No. 2962 Vol. L

AUGUST 1st, 1946

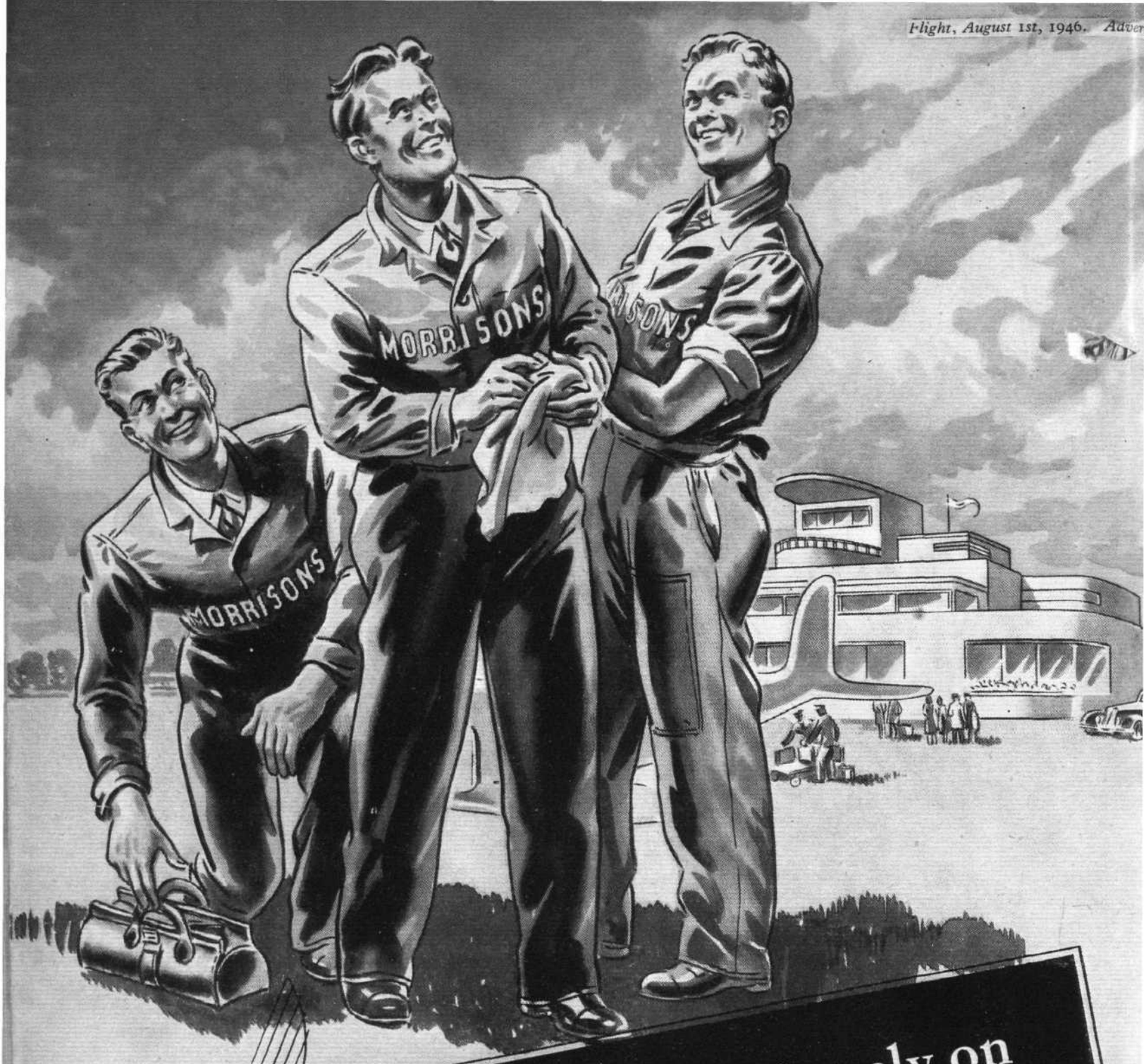
FLIGHT

and

AIRCRAFT ENGINEER

OFFICIAL ORGAN OF THE ROYAL AERO CLUB

ONE SHILLING



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FLIGHT and AIRCRAFT ENGINEER

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The Outlook

That "Fifth Freedom"

LESS than two years after the famous Chicago Conference, the United States Government has served notice of its intention to withdraw from the international air transport agreement at the end of the year's notice stipulated. That means, for one thing, that instead of having most of the world's air transport presented to her on a platter, America will now have to make separate agreements with the countries through which she wishes to operate her air services.

Incidentally, this move by America is a complete vindication of the British point of view on the so-called "Fifth Freedom," expressed so forcefully at Chicago by Lord Swinton, who was at that time our Minister of Civil Aviation under the Coalition Government.

It will be recalled that the United Kingdom proposed a multilateral convention which would cover the first four freedoms, but that the fifth freedom should be the subject of bilateral negotiations. This fifth freedom was the right of the aircraft of a state to pick up and set down intermediate traffic on long international routes.

At the time of the Chicago Conference the fifth-freedom agreement was signed by ten Latin-American states, by the U.S.A., and by the representatives of China, Sweden, Afghanistan, Liberia, Lebanon and Turkey, the last-named with considerable reservations.

Practical experience since Chicago has not fulfilled the expectations of the U.S. Government, and the modified form of the fifth freedom included in the Anglo-American agreement at Bermuda appears now, on more mature reflection, to have made America realize that circumstances alter cases, and that a sweeping unilateral agreement on the fifth freedom would not be likely to bring the United States the benefits which had been expected.

The announcement of America's change of policy has scarcely come as a surprise, since she has been hard at work making bilateral agreements for several months and will doubtless continue to do so. Thus at the expiration of the one year's notice there will be no hiatus in her dealings with other nations on this aspect of commercial air transport.

The Scots Spanner

WITH an energy and eloquence worthy of a better cause, the House of Lords in a two-day debate did succeed in throwing a spanner into the works of the Civil Aviation Bill. The first debate took place when the Bill was considered in Committee, and the second in the Report stage, when the Opposition forced a division on an amendment by the Earl of Selkirk. The amendment was carried by 62 votes to 24.

That there is far too much centralization in the Government's Civil Aviation Bill was the Earl of Selkirk's argument, and with that we are in complete agreement. But that a separate corporation for Scotland should be established does not appear to us a logical way of attaining decentralization. Our past comments will have convinced our readers that we are not ardent admirers of Lord Winster's aviation policy, and thus if we say that in this instance we believe his proposal to set up a Scottish division and a Scottish advisory committee is preferable to the Scottish corporation claimed by the Peers, we shall not be suspected of having been won over to the policy of the present Government. There are other aspects of the Bill which are in far greater need of amendment.

But if the subject of the debate was, in itself, not one which commended itself to most people, it served a useful purpose in indicating to the Government that the country is not unanimously behind it in whatever it decides to do. That is all to the good, and in the Commons there has been too much uncritical acquiescence in all recent Government measures. The Government defeat in the Lords had the result that the Bill had to go back to the Commons on Monday of this week.

The Bill in the Commons

THAT the Commons should reject the new clause proposed by the Lords was, perhaps, a foregone conclusion, and so the Bill is still hanging fire. Rather more surprising was the fact that there should be quite a lot of Socialist opposition to a suggested change in the composition of the Air Transport Advisory Committee. This change, which the Government asked the Commons to approve, was alleged to be part of a bargain made with the Lords to get the Bill through the Upper House, and that the House of Lords had been used to flout the expressed wish of the Commons.

The attempt to raise a constitutional issue between the two Houses was sharply rebuked by Mr. Ivor Thomas, the Parliamentary Secretary to the Ministry of Civil Aviation. He described as unrealistic the argument of some Members which, in effect, meant that the Commons must never agree to any amendment made by the Lords. He even went so far as to describe some of them as behaving like spoiled children. Mr. Thomas has had many unenviable tasks, and he has performed them with a skill which one must admire, even while disagreeing with the cause he was championing. In this instance he gained considerably in stature by his handling of a thorny situation, and the much criticized change was carried by 151 votes to 30.

Speed and Height

THIS issue contains a great deal of material dealing with the two aspects of flying which are most prominent at the present time in military aviation and research: speed and height. The article on jet fighters examines past achievements and speculates on possible future developments. There is ample scope for ingenuity, and equally there are many possibilities for taking the wrong turning at the numerous crossroads and forks. Consequently it will be intensely interesting to watch the success or otherwise of different designers during the next few years.

In the field of actual achievements, although the High-Speed Flight of the R.A.F. has not yet received its Meteors, the machines are being groomed by the Gloster test team, whose vitally important part in the work is described in this issue. Without that work the attempt to raise Group Captain Wilson's record to 1,000 km/hr (621.37 m.p.h.) could not have been undertaken with any degree of confidence. As it is, there is every chance that the R.A.F. will be able to attain that coveted figure.

By taking a Meteor to 46,500 ft Sqn. Ldr. Stanbury showed that this remarkable aircraft is by way of being in the world-record class in height as well as in speed. That it did not reach record height on this occasion is of minor importance. The flight was not officially observed and thus could not have been claimed in any case, but for an unpremeditated effort it was worthy of all praise, and provided yet another proof of the high quality of Gloster design and personnel.

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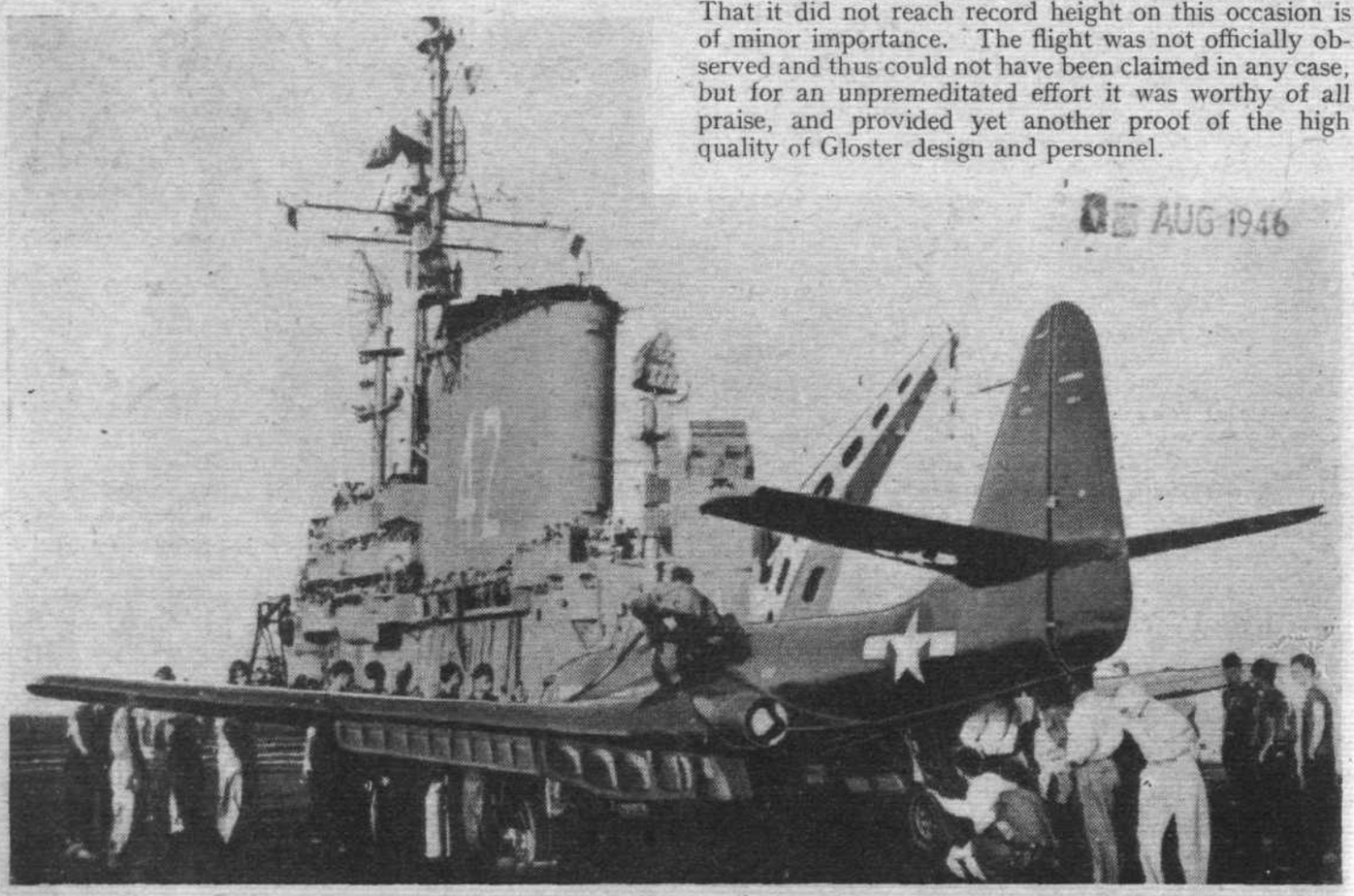
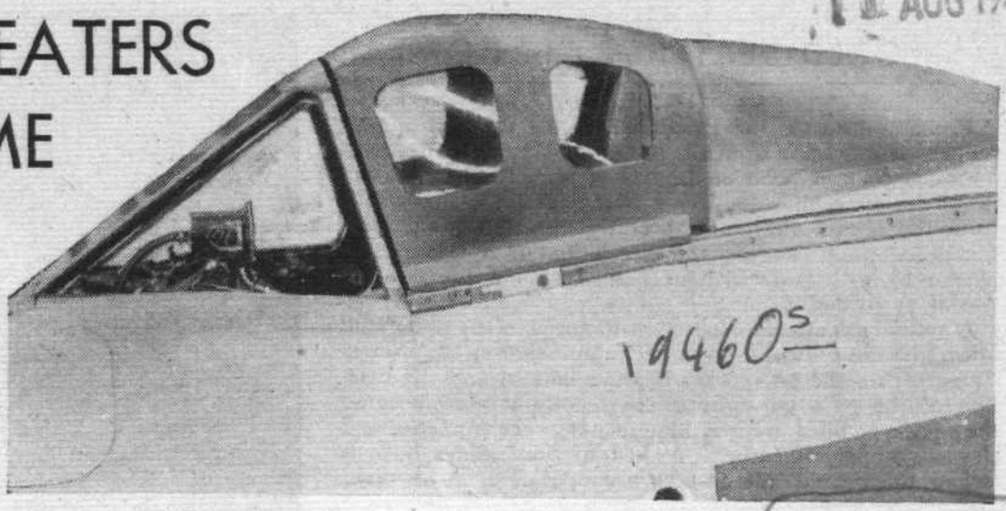


SEA-BORNE SPECTRE: On July 21 the McDonnell FD-1 Phantom jet fighter took-off from and landed on the carrier *Franklin D. Roosevelt*. Here this interesting new machine, referred to in the article *Jet Fighters* appearing in this issue, is being fuelled. Twin axial-flow Westinghouse units are installed in the wing roots.

Ass. Press.

WORLD-BEATERS AT HOME

Grooming and Proving the High-Speed Meteors: Background to the Record



"Flight" photograph.

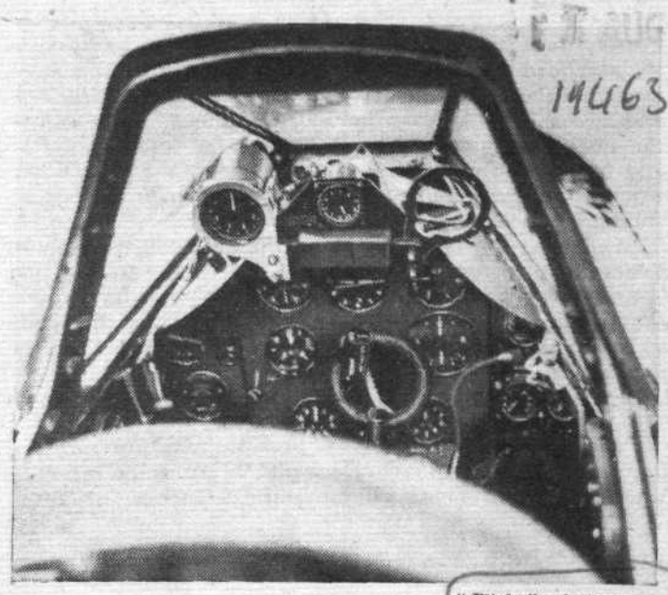
At 600-odd m.p.h. frictional heat is such that the transparent plastic cockpit hood softens appreciably. On the High-Speed Meteors it has been displaced by a duralumin enclosure with peepholes.

PILOTS of the R.A.F. High-speed Flight who will attack the world's air speed record in a fortnight's or three-weeks' time are confident that their Gloster Meteor IVs will comfortably and safely exceed the standing record of 606 m.p.h. established by Group Capt. H. J. Wilson in a similar aircraft. Their assurance is founded largely on the work of the Gloster technical and testing staffs charged with developing and proving the record aircraft before delivery to the Flight at Tangmere.

Last week we visited Moreton Valence to see the two specially prepared machines—EE549 and EE550—and to discuss high-speed flying with Mr. Eric Greenwood, O.B.E., Gloster's chief test pilot, and his distinguished team: Wing Cdr. R. P. Beamont, D.S.O. and Bar, D.F.C. and bar, U.S.D.F.C.; Sqn. Ldr. P. J. Stanbury, D.F.C.; and Sqn. Ldr. D. V. Cotes-Preedy, G.M., D.F.C.

Speeds appreciably higher than the homologated record have been attained by all four pilots, and on a hot day over the Bristol Channel Wing Cdr. Beamont has flown one of the High-Speed aircraft (fitted for the present with standard 3,500-lb Derwent Vs) at 632 m.p.h. This is a corrected figure corresponding to a Mach number of 0.813 and an A.S.I. reading of 608, noted half a minute after levelling out at 50ft from a shallow dive started at 1,500ft.

For the Herne Bay flights, it will be remembered, a low air temperature was desired, whereas the Gloster pilots have achieved their best speeds in warm weather, and Group Capt. Donaldson is hoping for a hot day. This implies no reversal of technical opinion. At Herne Bay two of the turns over land and it was considered advisable to avoid bumps, which at speeds of the order of 600 m.p.h. can be extremely violent and detract seriously from speed. The new South Coast course is almost entirely over the sea, and to achieve the speeds hoped for heat is a benefit because the speed of sound increases with temperature, and the permissible Mach number can be attained without running into compressibility trouble. In other words, higher speeds can be attained without exceeding design limitations.



"Flight" photograph.

The cockpit of EE549. From left to right, above the panel, are a Machmeter, an elevator angle indicator and the holder for an accelerometer.

Having completed initial flight trials to prove the special fuel installation, the two High-Speed aircraft are now receiving a finish superior even to that on the immaculate Meteors delivered to the R.A.F. Plate edges and rivet dimples are filled with plastic stopping, and the surface meticulously smoothed with abrasive paper.

The Gloster testing team, Mr. Eric Greenwood, third from left, discusses form with Wing Cdr. Beamont, Sqn. Ldr. Stanbury and Sqn. Ldr. Cotes-Preedy.

"Flight" photograph.

WORLD-BEATERS AT HOME

From a distance the standard Service camouflage will render identification difficult, but closer scrutiny will reveal a special cockpit hood of duralumin with two transparent peepholes in each side. This is a deplorable innovation from the pilot's viewpoint (literally) and has been reluctantly adopted pending the perfection of a transparent plastic to withstand without deformation a temperature rise of 35-40 deg C.

A second superficial concession to speed is the filling and fairing of the four gun-ports. The omission of the protective grills on the jet intakes is less apparent and the deletion of the gyro gunsight is not readily noticed because the space is filled with a Machmeter, accelerometer and elevator-angle indicator. Although the rudder tab is locked the geared aileron-tabs are operative. The dive-brakes are screwed down.

Increased Tankage

Before the buffed cowlings are screwed home the additional tankage and increased ballast can be seen. Mr. H. L. Mauler, Assistant Designer (Flight Development) who is, in effect, the Moreton Valence representative of Mr. W. G. Carter, the Chief Designer, showed us that in addition to the standard 325-gallon fuselage tank there are three small tanks in the magazine bay—a centre tank of 43 gallons and two side tanks each holding 13 gallons. Attached to the nose wheel mounting are lead plates totalling 450 lb and behind the pilot's frontal armour another 10 lb. Displacing the lower and upper guns respectively are weights totalling 356 lb and 198 lb.

In view of the fact that at no time are the High-Speed pilots likely to exceed 1,200ft, it is interesting to find that the oxygen gear is retained. The Gloster pilots have found that if the face is cooled by a whiff of oxygen the body feels less affected by the oppressive heat generated at high speeds.

In record-breaking trim the Meteor IVs will weigh 14,078 lb. The tare weight is 9,712 lb.

For initial tests the High-Speed Meteors are powered by standard Rolls-Royce Derwent V jet units rated at 3,500 lb thrust. These will be retained until the machines have been handed over to Group Capt. Donaldson at Tangmere (probably within a week) when the special Derwents, capable of delivering 4,200 lb thrust, will be installed. At present the High-Speed Flight is practising with three Meteor IVs almost identical with the standard R.A.F. fighters.

"Flight" photograph

Smoothing the rivet filler on a section of leading-edge

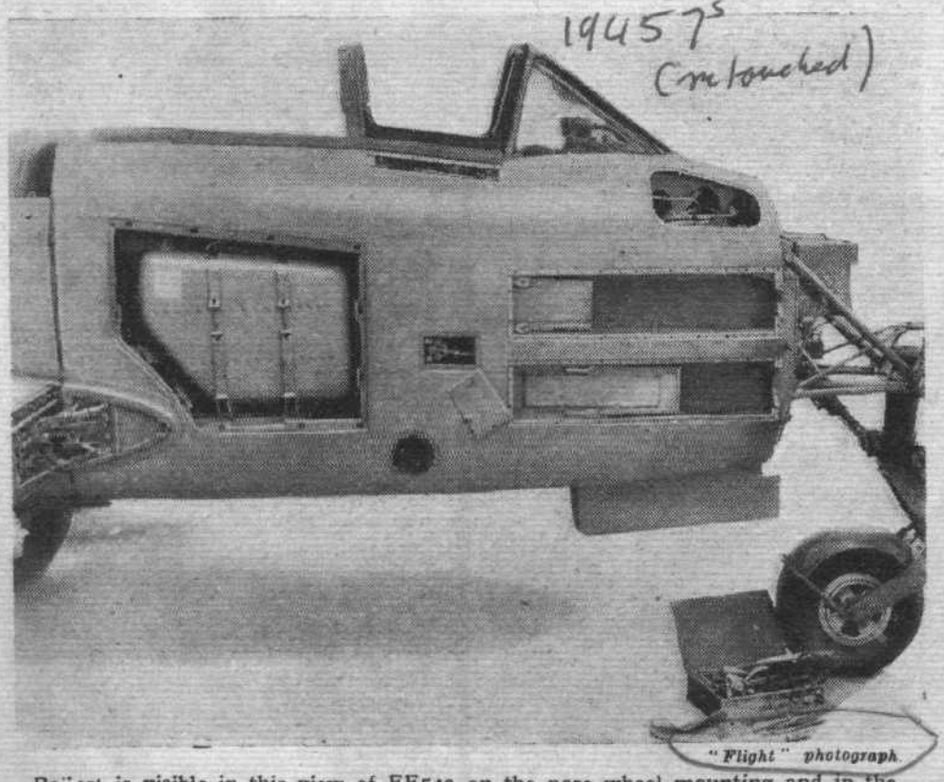
As delivered to the squadrons the Meteor IV is cleared for a Mach number of 0.83, though this value is not normally attained in service. It has been established that the type can be flown safely at Mach 0.84. On the verge of trouble at high Mach values the Meteor gives its pilot adequate warning by a gentle pitching, readily damped by throttling. With an injudicious increase of speed this motion becomes violent and further "pushing" by the pilot results in a sudden zoom.

Because of a superficial similarity to earlier models it is often forgotten that the Mark IV is virtually a new type, combining the tractability always characteristic of the Meteor with a vastly superior performance. The 7,000-lb thrust of the Derwent Vs gives startling acceleration and anyone who harbours a notion that pure-jet aircraft are necessarily handicapped by poor take-off should watch a Mark IV Meteor attained a height of 50ft in 650 yards or less. At low altitudes it climbs at 8,300 ft/min.

Fighter Command pilots are impressed by the Meteor's aerobatic qualities at heights where less powerful and well-designed fighters are sluggishly nearing their operational ceiling. It is estimated that at 53,000ft the Mark IV will still climb at 500 ft/min, but heights of this order have not been approached because a pressure cabin and the safeguard of a pressure suit have not been standardized.

We learned at Moreton Valence that the true sea-level speed of the standard Mark IV fighter with full war load is now 595 m.p.h., and that the climb to 40,000ft takes eight minutes or less. Thus the Gloster staffs, in conjunction with the Rolls-Royce team, have provided the R.A.F. with a general-purpose fighter superior to foreign counterparts by an unprecedented margin.

With a drop-tank the Meteor IV has a range of about 1,000 miles.

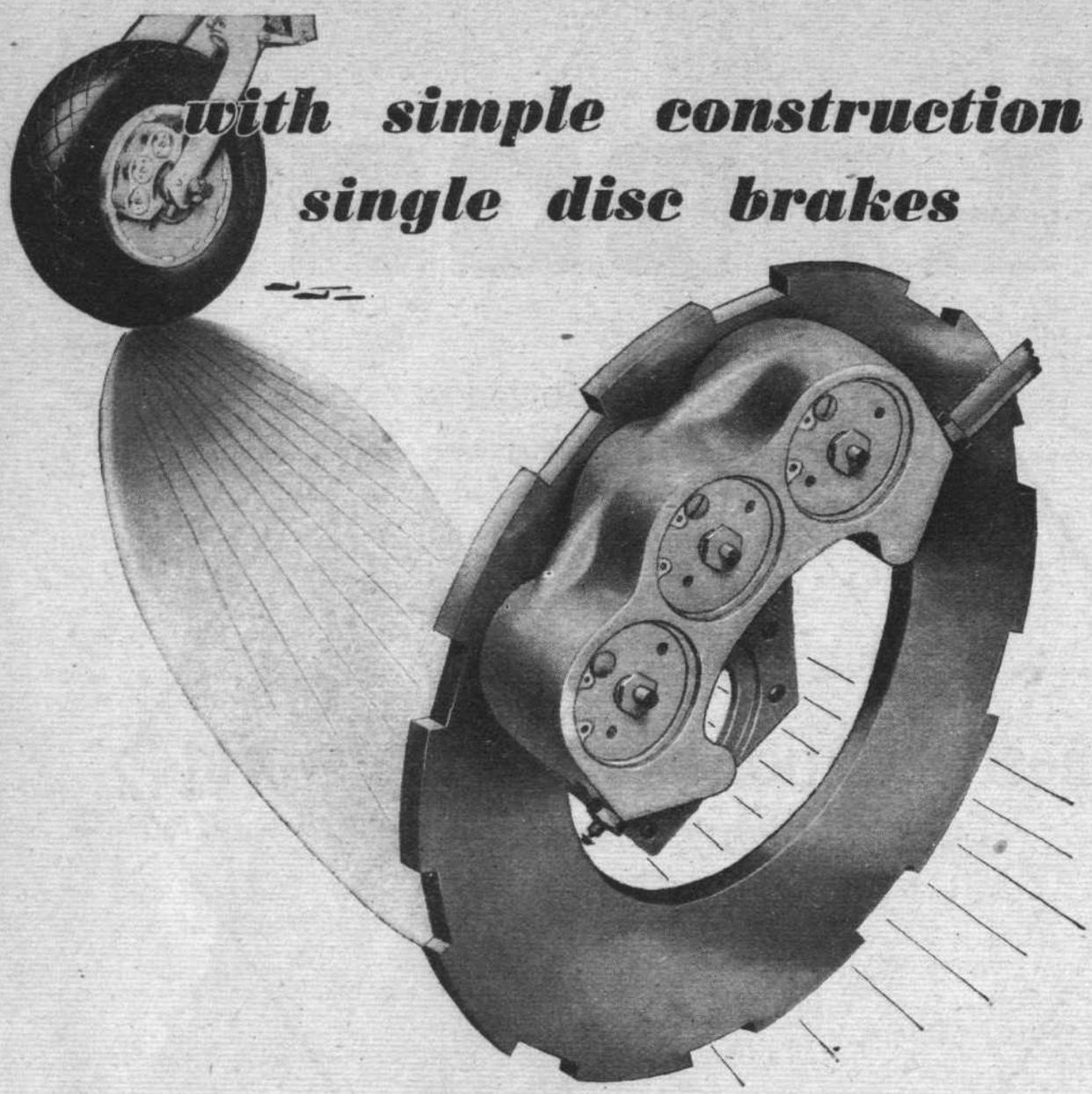


"Flight" photograph

Ballast is visible in this view of EE549 on the nose wheel mounting and in the gun channels. A 13-gallon tank is strapped in place.

GOODYEAR LEADS

with simple construction single disc brakes



THE wide acceptance of the Goodyear Single Disc Brake is due to the efficiency which derives from its simplicity of design, operation and servicing. It consists of a steel disc keyed to the wheel. The disc revolves between pairs of brake-linings worked by hydraulic or mechanical pressure. When the brake is applied the outboard lining is moved against the face of the rotating disc. The disc is free to align itself in the wheel and consequently moves inwards enough to make contact with the inboard lining. As pressure is increased the rotating disc is clamped more directly between the linings and its rotation is arrested.

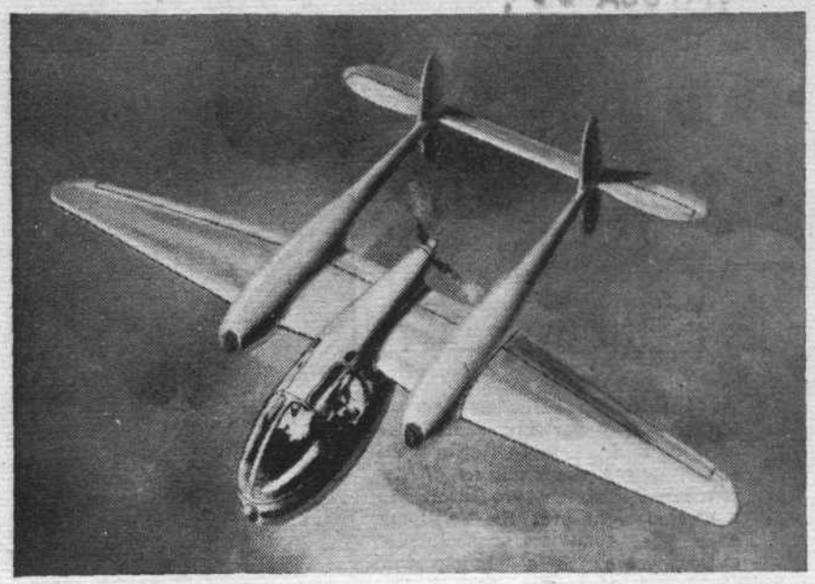
The disc is always exposed to the slip-stream thereby ensuring rapid heat dissipation. Light weight is achieved by the simple compactness of the brake assembly and the use of magnesium for the wheel brake. A compensating device automatically takes up wear of the lining and gives maximum braking efficiency all the time.

NOTE TO DESIGNERS. *Goodyear will give designers and engineers the fullest co-operation in all problems concerning aircraft wheels, brakes and tyres. Write to Goodyear, Aviation Products Department, Wolverhampton, England.*

GOODYEAR AVIATION PRODUCTS

Coupled Twin

An Interesting French Design : Improved Single-Engined Performance

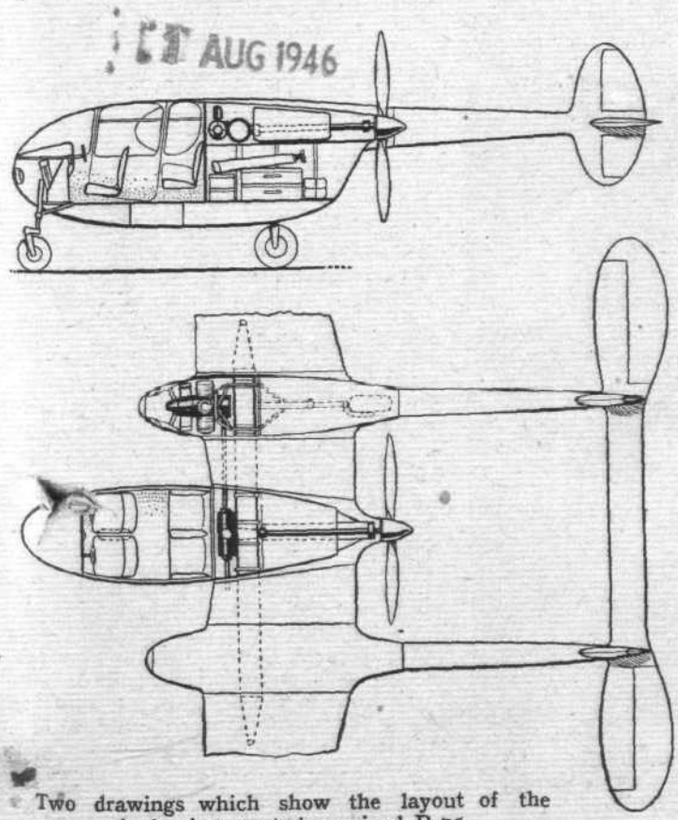


The two 175 h.p. Mathis are mounted in the noses of the twin booms.

ONE of the most obvious ways of obtaining most of the possible advantages of a twin-engined layout in small aircraft sizes is that of gearing the two engines to a single airscrew. The necessary shafting, gearing and free-wheeling arrangements are clearly a likely source of difficulties, extra weight and possible expense, and designers have so far been somewhat deterred.

Even so, the idea is still, it seems, worth serious consideration at least when planning certain classes of aircraft. In pre-war days, it may be remembered, something of the kind was attempted in America by Menascos when they introduced the Unitwin, which was virtually a couple of Menasco engines geared together and driving a common airscrew. With this layout, the designer had the advantages of a coupled twin, but these were somewhat overshadowed by inevitable cooling and accessibility difficulties.

Recently an interesting design has appeared from the French M.A.T.R.A. concern. This, the R-75, has been planned by M. Roger Robert, who was previously the chief designer of the Bernard Aircraft Company. In the R-75 the two Mathis 175 h.p. air-cooled Gr-7s are mounted in the wings in the normal way with extensions from the supports forming a twin-boom tail structure. Through a system of shafts, a bevel box and a free-wheel arrangement, the two engines drive a single pusher airscrew aft of the central nacelle.



Two drawings which show the layout of the single-airscrew twin-engined R-75.

With this installation the air-cooled engines can be kept conveniently cool, while the centre of gravity problems in the conventional pusher design have been avoided. It is arranged as a four-seater, with luggage space in the nacelle below the gear box and airscrew shaft. Naturally enough, the aircraft has a tricycle undercarriage.

The estimate performance figures of the R-75 provide an indication of the relative single-engined performance. With such a layout there is, of course, no difficulty about engine-failure directional control at any speed, and no losses in drag from the necessity of holding rudder against a dead engine. According to calculations, while the maximum speed at sea level is 218 m.p.h. with both engines in action, it is 155 m.p.h. with one of them throttled back. The respective rates of climb at sea level are 1,214 ft/min against 345 ft/min, while the ceilings are 18,000ft and 7,500ft.

In addition to its unorthodox power layout the R-75 is also unusual from the control point of view. In order to obtain the advantages of full-span high-lift flaps, the tail plane is designed with a very high aspect ratio so that the two elevator surfaces can, at the same time, perform the duties of ailerons. These elevator-ailerons are normally operated through a fairly conventional control system, but the designer has planned the aircraft so that the rudders can be locked, leaving a two-control arrangement.

M.A.T.R.A. will, incidentally, be showing the R-74—a single-engined version—at the Paris show in November.

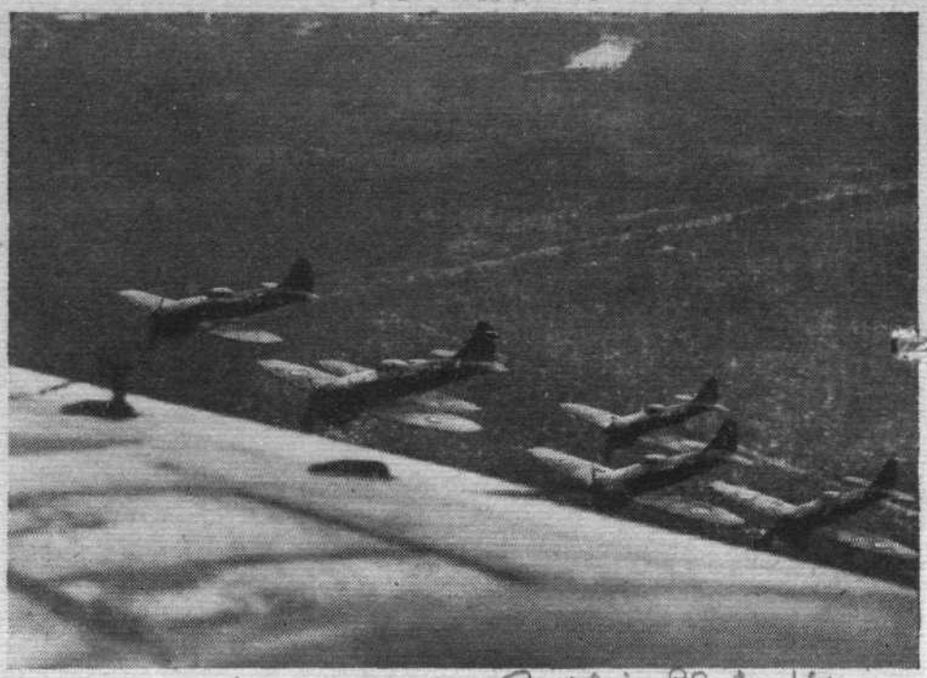
FUTURE AUSTERS

IN addition to the production of the 3-seater type developed from the Auster used during the war, and now named the Autocrat, Auster Aircraft are developing two more types. The first, the VI, is a somewhat larger aircraft powered with a D.H. Gipsy Major and with "external" aerofoil flaps. The second is the two-seater Auster Arrow, which has a 75 h.p. flat-four Continental. Ninety-five per cent of the Arrows are, we hear, earmarked for export.

CONVERSION COURSES

AIR SERVICE TRAINING, of Hamble, Southampton, have now announced a schedule for their various ground conversion courses for ex-R.A.F. personnel. The assembly dates are:—1st Class Navigators' Licence, August 13th; 2nd Class Navigators' Licence and "B" Licence Courses, August 20th and October 7th; Radio Officers' Conversion Courses, August 13th, September 2nd and October 1st; Radio Operators' Long Course, September 2nd and November 1st; and Licensed Aircraft Engineering Course, September 24th. Incidentally, all the ground courses have been approved by the Ministry of Labour and the Ministry of Education, under their training schemes.

HERE AND THERE



AFTERMATH: Hawker Tempest fighters, their war-time camouflage merging with a sombre Berlin landscape, patrol the environs of the stricken capital. An Avro Anson, still a blessed sight over the Continent as it goes about its unspectacular duties, serves as a photographic aircraft.

Graphic Photo Union

Supermarine Jet Fighter

MR. JEFFERY QUILL was at the controls of the new single-jet Vickers - Armstrongs (Supermarine) fighter on its first flight last Saturday.

Boscombe Down was used and the flight was in every way successful, the machine being in the air for about 30 minutes.

The new fighter has a wing similar to that of the Spiteful.

Army Air Force Day

TO-DAY is being celebrated by America as her "Army Air Force Day," and the "big act" on the programme there is the massed fly-past by aircraft of the U.S.A.A.F. over Los Angeles (originally it was to have been New York), in which the Lancasters of No. 35 Squadron are taking part as a climax to their much-publicized goodwill tour of the U.S. In fact, it was as a result of the U.S. Government's kindly invitation to the R.A.F. to send over a squadron of ex-operational "Lancs" to join in the fun that the good-will tour was laid on.

It was an equally nice gesture, of course, to arrange to-day's R.A.F. fly-past over the London home of Mr. Averill Harriman, the U.S. Ambassador, and to salute him in honour of the occasion with the roar of some 150 fighter aircraft—Mosquitoes, Spitfires and Tempests, followed by Meteors, Vampires and Hornets.

Mechanised Migration

SEVEN thousand day-old chickens will, it is expected, soon be flying every week from Australia to Singapore.

Before any amateur ornithologist seizes his pen to write and tell us they simply could not do it, perhaps it should be explained that they will not attempt the trip on their own fluffy little wings, but will travel in luxury by Lancastrian.

An experimental consignment of 400 was recently delivered without a single casualty, as a result of which a standing order has been lodged with Qantas to transport 1,000 chicks whenever cargo space is available, and the aforementioned rate of delivery is expected.

Petrol Models at Heston

THOSE interested in model aircraft, especially when powered by miniature petrol engines, will find Heston Airport worth a visit next Sunday, August 4th, when the Society of Model Aeronautical Engineers' contest for the Bowden International Trophy will be held.

Glancing through the rules for this event, one is impressed by the high standard they demand, for (among other things) failure to keep within a 20-second margin in duration costs the entrant all his marks for that flight, and only three minutes is allowed in which to start his engine from cold.

The following Sunday, August 11th, the decentralised competition for the *Flight* Cup for rubber-powered models built to a restricted formula will be "flown off" on each affiliated club's own flying ground.

Dingoes' Doom

INSECT pests of various kinds have for years been successfully attacked from the air (before the war "crop dusting" was almost a trade in itself in the U.S.), but the Queensland authorities in Australia have gone one better by using aircraft to combat the Dingo—a species of rather more than half-wild dog which has been breeding rapidly enough to provoke direct action.

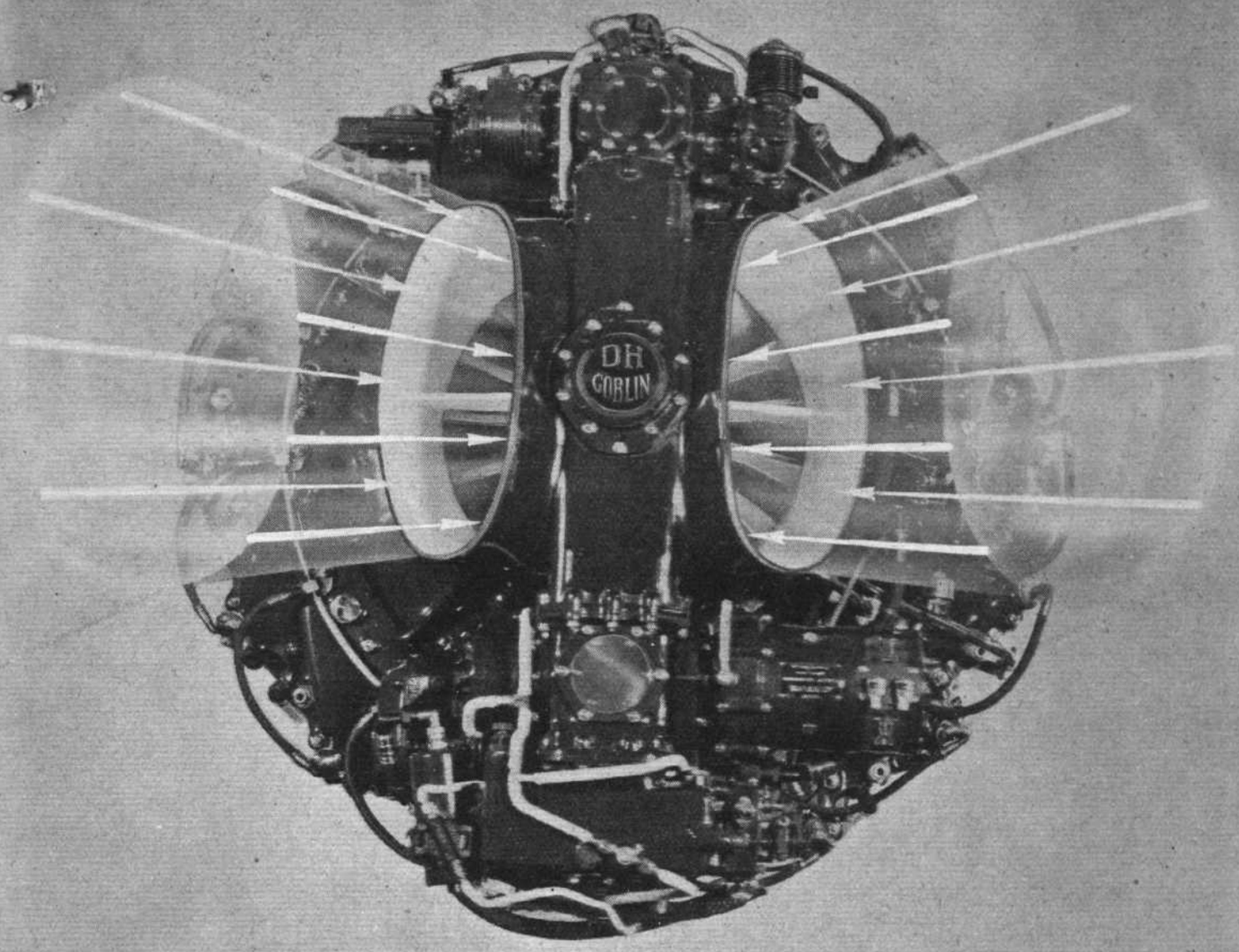
The help of Qantas has been sought in this battle, and experiments have been carried out in the dropping of poisoned bait in the rough country where these destructive creatures breed; during the war they have done damage to the tune of £1,000,000.

Incidentally it has been found that the best height for dropping the bait in tablet

CENTRE OF INTEREST: Instruction on the Vampire airframe and its Goblin jet engine are given at the de Havilland Service School at Hatfield. In this picture Swedish officers are being instructed by Mr. Bouet (extreme left), Mr. Don Richardson (extreme right) and (next to him) Mr. Williard James.

D.H.

High-velocity direct ducting



Maximum airflow—Minimum aircraft drag

Maximum ram effect—Minimum turbulence

D E H A V I L L A N D

high-efficiency

J E T E N G I N E S

DH
ENGINES

HERE AND THERE

form (flown out from England) is 1,500 ft to 2,000 ft. At lower altitudes the tablets are smashed and scattered by the forward velocity.

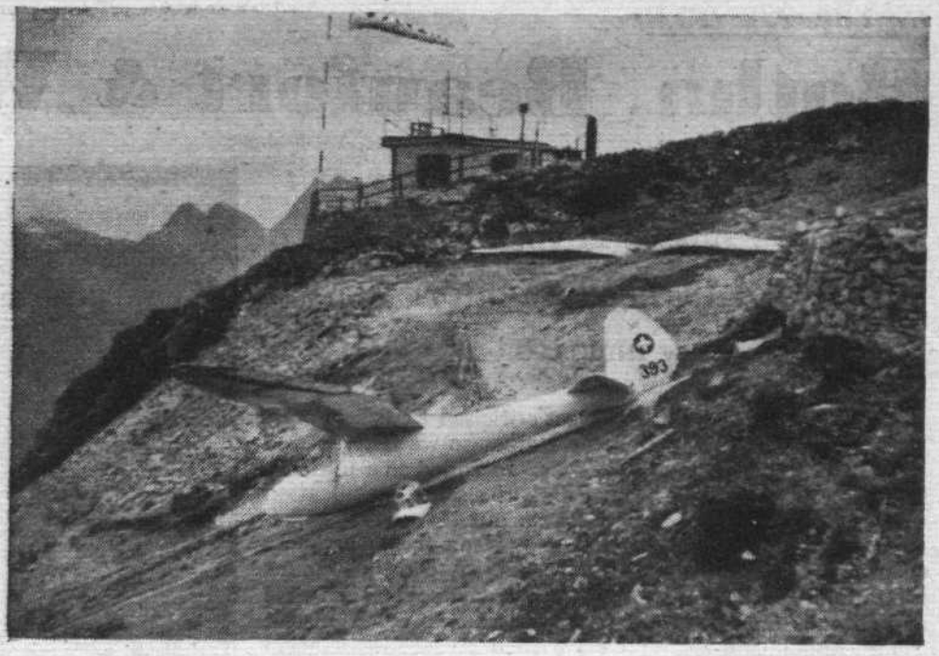
"Flight" Instructional Posters

IN order to meet the growing need for instructional matter concerning jet and gas turbine engines, *Flight* is producing a number of explanatory drawings as posters, suitable for display in factories, classrooms, clubs, libraries, etc.

The first three posters to be published are of the Rolls-Royce Derwent, the de Havilland Goblin II, and the Metrovick F/3 Gas Turbine.

Each poster measures 30in × 20in and is printed in black on stout paper. The price is 4s net for each poster; postage and packing in cardboard tube is 8d for a single copy and 9d for two or three copies.

Orders can now be placed and remittances should be addressed to the Publisher, Flight Publishing Co., Ltd., Dorset House, Stamford Street, London, S.E.1.



ALPINE SPORT: A Swiss S18 high-performance sailplane at the catapult launching site at the top of the Muottas Muraigl mountain in the Engadine, not far from St. Moritz. In the valley is Samaden airfield, the highest in Europe.

News in Brief

F/L. Minty 1 AUG 1946

THE R.A.A.F. has handed over 36 airstrips in the Commonwealth to the Civil Aviation Department, and an additional 122 have been listed for disposal.

* * *

A recent flight from the Cape to Johannesburg airport in 2 hr 6 min by a Gloster Meteor of the S.A.A.F. is claimed as a record for this 790 mile trip.

* * *

Wing Cdr. Falk, chief experimental pilot of Vickers-Armstrongs, Ltd., who was injured in a flying accident last month, is now happily reported to be out of danger and to be progressing favourably in hospital.

* * *

Air Marshal George Johnson, Commander of the R.C.A.F. in Europe, received the Legion of Honour at a ceremony, at the French Air Ministry last week, attended by the Canadian Ambassador to France, Maj. Gen. G. P. Vanier.

* * *

The formal signing of an agreement in London next month will complete the negotiations between the British and Southern Rhodesian Governments for the new air training scheme for R.A.F. pilots and navigators in Rhodesia. Earlier this year Air Marshal Sir Roderick Hill headed an Air Ministry mission to Southern Rhodesia to discuss the proposed scheme, and agreement was reached without any difficulty.

* * *

Flight regrets to record the death of Wing Cdr. F. A. Swoffer, M.B.E., who was appointed Controller of the States of Guernsey Airport when it was first opened in 1939 and, despite failing health, had been engaged on its rehabilitation since the end of the war.

* * *

To-day marks the inauguration of the "air department" of the Czechoslovakian National Security Corps (police), whose job will be to supervise air traffic and to hunt dangerous criminals. The creation of air police in Britain was suggested some time ago by a Member of Parliament, but was turned down by the Home Secretary.

* * *

The Croix de Guerre with palms—one of the highest French decorations for gallantry—has been awarded to Miss Phyllis Latour, now on the staff of East African Airways, for her services as a British agent behind the German lines in France when a section officer in the W.A.A.F. She made several parachute drops to work with the Maquis and was awarded the M.B.E. some months ago.

* * *

That the motor industry had been responsible for over 80 per cent of the peak war production of aircraft engines was mentioned by the Minister of Supply, Mr. John Wilmot, when he opened the new headquarters of the S.M.M. & T. in London on the occasion of the trade's "Golden Jubilee" celebrations.

* * *

Inventor or co-inventor in nearly 200 rubber patents, Dr. D. F. Twiss has retired after 32 years' service as chief chemist to Dunlop. It was his early experiments which resulted in the self-ventilating type of sponge rubber which is so widely used in aircraft.

* * *

The London offices of the Graviner Manufacturing Co. have now been transferred from Osterley to No 53, Pall Mall, London, S.W.1.

Assoc. Press

BIGGEST BOMBER: The Consolidated-Vultee XB-36 (six Double Wasps) is towed out for taxying tests at Fort Worth, Texas. Weighing over 100 tons this is the world's largest bomber. The tip of the fin is 55 feet high—equivalent to a five-storey building.

D

1 AUG 1946

IN THE AIR (XVII)

Botha, Beaufort & Whirlwind

Three Widely Differing Twins: Two Coastal Types and an Advanced Fighter

By INDICATOR

LET us face it. One of the most criticised British aircraft of the war period was the Botha, so we may as well say the worst and get it over. Intended as a torpedo-bomber and originally produced to the same specification as the Beaufort, this aircraft came out, I believe, somewhat on the heavy side and, for one reason or another, was eventually used for training purposes. A certain amount of trouble had been experienced with the control surfaces and shrouds during development and early production test flying, and it suffered in service from certain installation bothers which caused occasional engine failures. I always understood that the Botha had originally been laid out to take Taurus motors, and the fact that these were not then available in sufficient numbers and that the Perseus were standardized possibly had something to do with its failure to carry the expected load over the necessary range.

But, after saying the worst, the Botha had a number of very good features, and many of those who found themselves flying the type for considerable periods learned to like it. From the handling point of view it was certainly an extremely easy aircraft. Given a reasonable length of airfield, the Botha flew itself off and, with its comparatively flat ground angle, the landing could not have been more easy.

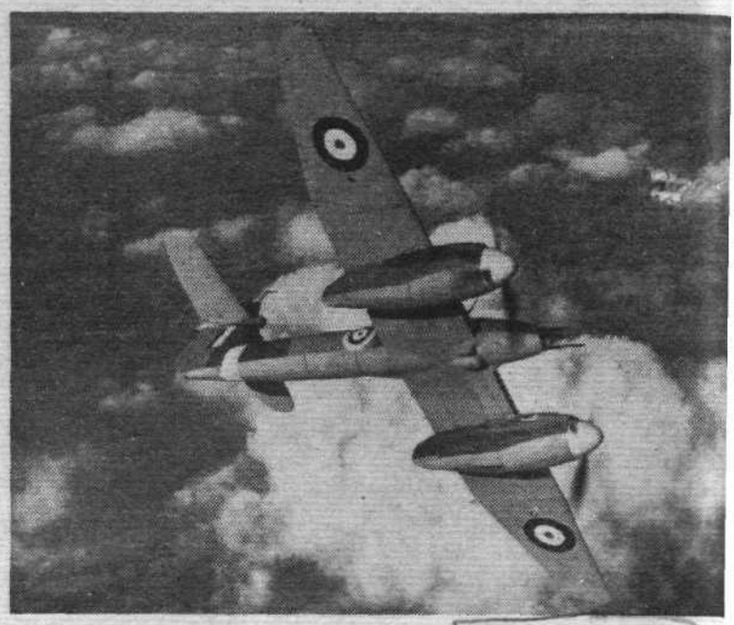
I must say that, in the course of fifty hours or so of flying with the type—both on test and on the endless inter-satellite delivery work inevitable with an aircraft which was "not wanted"—no particular troubles were experienced other than those common to most aircraft. The hydraulic system had its peculiarities and, at least in the early versions, the relief valve produced the most astounding and frightening noises and smells which, to the uninformed, could be very nerve-racking on a cross-country. It was for all the world as if some chap had been accidentally locked in the bomb bay and was hammering away at intervals to attract the pilot's attention. The smell was apparently the result of the presence of hydraulic fluid in fine suspension hanging throughout the aircraft.

Model Layout

In general, too, the Botha's control cabin layout might well have served as a model to all designers. Everything was comfortably positioned, the view was excellent, and all essential controls were mounted in or on a central pedestal, with the flap, undercarriage and bomb-door selector levers on the floor to one's right. The sliding windows at the side, with their one-handed catch-cum-handles, moved smoothly and positively, but these, like a great deal of the other equipment around, probably helped to increase the all-up weight.

Entry provided the only real difficulty. Though there was a full-size sliding roof as well as an emergency hatch on the right side of the control cabin floor, one entered through the door at the rear of the fuselage and, to reach the control cabin, it was necessary to squeeze one's way along a very narrow passage on the starboard side of the fuselage. This passage was no place for the claustrophobically inclined passenger, either when flying or when the engines were being started up. Although the main fuel cocks were in the control cabin, the individual tank controls were arranged half-way down this passage.

One of the more peculiar series of engine failure cases



"Flight" photograph.

First of the twin fighters, the Whirlwind possessed a number of extremely up-to-date features and, in spite of its then peculiar tailplane position, was quite pretty.

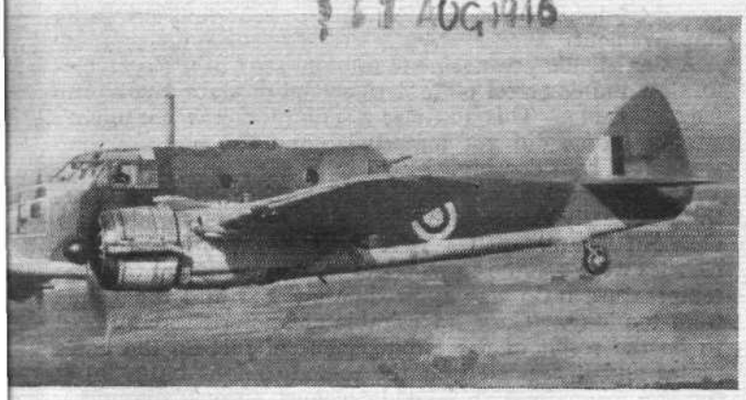
"Flight" photograph.

With an unfortunate history, following development troubles and an inter-pilot war of nerves, the Botha had, nevertheless, a number of good points.

was eventually pinned down by the investigating people to trouble with these controls. In some cases the marked positions did not quite correctly register, and the result was that the fuel supply might, at certain settings, be partially restricted. Consequently, there might be ample fuel for cruising or rated boost, but not quite enough for continuous running at take-off boost. It happened that one aircraft, which most of us had previously flown without incident, proceeded one day to suffer complete engine failure, one after the other, and the aircraft was put down in the sea. It transpired that the pilot concerned was in the habit of holding take-off boost until he had reached a reasonable operating height, whereas the other pilots in the team always reduced boost as soon as the undercarriage had been raised. Hence the fact that his motors died from

simple fuel starvation. But, in all, we collectively flew several hundred hours on scores of Bothas without running into any more serious trouble than a failure of the undercarriage, perhaps, to stay up after retraction, or a mildly runaway airscrew.

In many ways the Bristol Beaufort can be reasonably considered as the natural successor of the Blenheim—though it was designed to quite a different specification and became, in fact, merely a contemporary of the later Blenheim series. Though it was not, from the pilot's point of view, by any means as faultless as the Blenheim could be after correct training had taught one to deal with its mannerisms, the Beaufort did tremendously good work with Coastal Command until the torpedo-carrying Beaufighter arrived on the scene. But, in spite of the differences, a very large proportion of its pilots moved more or less straight from the cockpit of the Blenheim to that of the Beaufort, and the majority of people tend to look upon the latter very much as a somewhat more difficult "extension" of the former. Even if no information had been provided it would have been impossible to mistake the typically Bristol layout, and even the flying characteristics were, to some extent, similar. The Beaufort could,



One of the war's little publicised essential workers, the Beaufort, though designed to a very different specification could be considered as a development of the Blenheim.

in fact, be described as a rather more heavily loaded and less easy version of the Blenheim.

Unless and until trouble was experienced, the Beaufort handled comfortably, and except for a more pronounced tendency to swing on take-off, no averagely competent twin-engined pilot found much difficulty. It had, however, a marked disinclination to behave properly if engine failure was experienced, and at least one set of published handling notes remarked, under the heading "Safety Speed," that the Beaufort had "none at full power."

Which was fairly true, and unless very swift action was taken with the other throttle, a failure while using maximum boost during take-off could be extremely uncomfortable for all concerned. The situation was made no better in one's imagination by the fact that it was customary to use 15 to 25 degrees of flap on take-off, and we had all been brought up carefully in the speed-at-all-costs-on-take-off school. Of course, if one was to be entirely realistic in such matters, the fact that there was no possibility of reaching any sort of safety speed while using full power meant that a more rapid increase of initial height was probably just as important as any carefully drilled effort to obtain as much speed as possible as quickly as possible. None of which is meant to suggest that the Beaufort would not fly quite happily on one engine at lower powers, although somewhat firm handling was required in the early stages of failure. At least at one point in the life of the Beaufort we were all ordered to avoid certain revolution figures with the Taurus engines, and this avoidance became somewhat difficult when, as usual, the exact range concerned was forgotten as soon as the aircraft became airborne. All members of the crew (if any) were then asked in turn whether they could possibly remember these mysterious figures, since there was no very obvious vibration.

For a variety of reasons our first twin-engined fighter—the first, that is, to be specifically designed and made for such offensive purposes—saw comparatively little active service. There was, I believe, only one squadron of Whirlwinds, and the type was used first for defensive purposes in Scotland, and later for low-level attacks along the French coast. Not the least important reason for the discontinuance of its production was the fact that the engine manufacturers were very much too busy on the production of the various Merlin marks to proceed with that of the somewhat smaller Peregrine used in the Whirlwind. This interesting engine has been more than once described as a "steam-cooled Kestrel" development, and had the same internal dimensions.

Radiator/Lift Flaps

The Whirlwind, for those not actively and continuously concerned in its conduction, is remembered largely for the peculiarities of the hydraulic system. Perhaps one is particularizing too much in using the word "hydraulic," since the peculiarities were concerned largely with the way in which these hydraulics were applied. For instance, part of the Fowler-type lift flaps also performed part of the function of radiator flaps, and in order to maintain a reasonably low coolant temperature, it was necessary to climb with these flaps partly extended. The cooling system in general would hardly have survived the later runway and taxi-track development at the bigger airfields, since, sooner or later, if there happened to be any serious delay before take-off, two delightful fountains of steam appeared, and it was necessary then to turn into the wind and switch off. Two other hydraulic points of interest were, first, the fact that the main fuel cocks were hydraulically operated, and, secondly, that the actual *positions* of the flaps were set by the relative movement of the control lever. The flaps followed the movement of the lever.

From the flying point of view the Whirlwind was magnificent, and the one and only peculiarity was its tendency to develop tail shudder in any really tight turns. Presumably, there was some breakaway of the air flow around the engine nacelles and the centre section, so that, in spite of the high position of the tailplane, this, in certain conditions, was flying in turbulent air. Unless it was allowed to take charge on take-off or after landing, the Whirlwind could be treated as a single-engined type. And very modern it was—with leading-edge radiator entries, four-cannon nose armament and "almost-bubble" canopy. The Whirlwind just missed its way and was superseded before it could be developed further.

AIR LEAGUE'S POLICY

THE objects and policy of the Air League of the British Empire were enlarged upon at some length at the annual general meeting last month. The vital importance of the cultivation of sound and well-informed public opinion was stressed by the Earl of Harewood, who has been re-elected president. He said that we were just beginning to see the pattern of British air effort in the post-war era, and that the trends in both military and civil flying made it obvious that everything depended upon public opinion

Not only was it necessary to encourage intelligent support for a sound air policy, but it was also necessary to obtain unity of thought between the citizens of our own and other countries. The Air League has recently sponsored a mission to Canada, and one is now on a tour in Australia. Lord Harewood also spoke of the service which the Air League had done in organizing the Air Defence Cadet Corps in 1938.

Lord Strabolgi spoke of the vital importance of the flying clubs and suggested that the Government should be urged to offer more support to them.

Mr. J. Arthur Rank, who is the honorary treasurer, suggested that unless the people in this country were prepared to take an intelligent interest in aviation affairs, they would be given only what the Government found it convenient to give them. The League had spent £1,200 less in 1945 than in 1944, but there had been a fall in income. Nevertheless the League could be considered to be in as good a position as ever.

Annular Combustion Chamber

Notes on Some B.M.W. Development Work

A THOROUGH examination of the performance characteristics of the B.M.W. 003A gas turbine was recently concluded by the Wright Aeronautical Corporation, and the results have been presented before the S.A.E. in New York together with figures for the Jumo 004 for comparative purposes by Messrs. W. G. Lundquist and R. W. Cole.

Much of the information has already been published in *Flight* but in view of the scarcity of knowledge concerning large annular combustion chambers a short summary of the design and performance data will be of interest. It is the belief of most designers in this country and America that the annular chamber will ultimately prove to be the most efficient, although existing power units for the most part employ several small combustion chambers.

In their preliminary studies the German engineers decided that the best way to provide stable combustion without blow-out was to produce local eddy regions. The three principal forms of baffle which were tried are illustrated. The first form as shown at (a) Fig. 1 consisted of sixteen individual ceramic baffle plates mounted in the annular chamber. The fuel nozzle was located upstream and the sprays were arranged to impinge on the baffle plates. The total airflow passed around these baffles. In practice the airflow round the baffles was not uniform around the annular chamber, and the resulting temperature distribution downstream of the plates was bad. The blow-out characteristics were also unsatisfactory.

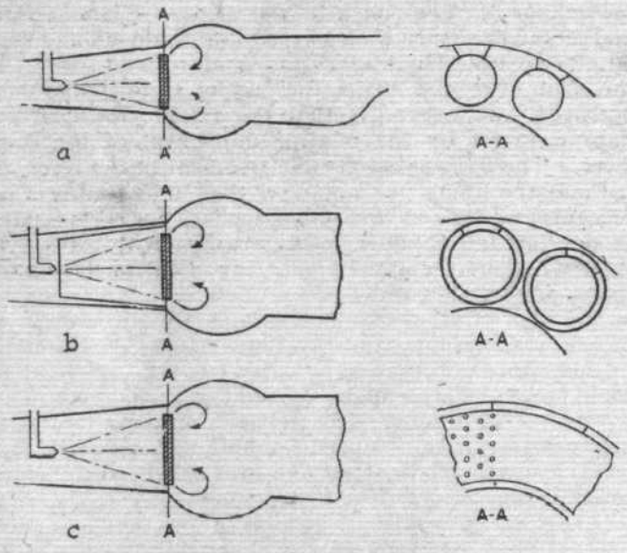


Fig. 1. Three attempts to produce a baffle plate burner. (a) with individual ceramic baffle plates ; (b) with similar baffles but conical tubes for air supply ; (c) with perforated annular steel plate.

The second form of baffle plate burner (b) was supplied with air through conical tubes projecting upstream. This arrangement made operation possible with full airflow and there was a considerable improvement in blow-out characteristics. Combustion efficiency and temperature distribution was still unsatisfactory, however, and both of these designs gave trouble due to the breakage of the ceramic baffles.

An attempted remedy for these troubles was to replace the ceramic baffle plates with perforated steel plates, and this measure resulted in virtually unlimited baffle life, with a further small improvement in the blow-out characteristics. However, there was no improvement in combustion efficiency and a later addition of more round baffle plates installed further downstream caused no improvement

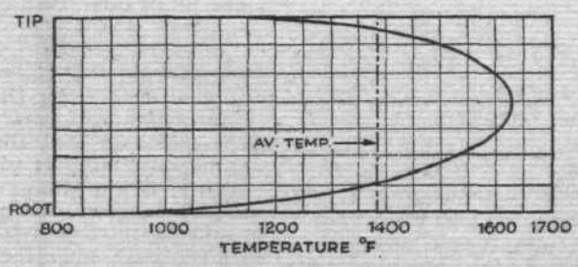


Fig. 3. Temperature spread at the nozzle of the combustion chamber. Temperature co-ordinates refer to the tip and root of the turbine stator blades.

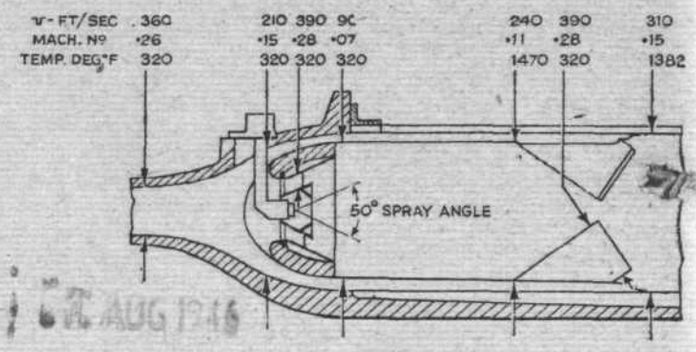


Fig. 2. The B.M.W. 003A annular combustion chamber and data. The low gas velocities are noteworthy.

A final baffle arrangement (c) consisted of a single perforated annular steel plate designed to produce a complete ring of flame. This too was a failure as the continuous annular flame did not materialize and the pressure drop was raised considerably.

At this stage it was decided that there must be something basically wrong with baffle plate burners, for although blow-out characteristics were passable, combustion efficiencies were only 60 to 70 per cent, the maximum to mean temperature ratio was approximately 2 : 1 and the flames were too long. These undesirable characteristics appeared to be the result of the impingement of fuel on the baffle plates and it seemed that the remedy might be to inject the fuel upstream into the eddy regions. Tried experimentally, this theory was apparently confirmed by a 20 per cent improvement in combustion efficiencies and a drop in temperature ratio to 1.5 : 1.

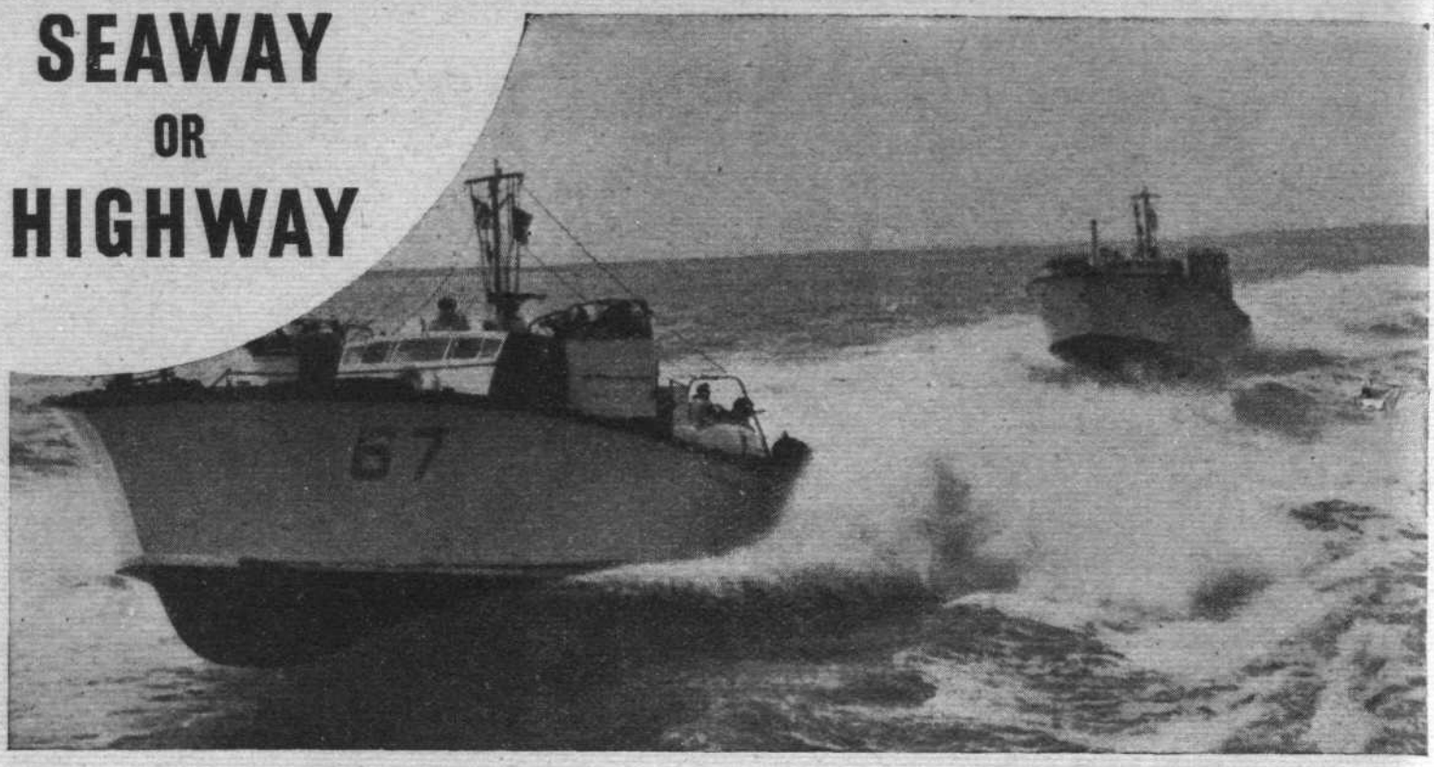
Division of Airflow

In spite of the improvement this type of burner did not go into production because another type under parallel development proved more efficient. This consisted of a conical burner producing toroidal eddies as a result of the airflow over the downstream edge of the burner cone, fuel being sprayed directly into the eddy zone. Another important basic change was also made, namely the division of the airflow into primary and secondary streams. The primary stream, representing 60 to 70 per cent of the air, was passed through the burner cones and the remaining 30 to 40 per cent of secondary air was introduced downstream. Sixteen holes were provided for the primary airflow to the burner cones and there were eighty secondary air nozzles which extended into the flame path and operated with a tip temperature of approximately 800 deg. C. These components had therefore to be made of special heat-resisting steel, while the rest of the combustion chamber was made of low carbon steel.

The final production combustion chamber, together with relevant data, is illustrated in Fig. 2. A small amount of air is admitted around the fuel nozzle itself to reduce the temperature at the centre of the flame and to cool the nozzle. The secondary air nozzles introduce air uniformly into the hot central core of the primary airstream. The figures for this combustion chamber were reported to be: Combustion effi-

(*Continued at foot of page* 113.)

SEAWAY OR HIGHWAY



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Decca Navigator

Southern England Chain of Transmitters Now Operational

In order to provide Government and Service authorities with the means of making extensive trials of the Decca Navigator system, a chain of stations sited in the South of England has been built. Three of these stations are now operational and the fourth is nearing completion. All have been built since the war, and the introduction of this new method of navigation shows considerable enterprise and has created wide interest in air and marine circles in this country and America.

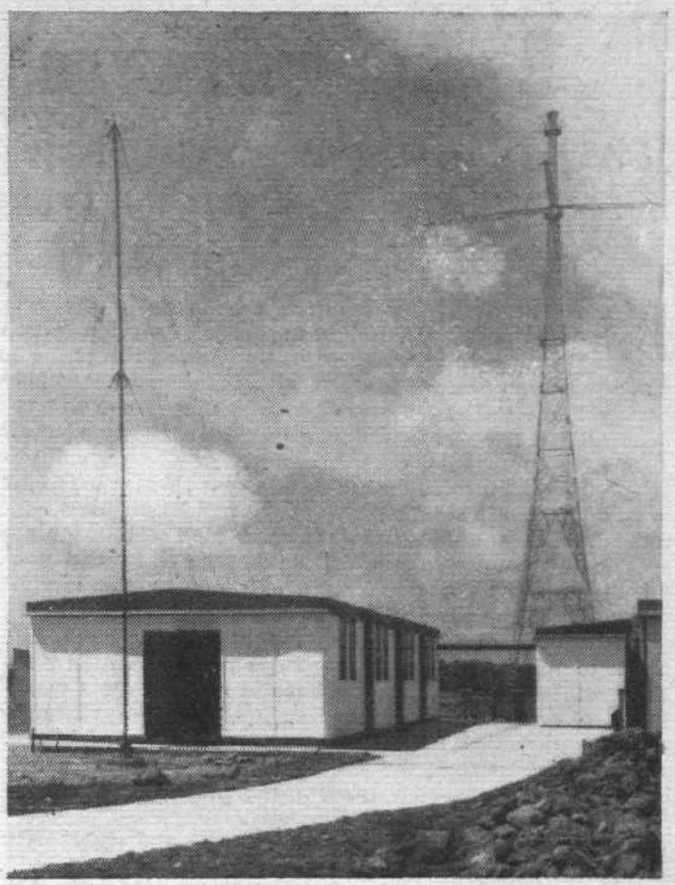
The Decca Navigator system employs the same basic principle as the wartime navigational aids Gee and Loran. However, whereas these two systems required rather complex receiving equipment and specially trained operators, the Decca system employs simple radio receiving equipment, and the results are indicated on three dials which can be read after a few minutes' explanation. The dials or meters give a reading in figures which refer to lattice lines on a chart of the area.

Accuracy within yards is attainable with the Decca system and position can be fixed with increasing precision as the range is decreased. The effective range is at least 300 miles in any direction from London, and during daylight hours transmissions can be recorded and used as a navigational aid up to a distance of 1,000 miles from the stations. The master station is sited at Buntingford in Hertfordshire and the two operational slave stations known as the red and the green slaves are at Stokeholy Cross, near Norwich, and East Hoathly, near Lewes, in Sussex. The purple slave will be at Wormleighton, Warwickshire.

This English chain of Decca Navigation stations was officially declared operational by the Admiralty and Ministry of Transport at 08.00 hours on July 18th.

Principal features of each station are the aerial system which is hung on a steel mast 325 feet in height, and two prefabricated main buildings. The master station consists of mast, transmitter building and reserve power building, while in the case of the slave stations the transmitter building is replaced by one housing the automatic phase control units. By means of this control a very high degree of synchronization is maintained between transmitters.

To ensure a reliable 24-hour navigational service, extreme precautions have been taken that no failure, either in power supply or radio equipment, shall interrupt the radio transmissions from the stations.



Master and slave stations for a Decca chain each comprise a 325ft steel mast and a transmitter building. The second hut may house either a reserve power unit for the master or an automatic phase control unit for one of the three slaves.

SELF-CORRECTING ALTIMETER

An interesting and useful development in instrumentation is announced by the American Square D Company, Kollsman Instrument Division. As is well known, the conventional sensitive altimeter is an aneroid device which records the obtaining barometric pressure relative to a pre-set datum pressure. As a consequence, it is possible in abnormal barometric conditions for an altimeter to register a figure which might be as much as 1,000ft out and, of course, when flying in the vicinity of high ground in blind conditions some considerable risk may be involved.

At present it is necessary for a pilot to depend upon audible contact with ground stations in order that he may reset his altimeter every 100 miles or so as pressure changes occur, but this new development, identified as Automatic Altimeter Setting, eliminates the potentially dangerous sources of error in the cases of the conventional altimeter. It also removes the work-load on the pilot, control tower operators and other operating personnel.

In the new Kollsman device a ground altimeter continuously sends out its own altimeter setting in the form of a coded radio signal. This is received in the aircraft by compact lightweight radio sets which are self-operative and can easily be combined with existing radio range stations. An automatic cut-out device prevents confusion when an aircraft is flying within the signal range of two ground stations; the device automatically cuts out the weaker signal. When the coded signal is received, it is automatically decoded and the altimeters in the aircraft automatically reset themselves accordingly.

Two provisions are made for the pilot to make sure the device is operating properly. First, he may manually set his altimeter to any arbitrary figure, and if the device is working correctly the altimeter then immediately returns itself to its original setting. Secondly, he can feed into his own altimeter a coded signal which represents "29.2" the setting for standard or average atmospheric conditions. If the device is functioning properly, the altimeter immediately sets itself to "29.2" then, when the pilot ceases to give the check signal, returns to the correct reading in accordance with the nearest ground station.

The method selected for the coded signals is to transmit an audible sound of definite frequency; that is, a musical note of a definite pitch, with each altimeter setting accorded a specific note. The altimeters fitted in the aircraft contain a frequency analyzer, which measures precisely the pitch of the incoming signal and so causes each altimeter to set itself "in tune" with the ground barometric condition locally.

ANNULAR COMBUSTION CHAMBER

(*Concluded from page* 112)

ciency, 92-95 per cent and maximum to mean temperature ratio 1.2:1. The temperature distribution at the nozzle end of the combustion chamber was quite good as may be seen from Fig. 3.

It has been revealed that while this combustion chamber proved fairly good as an initial model, several characteristics required improvement. The circumferential temperature distribution was not entirely satisfactory, the space between the burner cone and the small internal cone surrounding the fuel spray was apt to become completely blocked with carbon, the blow-out characteristics at altitude were unsatisfactory and it was not possible to restart the unit above 12,000ft.

American Newsletter

Freight-carrying Prospects : New C.A.B. Regulations : "Intermediate" Records : Transonic Development

By "KIBITZER"

IN a recent newsletter mention was made of the non-scheduled passenger, freight and charter services which have sprung up everywhere in the United States. The gloomy prophecies made then about the possibly short life-span of some of the lesser concerns may prove to have been all too accurate. For it didn't take the regular air lines long to make a complete study of the possibilities of the freight business and to decide that there was money in it. The result is that many of the regular airline operators who have suitable aircraft to spare (and more machines are now becoming available) have gone into the non-scheduled freight business as a sideline—to the natural detriment of the newer itinerant concerns.

The aircraft requirements for freight carrying have, as a result of this interest, been receiving more attention from the manufacturers. The questions of running costs versus speed, of design for cargo handling and of loading arrangements, and devices for maintaining constant temperatures, are all being examined. Personally, one has always felt that there was a good market in the States for a freight-carrying aircraft, because there must be plenty of cargo available if the operator sets about it in the right way. Where high-speed freight movement is so extensively organized it would seem that the best method would be by co-operation rather than by opposition to the established industries. A good liaison with the road haulage contractors should be possible, and this is perhaps how the wideawake companies will proceed in order to obtain return loads.

Another development which affects the itinerant operator is the issue by the Civil Aeronautics Board (which is the law maker for civil aviation over here, as opposed to the Civil Aeronautics Administration, which ensures that such laws are implemented) of regulations governing some of the activities of the non-scheduled companies. Admittedly these rules are only those which any self-respecting company would observe for its own safety, but they do represent the first official control of the charter companies by the Government. These were due to come into force on August 1st, and include rules relating to operational limitations; minimum aircraft instrumentation; "minimums" for flights in bad weather conditions; fuel reserves for instrument flights; and pilots' qualifications. They are undoubtedly to everybody's advantage, and will be welcomed by all responsible firms. They will also reassure the public, who were becoming rather too conscious of the fact that commercial aviation which was under no control by the Government, wasn't necessarily the safest way of travelling.

America is a land of statistics and statisticians; of facts and figures and charts and curves and adding machines and forecasts and assessments. These are the life-blood of some businesses. Now the slide rule experts have been getting busy forecasting the boom in air travel and have, not altogether surprisingly, come to the conclusion that the airlines may have over-estimated the passengers available and may have over-bought on space! A domestic airline here likes to carry a minimum of seventy-five per cent of its load capacity at all times, but if all the big aeroplanes now on order go into service, there may not be a sufficiently big air travelling public to go round. Some of the figures forecast for the machines available give American Airlines as having 103 aircraft to-day, with double this number by January, 1948, and, perhaps, a thousand by 1950. If all the other lines increase at this rate, an awful lot of people will need to travel if the seats are to be filled. As so often happens over here, air travel may prove to be one more case where the crystal-gazing department have magnified what they thought they saw.

Although one sees very little about it in the British Press, the Americans are gradually building up quite a nice list of world's records for themselves. Too great an importance is attached to the speed, height and distance records, and these are apt to overshadow some of the others—which is a pity. The recent American capture, by an Army B.29 Superfortress, of the weight-lifting height record in the 1,000 kilogram class is an example. The corrected altitude attained was 39,360 ft, whereas the previous record stood at 23,759ft. This is a pretty substantial improvement. Why doesn't the Royal Aero Club issue an up-to-date list of records as a delicate hint to the British aircraft trade and the Royal Air Force that such performances are a valuable boost for trade?

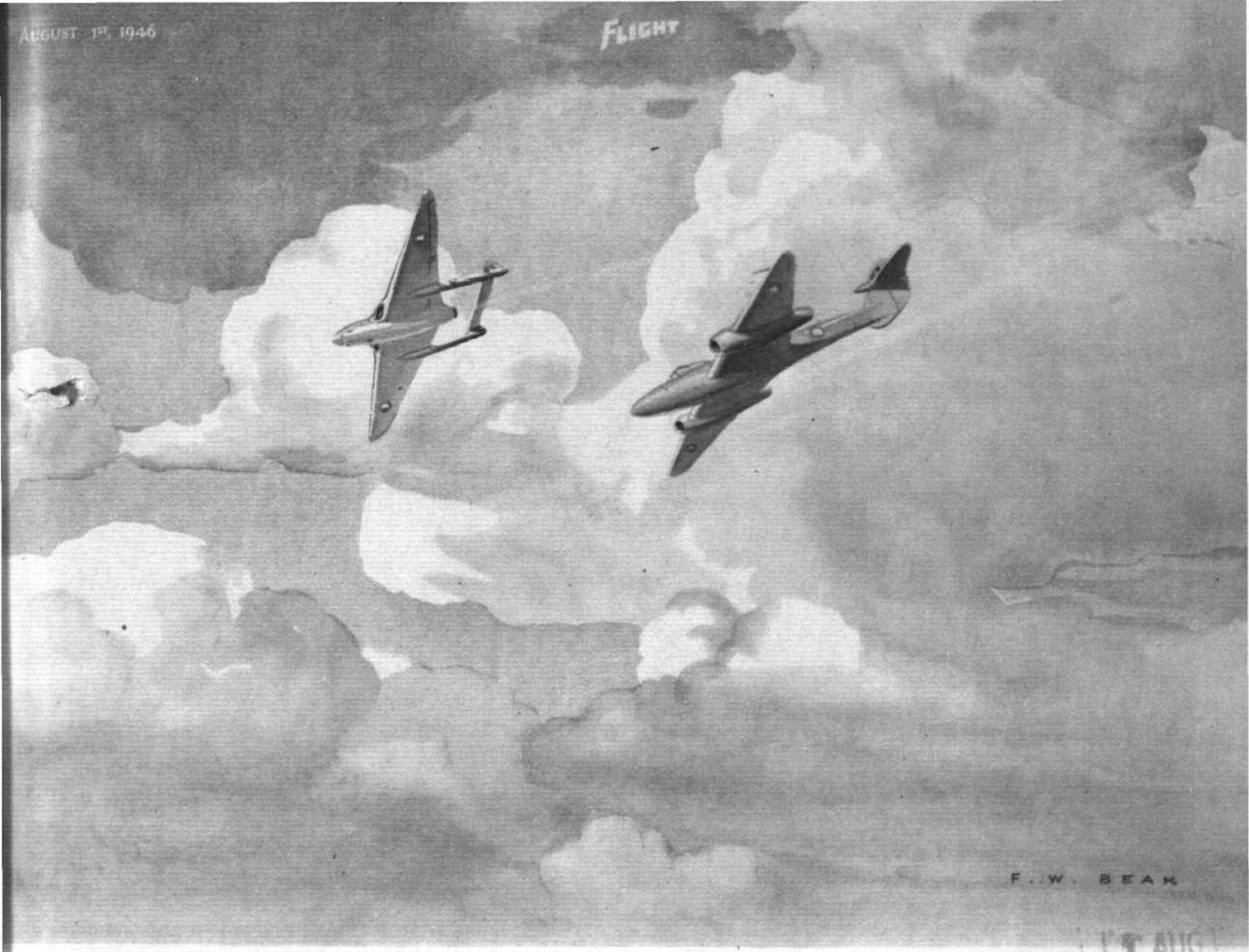
Judging by the rumours that are always going round here, one or two American firms are very keen to be the first to reach supersonic speeds with piloted aircraft. The U.S. Army Air Force has a big development programme on this, and both Douglas and Bell, as well as others, are said to be building, or to have built machines, some of which have flown. Presumably these latter have been "dry" launches from parent aircraft, probably B-29s. In one case both the launch and subsequent gliding flight have been very successful. What the landing speeds are is not known, but without the propulsive fuels on board the wing loading would not be so very high. If and when a jet- or rocket-propelled flight is made, and if the sonic range is pierced, no pains will be spared in cashing in on the resultant publicity. Whoever pilots such an aircraft on such a flight deserves all the praise he will get.

In some of the British illustrated papers a photograph was shown of a P-63 fuselage and tail assembly, fitted with very swept-back wings, and this was described as a supersonic experimental aircraft. This is incorrect, and although the real Bell supersonic job may (or may not) have swept-back wings, it is hardly likely to have a P-63 fuselage, engine, airscrew, tricycle undercarriage and tailplane! What it *will* have is pure conjecture, but it is not believed that it will embody such things as boundary layer suction, or anything remarkable in the way of wing section or wing form. The Douglas job is known to have a long, needle-shaped nose, but, as is the case with the Bell, this machine is probably only a "feeler" towards a final form.

VICKERS CHANGES

THE following changes in the directorate of the Vickers, Ltd., Group have been announced: Lt.-Gen. Sir Ronald Weeks, K.C.B., is appointed deputy chairman of Vickers, Ltd., from August 1st, and was appointed chairman of English Steel Corp., Ltd., on July 17th in place of Sir Alexander Dunbar; Sir Frederick Yapp relinquishes his office of managing director of Vickers, Ltd., on July 31st, but retains his seat on the board of that company. He retires on the same date from the boards of Vickers-Armstrongs, Ltd. (chairman) and English Steel Corp., Ltd.

Commander Sir Robert Micklem, C.B.E., R.N., is appointed chairman of Vickers-Armstrongs, Ltd., from August 1st, retaining the office of managing director (Engineering Works and Shipyards); Maj. H. R. Kilner, M.C., is appointed deputy chairman of Vickers-Armstrongs, Ltd, from August 1st, retaining the office of managing director (Aviation); and Sir Alexander Dunbar retires from the boards of English Steel Corp., Ltd., and Vickers-Armstrongs, Ltd., on July 31st.



JET FIGHTERS

A Consideration of Technical and Operational Requirements

By H. F. King, M.B.E.

THOUGH fifteen or twenty years may see "inhabited" fighters and bombers totally displaced or defeated by pilotless missiles, prudent preservers of the peace, however advanced in rocket and control technique, will reprieve their fighters so long as a potential aggressor retains his bombers.

Operational requirements will not be immediately and radically revised and the demand will persist for two basic classes of fighter—a single-seat day fighter and, to a lessening degree, a multi-seat aircraft for night and bad-weather fighting. This classification is elementary and embraces most of the so-called specialised types, e.g., army-support or low-altitude fighters, high-altitude interceptors, naval fighters and intruders, as we know them today. Usually these are mere adaptations of general-purpose designs; in fact it is difficult to name a fighter of recent years, apart from the German target-defence interceptors and a few "emergency" designs like the Welkin, which were planned with clear-cut requirements in mind and operated accordingly. Although so-called intercepters have sprouted R/P rails, shed their wing tips and successfully established themselves as close-supporters of the infantry, technical considerations governing the design of future high-speed jet aircraft will demand more precise definition of operational requirements. The Saunders-Roe twin-jet flying boat is a representative special-purpose design.

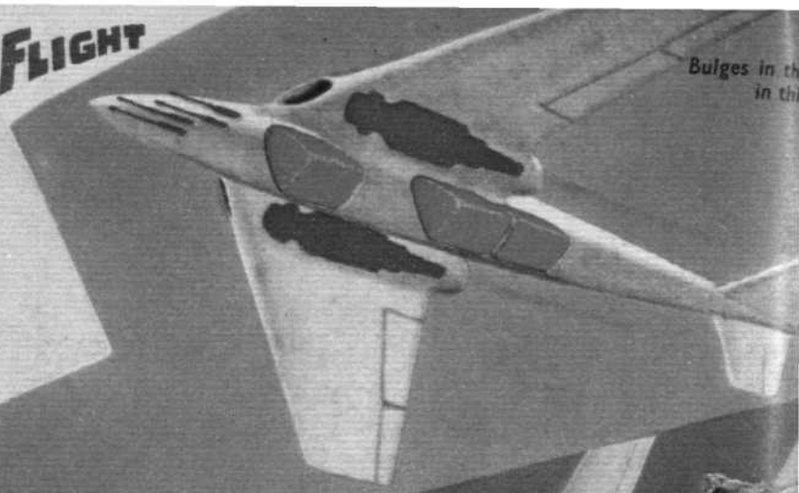
The jet fighter is not yet established in all tactical roles, and for a brief transitional period, the turbine-airscrew or ducted fan unit may be acceptable where requirements permit subordination of extreme speed; thus the Consolidated-Vultee XP-81 escort fighter now on test has a "propjet" in addition to a "straight" jet. When it is realised, however, that speeds of 550-600 m.p.h., service ceilings of over 50,000 ft. and mean rates of climb of 5,000 ft./min. are already achieved by standard jet fighters carrying full war load and without rocket assistance, there can be little doubt that the "straight" jet unit will soon become normal for fighters of all classes. Possibilities of supplementary rockets for fighters were discussed in *Flight* of May 23 this year.

Athodyd Possibilities

Dr. S. G. Hooker, whose pronouncements on such matters merit attention, has declared that he sees little hope for the aero-thermo-dynamic duct (athodyd or ram jet) as a means of propelling aircraft. It is true that fuel consumption may be from 50 to 100 per cent. greater than that of the gas turbine unit and that some supplementary form of propulsion is essential for take off, but the simplicity and power offered may yet warrant the application of the athodyd to fighters intended for the attainment of exceptional speed. Being dependant on speed for its power the athodyd may, of course, handicap climb performance.

As an illustration of what Germany was hoping to achieve, reference may be made to an athodyd-propelled

Simple and successful: outboard units and conventional airframe.



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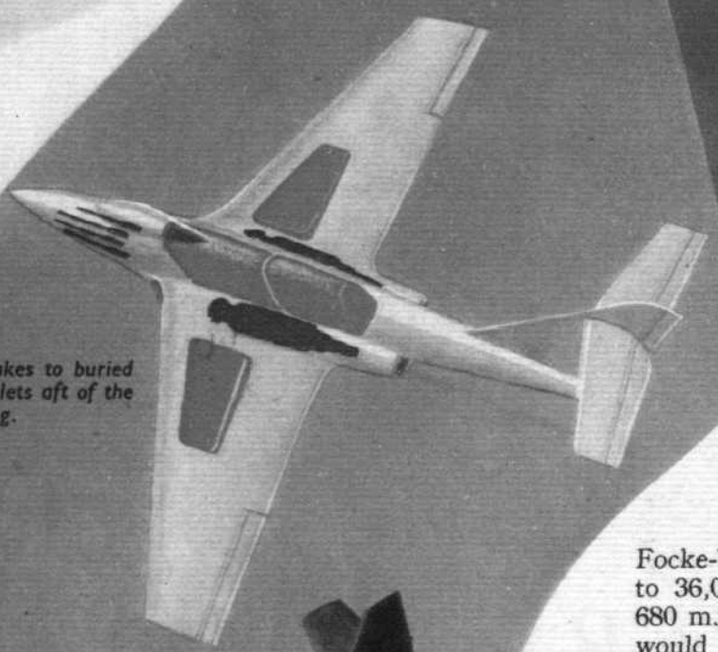
Twin jet nacelles in the fuselage sides, under the wing.



Wing-root intakes to buried units, with outlets aft of the wing.

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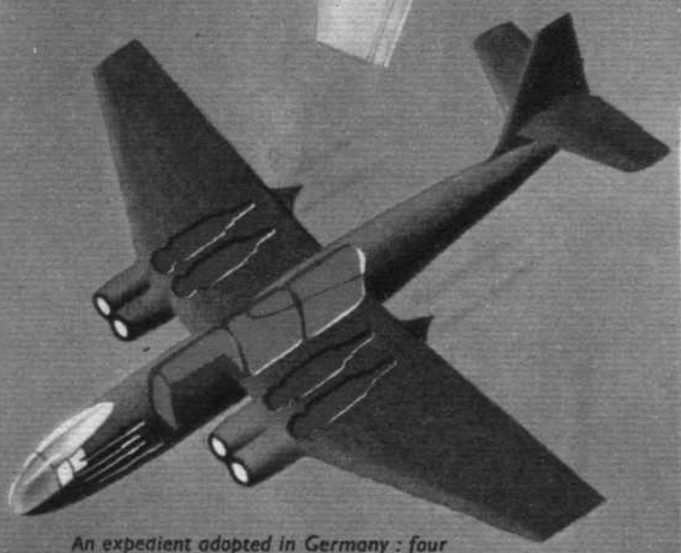
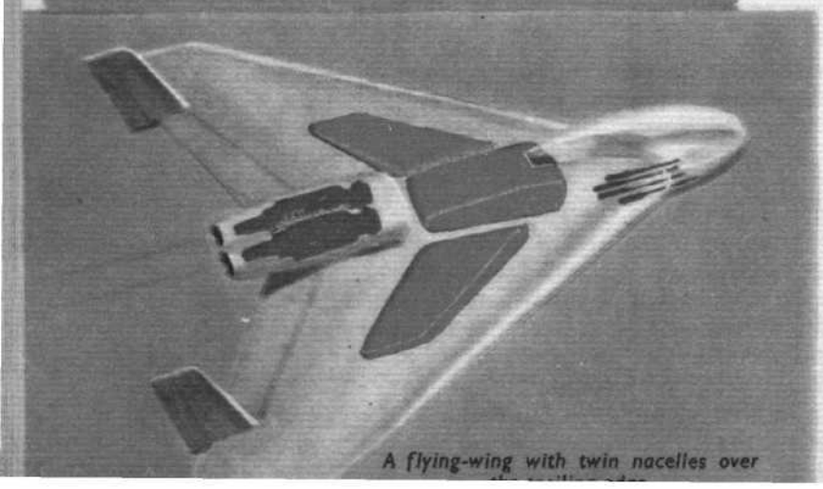


An expedient adopted in Germany: four units in twin nacelles.



A flying-wing with twin nacelles over

Focke-Wulf fighter which was to have two units, climb to 36,000 ft. in under 2½ minutes and attain about 680 m.p.h. at sea level, at which height the endurance would be 13 minutes. At 36,000 ft. the estimated endurance was 43 minutes.

This design was additional to a more adventurous project for a fighter in which three "wings" were rotated round the fuselage by small athodyds at their tips. The efficiency of this scheme was calculated to allow a range at sea level of 400 miles, or 1,500 miles at 46,000 ft.

Such bold departures, however, are not embraced by the present study, the principal concern of which is the turbine-jet fighter.

There is no occasion here to contribute to the axial-flow versus radial-flow gas turbine controversy. The radial-flow unit is now well established and for use in single-jet interceptors, in which the weight of the power unit is of greater importance than fuel weight, it may challenge the new axial designs. The characteristically slim form of the axial will, nevertheless, become increasingly desirable, though a diameter of two feet may fail to produce more than 3,000-3,500 lb. thrust.

Extending Range

Endurance and range attainable with the pure jet are being progressively extended by the use of drop tanks, towed tanks and fuel-tight wings, and in any case seem to have proved less of a handicap than was originally feared, due in part to an increase in operational height, a condition particularly favourable to the turbine-jet.

Having demonstrated its ability to operate without modification under desert and arctic conditions, the jet fighter is now in process of proving its aptitude for carrier use. Handling qualities up to the limiting Mach number are generally satisfactory, and provided that the

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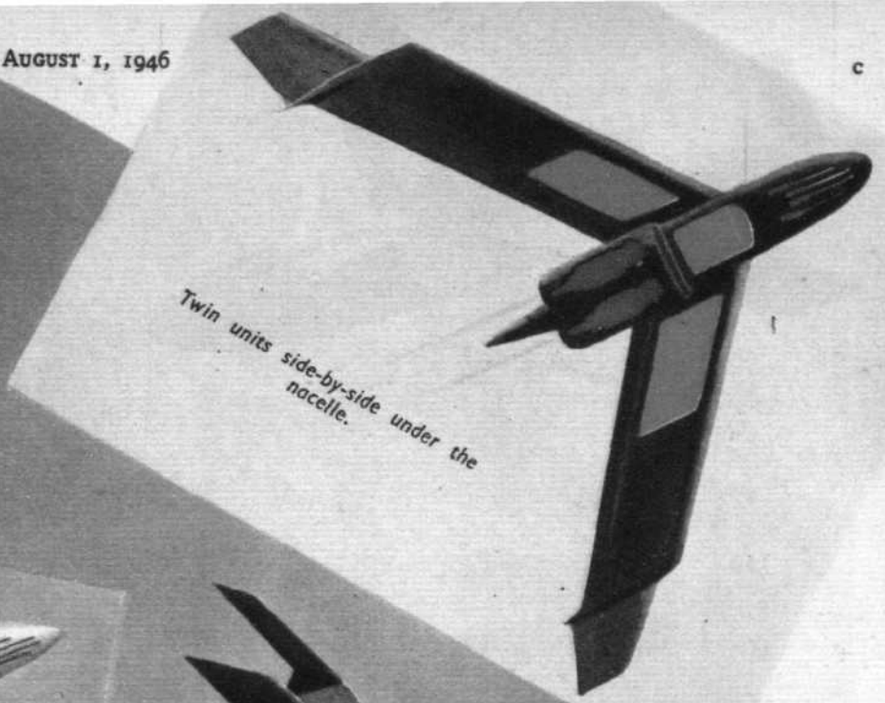
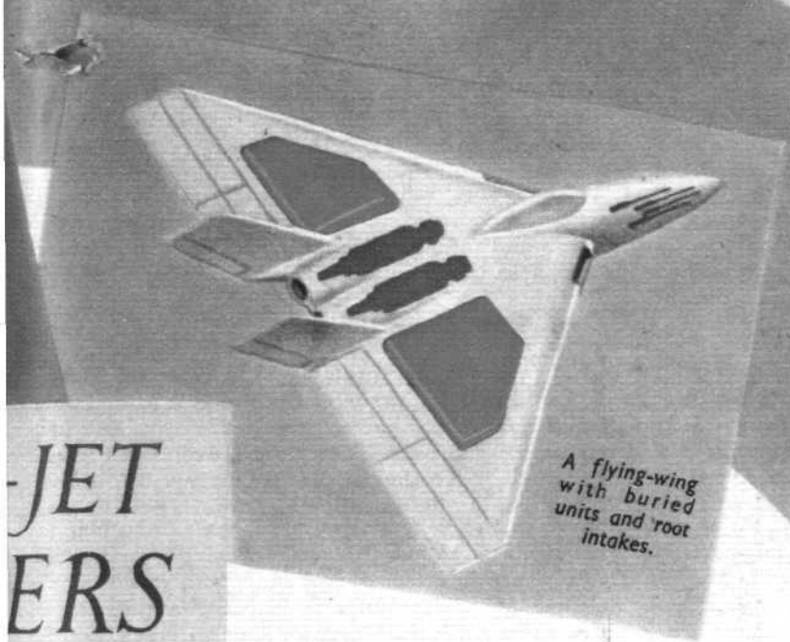
A unit above and below the wing—well suited to a tail-less aircraft.



Twin units side-by-side under the nacelle.



A flying-wing with buried units and root intakes.

-JET
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Side-by-side units in the tail of a broad fuselage.

designer is not too uncompromising in laying out the power plant, maintenance is greatly simplified, while rearming and refuelling are facilitated by the characteristic low build.

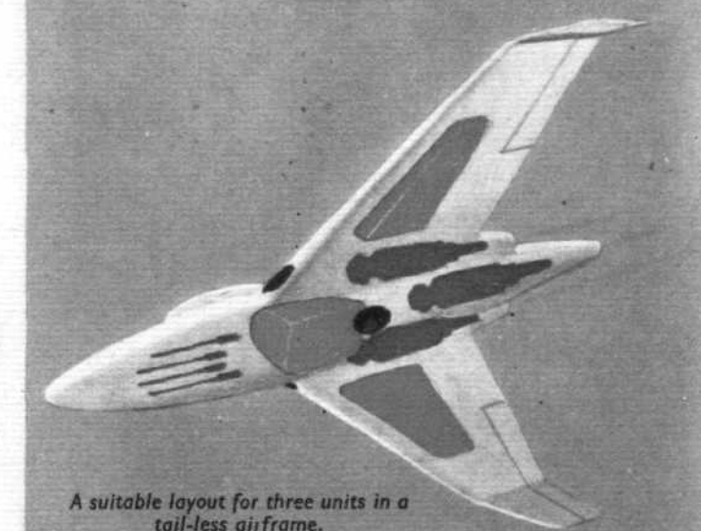
There is no denying that the gas turbine is particularly vulnerable to gunfire, but the configuration of a jet nacelle—particularly for an axial-flow unit—lends itself to armouring against fire from astern.

All-Round Efficiency

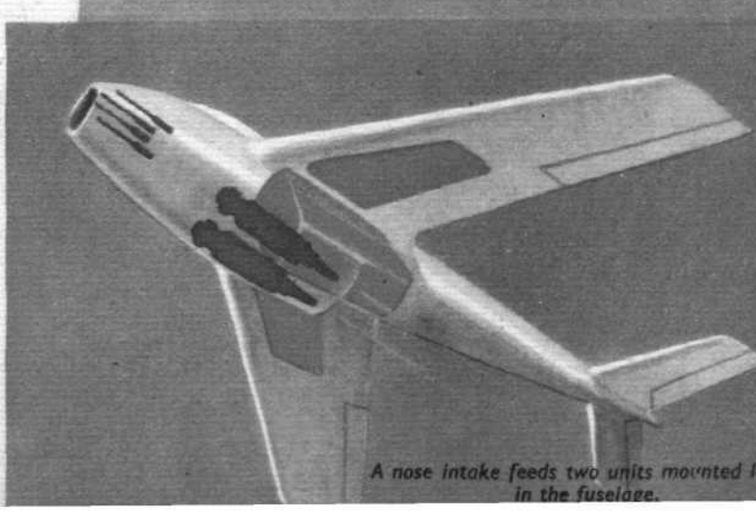
Typified by the Meteor IV the present-day fighter is not only faster at all heights than comparable piston-engined machines, but excels in rate of climb and service ceiling. The Meteor's range has lately been increased to over 1,000 miles though this is less than half that of the D.H. Hornet. On the other hand in rate of turn and rate of roll it shows up remarkably well and easily out-dives competitors handicapped by airscrew drag. In level flight earlier marks of Meteor were comparatively slow to accelerate but the Mark IV, with its Mark V Derwents, is said to be greatly superior.

It is not to be expected that the all-round efficiency of the Meteor will necessarily be reproduced in future jet fighters; these, being more specialised, will tend to accentuate one quality to the detriment of others.

Results of tactical trials with the Meteor and Vampire are withheld, though the manner in which both these aircraft have been displayed, both individually and in formation, is eloquent testimony to their flying qualities and to the confidence of their pilots. Some interesting observations have been made by Air Comdre. W. R. Worstall of Fighter Command, R.A.F., concerning their maintenance in service. Air Comdre. Worstall said that it had been possible to reduce the establishment of fitters in Derwent-powered Meteor squadrons to about half that required to service modern piston engines. Fuelling



A suitable layout for three units in a tail-less airframe.



A nose intake feeds two units mounted low in the fuselage.

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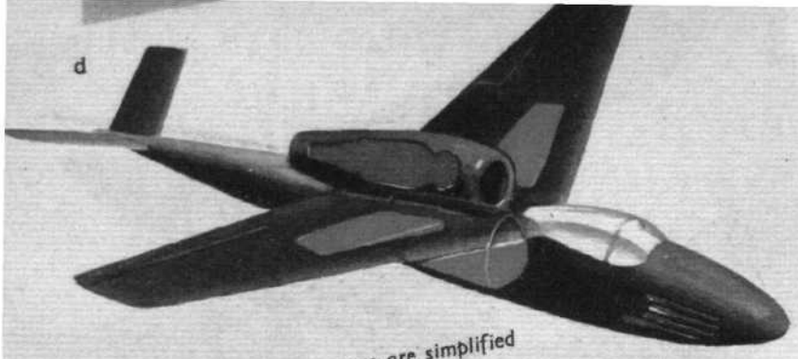
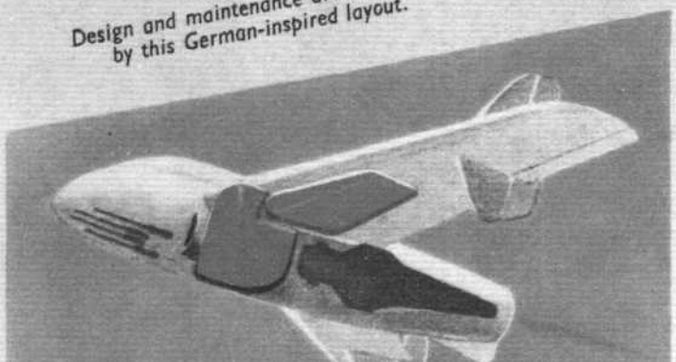


Design and maintenance are simplified by this German-inspired layout.



A suggestion for a tail-less fighter with "nostril" intakes.

Deep study convinced German designers of the advantages of this jet unit location.

SINGLE-JET Fighters

of jet fighters was a problem, however, as it was necessary to filter the kerosene more carefully than petrol, and to add oil. Another trouble experienced was that of starting. A quick start is of vital importance in Fighter Command and Air Comdre. Worstall criticised the electrical starting method. Various means of providing the necessary current have been tried in the Command, one being to rig up eight accumulators in a van. A remark by the Air Commodore that 45 minutes were required to undo the cowling screws was not intended to imply that wing-mounted units are undesirable from the viewpoint of accessibility !

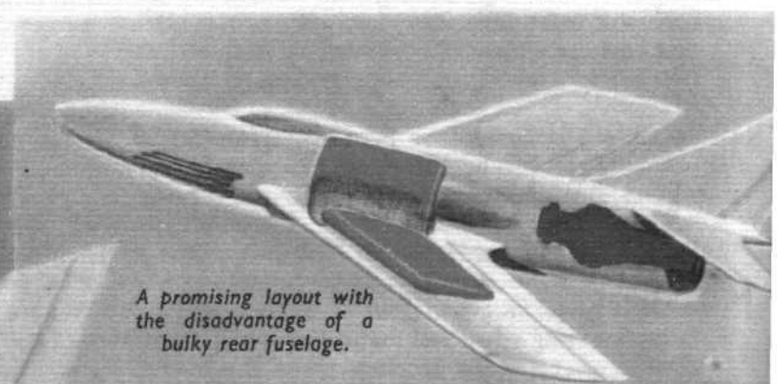
The next few years may see fighters not only with one or two, but with three jets; the four-jet Ar234C under development in Germany as a night fighter was merely an expedient.

That jet fighters will exhibit the peculiarities of their counterparts with the same number of piston engines is essentially true, though today it is difficult to ascribe to the "single" any inherent virtues other than lower cost and superiority in certain manoeuvres. Thus the D.H. Hornet, with twin R.R. Merlins now challenges its single-engine contemporaries on all operational scores (certainly in speed, climb and range), while the twin-Derwent Meteor at present leads the field of jet fighters.

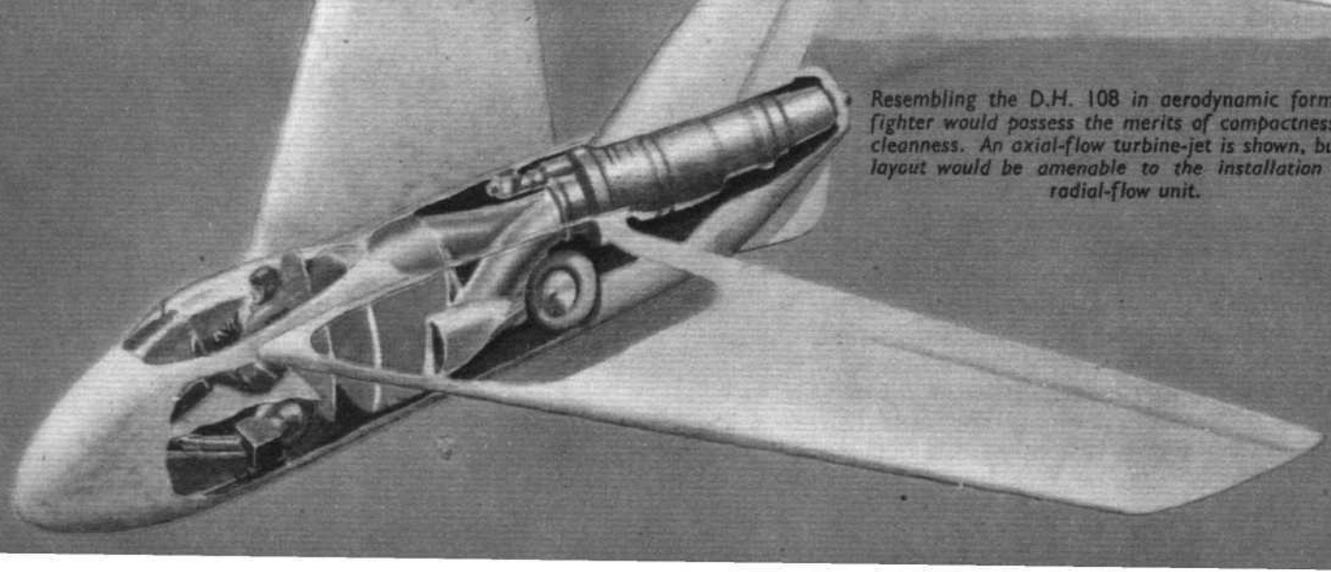
How Many Units ?

Mr. W. G. Carter, the Gloster designer, has referred to the "over-abundance" of thrust required by the modern interceptor for climb and offered by the twin-jet or three-jet layout, and has presented a strong case for the multi-jet design, even with wing-mounted units. It would, nevertheless, be instructive to observe his treatment of interceptor design allowing the option of, say, one unit of 12,000 lb. thrust, two of 6,000 lb. or three of 4,000 lb. Theoretically, at least, the efficiently designed single-jet fighter should equal the twin in rate of climb and excel it in speed.

Whichever number of power units is selected aerodynamic design is not likely to become stabilised for several years, and it may confidently be predicted that wings will be straight, swept-back, or swept-forward, uncompromisingly modern or defiantly conservative in section, and plain or slotted according to angle or their designers' foibles. They will, however, tend toward straight—even parallel—edges and squared tips. The fuselage will not immediately assume the high fineness ratio declared desirable because its design will be conditioned by fuel stowage, jet location and military requirements ; in fact internal power plants may establish grotesque, though aerodynamically eligible



A promising layout with the disadvantage of a bulky rear fuselage.



Resembling the D.H. 108 in aerodynamic form this fighter would possess the merits of compactness and cleanness. An axial-flow turbine-jet is shown, but the layout would be amenable to the installation of a radial-flow unit.

body forms. In some designs horizontal tail surfaces will be eliminated; in others they will be set at a sharp dihedral and displace the fin. Alternatively, a monstrous growth of the fin may, in effect, become a boom carrying the horizontal surfaces sufficiently far aft of the c.g. and clear of the jet stream. A tricycle undercarriage will generally be chosen, but stowage will promote acute difficulties.

One of the most interesting, if perplexing, design problems will be the location of the power plant and air intakes. Many solutions which appear ideal on paper will prove inadmissible because they restrict breathing, promote undue duct losses or compromise maintenance.

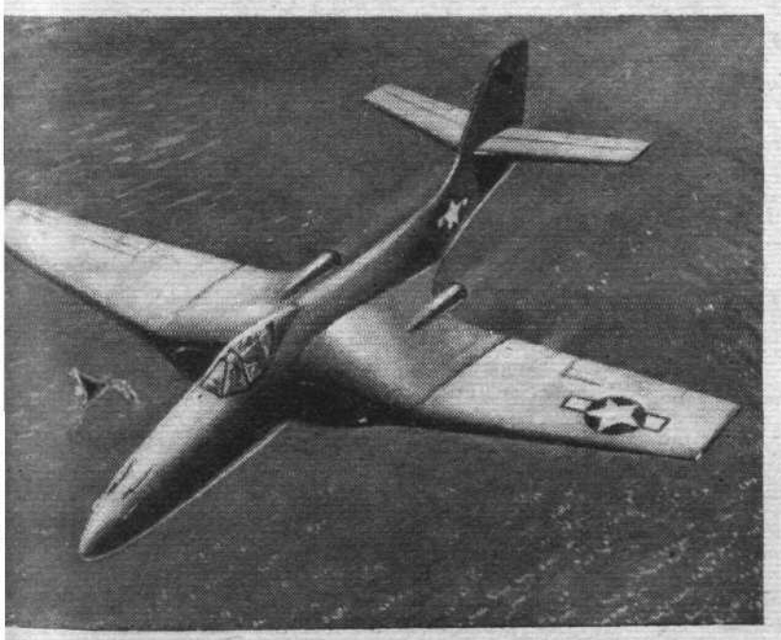
The configuration of the axial-flow turbine-jet readily permits external attachment to an airframe. This attribute was effectively exploited on the German Ju 287 prototype bomber, on which various jet combinations were possible, and on some Blohm and Voss asymmetric designs, but the classic illustration is the Heinkel *Volksjaeger* on which the BMW 003 unit is mounted on top of the fuselage.

No fighter having an external jet unit *below* the fuselage has materialized, designers having preferred to develop this concept into a buried, lower-fuselage installation. The latter layout was, in fact, favoured by the principal German designers for their new single-jet fighter projects. A long intake duct, undercarriage stowage difficulty and the necessity for making wheels-up landings more or less on the jet unit itself were disadvantages.

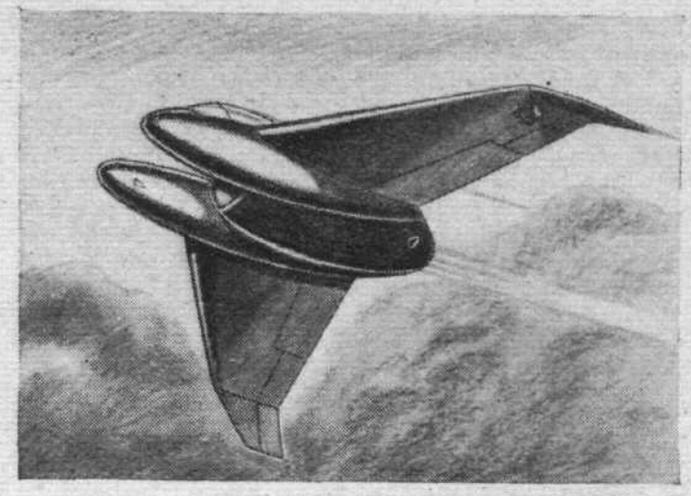
Accessibility

Undesirable duct length or curvature and exasperating inaccessibility must be contended with in the true buried installation, exemplified in the Lockheed P-80 Shooting Star, Republic XP 84, Ryan Fireball and Messerschmitt P 1110, though on the score of maintenance the possibility has been successfully demonstrated both in the Shooting Star and the Ryan Fireball of disconnecting the rear fuselage as a unit. On the Republic fighter zip-fasteners are applied to the intake duct to afford access to the front of the turbine jet. In certain installations boundary layer suction may be necessary to reduce entry losses.

Simplicity and accessibility are offered by mounting the power plant in a nacelle and supporting the tail surfaces on booms, but at high Mach numbers this may induce severe down-loads on the tail. Though doubtless aware of this theoretical restriction the de Havilland Company proceeded with the twin-boom Vampire (just as the D.H. jet team adhered to the single-sided compressor), while in Germany Focke-Wulf abandoned the Vampire arrangement which they had considered in the early design stages of the Ta 183. A similar scheme has been studied by the Swedes for a jet fighter of their own design.



The deep wing roots of the McDonnell FD-1 (Phantom) deck-landing fighter of the U.S. Navy, house two axial-flow Westinghouse turbine jets. The gross weight of this neat fighter is under 10,000 lb.



A Heinkel single-jet proposal with the intake between two nacelles, one housing the nose wheel and armament, the other accommodating the pilot.

Whatever its future, the Vampire design has served its purpose well: it has made possible rapid production of a sound single-jet fighter with adequate performance and first-class handling qualities. Future D.H. fighters will doubtless reflect experience the company is now acquiring with the D.H. 108 research aircraft.

With the twin-boom arrangement a straight-through duct with nose entry is a possible alternative to the wing root intakes used on the Vampire; as on any fuselage or nacelle installation, scoops on the fuselage sides might be adopted. Similar nacelle and intake arrangements could be retained for a tailless or semi-tailless design, the latter having only vertical surfaces and being exemplified by the D.H. 108 and certain Messerschmitt and Heinkel designs.

Annular Intakes

The annular intake round the fuselage, with pilot and/or armament in the nose portion, as in the Miles M 52 supersonic project (now shelved), is an interesting possibility. The Russians are believed to have designed a fighter along these lines, in which the nose cone houses the guns.

Equally striking but less promising is the mounting of a turbine-jet unit in the nose of the fuselage with the efflux at the sides and beneath, as on certain radial piston-engine installations. This scheme was at one time proposed for a jet version of the Fw 190, using a radial-flow Focke-Wulf unit.

In planning a twin-jet fighter the designer has the choice of installing the units on the wing (Gloster Meteor and Me 262A), or in the wing roots (McDonnell FD 1 and Me 262 HG III). He may bury them partially in the fuselages sides (Bell XP-83) or place one above and one below the fuselage (Gotha P.60). A side-by-side layout above or below the fuselage is a further possibility (Arado Night Fighter Project 1) or the units may be disposed side-by-side or superimposed inside the fuselage (Focke-Wulf Night Fighter III and Bv P.215).

The Meteor, with its long and bulky wing-mounted nacelles, holds the world's speed record, lending weight to its designer's contention that this arrangement belies the first impression of being less favourable for high-speed development than a single-jet design. Although the low-speed drag of the twin may be as much as 50 per cent higher, the critical factor is *percentage* increase in drag, and experience is beginning to show that wing nacelles do not greatly influence the rise in drag due to compressibility. They are three-dimensional bodies, and Mr. Carter believes that if precautions are preserved to harmonize the associated air-flow characteristics of wing and nacelle, supersonic flight may be accomplished. Against this promise must be set the increased inertia in roll and yaw of a fighter with wing-mounted units. It has lately been an-

nounced that the Meteor IV wing has been reduced in span to increase the rate of roll.

The wing-root installation appears attractive but, on a fighter of reasonable proportions, demands jet units of very small diameter in conjunction with wing roots of deep section (as in the case of the McDonnell FD-1 with two axial-flow Westinghouse units of 1,400 lb thrust) or swelling the wing contour to form nacelles, as proposed by Messerschmitt. By mounting the units on or in the sides of the fuselage, above and below, or side-by-side beneath, reasonable accessibility is achieved and the power plant mass centralized, but the side-by-side or superimposed internal layout must compromise maintenance, even should the rear fuselage be made detachable.

A striking layout is demonstrated in the Saro E.6/44 fighter: here two axial-flow units are mounted in parallel, partly in the hull and partly in fairings under the wing roots. There is a single intake in the bow.

JET FIGHTERS (continued)

While the gas turbine has been making its spectacular début aircraft designers have studied aerodynamic and structural problems to permit its safe and most effective utilization in fighters. The aerodynamic difficulties have been analysed and described by various authorities and are largely concerned with the effects of compressibility as the speed of sound is approached. Thus the most meticulous study of airflow is demanded of the jet-fighter designer. Aerodynamic factors inevitably affect the design of the structure, particularly of the wing, while flight at speeds of the order of 600 m.p.h. imposes severe demands on strength. Wings, fuselage, fin and tailplane must be subjected to tests simulating the most exacting conditions to be expected in flight, while horizontal surfaces, fixed and movable, must show exceptional torsional stiffness. An ultimate strength pull-out factor for the Meteor IV is 10 at 500 m.p.h., 8.5 at 550 m.p.h. and 7 at 600 m.p.h. indicated.

Armament

Parallel with his study of aerodynamic, structural and power-plant problems the designer of a jet fighter must consider military requirements, notably the disposition of adequate armament. Structural distortion must be avoided and for this reason, and because the wing has become progressively less amenable to armament installation, the tendency is toward the grouping of guns or rocket-projectile clusters in the fuselage. The gun barrels must not protrude unduly into the air stream and precautions must be taken to ensure that the pilot is not dazzled by their flash.

The armament of jet fighters is now undergoing serious consideration and, no doubt, revision. That the Meteor IV should mount the same armament as the Hurricane II C seems incongruous, though it might be argued that four 20 mm Hispanos can still deal adequately with any fighter or bomber of any air force. Even so, designers may count on combinations of much greater potency, if less readily adaptable to their airframes.

The low-velocity, high-capacity gun typified by the 30 mm MK 108 may be deemed superior in some instances to the high-velocity weapon of smaller bore and a similar weapon of 40 mm may ultimately find a place where large aircraft are likely to be the target.

Where higher velocity and flatter trajectory are demanded a gun on the lines of the Mauser MG 213 may provide the answer. This is available in either 20 or 30 mm calibre, muzzle velocities being about 3,000 ft/sec and 2,000 ft/sec, while rates of fire of up to 1,200 r.p.m. are possible.

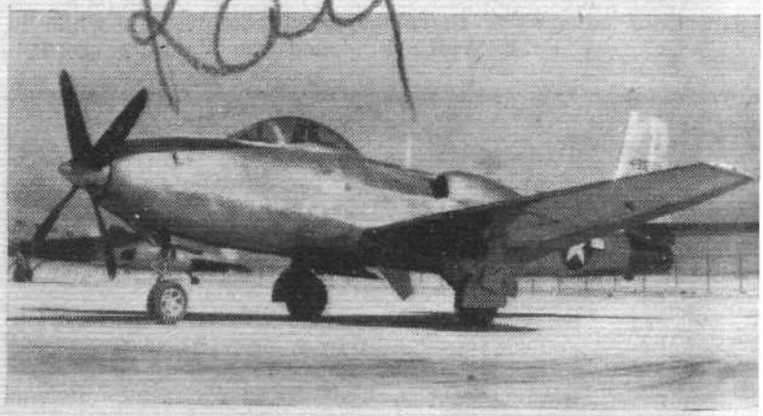
The use of the rocket projectile as an air-to-air weapon has been postponed because of the low velocity obtained, but for attacking bomber formations nose clusters of R/Ps, with suitable fairing arrangements, may be adopted.

It is of interest to compare the armament of current jet fighters. The Meteor IV carries 600 rounds for its four 20 mm Hispanos while the Me 262 is provided with 360 rounds for its 30 mm MK 108s—sufficient for 8-10 bursts of about one second's duration. The Americans, though fully aware of the merits of the 20 mm Hispano, have found it expedient to arm the Lockheed Shooting Star with six 0.5in Brownings for which a total of 1,800 rounds is provided.

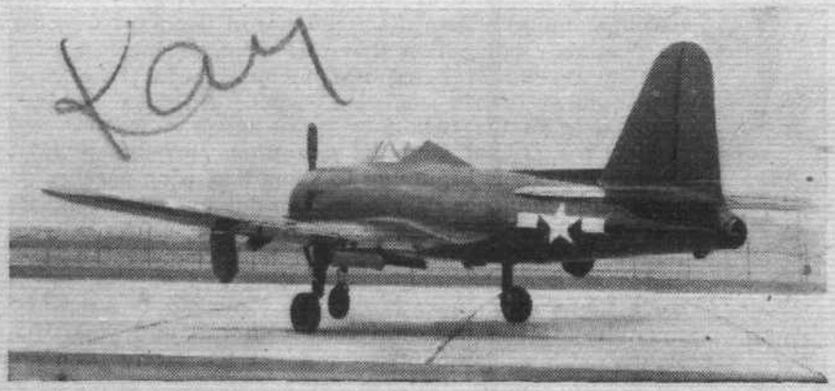
An experimental installation on the Me 262 was a 50 mm high-velocity gun, the barrel of which projected about five feet from the nose. Firing trials were encouraging.

The possibilities of converting a jet fighter for bombing were discussed in *Flight* of July 18th. Two 1,000-lb bombs are a possible load on the Meteor IV and the Shooting Star will carry 2 × 500 lb. Bell's XP-83, a 12-ton fighter designed primarily for long-range escort, can handle 4,000 lb. These bomb loads are alternative to drop-tanks.

For the present the jet fighter is noted for its essential simplicity. Controls and instruments in the cockpit are fewer than on comparable piston-engined aircraft, and absence of vibration facilitates instrument reading. Complication will inevitably result from operational demands. Air brakes, as on the Meteor IV and Vampire, will be essential unless tactics are drastically revised; these will permit steep diving and prevent overshooting a target. Catapult seats are already being designed into new prototypes and the phenomenal rates of climb, and ceilings of over 50,000 feet, will mean that pressurized cockpits can no longer be avoided. The Americans are equipping their jet fighter pilots with anti-g suits and are providing cork-lined

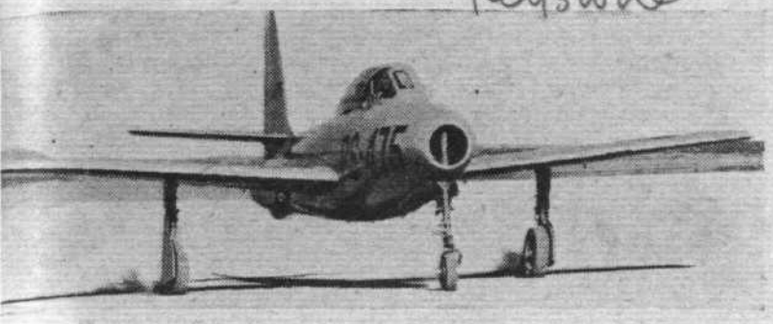


Developing the Fireball theme, the U.S. Army's Convair XP-81, above, has a T.G.100 "prop-jet" in the nose and an I-40 Whittle-type turbine jet with "nostril" intakes in the fuselage.



The Ryan FR—1 Fireball (below) is an interim fighter for the U.S. Navy, having a Wright Cyclone piston engine and a Whittle-type General Electric I.16 turbine jet. It is said to be very popular among pilots.

Keystone



British visitors to America have been particularly impressed by Republic's XP-84 with a single axial-flow General Electric gas turbine and "straight-through" duct.

helmets ("glamour hats") as a measure of protection against bumps.

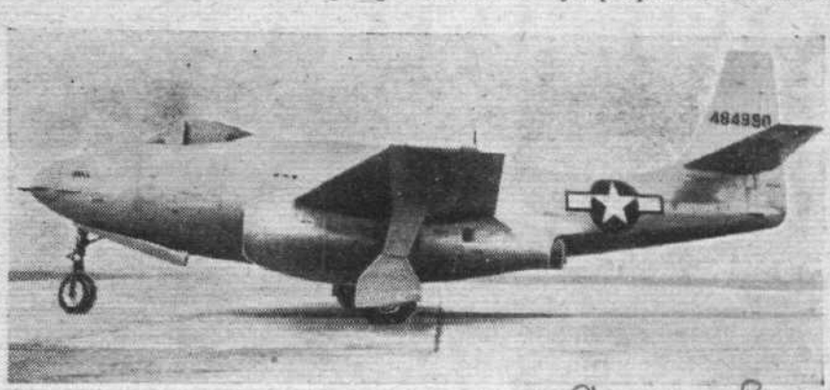
Special precautions are being taken to retain the cockpit hood at great speeds, and this problem may expedite the adoption of a prone position for the pilot, as in the Northrop XP-79, which will in any case be desirable if high accelerations are demanded.

To safeguard the pilot against "explosive decompression" should the cockpit enclosure be pierced by enemy fire, arrangements are made on the Lockheed Shooting Star for automatic reduction of pressure when the gun-control switch is operated.

In general, the pilot's view from the jet fighter is superior to that from a piston-engined machine, but this will be marred unless means are discovered to permit the continued use of transparent enclosures. The noise level is less, and if an automatic pilot is fitted, as on the American long-range twin-jet escort fighters, patrol and escort work should be less exacting than hitherto, particularly as the jet fighter has a short endurance for a given range.

In the foregoing remarks the jet-propelled, multi-seat night and bad-weather fighter has purposely been ignored. The introduction of aircraft of this class will be attended by the same problems now besetting the single-seater, and added difficulties will be presented by the need to stow elaborate radar equipment (to permit interception and attack without optical vision), heavier armament, relatively greater tankage, full night-flying equipment, and a crew of two or three.

It should certainly be possible at this stage to build a twin- or triple-jet two-seater weighing less than 30,000 lb and having a top speed of the order of 600 m.p.h., a three-hour endurance and an armament of four or six 20/30 mm guns. Some interesting designs, including flying wings, were proposed by German designers. Their chief shortcoming threatened to be inadequate endurance.



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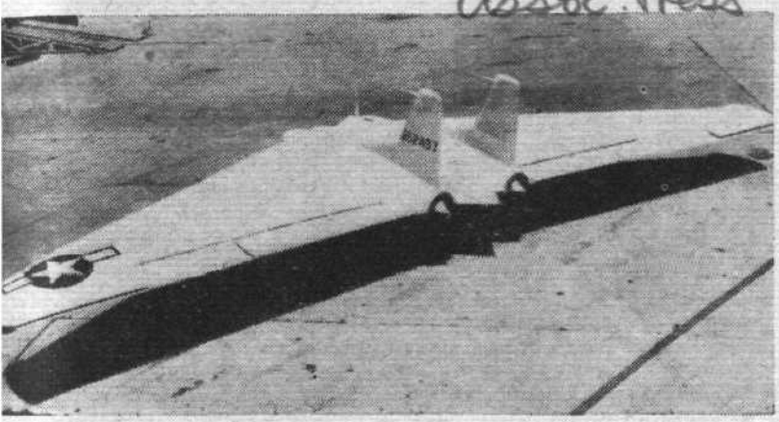
Weighing over 12 tons, the Bell XP-83 long-range fighter has twin General Electric I-40 units, disposed in the manner first demonstrated in the company's P-59.

Assoc. Press



A prone position for the pilot is but one unorthodox feature of the XP-79, a new fighter by the enterprising Northrop concern. The units are axial-flow Westinghouse.

FROM THE FLYING CLUBS

PRIVATE owners, club members, and charter operators visiting Weston-super-Mare are now able to obtain 73 and 87 octane fuel, which is being supplied by Western Airways.

* * *

To be known as the Kendal and Westmorland Aero Club, a new club in the course of formation in the Westmorland area. Flying will be carried out from Middleton Sands, near Morecambe, and the organizer is Mr. L. A. Lyons, Yard 119, Highgate, Kendal. An inaugural dinner and dance will be held in Kendal on the last Friday in September.

* * *

It appears that something like ten thousand spectators arrived at Rearsby during the flying display on July 21st. This was 5,000 in excess of the estimated figure, and explained some of the difficulties experienced in populace control. About 4,000 of the total were gate-crashers, but at least the total figure gives an indication of the amount of interest in the area. The car arrivals formed, at one time, a solid block over four miles of the Leicester road.

* * *

The new Associate Membership branch of the Royal Aero Club proved its value during the week or two previous to the Deauville Rally. Flt. Lt. de la Hoyde, who is in charge of the passport and visa section of the touring department, saved, at the cost of a good deal of midnight oil-burning, many of the prospective guests the trouble involved in obtaining such things. Actually, twenty-seven passports and a hundred and three visas were obtained by the R.Ae.C., and some fifty customs carnets for aircraft were also issued.

The Yorkshire Aeroplane Club, which operates from Sherburn-in-Elmet, has reduced its flying rates from £4 10s and £3 10s to £4 and £3 per hour respectively for dual and solo.

* * *

The Aero Club of Le Touquet has informed our own R.Ae.C. that the airfield there is now open to traffic. It came into use officially on July 14th. Pilots are asked to use the marked cement runway.

* * *

The United Services Flying Club at Elstree now have four Auster J.1s in action and five instructors on the strength. Meanwhile, the wreckage of the Auster Plus D, which was duly delivered to the club from the R.A.F., is gradually being made airworthy and may yet fly during this year. Regular Sunday events of interest are now being organized; last Sunday, for instance, there was a "tea patrol," planned on the lines of the pre-war "dawn patrols."

* * *

The Government of India has decided to subsidize the clubs on a scale which will permit very inexpensive flying instruction. So that the subsidy can be put to the best possible use, the instructional rates will differ according to the age of the members, and those under 28 years of age will obtain their flying at half the standard figure—which is Rs.30 (about £2 5s). The lowest rate is, in fact, less than half the normal pre-war charge at any Indian club. There are active flying clubs in India at Bombay, Madras, Calcutta, Patna, Delhi, Lahore and Karachi, but, later on, the Government proposes to encourage the formation of clubs at other centres.

Amendments to the Bill: British European Airways' Plans : Orders from the Argentine

CIVIL AVIATION NEWS

ATLANTIC LANCASTRIAN: One of the six Avro Lancastrians used by Trans-Canada Airlines for their Atlantic services being refuelled at Montreal. This particular Lancastrian has a slightly modified nose.

Martin & Kelman

CIVIL AVIATION BILL IN THE LORDS

IN spite of the fact that the result of the Scottish stand in the Lords should by now be known to readers, it will be as well to run through the adventures of the Civil Aviation Bill in the House of Lords during last week.

On Monday, July 22nd, the Lords resolved itself into a Committee, and their Lordships plunged immediately into the consideration of a proposal to form an additional Corporation for the organization and operation of the internal air services of Scotland, and for services to and from North of the border. This Corporation to be established in Scotland and with Scottish executives.

The peers from the North ranged themselves and divided their arguments, which were concerned mostly with economic efficiency, policy and sentiment. The main objection to the Government's scheme for a Scottish Division of B.E.A.C. was that it represented centralization of control in London, and it was argued that decentralization, apart from being a living necessity to Scotland, had, in fact, been heavily emphasized as pre-election Government policy. The Earl of Selkirk claimed that the purpose of the amendment was to introduce a measure of decentralization and flexibility in an otherwise somewhat rigid structure.

Decentralization or Disintegration

The spectre of Whitehall over Scottish interests so obsessed the minds of their Lordships that many were the illustrations of the apparent horror with which the Scots held the system of a London headquarters controlling any of their functions. It was not merely the bogy of centralization which worried some of them, but they felt strongly that there would inevitably arise either a Scottish Division situated in Scotland, with out automony and out of touch with the parent Corporation, or a Division predominantly English, with Scottish advisors situated in London and out of touch with the people concerned and with northern requirements. It was contended that a policy was bad which allowed no real and direct attachment for the Scots in their air services, and also that a policy of centralization was, as Lord Airlie, said, "pinning us hand and foot."

Sentiment was said not to enter into the arguments, but Lord Tweedsmuir, in supporting the amendment, considered the vigour, energy and enterprise that the people of Scotland would be capable of putting into this project—only if there was some measure of autonomy. There were many other contributions in favour of the formation of this new "resident responsible executive management."

Lord Winster was, however, unable to agree that a fourth Corporation was necessary. Scotland, he told the House, would be offered a full share of services comparable with any in the world. The Scottish Division of B.E.A.C., he promised, would be a reality with a large share in the planning of Scottish services, and the Scottish Advisory Council would advise the Minister and Corporation on whose board it would be represented. The proposal was resisted by the Minister, and, naturally, by the Government, because they genuinely believed that a fourth Corporation would not be in the true interests of Scotland, and the Minister said that he had not heard a single economic or operational argument to contradict that. Viscount Swinton proposed, as a compromise, a Scottish subsidiary to B.E.A.C., resident in Scotland and with Scottish directors. That suggestion was also rejected and the amendment was withdrawn, to be put down later at the Report Stage.

On Thursday discussion in the Lords centred on the proposal to form the Scottish "subsidiary"—the modification of the original amendment. In supporting this proposal, Viscount Elibank drew attention to the really deep sense of Scottish feeling which had emerged in this matter. In defending the Government's determined resistance to the proposal, Lord Winster declared that it would involve uneconomic and inefficient dispersal of resources. He did agree later, however, that there would be no objection to including the provision for a Scottish Divison of B.E.A.C., and the establishment of the Advisory Council in the terms of the Bill, as against the present form of being merely a promise by the Minister.

The House divided and the Government was defeated. The Bill, in consequence, was returned to the House of Commons As a result of a proposed amendment by Lord Balfour, which was subsequently withdrawn, the Minister gave the assurance that he would ask the Corporations to allow facilities to their employees for joining R.A.F. Reserve formations, and to grant additional leave of absence for attending appropriate training courses, subject, naturally, to Corporation service requirements. The question of pay would require further discussion

The vexed question of whether agencies should be allowed to run organized air tours occupied much of their Lordships' time on Tuesday. The matter is of great moment to the charter companies and a real concession by the Government means that a vast field of opportunity will be thrown open. It was argued that, if the proposal to allow such tours to be run by everyone was passed, it would encourage chartered services, and Lord Grimthorne considered that the smaller type of aircraft used by the charter companies would give assistance to the aircraft industry in their development of overseas trade. Lord Winster did not like it, but agreed to consider the proposal. However, he returned to the House on Thursday with the striking concession that charter companies and the Corporations may be booked by agencies to run air tours. This amendment was naturally passed by the House.

SCANDINAVIAN ADDITIONS

DURING July several changes and additions were made to the services run by Norwegian Airlines (Det Norske Luftfartselskap A/S) operating, in some cases, in co-operation with Danish D.D.L. On July 15th the pre-war Trondheim—Tromso service was reopened, using Ju.52 seaplanes, while the Copenhagen—Zurich—Marseilles run is being shared between the two companies—D.D.L. flying to Zurich and D.N.L. between Zurich and Marseilles. Douglas DC-4s have been put on to the D.D.L. service between Oslo and Copenhagen.

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CIVIL AVIATION NEWS

BRITISH EUROPEAN PLANS

SIR HAROLD HARTLEY, chairman designate of B.E.A.C., held a Press conference on Friday, July 26th, in the room which will soon be his office. The office, in the building which will eventually house the administrative section of the new Corporation, is in Bourne School—evacuated during the war owing to its proximity to Northolt Airfield. There has been criticism that an airline should have ousted a school, but in the circumstances it would be quite impossible for a school to function in that position, just off the end of one of the main runways. Sir Harold and his staff are not to be envied, for telephone conversations on days with an easterly wind are likely to resemble R/T conversation in the middle of a thunderstorm.

The interior of the building is decorated in the airline colours of light grey and red—very attractive for walls, picnic boxes and B.E.A. girls, but we understand that the aircrew have raised objections to being dressed in this particular colour scheme.

THE FIRST SATURN : To be considered as the logical successor to the Lockheed 14 and Hudson, the prototype Saturn has recently made its first test flight. It is a 14-passenger type, of medium range, and is intended for branch-line service.

Sir Harold paid a striking tribute to the assistance given by all branches of B.O.A.C. to the European Division during its gradual formation and assumption of responsibilities. Recruits had come from all sections of the community and he disclosed that 32.9 per cent were from the R.A.F.

The importance of the Mediterranean was appreciated by the Corporation and in this connection the Italian agreement was a step in the right direction. It was interesting to hear that a special department had been created within the Corporation to enquire into the means of utilizing the progress in the use of radar as far as civil flying is concerned. Although it was the Ministry's responsibility to provide control systems for bad weather and avoiding congestion, this was receiving particular attention by B.E.A., as it was so necessary to the efficient and safe conduct of all air travel.

On the subject of aircraft and routes, it was estimated that fifty routes would be covered by the spring. Internal routes would be flown with Dakotas as these were replaced on the Continental routes by the Vikings, of which fifty would be, it is hoped, in service by April 1st. Ultimately, of course, all services will be flown with British aircraft.

There was no "bogy" about the Viking, the chairman said, and he explained the reasons for the rumours which had circulated recently. The temporary grounding of the type was quite a local action at the training school, where it had been found that an over-zealous mechanic had stripped a thread on a petrol union.

Sir Harold aims to provide a British airline service combining safety, regularity and punctuality—which were what the public demanded.

CONSTELLATION CONSTERNATION

THERE was a momentary crisis in some circles last week when it was reported that the Civil Aeronautics Board had called upon the Lockheed Aircraft Company and four other firms to show why the Constellation airliners should not be removed from service permanently. Obviously, the statement could not be accepted at its face value, and it soon became evident that this apparently very drastic move had been made to meet the regulations which limit the period of suspension of certificates by the Civil Aeronautics Board to thirty days. At the expiration of that time certificates of airworthiness are revoked, and until the aircraft can be satisfactorily modified, a new certificate is not issued. It is understood that the modifications necessary in this case are not likely to present any difficulties, and as soon as they are completed a new application will be made. It has been hinted that the Constellations might be expected to be back in service by the middle of September.

An interesting revelation is the news that while it is intended to fit the Constellations with a fuel injection system, there is no necessity for that to be completed before they go back into service again, and these modifications will be made during the course of the next few months. This is a result of the finding that the accident in Pennsylvania was not connected in any way with engine trouble.

The only B.O.A.C. Constellation grounded on this side of the Atlantic has been flown back to America for modification.

By the time this appears in print, it is probable that the C.A.B. will have announced the changes which will be required before the Constellations can return to service. According to the air correspondent of a New York newspaper, the modifications include the complete re-wiring of the electric installations; the overhaul of the hydraulic, fire detection and fire extinguishing systems; a check of the fire-resisting qualities of the interior furnishings; and the installation of bulkheads and doors between the various sections of the fuselage.

MARINE TERMINAL

IT is understood that the Committee which has been studying the question of a permanent flying-boat base in this country has completed its report. This has now reached the Minister of Civil Aviation, but it may be some little time before this report and the findings are made available to the public.

SOUTH AFRICAN INCREASE

THE "Springbok" service between London and Johannesburg is now running four times a week in each direction.

Passages to South Africa are still in great demand, but it is understood that the waiting list is steadily diminishing. The extra York a week will, in fact, assist to the extent of providing seats each way for only six passengers of the non-priority "commercial" category. The Yorks in use on this route—which, incidentally, is run jointly by B.O.A.C. and South African Airways, the latter being responsible for crews and servicing south of Nairobi—are passenger-cum-freight aircraft, and are each carrying twelve passengers and three tons of mail and freight. The other six passengers on each aircraft are Government sponsored.

ARGENTINE ORDERS "FREIGHTER-WAYFARERS"

FIFTEEN Bristol 170s have recently been ordered by the Argentine Aeronautical Purchasing Committee. Deliveries are to be started very shortly and should be completed early in 1947.

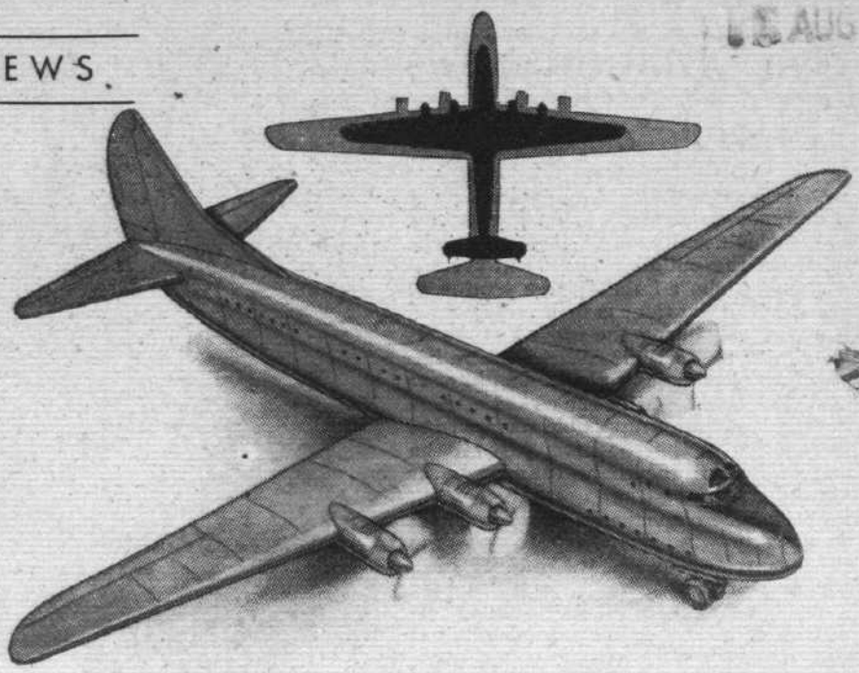
These 170s will be "combination" types, in which both freight and passengers will be accommodated. The former will, of course, be carried in the nose and loaded through the special doors, while there will be, behind the bulkhead, seating accommodation for sixteen passengers.

The contract, which is the first major post-war order to be received from abroad by Bristol's, was the direct result of the exploration of the South American market made recently by the Company's sales director, Capt. K. J. Bartlett. Incidentally, a Freighter-type 170 is due to leave during this month for a demonstration tour of North and South America.

CIVIL AVIATION NEWS

Heston of pre-war years. The situation there is already becoming very similar, with two or three charter companies and a strong admixture of club life to maintain a reasonably free-and-easy atmosphere.

At the moment there are British-American Air Services, and a new charter concern, Modern Air Services, to represent the charter operators, with British Aviation Services and the West London Aero Club in residence alongside B.O.A.C.'s maintenance school, and the B.E.A. Division's Stores. The latter are carrying on at White Waltham as, so to speak, an aftermath of the wartime A.T.A. The organization of airfield tenancies is controlled by the Ministry of Supply. One hears that a well-known aircraft manufacture concern is likely to make White Waltham one of its bases in due course, but that this invasion is not likely to alter the general situation. Certainly, Heston's place in the scheme of things must be taken during the coming year, since this airfield is due to be closed in August, 1947, for reasons of local operational safety if for no others.



CONSTITUTION CONTRAST: The relative sizes of the Lockheed Constellation and Constitution, as well as the general layout of the latter, are approximately depicted in these *Flight* drawings. It will be seen that the Constitution fuselage is of hour-glass section.

CENTRAL PASSENGER-HANDLING

RUMOUR has it that the Airways Terminal in Buckingham Palace Road may quite soon cease to be monopolized by B.O.A.C. If the rumour has foundation, as one hopes it has, the booking and passenger handling arrangements, in fact the ground floor organization, will be taken over by an independent body to act on behalf of the airlines. Whether it will be under Government control or be a commercial concern nobody has yet divulged, and whether the facilities will be limited to the Corporations is yet another question. But a central airline booking point for all operators will certainly be advantageous from the passengers' point of view and will, additionally, assist necessary inter-operator collusion in the matter of passenger accommodation on the different services. At the moment, with so much excess prospective traffic, such co-ordination is unnecessary, but the need will certainly arise.

THE FAROES SERVICE

THE Faroe Islands, two hundred miles north-west of the Shetlands, are to be linked with the U.K. and Denmark by a weekly air service run under charter by Scottish Airlines.

The Islands experience some of the worst weather in the Northern Hemisphere and many wartime R.A.F. pilots will recall the clouded cliffs which rise sheer out of the sea.

Aircraft will make a refuelling call at Prestwick on the return journey, as well as the outward journey from Copenhagen, there being no fuel on the Island. The service started on Monday, July 22nd.

BREVITIES

The second Sandringham flying boat for service with Tasman Empire Airways left Poole on July 25th for delivery to New Zealand. Capt. A. M. Foster is in command. One more remains to be delivered.

* * *

P.I.C.A.O.'s South Pacific Regional Section is expected to meet somewhere in Australia on February 1st, 1947, for discussions. Sydney has been named as the meeting place for the Regional Traffic Conference of I.A.T.A. starting on January 14th, 1947.

* * *

The establishment of the proposed North Atlantic Regional Secretariat of P.I.C.A.O. has been postponed until September, though temporary staff is already at work. The purpose of the office will be that of acting as the agent of P.I.C.A.O. in the organization of North Atlantic Route Service meetings, and the distribution of information.

* * *

B.O.A.C. are planning to increase the frequency of their flying-boat service to Australia to three a week at the expense of the U.K.-Singapore service, the frequency on which is being reduced to two. The Australian route passes through Singapore.

On June 19th a B.O.A.C./Qantas Lancastrian was compelled to reduce the passenger load to two, in order to carry over one ton of air mail containing 264,384 letters. During the past twelve months, Lancastrians on the London-Sydney route have carried an average of five passengers per trip.

* * *

The Madras-Hyderabad-Nagpur-Bhopal-Gwalior-Delhi service is now operated twice a week by both Deccan Airways and Indian National Airways. Hyderabad to Bangalore is also covered by a twice-weekly service.

* * *

It is expected that Woolsington will become the civil airport for Newcastle, although a certain amount of airfield work will need to be undertaken first. It is located about six miles away from the city.

* * *

To provide improved handling facilities for aircraft at Shannon, new taxi strips are to be laid as soon as possible, and some of the installations on the airport are to be moved to their permanent locations earlier than had been originally intended.

* * *

The American Air Line Pilots' Association are said to be negotiating for an increase of pay for the pilots. Although the suggested figure is 19,800 dollars a year, the magazine *Time* is of the opinion it will be raised to only 12,000 dollars!

AIRSTRIP . . . No. 25

VOSPER

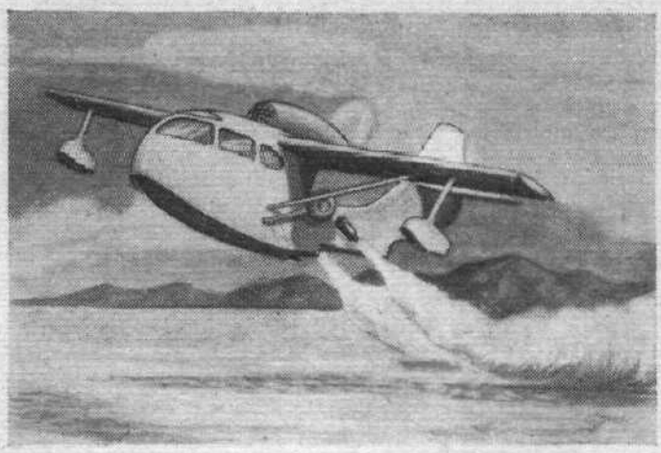
PORTSMOUTH

Assistance from Rockets

American J.A.T.O. Units : Application to Civil Aircraft and Sailplanes

LIKE many of the more useful but initially revolutionary devices, rockets for assisted take-off experienced a rather discouraging reception in America. In fact, at one time it appeared that, because modern machinery could clear and prepare jungle landing strips more quickly than it was thought aircraft could be modified for rockets, they would not be adopted at all. However, Jato, as it is called in America, has proved its worth in the meantime for a number of different uses. In particular for assisted take-off with heavy loads from deck or land, or in emergencies such as occur in sea rescue work by flying boats, and during salvage of aircraft which have made forced landings in difficult terrain.

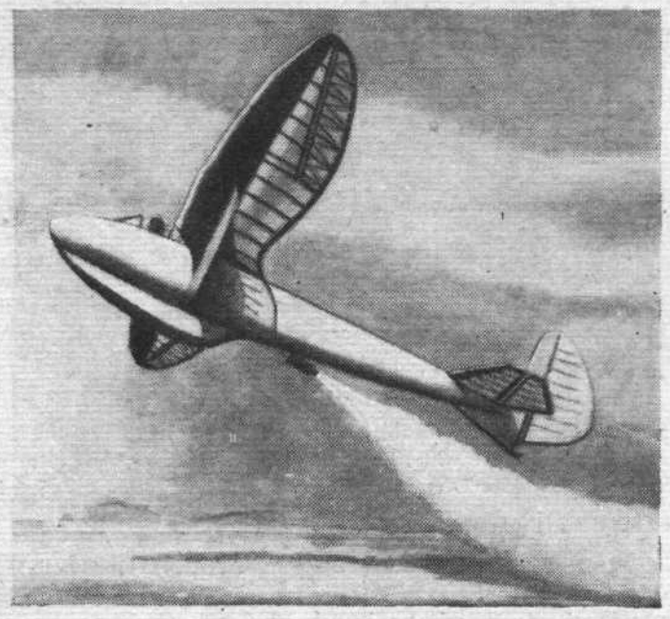
The American Aerojet rocket unit, which is now widely used, weighs 205 lb loaded and 115 lb empty. It comprises a large steel bottle about ten inches in diameter and three feet long, and is a true rocket in that it contains both fuel and oxygen, and is capable of delivering its rated power regardless of altitude or atmospheric conditions. There are two attachment lugs on the side of the bottle.



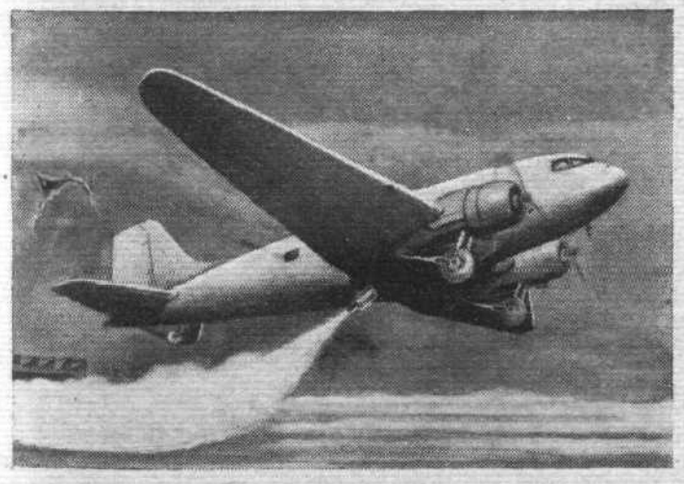
Rocket assistance on take-off will enable light amphibians such as the Seabee to operate safely from much smaller stretches of water than at present.

Known as the 12AS-1,000 D-1 the standard unit gives 1,000 lb thrust for twelve seconds or the equivalent of 330 h.p. at 90 m.p.h. The propellant material is cast in the form of a cartridge which is fitted into the bottle, and an igniter, electrically operated by the pilot, is added in the same manner as a bomb fuse. It takes less than half a second to develop 80 per cent thrust after closing the igniter circuit.

The fuel has a minimum ignition temperature of 275 deg F and is not sensitive to the shock of ordinary handling. The exhaust smoke is neither toxic nor corrosive. A safety cap is incorporated which will blow out at more than one and a half times operating pressure and a protective cap keeps the carbon-lined nozzle and throat clean and dry. Tests with a D.C-3 transport show that at sea level the take-off run and climb to clear 50ft is reduced from 4,000ft to 2,587ft and from a runway at an altitude of 4,800ft from 5,500ft to 3,621 ft. The tests were made at 25,200lb all-up weight and the Jato was fired to operate at rated thrust two seconds before speed is reached at which the rudder will control yaw resulting from the failure of one engine. In practice this is at a point 1,115ft along the runway with an aircraft speed of 84 m.p.h.



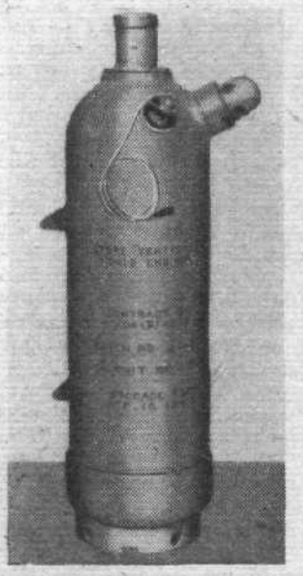
The development of rockets suitable for driving sailplanes to soaring altitude will open up many new possibilities.



With the help of an Aerojet unit a loaded D.C-3 can take off with 500 yards less runway than is normally required.

Various applications of Jato for small civil aircraft are foreseen by the Aerojet Engineering Corporation, and a unit delivering 150 to 250 lb thrust for about 25 seconds is likely to be a requirement for emergency operation from small fields and for assisting low-powered amphibians to take off from small lakes. This is particularly important in America, where this type of medium-sized, light aircraft, exemplified by the Grumman Widgeon or Republic Seabee, are often used to fly to comparatively inaccessible lake country for a week-end shoot.

A further interesting appli-



The standard American Aerojet rocket motor weighs 205 lb when charged and 115 lb empty.

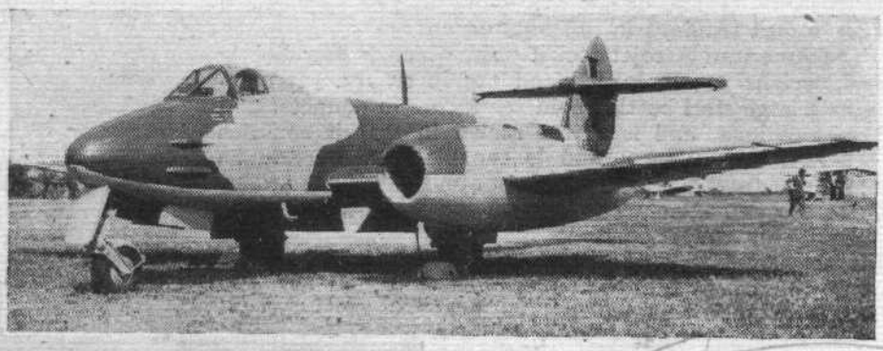
ASSISTANCE FROM ROCKETS

cation, and one that is likely to become increasingly important in this country both on its own merit and as a result of the intolerable position regarding C. of A.'s for very light aircraft, is for take-off and initial attainment of altitude on gliders and sailplanes. Taking basic characteristics as follows:— gross (motorless) weight = 875 lb; wing area = 166 sq ft; max. gliding ratio = 23:1, a careful analysis of the power requirements for sailplanes has been made and the most efficient compromise appears to be a rocket giving 500 lb thrust for 24 seconds. This would take the sailplane to between 1,000 and 1,500ft depending upon the skill of the pilot, at a rate of climb of approximately 3,000 ft/min. A sailplane can begin to take advantage of thermals from about 1,000 ft and with rocket assistance, could be flown from any convenient airfield without the need for dismantling, hauling and cumbersome launching devices. The angle of climb would be much the same as when using a winch and forward speed would necessarily be fairly restricted.

It is said to be simple and inexpensive to fit the aerojet attachment mechanism and the refill cartridges are easily inserted into the chamber. The units are safe to store, but should be kept in an upright position. They are unaffected by moisture and have a normal storage life of twelve months.

The use of rockets to launch gliders is not entirely new having been tried in Germany and in this country also. However, the general use of this method will depend upon the availability and cost of the "power eggs" and the results of experience in club usage. For sailplanes, the aim must be to produce at reasonable cost, very light and simple attachment fittings and bottles needing little servicing. The "refills" must be cheap, easy to store and simple to handle and install on the aircraft.

A Meteor Height Test



"Flight" photograph.

METEOR and AIRACOMET

The Meteor IV attains high altitudes because it has tremendous power and a moderate wing loading (about 37 lb./sq. ft.). The old Bell YP-59A (left) has much less than half the power but a wing loading of only 28 lb./sq. ft.

A METEOR IV fighter with pressurized cockpit reached 46,500 ft last week. The circumstances of the flight are of some interest in showing how casually such occurrences are treated at Moreton Valence.

Over lunch with the Gloster test pilots the conversation developed, by way of speed, speed, handling qualities and speed, to altitude. We recalled that a Bell YP-59A Airacomet had reached over 47,000 ft, which Eric Greenwood considered a good show if the old Whittle-type General Electric I-16 units were used, and mentioned that this early American jet fighter, now a trainer, has a very low wing loading. After some discussion it was decided that the Americans had claimed only 45,000 ft or so, but Greenwood was confident that whatever the figure the pressurized Meteor would beat it comfortably. Philip Stanbury agreed and the talk inevitably reverted to speed.

After lunch Stanbury asked Greenwood if he could go off and fly. Within an hour we met him on the tarmac and asked what speed he had reached. He said he had not tried to go quickly, but that he had been upstairs. How high? Oh, about 46,500 ft. . . .

He was flying a Meteor soon to be handed over to Rolls-Royce for testing turbine-jets at high altitude. The pressurized cockpit produces conditions equivalent to 28,000 ft, and the cockpit canopy is, of course, double, and contains a de-misting element. It has already been stated that the potential ceiling of the Meteor IV is well over 50,000 ft: at 53,000 ft the estimated rate of climb is still 500 ft/min.

On checking the facts relating to the Airacomet's performance, we find that this aircraft achieved 47,700 ft, considerably more than two years ago, establishing an American altitude record. Engine trouble forced a descent, otherwise it was thought that the machine would have climbed above 50,000 ft. The cockpit, of course, was pressurized.

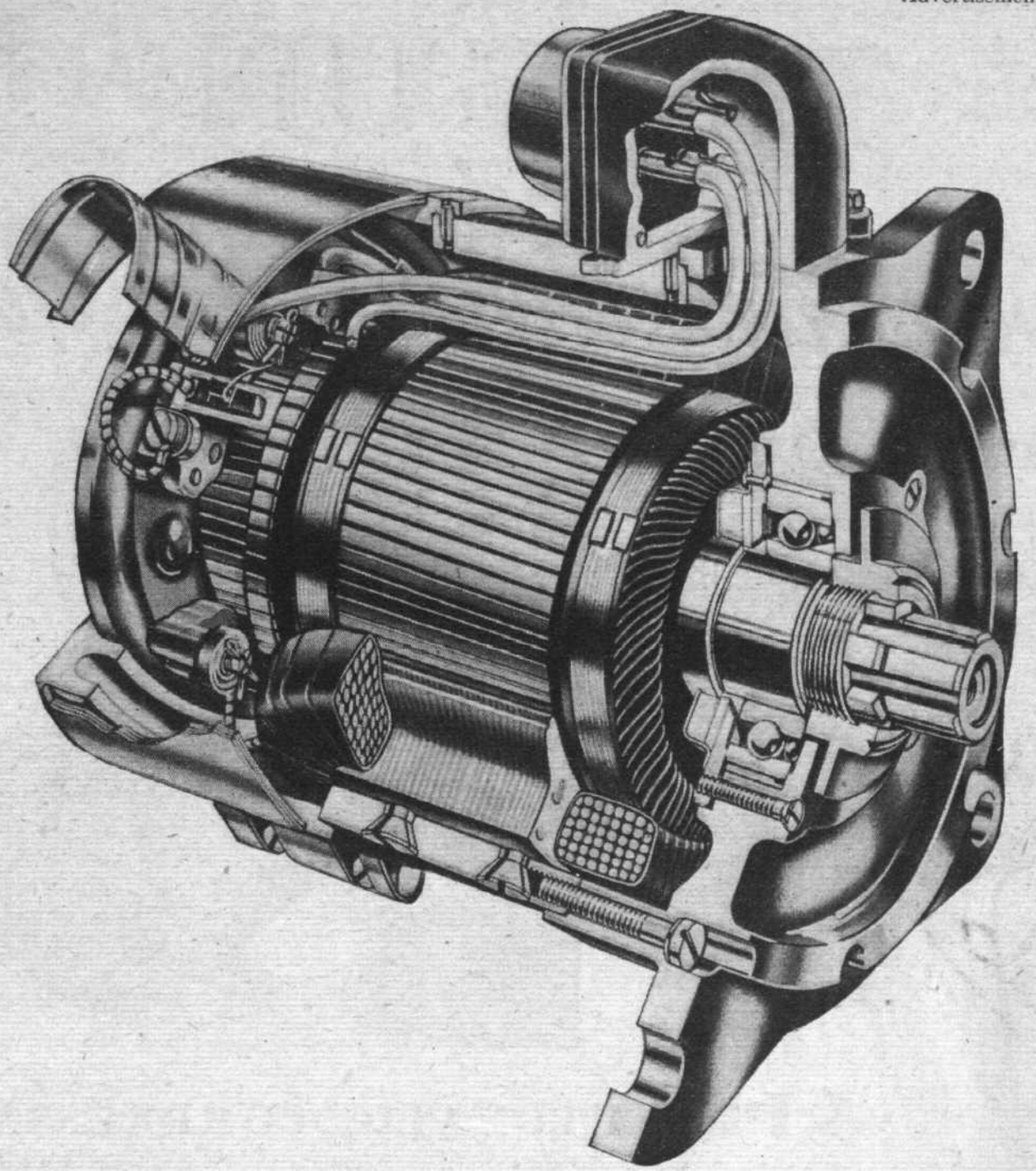
Doubtless we shall soon hear that the Meteor has beaten the performance of the old Bell, but it is to be hoped that the pilot will have a pressure-suit in addition to cabin pressurizing. Failure of the cabin at such heights may at best have serious results and at worst quickly prove fatal.

THUNDERJET EXCEEDS 590 m.p.h.

PERHAPS the most promising of the new American jet fighters, the Republic P-84, or Thunderjet, is stated to have a top speed in excess of 590 m.p.h. This was announced when more than 200 reporters and correspondents, together with U.S. Army officials, watched a demonstration at Wright Field recently. The "service range" was given as 1,000 miles and the service ceiling as more than 40,000ft.

This attractive-looking fighter has now been in the air more than twenty times since its initial flight at Muroc Field, California, on February 20th. The span is 36ft 5in and the length 37ft. An axial-flow General Electric turbine-jet of unspecified thrust is fitted and has a nose intake and tail eflux. The jettisonable "bubble" canopy is electrically operated and can be opened by the pilot at all speeds, and the pressure cabin contains a pilot-ejection seat. Range can be increased by wing-tip tanks, as introduced on the Lockheed Shooting Star. Another feature in common with the Shooting Star is a detachable rear fuselage which is claimed to permit complete replacement of the power unit in 50 minutes. Use is made of zip-fasteners to facilitate inspection of the unit.

Over 100 Thunderjets have been ordered by the U.S. Army, and the second machine has been completed. The makers are confident that the speed can be increased to considerably more than 600 m.p.h., and a Thunderjet may soon attack the World's Air Speed Record. Its success will depend on the thrust obtainable from the G.E. turbine jet; little or no external "cleaning up" will be possible, for the aircraft, as already flown, is probably the cleanest fighter yet built.



GENERATORS FOR AIRCRAFT. The Rotax range of engine-driven generators covers output requirements from 150 w., 12 v., up to 4,500 w., 29 v., either clockwise or anti-clockwise rotation. The illustration shows the Rotax B.2001 D.C. Generator, fitted to the de Havilland Gypsy Queen engine and other installations. **Output** is 1,000 watts (35 amperes, 29 volts), and when used in conjunction with a voltage control unit will maintain this output over a **speed range** of 3,500 r.p.m. to 6,000 r.p.m. Simple **Blast Air-cooling** enables the generator to be **continuously rated** under full load conditions. The **Power/Weight ratio** is 62·5 watts/lb. Electrical connection by **plug and socket.** **WEIGHT** 16 lb.

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Scientific A14

WILLIAMSON O.S.C.-1 AIR CAMERA

Heated "Bubble" Installation : Remote Control of Shutter Speeds Incorporated

THE science of photogrammetry should receive much stimulation following the announcement made at the annual general meeting of the Williamson Manufacturing Co., Ltd., by Mr. Colin Williamson, chairman of the company, that £5,000 had been voted to endow a Chair of Photogrammetry at the London University.

Air survey, in consequence, receives a dignity of which it is worthy, and a new field of scope and opportunity is open to our young technicians and scientists.

The result of much scientific research and mechanical engineering is exemplified in the Williamson O.S.C. Mk.I Photogrammetric Air Camera, which has been produced to meet the exacting demands of modern air survey.

In light of the long experience which the Williamson Company are in a position to apply to the problems concerned with air photography, developments can be seen in the design of the new camera. For instance, advantage has been taken of the high degree of reliability which has now been attained in electrical services. This has resulted in an all-electric operation of the camera which is arranged in such a manner that the independent functioning of each unit is provided. The shutter, film wind, pressure plate, and instrument exposing switch are each separately powered units, electrically interlocked to ensure a correct functioning sequence.

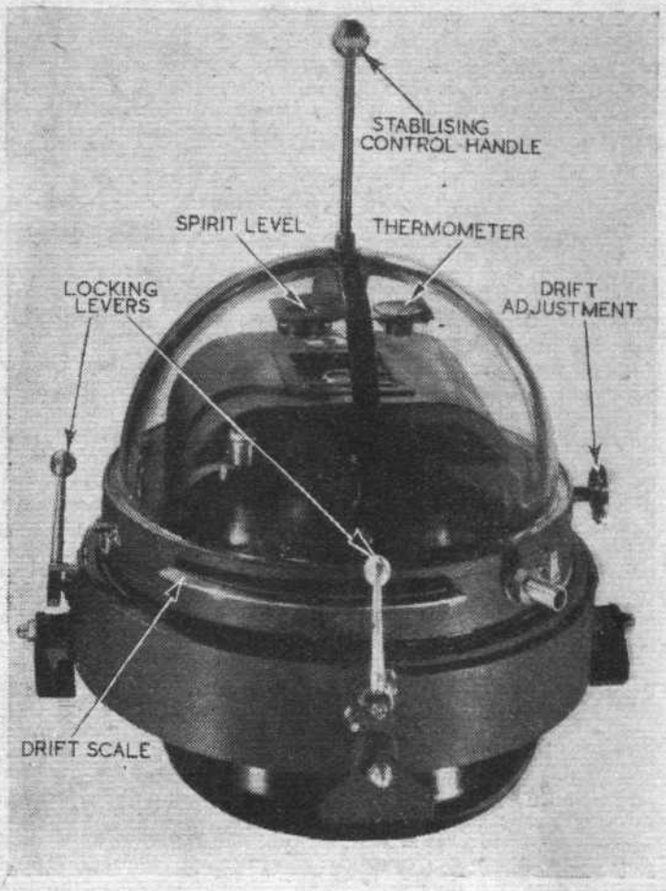
The camera body itself is of solid aluminium, providing the required degree of rigidity between the register glass and the lens, which in turn are seated on parallel machined faces accurately spaced and tested for flatness and parallelism.

Each camera unit is integral to its appropriate lens and cone, and in addition to containing the usual lens, shutter and shutter driving mechanism, it also contains the instrument recording equipment and electrical connections. Operated by a remote control giving accurate exposure intervals over a range of from 2 to 60 seconds. Remote control of the shutter speeds is also provided.

The efficient operation of the camera in view of the extremes in climatic conditions to which it may be subject in the course of normal routine is ensured by the installation of a hot air system which takes the form of an air-heated enclosure within which the camera operates. This innovation forms the subject of a patent taken out by Williamsons in 1937. Heat is obtained from the normal cabin heating supply. It ensures not only satisfactory protection in the interests of the camera's mechanical efficiency, but it also plays an important part in maintaining constancy on all optically calibrated points and serves to regulate the temperature variations which might otherwise create distortion effects. In effect, the camera operates within a bubble of warm air.

Heat Circulation

The hot air supply is not fed directly into the enclosure, but is led by a pipe into the camera body and thence to a nozzle which projects the heated air over the back of the lens filter glass to avoid any possibility of condensation. The air then freely circulates within the camera body, and finally passes out to the enclosure through holes on the opposite side. A thermometer is fitted under the transparent cover adjacent to the spirit level and the supply of hot air may be suitably regulated to maintain stable conditions within the enclosure. When adequate exhaust heat is available this is the most convenient and efficient method of heating the enclosure, but an electrical blower and heater unit has been designed for use with the O.S.C. Mk.I. A consumption of 800 watts for blower and heater will cover a temperature rise of 30 degrees, and 1,000 watts is required for 50 degrees. Petrol air heaters, now being employed for aircraft heating can also be used for that camera heating system. An innovation in camera instrument installation is the provision of a Kollsman self-correcting altimeter, and this introduces for the first time a means of recording accurately indications of relative altitude.



The O.S.C. Mk. I camera shown in its completely enclosed mounting, which provides a balanced temperature both inside and outside the camera. The tilt and drift adjustment and the control column used to enable the camera to be stabilised in verticality in conjunction with the spirit level is also shown

Eric Freeman P. 644

The complete camera enclosure is supported on two horizontal tilting axes disposed at right angles. Each of these tilt axes can be separately locked by conveniently arranged handles. Apart from functioning as locks, the requisite amount of friction may be applied by these handles to make operations by the stabilising control handle possible without excessive effort while ensuring at the same time the camera will not shift.

Messrs Williamsons have established an organization in Canada to deal with service and maintenance problems appertaining to their air survey equipment. This is a logical step in view of Canada's vast national development programme entailing the extensive application of photogrammetry.

FORTHCOMING EVENTS

Aug. 14th (provisional date).—Attempt on World's Air Speed Record by R.A.F. High Speed Flight.

Aug. 22nd.—Model Engineer Exhibition opens at the New Horticultural Hall, Vincent Sq., Westminster, London.

Sept. 9th.—Ministry of Civil Aviation demonstrations of technical radio equipment. More details pending.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

RUNWAY CONTROLLERS

Modification to Age Limit

FURTHER to my letter which you kindly published (*Flight*, July 11th) protesting against the Ministry of Civil Aviation's lower age limit of 25 for runway controllers, I have been notified that the M. of C.A. has investigated this matter and has now agreed to establish 23 as the lower age limit.

PETER J. CROFTS.

CONSTELLATION CRISIS

Was That Belly-landing Really Necessary?

A GREAT deal, much of it nonsense, has been written about the two recent accidents involving Constellation aircraft. One fact, however, seems to have received no attention at all, which to me seems very strange.

In the first of the two accidents, one of the engines caught fire owing to damage to a hydraulic pipeline, and this engine finally fell out. The aircraft was then *belly-landed* on a convenient airfield. The question that comes to mind is, why belly-landed? Surely these apparently admirable aircraft are fitted with some form of emergency gear for lowering the undercarriage in the event of total failure of the hydraulic system? Or was there some non-apparent external reason for adopting this form of landing?

Perhaps I have missed some simple point in the various accounts of the event which cover this matter, but if not it would be interesting to hear the real reason for the pilot's action.

D. I. C.

HOW TO GET A LIFT

Fruits of "Operational" Experience

AS the Ex-Amateur Hitch-Hiking Champ. of the R.A.F., with some six years of hardened hitch-hiking operational experience, may I, in all modesty, offer these non-operational hitch-hiking pupils a little instruction?

To obtain a lift, walk smartly into the middle of the road (and when I say the middle I don't mean the kerb), and squarely face the oncoming traffic. Standing easy, the feet a little farther apart than the parade square regulation distance, and sinking all dignity, fully extend the arm nearest the line of traffic.

Having selected your unidentified bogey, begin to wave your arm strongly backwards and forwards at recommended cruising revs of 60 per minute. As the range rapidly decreases, look the hostile squarely between the eyes and allow those masculine features to part in a broad smile of condescension.

The result is interesting. It may be that the target identifies itself as friendly and stops, probably because it is uncomfortably embarrassed by such public candour. This is definitely "one confirmed."

Or the bogey may be a bandit and attempt to evade the *flak* by moving over to the wrong side of the road from which position you give him a full 90 degree deflection squirt of thanks.

Follow these broad principles, and 75 per cent success is assured from the Rolls to the hearse (without the bod).

FRANK JAMES.

FLIGHT OF BIRDS

Why Vee Formation is Adopted

REGARDING Vee formations, I would refer readers to an interesting article by Dr. F. W. Lanchester entitled "Formation Flying," which appeared in *Flight*, March 28th, 1940. The correspondence columns of April 11th and 25th, 1940, are also relevant. Although fixed-wing aircraft are very different to flapping-wing birds, the arguments (being based on considerations of induced drag) should apply in principle to both.

Briefly, the facts, as I understand them, are as follows:

(i) Line abreast formation with wing tips touching can be considered to be the theoretical equivalent of a single composite aircraft whose span and all-up weight are the sum of those for the component aircraft.

(ii) The total *induced* drag of the composite aircraft is then equal to that for one of the component aircraft. Each such component, therefore, benefits by a reduction in induced drag, and an increase in maximum speed ought to be possible. For this argument to be exactly true the adjacent wing tips would have to be rigidly connected, and the all-up weights of the components graded in accordance with the lift distribution of the complete composite wing.

(iii) The velocity for minimum total drag is reduced as the number of components is increased.

(iv) A close obtuse-angled Vee formation is the most practicable approximation to a very tight line-abreast formation in that adjacent wing tips can be directly behind one another or even overlap. However, the central component now obtains little, if any, assistance from its neighbours.

(v) In a close Vee formation, experience with aircraft shows that there is a tendency for the outer components to be drawn towards their inner neighbours.

(vi) In the case of bird Vee formations, (ii) indicates that the heavier birds should be in the centre whilst (iv) requires that the leader should also be the strongest. The leader will in any case probably tire more quickly than his fellows, which explains the observed changes of leadership. Paragraph (ii) indicates that there should be an economy in calorie consumption, although this is not realized with aircraft as coarse use of the throttle is necessary to maintain station. The statement that rate of wing-beat is slower for a bird in formation than for one that is not, presumably for the same speed, goes to show that there is a real aerodynamic advantage. The phenomenon of (v) above would tend to keep the formation together.

(vii) Line astern formation is the acute-angled limit of a Vee formation and seems to be the worst possible except for bicycles behind lorries and Big Chief Bluenose and his braves padding along forest trails.

D. W. L. FAIRBANK.

AIR HOSTESSES

Passenger and Publicity Appeal

AS an occasional passenger on British, American, and other airlines I find the subject of air hostesses very interesting. Our friends in America who, I believe, were the first to introduce air hostesses some years before the war, generally have good reasons for this type of innovation, and in this case it was probably a psychological one. Imagine a family man saying to himself: "If a slip of a girl can fly from coast to coast day after day and emerge smiling at each stop, surely the wife and I will be safe to do a trip by air." Again, in a country so preoccupied with romance and attractive women the feminine appeal angle cannot be overlooked. Whatever the reason, apart from their usefulness, air hostesses represent one form of publicity for the airline, and as such must be appealing in the broadest sense. They must also be paid appropriately.

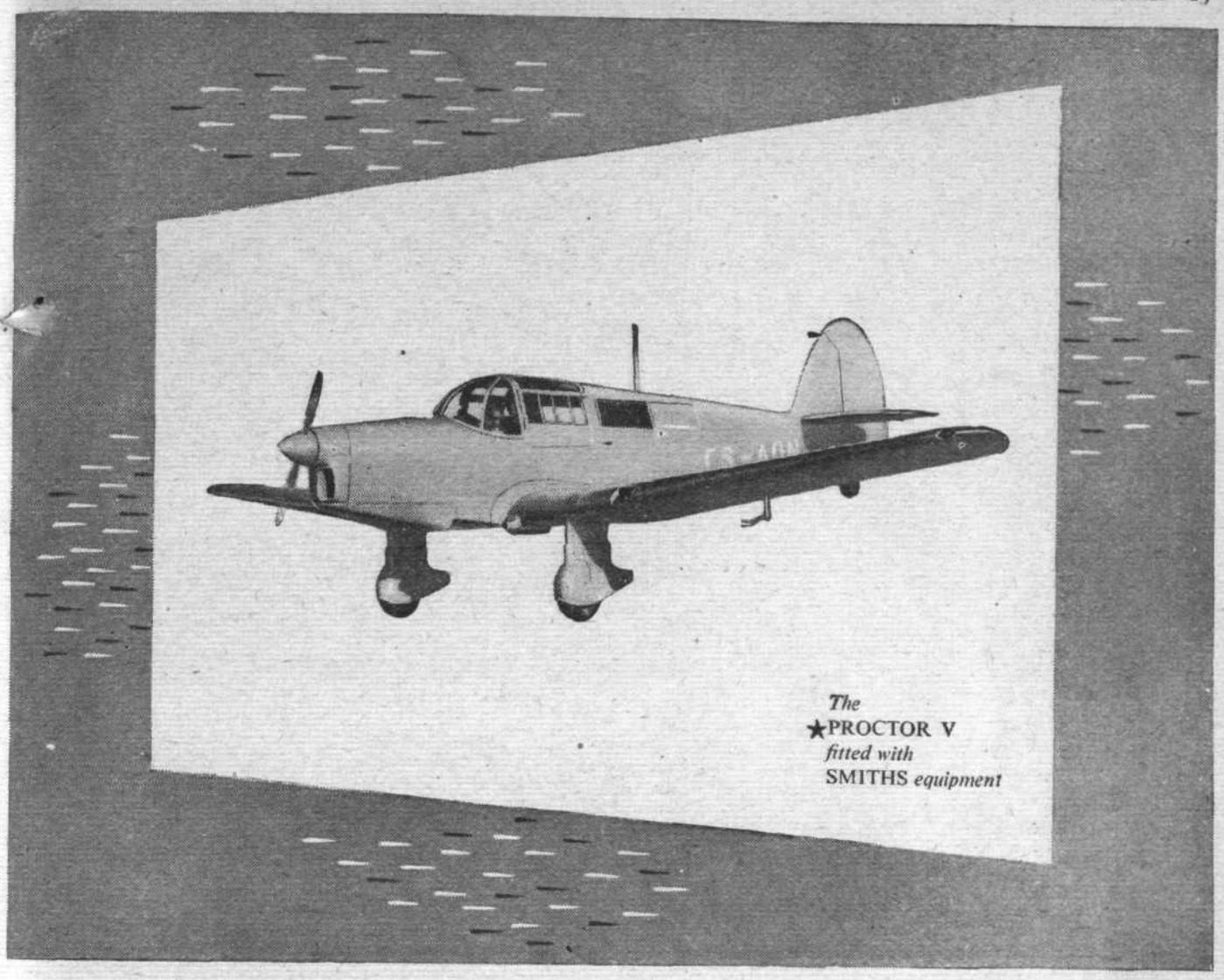
In this country we seem to have lost touch with some of these points, and while just as much work and personality is expected of our air hostesses we tend to put them in ordinary-looking uniforms and pay them very ordinary wages.

The opinion of other passengers to whom I have spoken is that a steward is, in general, preferable, and that if some emergency should arise in which a women is required, a woman passenger would almost certainly be able to cope. Some of your readers may feel differently about this.

From the operator's point of view women can be plenty of trouble, and not the least of the worries is the annual turnover of air hostesses which is, I believe, in America about 300 per cent per annum. At this rate the training of new staff must be a full-time job and uniforms become a major expense.

Why an air hostess is expected to have a showgirl-like appearance and an Oxford accent, while a good Cockney steward in a white jacket is acknowledged as unsurpassed in his job, I do not know. But if we are to have air hostesses on British airlines we cannot afford to have anything but the best, and that entails good working conditions, smart uniforms and reasonable pay. The job is by no means a "piece of cake" as no doubt many have found out, and the enthusiasm which led many girls to seek one uniform in exchange for another during the past year may prove short-lived.

A. BARON.



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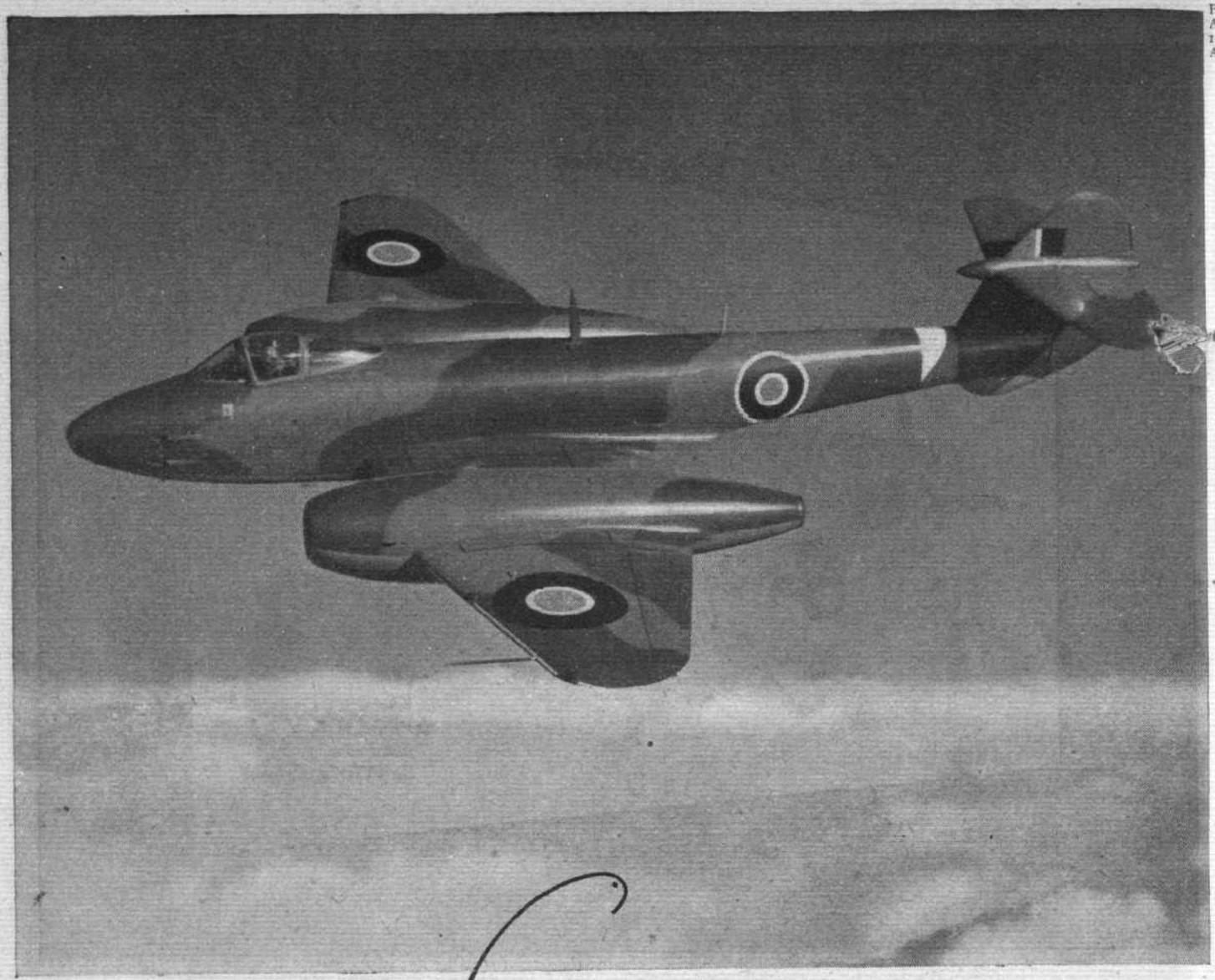

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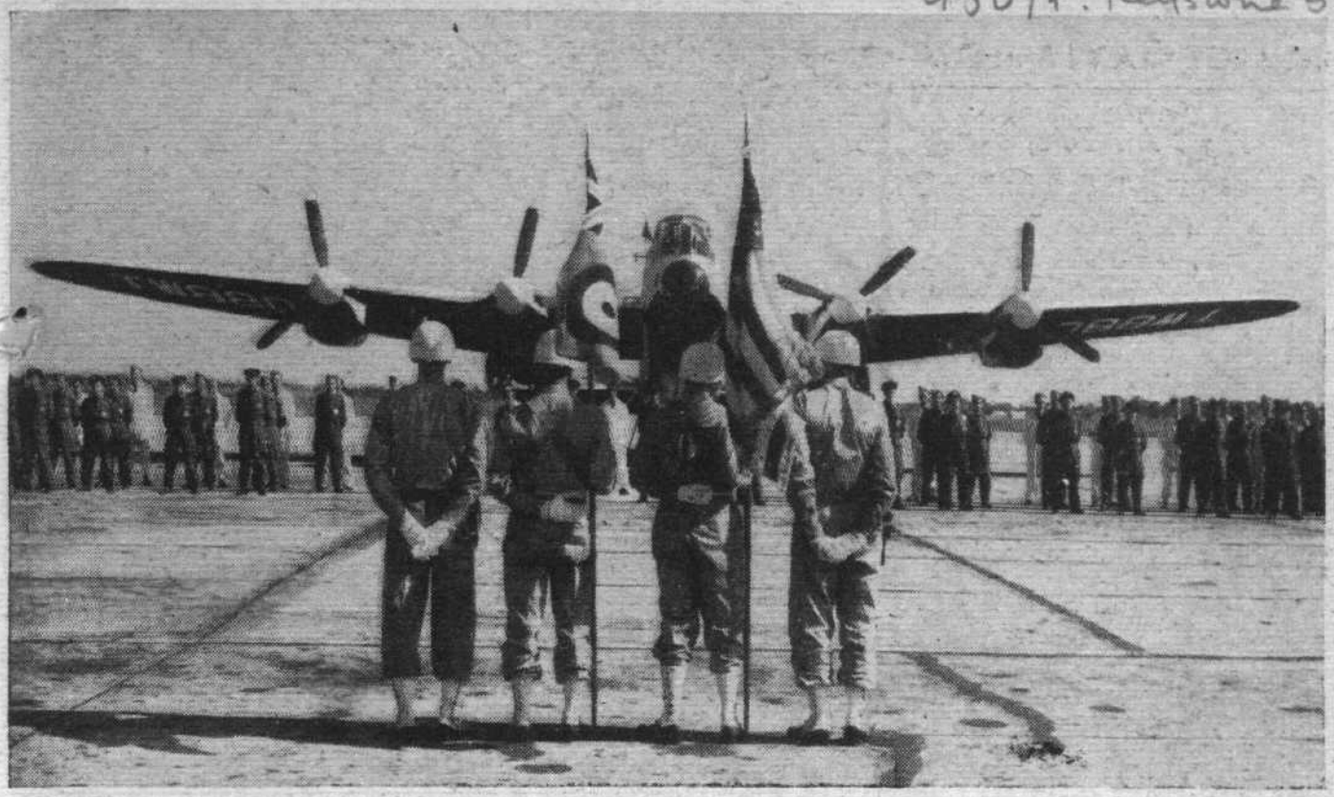


AIR AMBASSADORS : A scene at Mitchell Field, New York, after the Lancasters of No. 35 (Pathfinder) Squadron had landed ; in the foreground are members of the American colour guard. Officers and airmen of the Squadron are seen paraded in front of one of the aircraft. The magnificent programme of entertainment provided for the Squadron proves that America has not forgotten the war-winning alliance between the U.S. Air Force and Bomber Command.

SERVICE AVIATION

Royal Air Force and Naval Air Arm News and Announcements

Interim Leave Arrangements

LEAVE for R.A.F. personnel at home and abroad is now governed by new provisions which were brought into force on July 1st. The new arrangements are temporary and will not affect leave regulations enforced under normal peacetime conditions.

Men stationed in the United Kingdom will receive 30 days a year normally taken in three ten-day periods, with free travel. Absence on short pass up to 48 hours, hitherto permitted only once a month, may be granted in future as often as men can be spared, at the discretion of commanding officers, but may not be accumulated or added to privilege leave.

For the R.A.F. forces with B.A.F.O. (Germany), in Austria and Northern Italy (north of the Apennines only), 38 days' leave a year, to be taken in two periods, will be allowed after four months' continuous overseas service.

The Air Council has decided that for R.A.F. overseas commands, other than those mentioned above, a reduction in the length of tours overseas is more practicable than the existing arrangements for home leave, which will therefore be discontinued from October 1st next. After this date periods of service for married and single men in the Mediterranean/Middle East, South East Asia and India Commands will be reduced from three to two and a half years. This move was taken only after discussion with the commanders-in-chief of the areas concerned, who reported that general opinion favoured the course now being adopted.

Embarkation leave will be seven days for the three overseas areas which receive home leave, and 14 days for the other commands abroad. The present arrangements for local leave in overseas commands will remain in force.

Recognition Journal Re-appears

THE Inter-Services Aircraft Recognition Journal, which was published monthly between September, 1942, and September last year, is now being issued again to the Forces, the Observer Corps, and the A.T.C.

Although smaller than wartime copies —the latest issue is printed on 12 pages of art paper instead of the former 24— the general form of the Journal has changed little, with the exception that photographs have almost entirely replaced silhouettes as the chief aid to identification. The July number contains 69 photographs, 25 "sillographs" and only six sets of three-view silhouettes.

The Journal is issued officially by the Air Ministry, in collaboration with the Ministry of Supply, and is not for sale to the general public.

Air Training Agreement

THE Air Ministry announced last week that the draft agreement on the main features of an Air Training scheme in Southern Rhodesia had been accepted by the governments of the U.K. and of S. Rhodesia. Formal signing of the agreement will take place in London next September.

The negotiations with the government of S. Rhodesia were carried out by an Air Ministry mission, headed by Air Marshal Sir Roderick Hill, the Air Member for Training.

Awards

THE KING has been graciously pleased to approve the following awards :—

George Medal

F/O. B. D. BANCROFT, D.F.C., R.A.A.F., No. 96 Sqn.
W/O. M. DAVIES, R.A.F., No. 343 M.U.
W/O R. C. JONES R.A.F.V.R., No. 5 A.N.S., Jurby.

B.E.M. (Mil.)

Flt. Sgt. A. B. C. FROST, R.A.F., No. 298 Sqn.
Flt. Sgt. F. L. THOMSIT, R.A.F.
Sgt. F. J. CURGENVEN, R.A.F., No. 2744 Sqn. R.A.F. Regt.
Sgt. (now P/O.) J. L. N. WARREN, R.C.A.F., No. 434 Sqn.
L.A/C. S. FAIRLEY, R.A.F.V.R., No. 67005 A.M.E.S.
A/C.1 W. MILLS, R.A.F.V.R. No./17 O.T.U.

Roll of Honour

Casualty Communiqué No. 595.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed. Casualties "in action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Of the names in this list, 101 are second entries giving later information of casualties published in earlier lists.

SERVICE AVIATION

Royal Air Force

KILLED IN ACTION.—F/O. H. J. Batten; F/O. R. G. Dight; Flt. Sgt. E. Hale; P/O. A. M. Howe; Flt. Lt. P. N. Osborne; L.A/C. L. H. Singleton; F/O. T. K. B. Smith; Flt. Lt. J. D. Taylor, D.F.C.

MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. D. S. Bowden; F/O. J. Jones; F/O. N. Kerr; F/O. D. F. Kingscote; F/O. J. F. Manktelow; Flt. Sgt. J. Martin; Flt. Sgt. G. W. Newton; Flt. Sgt. J. Parkes; F/O. A. W. Pearson; Flt. Sgt. J. C. Ruston; W/O. T. H. J. Ryalls; F/O. J. E. H. Steele.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.— Act. F/O. N. S. Ayres; Sgt. E. D. T. Brockhurst; Sgt. A. W. Brooks; Flt. Sgt. J. D. Cairns; Sgt. E. G. Gully; F/O. H. B. Hale; Sgt. E. G. Hobbs; Sgt. A. Johnstone; Sgt. G. A. Keens; Sgt. D. Marsden; W/O. A. E. Redford; P/O. J. E. Sweetman; Sgt. L. J. Vowler; Sgt. W. R. Wilcox.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. E. H. M. Barr; Flt. Lt. J. Bone; W/O. J. A. Carroll; Sgt. A. T. Clyde; Sgt. R. H. Conning; Act. Wing Cdr. K. B. Corbould, D.F.C.; Sgt. A. H. Croll; F/O. A. W. Delieu; Sgt. H. J. Depotex; Flt. Lt. J. A. B. Dobson; Sgt. J. Eve; Flt. Sgt. M. K. Farrington; Sgt. W. Forbes; W/O. C. E. Foster; Sgt. E. F. W. Fowler; Sgt. R. R. Frost; Sgt. G. T. Greenwood; Flt. Lt. R. V. L. Griffiths; P/O. K. A. J. Hewitt; Flt. Sgt. R. Hildesley; Sgt. W. B. Keal; Flt. Sgt. R. S. Lewis; Sgt. W. C. Lewis; Flt. Sgt. E. C. McLenaghan; Sgt. G. McLoughlin; Flt. Lt. L. McNeill; Flt. Lt. G. W. S. Moseley; Flt. Sgt. D. W. Muggeridge; Flt. Sgt. D. L. Pratt; P/O. B. Raises; Flt. Sgt. L. Robinson; Flt. Sgt. J. Scott; Flt. Sgt. G. R. Smith; Sgt. S. O. Spence; W/O. J. Stewart; Sgt. M. E. Taylor; F/O. C. P. W. Warren; P/O. H. Wright; F/O. P. A. G. Ythier.

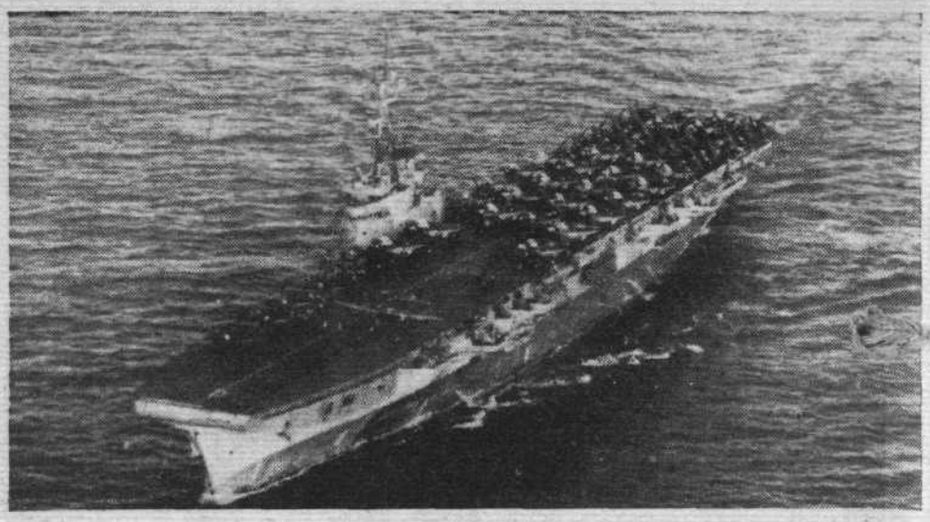
PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW REPORTED KILLED IN ACTION.—Flt. Sgt. K. Bullimore.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Flt. Lt. C. V. French; W/O. J. S. McPhete, D.F.M.

MISSING.—L.A/C. G. C. W. Meek.

KILLED ON ACTIVE SERVICE.—Flt. Lt. D. V. Appleton, D.F.C.; Cpl. F. J. Ball; Wing Cdr. C. T. T. R. Bouchet; Flt. Sgt. W. A. Bullock; Act. Wing Cdr. H. H. Burnell, D.S.O., D.F.C.; Flt. Lt. H. B Carroll; A/C1 E. G. Chilton; L.A/C. G. A. Close; F/O. H. G. Duncan; W/O. R. B. Farmiloe; L.A/C. S. Freer; L.A/C. W. D. George; L.A/C. T. S. P. Kenny; Flt. Lt. N. Mandelson; F/O. R. W. Meager; A/C.2 N. C. Miller; Flt. Sgt. R. A. Mills; Flt. Lt. P. E. Morris; Flt. Sgt. D. G. Patten; Act. Sqn. Ldr. N. D. Samuel, D.F.C.; Sgt. E. M. W. Smith; LA/C. R. A. C. Springett; W/O. F. J. Waldron.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Flt. Lt. M. Holme; L.A/C. D. G. F. Knott; L.A/C. S. Moore; A/C.1 W. C. Strickland; Act. F/O. E. S. Till.



FOR FRANCE: The Admiralty has arranged to transfer to the French Navy the light fleet carrier *Colossus*, pictured above. A French crew is expected to arrive at Portsmouth to-morrow aboard the battleship *Richelieu*; the official ceremony of transfer will take place next Tuesday, August 6th.

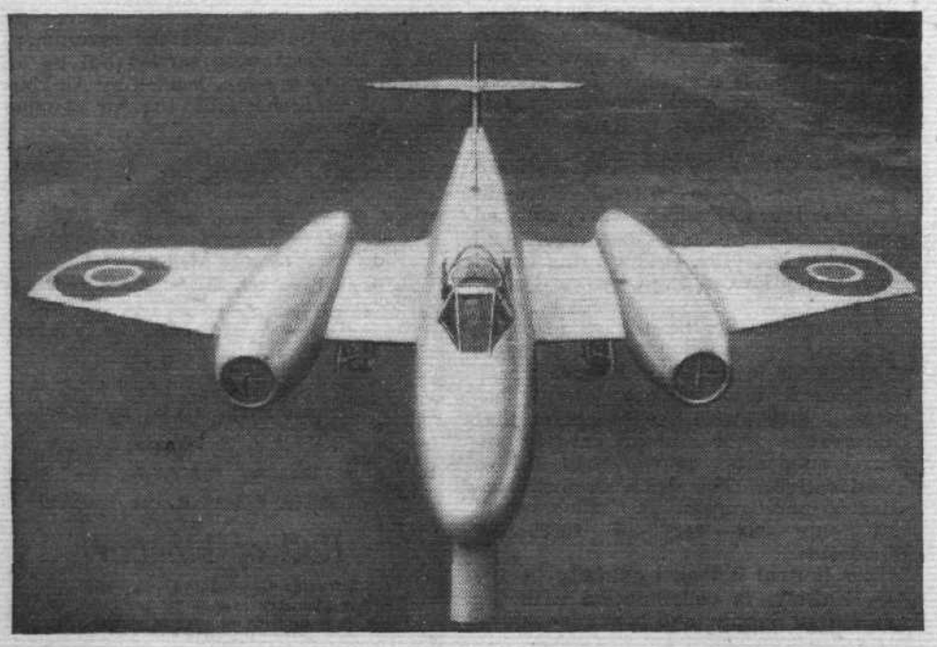
MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—A/C.1 R. C. A. Bullock; A/C.1 G. Coates; W/O. F. G. Ford; W/O. P. Hutchison; A/C.1 S. W. Matthews; A/C.1 R. R. Paterson.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. R. F. Atkins; L.A/C. R. D. Bond; Sgt. P. R. J. Kingham; Sgt. G. C. H. Lauener; Sgt. C. J. H. Lister.

WOUNDED OR INJURED ON ACTIVE SERVICE.—F/O. R. W. Knape; Sgt. W. Learmonth; Flt. Lt. N. Newman.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Flt. Sgt. C. F. Blair; P/O. B. P. Van Boolen.

DIED ON ACTIVE SERVICE.—A/C.1 L. Baguley; A/C.1 A. Baron; L.A/C. E. Bassett; A/C.1 E. C. S. Bates; A/C.1 E. Birch; A/C.1 T. W. Blazley; A/C.1 J. W. Blythe; Cpl. H. Bodman; L.A/C. C. J. Bond; Cpl. F. Boulton; L.A/C. S. Bousfield; A/C.2 S. Boylan; L.A/C. K. S. Brackenbury; A/C.1 D. G. Broughton; F/O. M. E. Brunt; L.A/C. H. A. Bunhill; F/O. H. G. Burgess; Flt. Sgt. A. E. B. Castell; Cpl. S. H. L. Castle; Cpl. A. C. Clark; A/C.1 H. Coggan; Cpl. A. F. Cramp; A/C.2 G. B. R. Cripps; A/C.1 D. Currie; A/C.2 J. H. Dobson; L.A/C. T. G. Elliott; L.A/C. B. R. Etheridge; L.A/C. C. E Failes; A/C.2 L. A. Ford; Cpl. C. S. Gardner; L.A/C. A. J. Gilder; L.A/C. F. R. Goodwin; L.A/C. T. E. Gorringe; L.A/C. E. S. Griffiths; A/C.1 E. Hall; A/C.1 D. G. Harding; Flt. Sgt. S. V. Hetherington; Cpl. A. P. Hickman; A/C.1 R. E. Hill; L.A/C. E. G. Hills; Flt. Sgt. G. J. Hodges; Cpl. W. Hodgson; A/C.1 W. Hodgson; L.A/C. S. G. Holway; L.A/C. H. E. Hudgell; L.A/C. H. Ingham; L.A/C. C. R. G. Jennings; L.A/C. W. E. Jones; A/C.1 W. F. Jones; A/C.1 A. W. Justice; Cpl. F. G. Kay; L.A/C. V. Kay; L.A/C. A. A. W. King; L.A/C. A. J. Lawford; L.A/C. J. Lealand; A/C.1 J. A. Leary; L.A/C. A. Little; A/C.2 J. Lucas; L.A/C. R. A. Lund; L.A/C. G. W. Lunn; A/C.2 F. Lunt; A/C.1 J. R. McCandless; Sgt. T. H. McDermott; Act. Sgt. E. McGuinness; L.A/C. D. MacRae; L.A/C. T. Maitland; W/O. L. G. Marsh; Cpl. E. Mason; L.A/C. T. R. Matthews; A/C.1 J. E. Maynard; L.A/C. B. Miller; L.A/C. D. C. Miller; A/C.1 J. E. Millett; A/C.1 H. Morris; Flt. Sgt. R. S. Norman; A/C.1 R. T. O'Dea; L.A/C. H. R. Osborne; L.A/C. C. R. Palmer; L.A/C. L. A. Palmer; Cpl. H. S. Perry; L.A/C. L. D. R. Reid; A/C.1 C. Rhodes; A/C.1 D. A. Richards; A/C.2 L. L. Richards; L.A/C. H. W. Riches; A/C.1 H. S. Robb; L.A/C. A. E. Rowe; L.A/C. F. S. Sampson; A/C.2 A. M. Sands; A/C.2 E. J. Sayer; A/C.1 G. B. Smith; A/C.1 S. J. Smith; A/C.1 A. L. Smithers; L.A/C. E. H. E. Spargo; A/C.1 A. G. Symonds; L.A/C. R. D. Talbot; Cpl. T. L. Tooze; A/C.1 E. S. Trickett; A/C.2 T. S. Tristham; A/C.1 A. W. D. Trout; L.A/C. R. J. Turner; L.A/C. F. Urry; Sgt. H. Vickerman; L.A/C. G. R. Walker; A/C.2 M. S. Walker; F/O. N. Walley; Cpl. R. Walton; L.A/C. W. H. Wansbury; A/C.1 A. T. Ward; Cpl. A. W. Ward; A/C.2 C. Ward; A/C.2 J. Waterhouse; L.A/C. V. E. D. Weir; L.A/C. H. W. Westwood; Cpl. R. A. Whittaker; Flt. Sgt. D. C. Williams; L.A/C. J. Williams; Cpl. L. R. Williams; A/C.1 R. H. Williams; A/C.1 A. L. H. Workman; A/C.2 E. Wragg; A/C.1 J. H. York; A/C.1 R. York.



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Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—A/CW.1 J. Dyson; L.A/CW. A. G. Hope; L.A/CW. M. Isherwood.

Royal Australian Air Force

KILLED IN ACTION.—Flt. Sgt. F. C. H. Ray.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—F/O. T. J. Bolger; F/O. F. M. Jackson.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. J. Austin; Act. Flt. Lt. L. E. Button; Flt. Sgt. P. J. P. Carlon; F/O. C. A. Cassidy; Flt Sgt. M. J. Coleman; F/O. G. W. Duggan; Flt. Sgt. W. F. Duncan; F/O. H. V. Ellens; F/O. N. C. Fernley-Stott; Sgt. L. L. Hall; W/O. N. J. Hall; Flt. Sgt. K. R. Henderen; F/O. R. M. Herapath; Act. F/O. H. T. Hesketh; F/O. F. H. R. Kemp; Sgt. J. H. Lockhart; F/O. P. MacDonald; P/O. T. B. McManus; Flt. Sgt. C. R. Mangnall; W/O. D. B. May; P/O. S. W. Neilson; W/O. E. R. W. Oliver; F/O. V. D. Powell; F/O. B. T. Roberts; F/O. A. H. Scott; Flt. Sgt. M. A. Smith; W/O. P. H. Wales; Flt. Sgt. P. W. K. W[illegible]; Flt. Sgt. B. T. T. Wilson; Flt. Sgt. R. J. [illegible]ng.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW REPORTED KILLED IN ACTION.—F/O. E. A. Adams; F/O. H. S. Chatto; F/O. L. A. Ellis.

KILLED ON ACTIVE SERVICE.—W/O. I. L. Baker.

Royal Canadian Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. J. A. Bellamy; F/O. R. W. Donovan; P/O. H. Sigal.

MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Flt. Lt. F. B. Gregory.

DIED ON ACTIVE SERVICE.—L.A/C. E. Zarowny.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. E. P. Smith.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—F/O. A. A. Kingsbury.

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AVAILABLE FOR AIRCRAFT POWER UNITS OF ANY SHAFT HORSEPOWER

THE "PORTSMOUTH"
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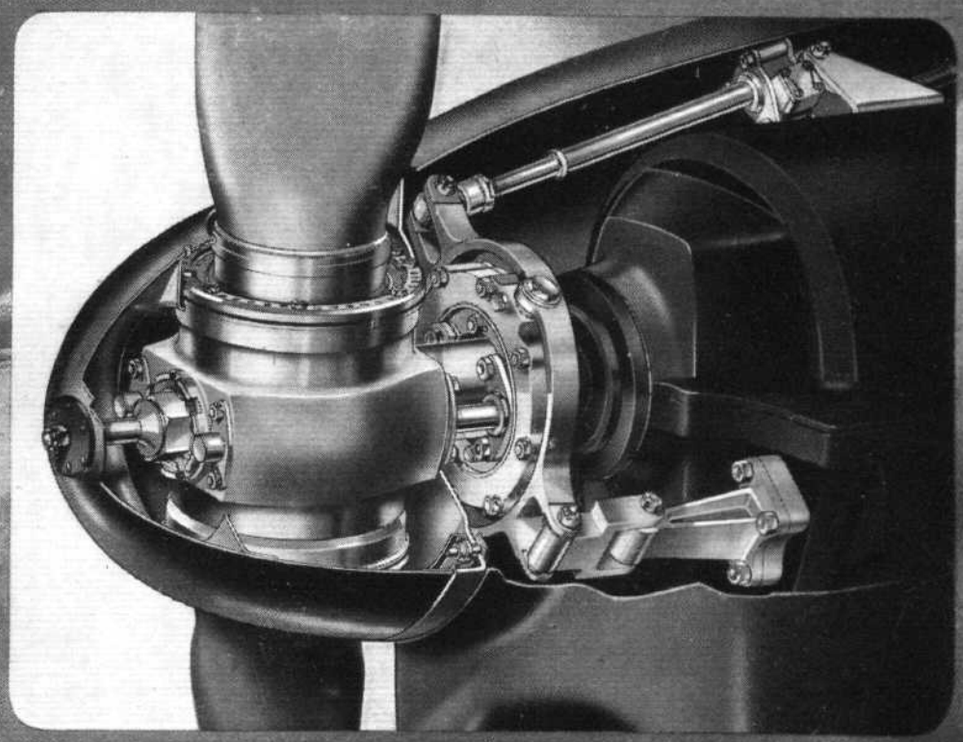

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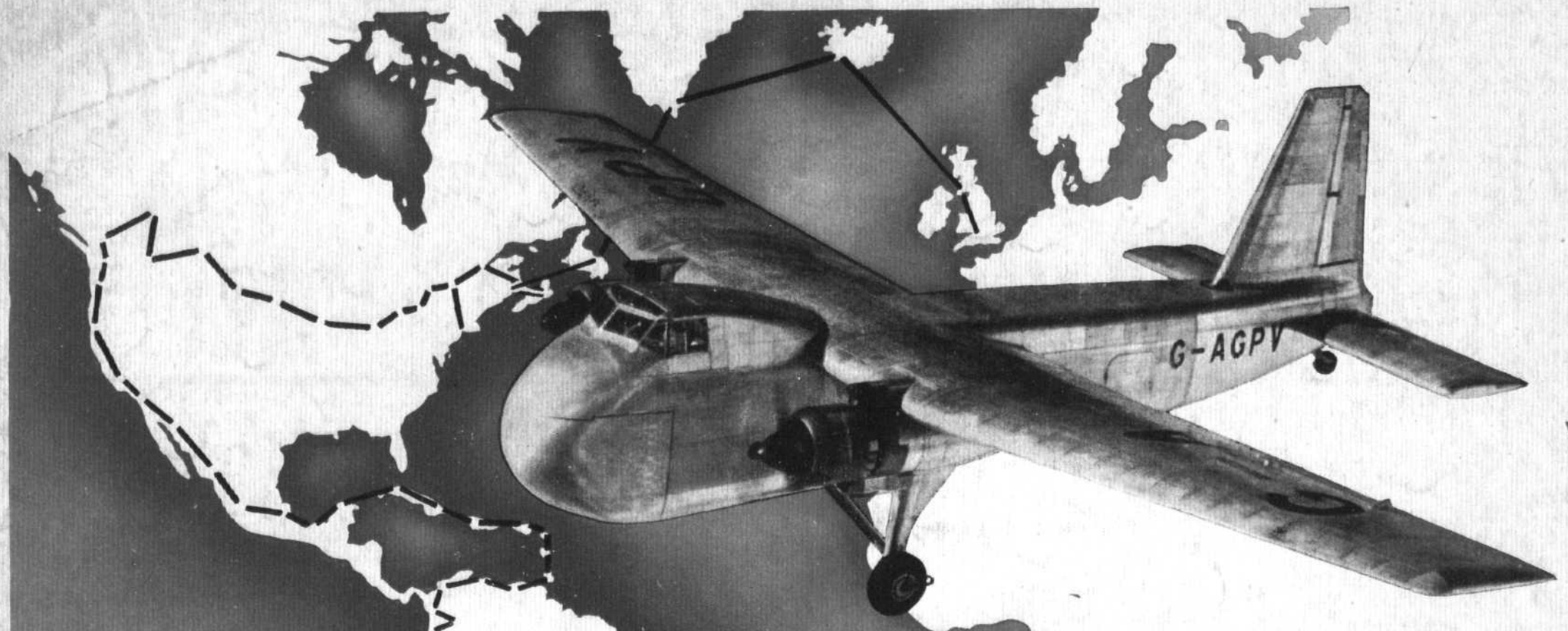

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One of several demonstration tours planned for "Bristol" Freighters and Wayfarers consists of a complete circuit of North and South America with stopping points at all principal towns en route. The purpose of the tour is to demonstrate that the aircraft is particularly suitable for operation in various parts of the American Continent, and the most practical means of proving these claims is to put the aircraft through its paces within that territory. Further details of this and other tours now being planned will be announced shortly.

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