which in a few minutes are going to enable me to take hands and feet off the controls to allow the aircraft to fly itself at something like 300 m.p.h. (They are so sweet, these modern fighters, that they scarcely need a pilot for straight and level flight however fast they are travelling.)

Now comes the usual starting procedure—petrol to main, a stroke or two on the priming pump, magneto switches on, starter cartridge in the breech, throttle half an inch open, and finally a call to the fitter down on the ground: "All clear?"

There's nothing to all this—it's just routine, like starting a car in the morning. One hardly thinks about it. It's when the engine is warming up that one begins to notice things specially. The pressure and the temperature of the oil and the temperature of the coolant are, I suppose, the things to which the eye wanders most frequently during these few minutes. If one of them is wrong it is about even chances that you will break your neck if you attempt to take off, or at any rate break the aircraft.

When the engine is warm enough to run up to full power the supercharger boost and the revs. become items of first importance. The 2,000 available horsepower causes quite a draught, so the sliding hood is shut before it is unleashed. Omission to do this may result in its being uprooted from its guides and deposited 50 yards away by the slipstream. If everything is all right after testing the magneto switches and, lastly, the variable-pitch propeller, the chocks can be waved away; and after that the sooner one is off the ground the better. These engines require a wind of about 200 m.p.h. for efficient cooling—and one doesn't reach this speed taxying!

However, there's still one more detail to attend to—button A of the R/T set has to be pressed:

"Hallo, Bughouse. This is Mermaid. Permission to scramble, please." And back like a flash comes the answer from control. There will be no more radio to bother about until I'm in the air now, and even then it will only be a flash—"Hallo, Bughouse. This is Mermaid. Airborne, out."

I get the green light from the control van on the end of the runway, turn into wind, and slowly push the throttle along the whole length of its slide. A jab on the rudder checks the swing as the full power is unleashed, and the smooth tarmac unrolls. Just for a second one's eyes are everywhere. Somehow they succeed in looking at the boost gauge, the rev. counter, the airspeed indicator and the runway all at once. On this particular occasion it is quite a feat, for a duststorm blasts its way out of the cockpit and impartially into my eyes . . .dried mud . . . some ass with dirty boots . . . eyes smarting . . . everything filthy . . . I'll run 'em all in for this.

But long before the flight is over I've forgiven, if not forgotten. I know so well how difficult it is to keep every corner free of dust, specially in winter when muddy boots are inevitable. It is just bad luck that in this particular type of aircraft (and it's true of most) every cranny gives up its grit under the blast of the propeller and deposits it in the pilot's eyes.

Undercarriage selected "up" . . . green lights replaced by red . . . throttle back . . . revs. back . . . hood closed . . . peace at last . . speed nearly two hundred . . . phew, that was an unpleasant take-off!

From now on I've got a real job to do. In what amounts to little more than seconds I'm up to 5,000 feet and all ready. I've got to see that every single gauge is giving a normal reading. I take the engine gauges first, and watch them like a cat watches a mouse. Any abnormal reading will persuade me to run for home as though a pack of hounds were after me. That coolant temperature gauge is the talisman—and the oil pressure gauge, of course. And speed? Well, "C for Charlie" is an old friend, and she reproduces her paces like she did on the first day we got her. By twiddling the trimmer wheels she's flying "hands off" now, covering rather more than four miles every minute.

We climb, and the temperatures rise. Another mile of air separates us from the earth, but everything is still well within the safety limits. The engine is definitely O.K., and I can turn to other things.

Rigging? Well, the trimmers are all normal, and she's flying "hands off."

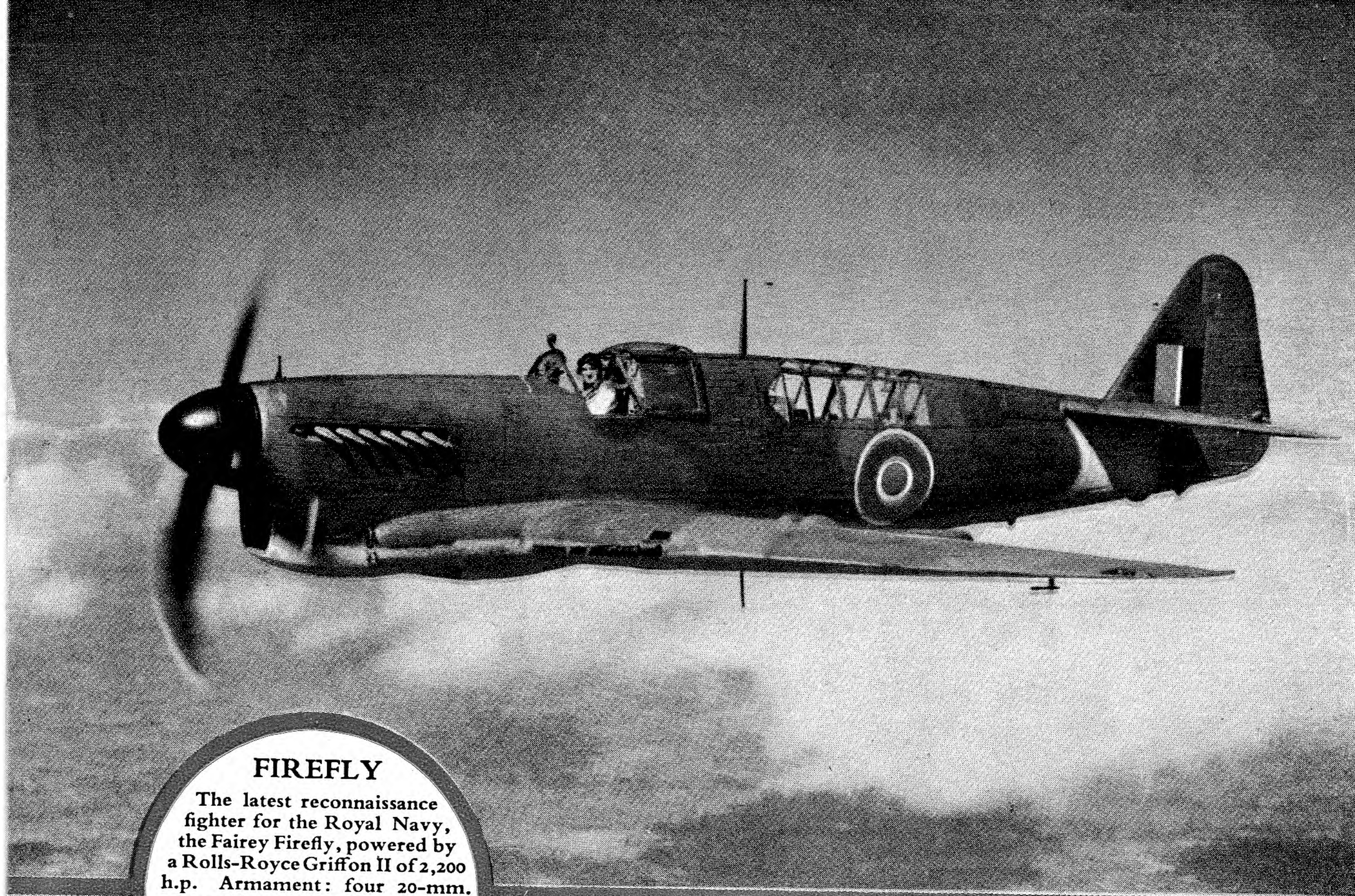
Blind-flying panel? This is easy to test. One only has to watch how the needles behave in turns, dives and climbs . . . but no, the gyro indicator is U/S. By setting the magnetic compass to the south, lining up the gyro, and turning through 360 degrees the magnetic needle is once more back in its original position, but not the gyro indicator. It has precessed ten degrees . . . shall report this when I get down.

Cannons? I'm not testing these today . . . range closed . . . nice job for tomorrow . . . anyhow, the aircraft is not operational at the moment.

And the R/T? It was all right immediately after taking off, but now I'm 50 miles away. Try it . . . switch to transmit . . . "Hallo, Bughouse; this is Mermaid. How are you hearing me? Over." And Bughouse comes back: "Hallo, Mermaid. This is Bughouse. Receiving you strength three. Over." I acknowledge, and am satisfied. Strength three is nothing great, but it's reasonable.

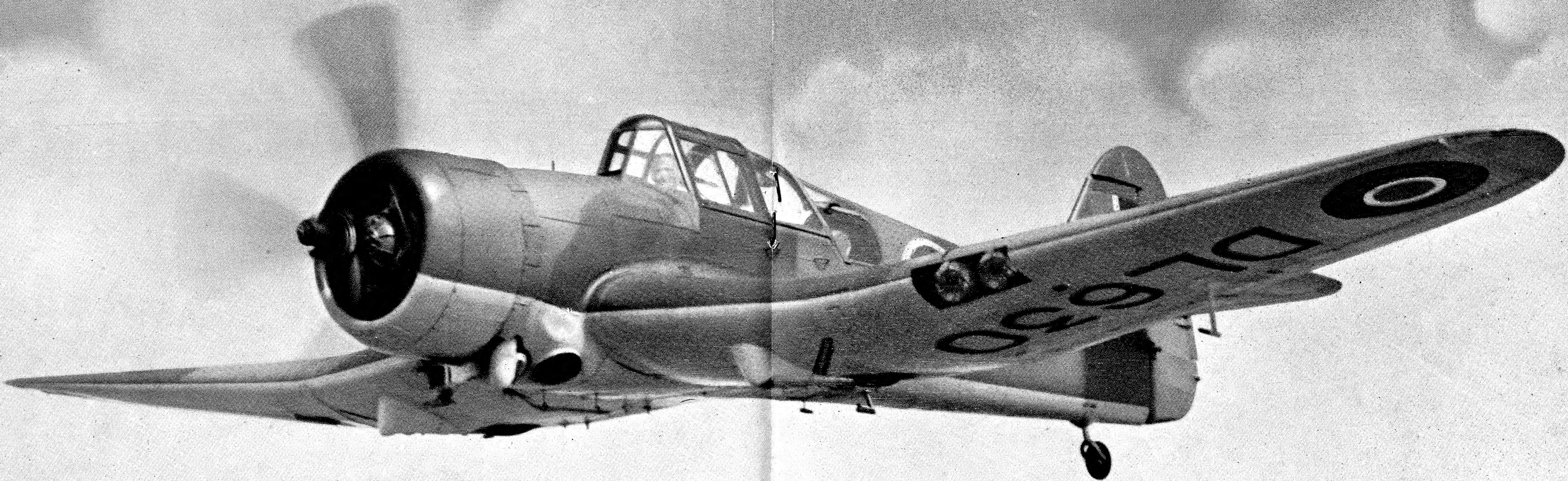
Now I throttle back, put the propeller into fine pitch, lower the undercarriage, and select "Flaps down." Lights twinkle in the cockpit and tell me that the wheels are O.K. for landing. I'm still 10,000 feet up, so the matter is of no urgent moment. In fact, a second later I've opened up again, raised the undercarriage, then the flaps, and pulled the engine back to cruising revs. The test is over.

What happens next is nobody's business. I've 10,000 feet in hand and a superb piece of machinery under me. If this is pointed earthwards and urged on by sufficient horses, the result is quite a speed. If it is pulled up, given aileron and a jab of rudder, the textbooks say something about a barrel roll . . . but I've said this is nobody's business. What's more, there's not another aircraft in this brilliant patch of blue sky, and the cloud sheet below makes it a nice private world. One can shoot a monumental line all to oneself, and then make a landing as though butter wouldn't melt in one's mouth. I did all this, and then returning to the office wrote sedately in the authorisation book, "D.C.O" . . . duty carried out.



FIREFLY

The latest reconnaissance fighter for the Royal Navy, the Fairey Firefly, powered by a Rolls-Royce Griffon II of 2,200 h.p. Armament: four 20-mm. guns. Top photograph is early version with low windscreen and exposed cannon, lower picture is the more recent model with high screen and faired guns.

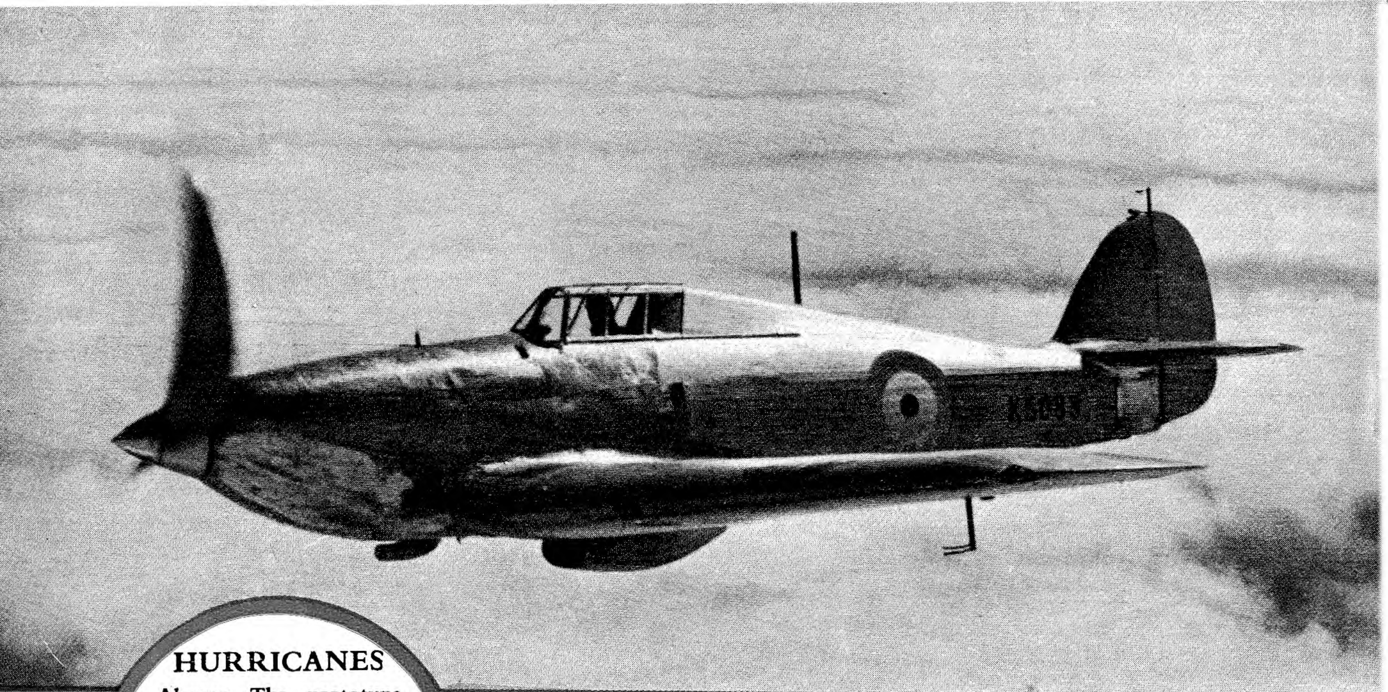


MASTER and VALIANT

This country has overcome the problems of pilot production, largely with the aid of the Dominions through the British Commonwealth Joint Air Training Plan, using aircraft of British and American design, some being built in the Dominions. Among the most famous are the two types illustrated, the Miles Master III and the Vultee Valiant, which are in wide service with the R.A.F. and the U.S. Air Services.

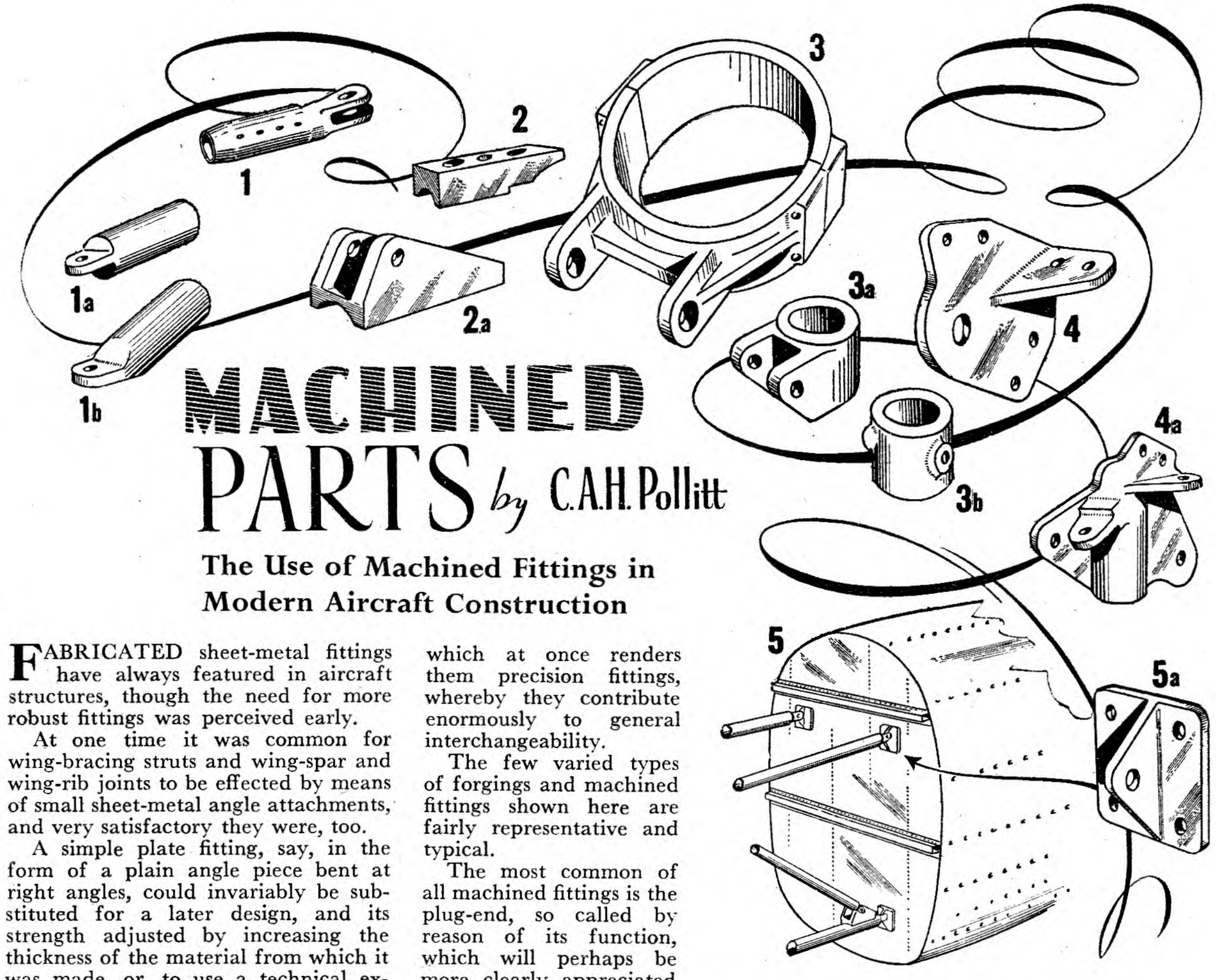
The Master, which first appeared among the new types at the last Hendon Air Display in 1937, is an advanced trainer with, in its latest version, a Pratt & Whitney Twin-Wasp Junior SB4-G two-row radial motor rated, according to Jane's All the World's Aircraft, at 750 h.p. at 9,000 feet, at which height the speed is 231 m.p.h.

The BT-13 (SNV-1) and BT-15 Valiant, built by Consolidated Vultee, are basic trainers with either a Wasp Junior R-985-AN-1 (BT-13A or SNV-1) or a Wright Whirlwind R-975-E3 motor (BT-15). With the Wasp Junior, the maximum speed is 182 m.p.h. at sea level. Both engines are rated at 450 h.p. at take-off.



HURRICANES

Above: The prototype Hurricane of 1936. Over ten thousand Hurricanes have been made since the type went into production in 1937, and the latest mark, the IID, is shown below. This is a tank-destroyer armed with two 40-mm. guns. The Mk. II can also be fitted with rocket-projectile gear.



MACHINED PARTS by C.A.H. Pollitt

The Use of Machined Fittings in Modern Aircraft Construction

FABRICATED sheet-metal fittings have always featured in aircraft structures, though the need for more robust fittings was perceived early.

At one time it was common for wing-bracing struts and wing-spar and wing-rib joints to be effected by means of small sheet-metal angle attachments, and very satisfactory they were, too.

A simple plate fitting, say, in the form of a plain angle piece bent at right angles, could invariably be substituted for a later design, and its strength adjusted by increasing the thickness of the material from which it was made, or, to use a technical expression, by increasing the gauge.

This was all well and good so long as structure loads were sufficiently reasonable to permit them being catered for by such straightforward and simple fittings. But it eventually became obvious that this practice was being outdated by the need for higher reserve factors in heavier and faster aircraft.

It was the advent of high-tensile light alloys which, more than anything else, brought about and probably accelerated the changeover to small castings and, in particular, turned and machined fittings.

As the field of application broadened so the process of manufacture improved, and by the use of die castings and forgings rapid manufacture was combined with still higher-grade materials in the large-scale production of standardised fittings.

Machined fittings—by which is meant all parts cast, or forged and machined, from a solid piece of metal—have probably more prolific application to aircraft structures than have any of the other units. The greatest assets of forgings are the ease with which they can be moulded to any shape, and their greater accuracy, which at once renders them precision fittings, whereby they contribute enormously to general interchangeability.

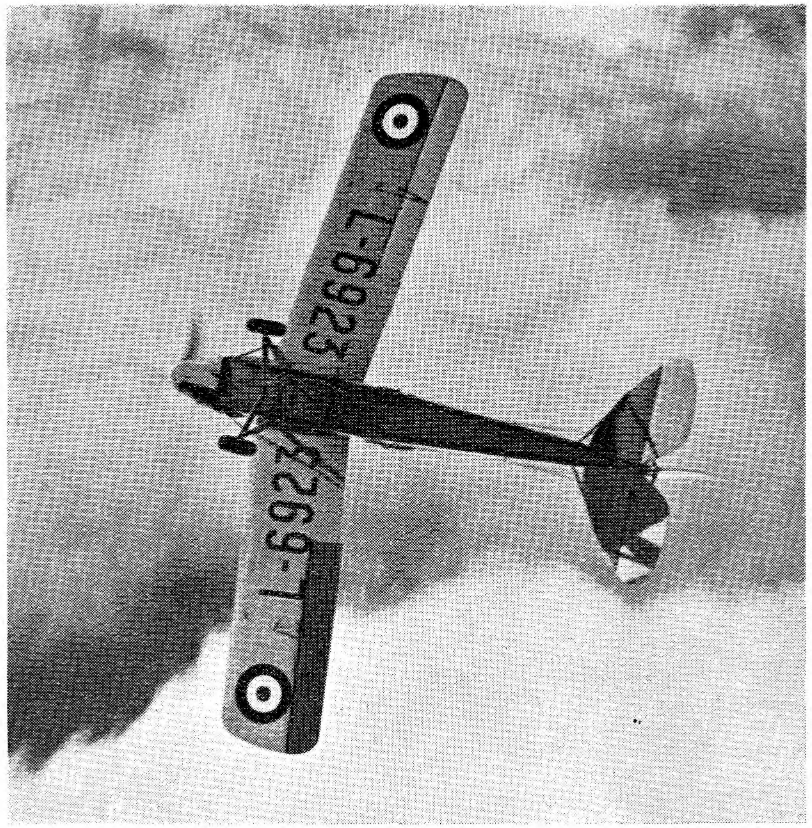
The few varied types of forgings and machined fittings shown here are fairly representative and typical.

The most common of all machined fittings is the plug-end, so called by reason of its function, which will perhaps be more clearly appreciated from Figs. 1 and 1a, where there are shown examples of both the internal and external varieties. In the more conventional form the jaws are produced from the previously shaped spherical end, a practice which arises from the obvious convenience of so doing and is a satisfactory alternative to the profile milling of the jaws.

Slipper fittings also figure prominently on the list (Figs. 2 and 2a). These are similar to another type of fitting usually found on undercarriage retracting mechanisms. This is a short sleeve with lug attached for securing the end of either a bracing strut or radius rod.

On the Lancaster there is an interesting example of this sort of thing in the form of a fitting similar to that shown in Figs. 3 and 3b. This attaches round the undercarriage leg and incorporates two lugs, between which fits the end of the radius rod. This fitting is a good example of neat and compact design, and it will be observed that it is made in two pieces to facilitate removal and replacement without disturbing any other fittings on the oleo leg.

An important feature of any split fitting such as this is the need to arrange the bolts holding the halves together in such a manner that the distance between them, measured across the fitting, is an absolute minimum. On this there depends the the degree of tightness with which the fitting can be made to grip the undercarriage leg, and there is also some gain in strength. With the smaller types of military aircraft, usually in the single-engined category, it is still common practice to incorporate a tubular structure for the pilot's cockpit. This means that the pilot is contained within an assembly of tubes and struts to which it is convenient to attach his many levers and switches. This form of composite construction calls for some sort of fitting with which to attach the tubular structure to the metal shell of the fuselage. One of the commonest methods is to introduce a bulkhead or diaphragm immediately aft of the cockpit. To such a diaphragm it is a comparatively straightforward business to effect the necessary attachment, and an arrangement similar to that shown in Fig. 5 and 5a is typical practice.



The Tiger Moth. [*Flight* photograph

UNDER THE HOOD

IN A TIGER MOTH

by Lieut. R. G. Worcester, R.N.V.R.

FIRST of all, a word about the instruments of a Tiger Moth, which, from left to right, are: A.S.I., altimeter, fore-and-aft spirit level, turn and bank (the central instrument), and on the right-hand side the revolution indicator and oil-pressure gauge.

It is absolutely essential to learn the actions and general characteristics of these few simple instruments and trust them. Bodily sensations under the hood are very strong (especially the agonising certainty of being *tilted*), but they must be conquered, for nearly always they are unreliable and misleading enough not to be able to detect as much as a rate-1 turn.

In the Tiger Moth (or any other light aeroplane without gyro instruments) the three dimensions of flight are shown as follows:

Lateral movements—Top needle of T. & B.

Vertical movements—A.S.I. or spirit level.

Turning movements—Bottom needle of T. & B.

In general, then, it is best to concentrate the full attention on the A.S.I. and the top and bottom needles of the turn and bank. These three vital needles tell you everything you want to know in cloud. It takes about five to eight hours' flying to learn to use these instruments properly. This is the normal routine of a flight under the hood:

Take-off

Take-off under the hood is not easy to learn initially. When you have taxied to the downwind end of the airfield turn into wind and pull the hood into position; there is a little clip just above the T. & B. Adjust the heading on the compass according to the direction of take-off and do the cockpit drill (trim central, petrol on, throttle nut screwed up and slots unlocked). Then fully open the throttle, closely watching the bottom needle. Coarse rudder can be used while gathering speed to keep the aircraft heading straight. When flying speed is nearly reached keep an eye on the top needle to counter any sign of a wing dropping, and watch the A.S.I. as it climbs up. As soon as the wheels are clear of the ground adjust the machine into climbing position, still with the main attention on the bottom needle.

Climb

The correct climbing attitude should give an A.S.I. reading of about 65 m.p.h. Once clear of the aerodrome settle down and relax a bit. If the A.S.I. starts to stray towards 70 m.p.h. it means the nose has dropped a bit, and the merest suspicion of a backward movement on the stick is all that is required. Always make the control movements very gentle, and pause to watch the stick effects upon the A.S.I.: remember, there is a slight lag on the A.S.I., and this must be taken into account. The stick should be held lightly, between finger and thumb, as the aeroplane will, if properly trimmed, fly "hands off." Keep the throttle about an inch or so back from the maximum position, which should give about 2,000 r.p.m., and be sure the oil pressure is around 40 lb./sq. in.

Cruise

When you reach 4,000 feet or cruising height ease forward on the stick very gradually until the spirit level shows level flight, and hold it there till the A.S.I. settles down—which, depending on the aeroplane, will probably be showing about 80 m.p.h. when throttled back to 1,900 r.p.m. Then retrim to fly "hands off."

Turns

Turns under the hood should never exceed rate-½ (half a division on the scale of the bottom needle). A perfect turn will leave the top needle central, since the centrifugal and gravity forces will cancel each other out. But do not worry if slight "holding off" of bank results in the top needle edging outwards until it is in line with the bottom needle. A skidded turn, if done slowly, will reduce compass errors with less likelihood of A.S.I. variations. It is essential to make all turns on to compass courses slowly, otherwise the compass needle will not follow the turn accurately; also the compass always lags on northerly courses, so straightening out should be completed about 20 degrees before north, and on southerly courses the compass needle should be allowed to overshoot the south mark by some 20 degrees. On easterly and westerly courses the needle is fairly accurate.

Spinning

First action: lock the slots and then close the throttle, and pull the stick back slowly till the speed begins to fall away. When the needle registers about 40 m.p.h. pull the stick right back and put on full rudder in the desired direction. At once the bottom needle will register maximum turn (rate-4 on the scale), and the machine will commence the spin. To get out of the spin kick on opposite rudder until the bottom needle is central. It is vital to ignore bodily sensations entirely and use the rudder according to the bottom needle, and firmly if necessary. With the bottom needle in the middle, ease the stick forward and let the speed build up to about 80 m.p.h., then open the throttle to 1,900 r.p.m. and stick back till the spirit level shows level flight. Finally, unlock the slots.

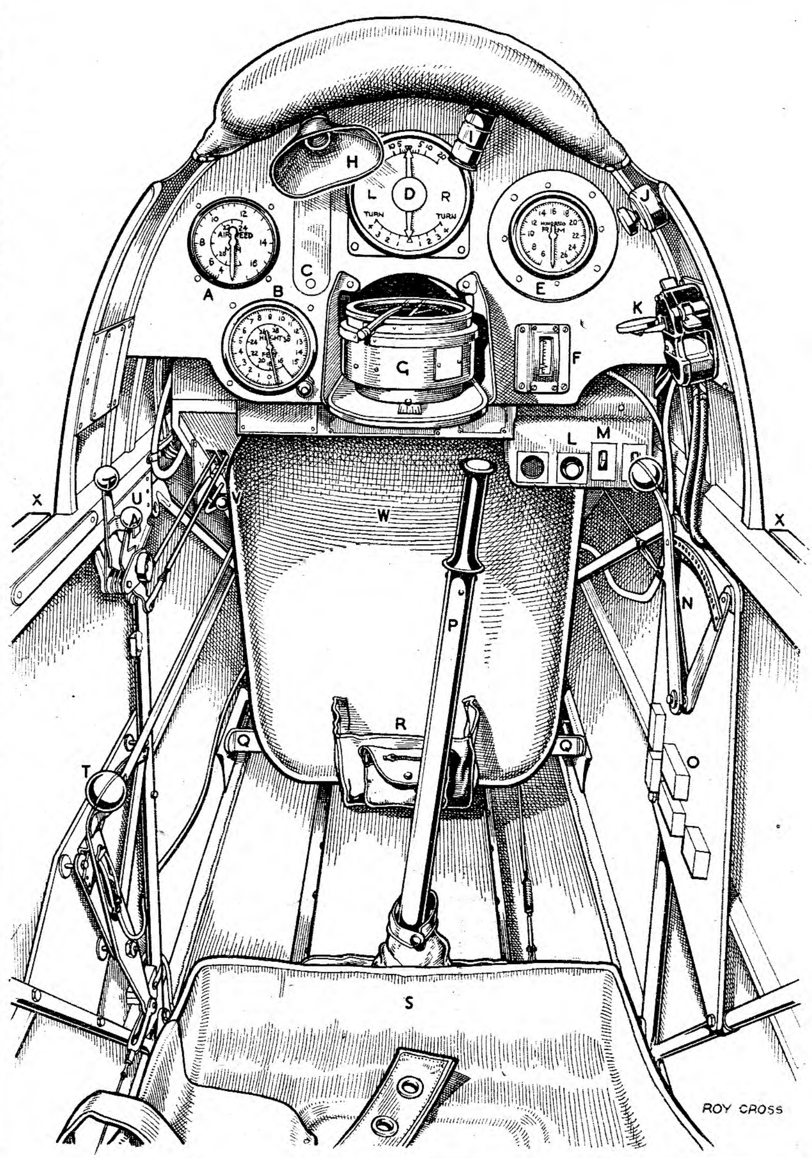
Do not let the speed get too high; if a dive of, say, 100 m.p.h. or 120 m.p.h. develops an unnecessary amount of height will be lost, and in any case it is not easy to return the aircraft to level flight without zooming.

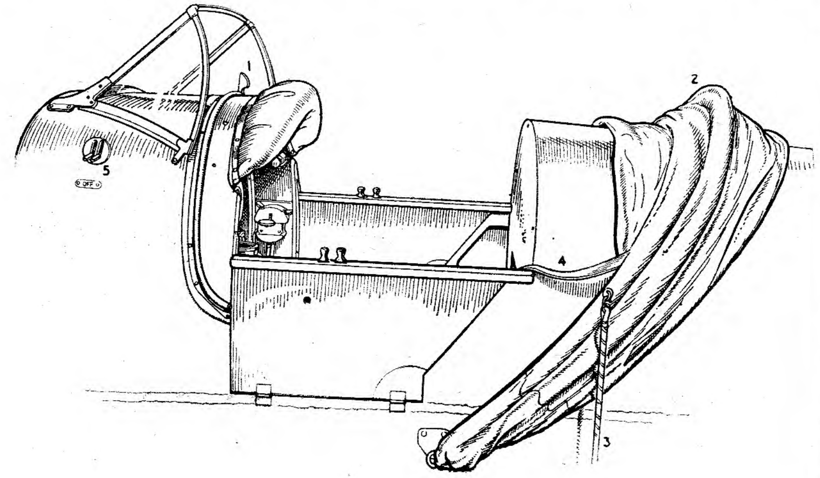
Gliding

Close the throttle fully and put the trim back to the end (or within a notch or two of the end), and hold the glide steady at about 60 m.p.h., taking great care all this time to ensure the bottom needle has not wandered. In all movements keep an eye constantly on the bottom needle, as the rudder is very sensitive on the Tiger.

TIGER MOTH II

Overall length	23 ft. 11 in.
Overall height	8 ft. 9½ in.
Overall span	29 ft. 4 in.
Chord of main planes	4 ft. 4⅜ in.
Dihedral (top plane)	2 deg. 45 min.
Dihedral (bottom plane)	4 deg. 30 min.
Areas	
Main planes (including ailerons)	239 sq.ft.
Ailerons	22.4 sq. ft.
Tankage	
Fuel tank	19 gallons
Oil tank	2.1 gallons
Engine	
Type	Gipsy Major
Rated power at normal r.p.m. (2,100)	120 b.h.p.
Maximum power at 2,350 r.p.m.	130 b.h.p.





Above: The Tiger Moth's rear cockpit fitted up for night flying. A, airspeed indicator; B, altimeter; C, position for spirit level, actually not installed on this particular machine; D, turn and bank indicator; E, r.p.m., fuel-pressure gauge; G, compass; H, speaking-tube mouthpiece; I, dash floodlight; J, dimmer switch for floodlight; K, Morse light tapping key; L, flare release button; M, wing tip flare and navigation light switches; N, locking lever for auto-slots, shown in unlocked position; O, electrical panel; P, stick; Q, rudder pedals; R, bag for course and height indicator; S, seat; T, longitudinal trim lever; U, throttle and altitude levers; V, fuel cock; W, front seat; X, side panels hinged down for entrance and exit.

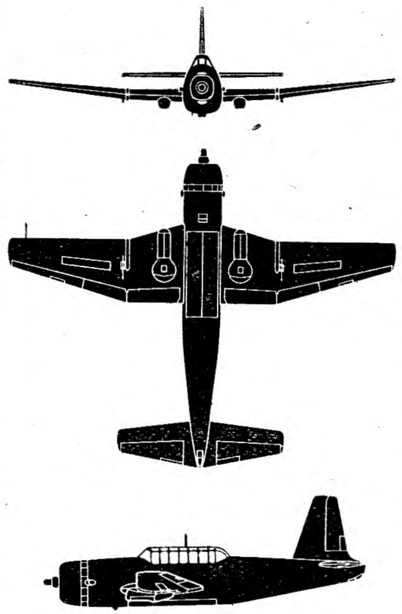
Left: An exterior view of the rear cockpit, with the folded blind-flying hood (2) and the catch which keeps the hood in the closed position (1). 3, elastic hood-retaining cord; 4, pilot pulls on this strap when in flight to close hood; 5, engine switches.

Vultee Vengeance

by Maurice F. Allward

VERY little has been heard of the Vultee Vengeance since it went into production about three years ago, just before the Japanese attack on Pearl Harbour. This is most probably due to the fact that it is serving with the R.A.F. in India, and both men and material posted to that forlorn war-front seem to become automatically part of what has been unfortunately, but popularly, christened the "Forgotten Army," fighting the jungle and the Japanese in fearful conditions. When the war in Europe is over and our efforts are directed wholly against Japan, the exploits of the Far Eastern Forces will be given the recognition and publicity that is long overdue. Then, too, more news of the activities of the Vengeance will be forthcoming.

The Vengeance was conceived at the time when the German Ju 87B Stuka was conquering one European nation after another, at a time when many people did not appreciate the true reason for the success of the dive bomber—that it could gain good results only when opposed by inadequate fighter defences and A.A. fire. The Battle of Britain proved decisively what happens when dive bombers meet a well-organised defence; and later campaigns, notably those in the Middle East, have shown that the Allies were wise in developing the fighter-bomber as their tactical weapon. It is thus primarily a land-based dive bomber, although it is probable that it will perform useful work as a level bomber or fighter-bomber in a similar way that Typhoons and other fighters turn dive bombers when the situation so demands. A modern warplane is not likely to be a very great success if it cannot be used for purposes other than that for which it was designed. Hurricanes, Beaufighters and Mosquitos, to name but a few would be famous if only by reason of their versatility.



CONSOLIDATED VULTEE VENGEANCE A-31 & A-35

Four .300 in. wing guns and two .300 in. rear-firing movable guns. Maximum bomb load 1,500 lb. Span 48 ft., length 39 ft. 9 in., height 13 ft. 7 in., wing area 332 sq. ft. Loaded weight 12,480 lb. Performance: maximum speed 275 m.p.h., service ceiling over 20,000 ft. (figures from Jane's). Power plant: one Wright Cyclone GR-2600-A5B radial motor rated at 1600 h.p. at 2400 r.p.m. at sea level on 91 Octane fuel.

However, with its 1,600-h.p. Wright Double-Row Cyclone GR-2600-A5B-5 14-cylinder two-row air-cooled radial engine, the Vengeance is a formidable dive bomber, and should be a valuable asset to the United Nations before the Japanese are finally beaten.

Size and Range

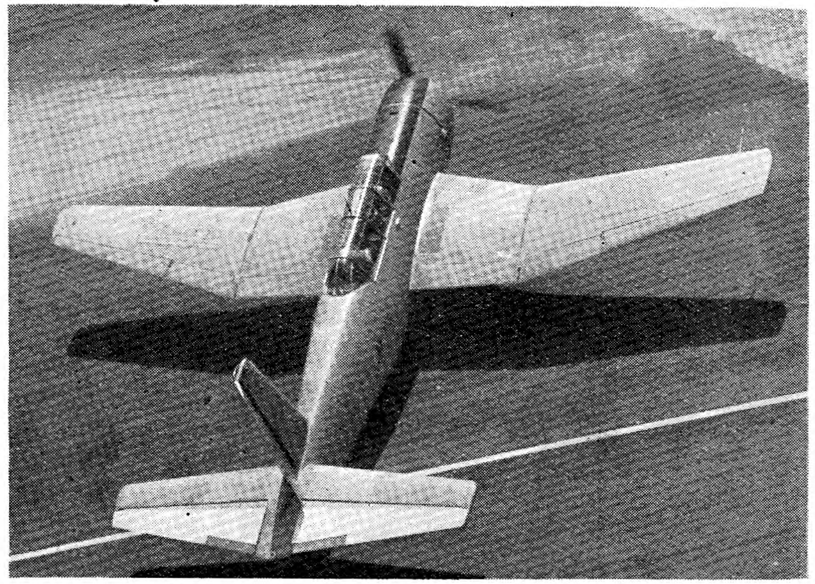
In common with many other American warplanes, the Vengeance is of very generous proportions compared with contemporary British types. This is another indication of the duties for which it was intended, and the large amount of fuel carried inside the deep fuselage gives the Vengeance the wide radius of action so essential in the Pacific theatre of operations. With long-range drop tanks slung under the wings, the operational range is nearly 2,000 miles with a full military load of one ton.

Armament

The bomb load, usually four 500-pounders, is carried horizontally in the fuselage underneath the pilot, and is extended for dive bombing. To help the pilot with his navigation, and to ward off attacks from the rear, a second person is carried in the aft cockpit who operates a pair of .303-inch machine-guns. The pilot keeps down the heads of any offensive-minded anti-aircraft gunners by means of other .303-inch machine-guns installed in the wings. Later it is probable that these will be replaced by that far more effective gun, the .5-inch. The fuel tanks are self-sealing, and a heavy weight of armour plate protects the crew as well as some of the most vital parts of the airframe.

The fuselage is of semi-monocoque construction with a very clean surface, resulting in a low skin drag. The cantilever wings of stressed-skin construction are fitted with specially designed hydraulically operated dive brakes, on both the upper and lower surfaces, which hinge up and down respectively. These keep the speed constant during the almost vertical dive. Attached to the front spar is the backwards retracting undercarriage, the wheels of which turn through 90 degrees to lie flat in the wing. A point of interest concerning the wing is that the sharp sweep-back of the centre section was not there originally. The wings were designed with a straight leading-edge and a tapered trailing-edge, but an unfortunate error in the initial weight calculations resulted in the estimated position of the centre of gravity being farther forward than it really was. To correct this the wing had to be moved aft, and this was done with the minimum of re-design by cranking the centre section backwards to form that very distinctive feature of the Vengeance. Had the wing been moved back as a complete unit, this would have entailed very extensive alterations to the fuselage, which, as it was, were largely avoided by the ingenious step taken.

One of the most useful gadgets incorporated on the Vengeance is the special trim tab fitted to the rudder. This acts as a servo tab at high speeds, and enables the pilot to use the rudder without applying excessive force to the rudder bar, yet at low speeds it retains the all-important "feel" that is essential when landing or flying near the stalling speed. This tab means that it is possible for the pilot to keep on his course without having to trim the rudder all the way down the dive, as is the normal practice. The pilot is thus able to concentrate on aiming at the target undistracted by having to retrim.



This top view of the Vengeance shows to advantage the angular lines, the cranked appearance of the wing due to the kink in the leading edge and the forward-placed fin and rudder.

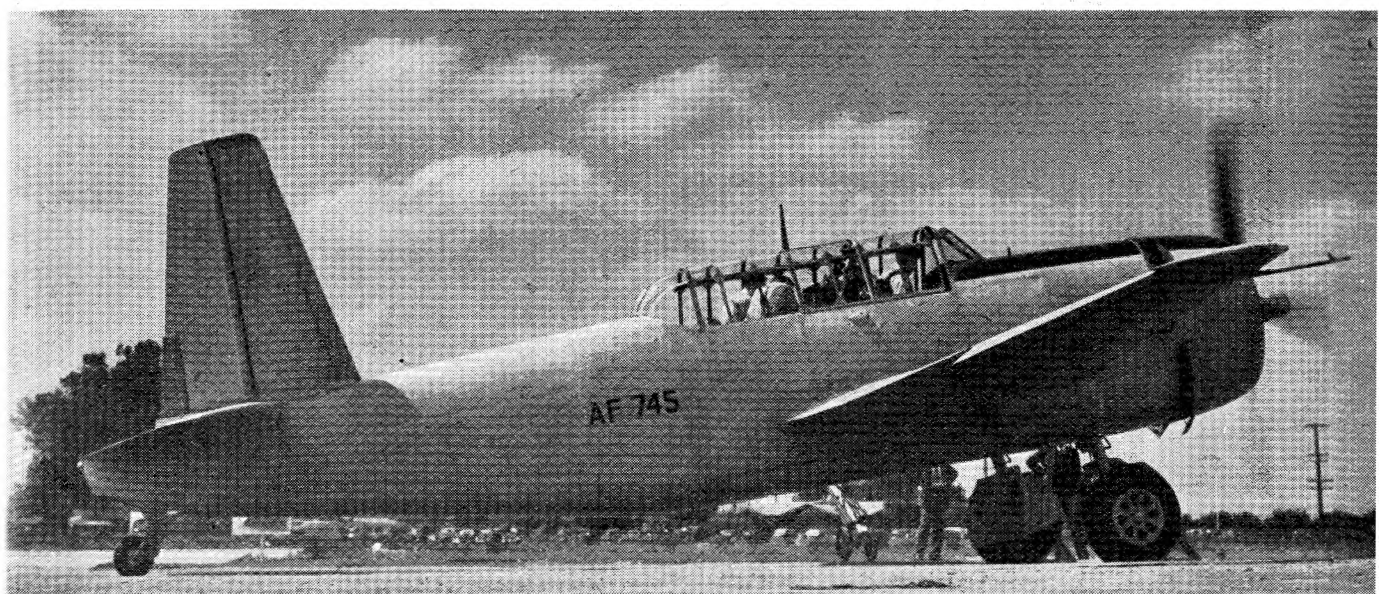
Recognition

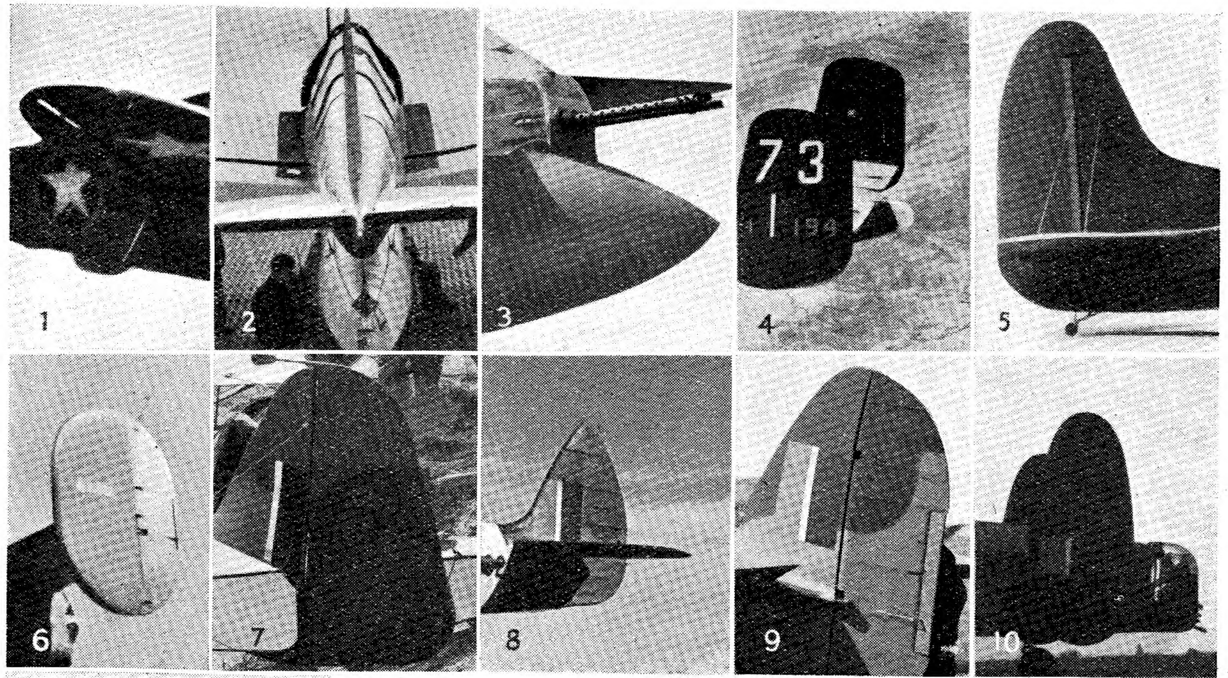
The greatest recognition feature of the Vengeance is its angularity, unbroken by a single smooth curve. The tall square-tipped fin and rudder, set well forward of the tailplane, is visible from a great distance. In front view the marked change of dihedral outboard of the prominent "knuckles" of the undercarriage is very noticeable. In plan view the wings are of distinctive form, with the sharply swept-back centre section and the tapered trailing-edge of the outer wings. The span is 48 feet, the length 40 feet; the top speed is just over 275 m.p.h. and the range 1,200 miles while cruising at 200 m.p.h.

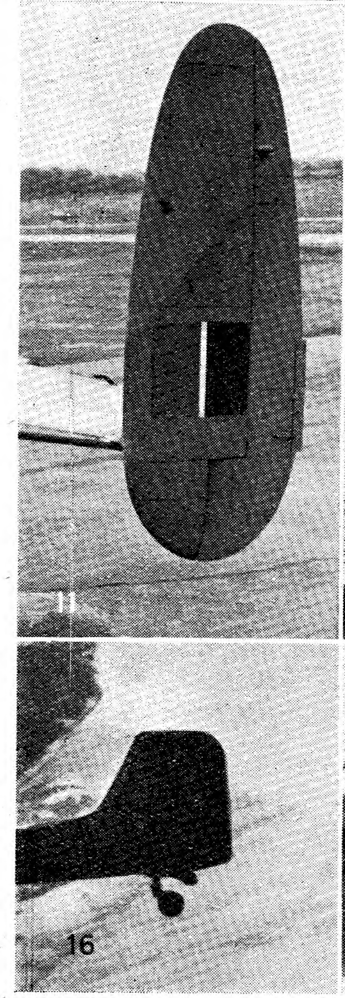
The Vengeance as supplied to the U.S.A.A.F. is known as the A-31, the name Vengeance being bestowed by Britain when the Purchasing Commission ordered some in July 1940. A slightly modified version has been reported in service with the U.S. Navy, and is then designated the TBV-1. This probably carries a 22-inch torpedo slung externally, and this version was to have been called the Georgia.

The Vengeance was designed by Mr. R. W. Palmer, of Vultee Aircraft Incorporated, of Nashville, Tennessee.

The sturdy undercarriage and deep fuselage are apparent here as the Vengeance warms up before take-off. Both this and the photograph at the top of the page appear to be of the prototype machine.

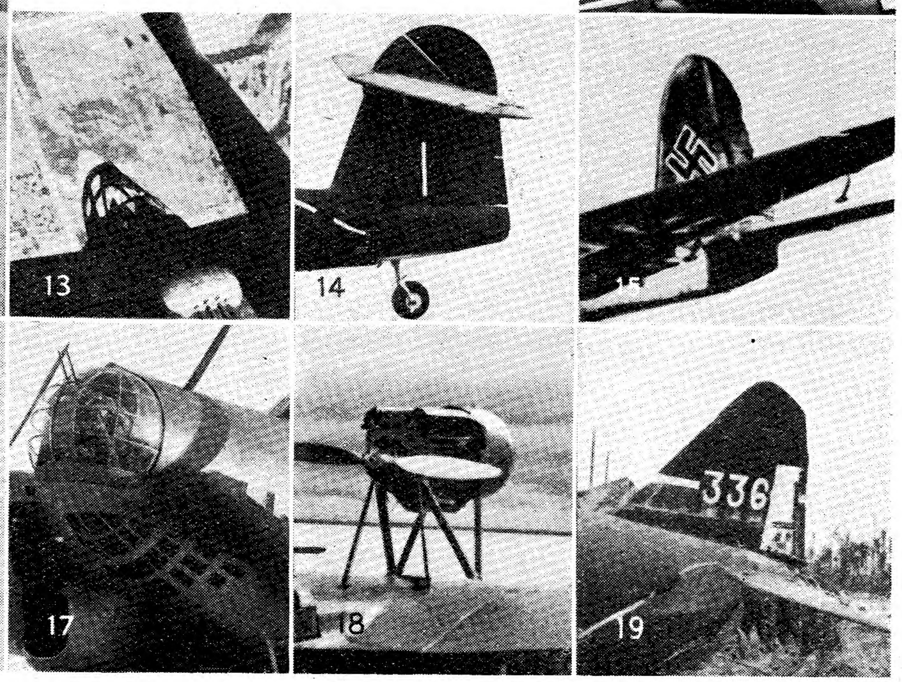


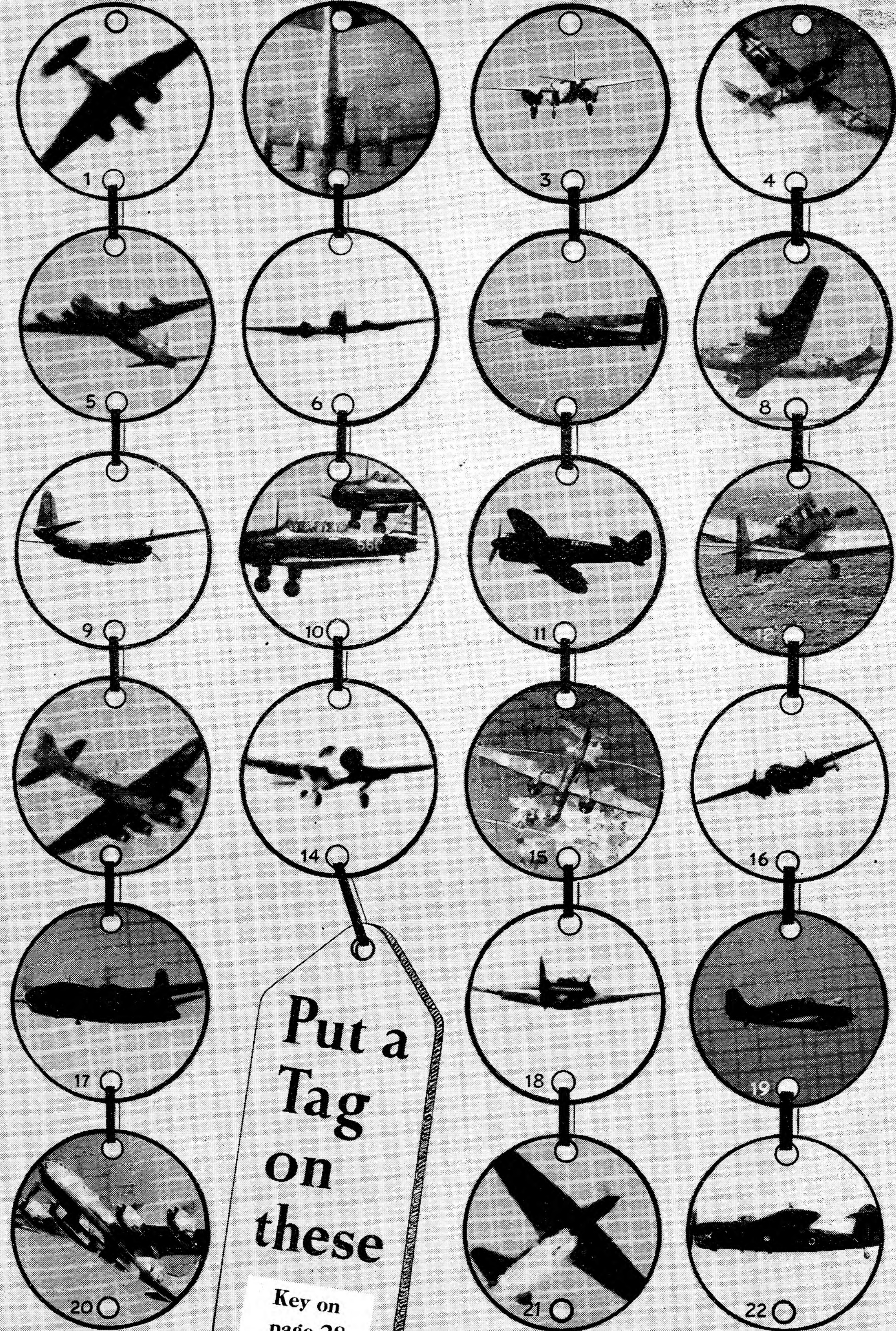




DISCERNIBLE DETAILS

For Key see page 28.





Put a Tag on these

Key on page 28

BOOKS

Unofficially Reviewed by the Editor

The Air Battle of Malta
His Majesty's Stationery Office. 1/-.

A well-illustrated official account of the great air battle of Malta—the island which stood out for so long against what seemed to be overwhelming air attack. The booklet has 96 pages of good paper, with paper cover.

British Aircraft
VOLUMES I and II. By R. A. Saville-Sneath. Published by Penguin Books. 5/-.

In volume I Mr. Saville-Sneath describes and illustrates modern British aircraft which we all know, and in volume II deals largely with older aircraft, but has sections on jet-propelled aircraft, gliders, rotor planes and helicopters, British aero-engines and airships.

Taken together, the two volumes form a valuable catalogue of British aircraft of today and yesterday.

War Planes of the Nations
By William Winter. Published by George G. Harrap & Co. Ltd. 15/-.

An ambitious attempt to describe and illustrate the aircraft of all nations. The 389 pages are not sufficient to deal with them all adequately, and many of the particulars are out of date. Some of the aircraft included are now of no interest. There are photographs and three-view drawings, but some of the latter are not so good as others.

Aircraft Classified
By Edward J. B. Irving. Published by Harpers of Holloway. 3/-.

The classification and coding of aircraft is a fascinating procedure which most of us have attempted at some time, but our systems appeal to ourselves more than to others. Here the author has made a gallant attempt to classify 600 aircraft by constructional features and functions, and succeeds in presenting a pocket-book which has the air of a ready-reckoner.

Radio for Aeroplanes
By D. Hay Surgeoner, A.F.R.Ae.S. Published by Longmans, Green & Co. Ltd. 3/6.

A brief and clearly written introduction to aircraft radio, including chapters on direction-finding and beam approach. Intended for the wireless operator, it should be of value also to other members of the aircrew who wish to know something about radio.

Elementary Mathematics for Radio Students
By W. E. Flood, M.A. Published by Longmans, Green & Co. Ltd. 1/6.

Although this book starts off simply enough with the statement that "A fraction is part of something," it quickly becomes more involved, and is intended for the reader who has had a reasonable grounding in mathematics but desires practice in the calculations especially required by radio students.

A Complete Course in Elementary Aerodynamics
By N. A. V. Piercy. Published by English Universities Press Ltd. 21/-.

The title well describes this book. It is not a highly technical treatise, but it is not for those who want a superficial understanding of the subject "without tears." It presupposes an elementary knowledge of algebra, geometry,

CONTINUED ON PAGE 26

BOOKS

CONTINUED FROM PAGE 25

trignometry and mechanics, and should be of value to the instructors and intelligent students who intend to pursue the matter further.

The Great German Conspiracy

By H. W. Blood-Ryan. Published by Lindsay Drummond Ltd. 12/6.
Fear of a third world-war is in everybody's mind. This book tells how the first one led to the second, and should give the reader some idea of how to prevent it happening again.

AIR RECONNAISSANCE

CONTINUED FROM PAGE 10

(*a*) Freshly turned-over earth (spoil) shows up white.
Examples: Newly dug slit trenches at 'K'. Levelling operations at 'L'.

(*b*) Disturbed earth remains a lighter shade for a considerable time, but if vegetation is allowed to grow it usually grows thicker in the disrupted patch and appears dark on the photograph.
Examples: Levelling operations when airfield was constructed still evidenced by scraped effect on landing ground. In places the layout of the old field system may still be discerned.

(*c*) Vegetation gives rise to varying tones due to colour and richness.
Examples: Field system. Damp ground produces thicker vegetation, which reproduces dark on the photograph; white crosses on airfield probably indicate a damp unserviceable patch.

(*d*) Tracks generally appear light, with used tracks lighter than unused ones.
Examples: Compare perimeter track at 'X' with dummy road at 'Y'.

B. USE OF SHADOW.
Shadows indicate the third dimension.
Example: Aircraft hangars, earthworks 'M', aircraft shelters, trees, control tower at 'N'.
NOTE: When interpreting an aerial photograph always turn it so as to be looking up-sun, with shadows coming towards the eye, otherwise inverse effect may occur; e.g., hole in ground may appear like a mound.

C. SCALE.
Scale is calculated from measuring a known length on the photograph, such as the wingspan of a well-known type of aircraft.

DAMM AIRFIELD
A, Barracks. B, Headquarters buildings. C, Compass swinging base. D, Servicing tarmac. E, Light railway. F, Refuelling point. G, Ammunition dump, H, Aircraft hangars. I, W/T station. J, M/G and rifle ranges. K, Slit trench. L, Levelling operations. M, Strong points. N, Control tower. X, Perimeter track. Y, Dummy road.