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The Outlook

The Air-based Campaign

A GOOD deal has already appeared in *Flight* about the part played by the air in the liberation of Burma; but it is gratifying to hear the account given by General Sir Joseph Slim, K.C.B., of the reliance he placed on the help given to the 14th Army by the Royal Air Force. The R.A.F. began to get its reinforcements in 1943, and from then on the British were much superior to the Japanese in the air. "All the plans I have made have always been based on that superiority," said General Slim, and he also insisted that the fighting did not consist of haphazard jungle *mêlées*, but that the campaign was all of a piece, and his plans were adhered to throughout. He added that "the air was the answer to almost everything when fighting on a front of 700 miles."

Of course, this superiority was based on the work of the fighter squadrons. A General or an Air Marshal can do little with even superior strength in reconnaissance or transport aircraft unless the fighters deny the use of the air to enemy fighters and bombers and make it safe for his own machines. Our fighters ruled the air, and that made everything else possible. The superiority of fighters is now an essential preliminary to all military operations, and Field Marshal Montgomery has made this point as strongly as General Slim has made it. For the future all Staff Colleges will regard it as a basic principle.

Having achieved this superiority, what a wonderful use General Slim made of his superiority! The work of the air reconnaissance squadrons is too often taken for granted in reports of military operations; but it is vital to success. In jungle fighting it is particularly difficult for the reconnoitring machines to bring in complete reports of every move of the enemy; but there can be no doubt that General Slim always knew with sufficient accuracy what the enemy was doing.

Then came the chance of the transport aircraft. Their work in the late Burma campaign was unprecedented, and was marvellous to those who had not appreciated the potentialities. Whole divisions were moved by air, together with their equipment, and armies were enabled to rush forward at high speed through a country where ordinary means of transport were at a minimum, simply because they could depend on air supply. The surprise to the Japanese General Staff was overwhelming. Nothing like it had ever been foreseen, and it, too, will go down to history as a subject for Staff Colleges to study and digest.

Per Avro ad Astra

ONE of the first British aircraft firms to produce an aircraft type specifically for commercial aviation after the first world war was A. V. Roe and Co., Ltd. The first firm to have a corresponding type flying after the termination of this European war is A. V. Roe and Co., Ltd. This is no mere coincidence. It is no reflection on other British designers to say that Mr. Roy Chadwick and his team have a particular flair for designing, with ease of production in mind, nor is the fact that the Mr. R. H. Dobson (still "Dobbie" to his innumerable friends) who was in charge of production after World War I is still at the helm, as Sir Roy Dobson, after this war, unconnected with the structural simplicity that has enabled a totally new type to be got into the air so quickly. Between them the two Avro Roys always seem to produce something which blends aerodynamic efficiency with manufacturing common sense.

By way of showing how far we have come during the intervening years, it is interesting to compare the early Avro with the Tudor I described in this issue. Early in 1920, in February to be more explicit, the Avro 547 made its first successful test flight at Hamble. It was a triplane powered by a 160 h.p. Beardmore engine. Carrying pilot and four passengers it weighed 3,000 lb. and cruised at 80 m.p.h. at a fuel consumption of better than 9 miles per gallon. The wing loading was 6 lb./sq. ft., and the power loading 18.8 lb./h.p. The speed range was 45 to 94 m.p.h., and the climb to 1,000 ft. took 38 minutes.

The only discernible similarity between the two machines is that liquid-cooled engines figure in both. The only radial air-cooled engines in production at that time were the A.B.C.s which, due to having been rushed into production prematurely, were unreliable. The Beardmore, although heavy, was very reliable for those days. The Tudor I has Rolls-Royce Merlins and is the first post-war British commercial aircraft of specifically civil design to use liquid-cooled engines. For long-range operation (the Tudor I is designed for the Atlantic crossing) low drag is one of the most important considerations, and this may have influenced the choice of power plant.

It is indeed a long way from the modest 80 m.p.h. of the Avro 547 of 1920 to the 300 m.p.h. of the Avro XX of 1945, and from the somewhat cramped quarters of the four passengers in the triplane to the luxurious accommodation for twelve passengers in the supercharger cabin of the Tudor I.

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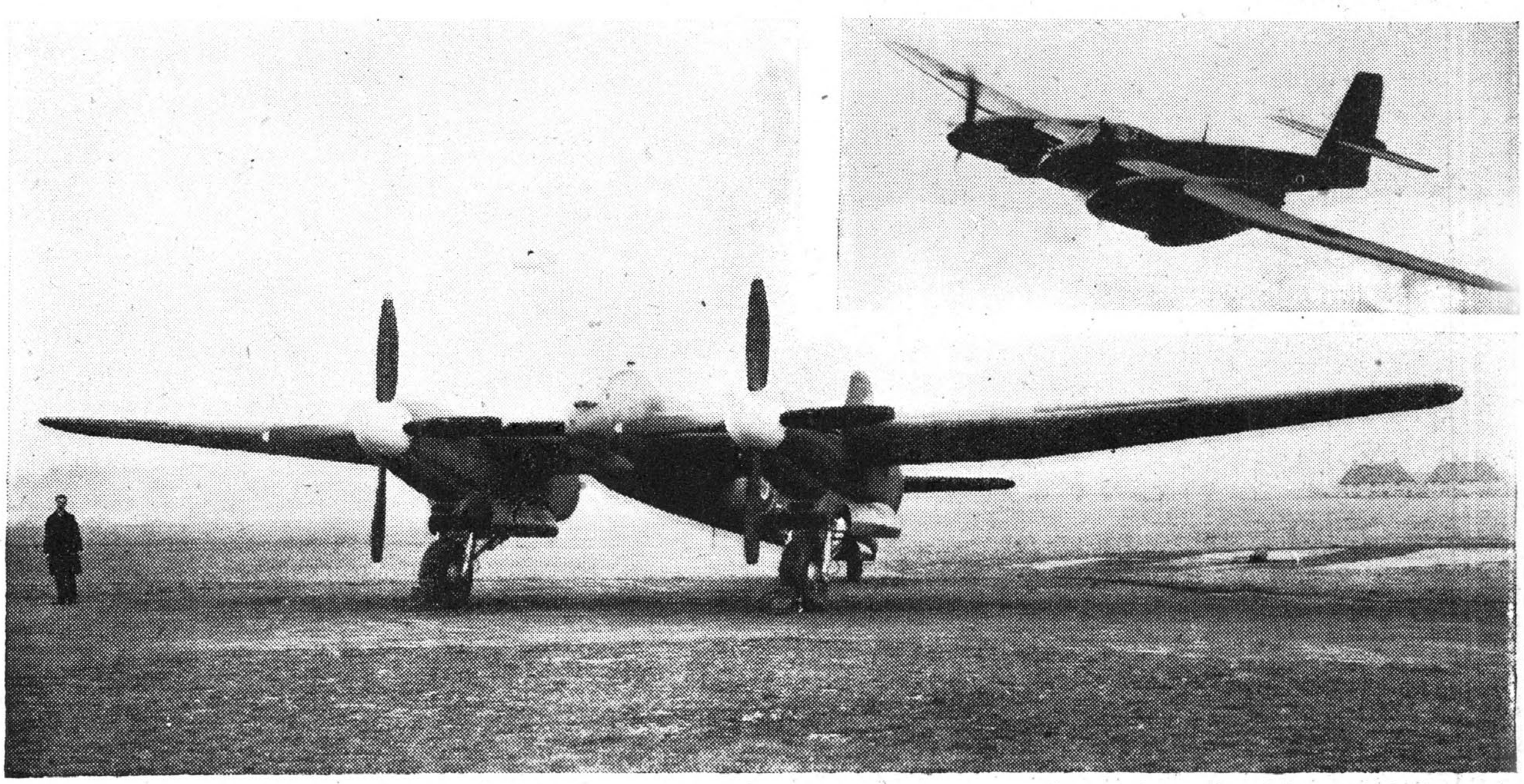
Night and Weight

THE Americans have started night raids on Japan, thus accepting the R.A.F. form of attack for the Far East war while never employing it during the European campaign. Several factors contribute to the decision.

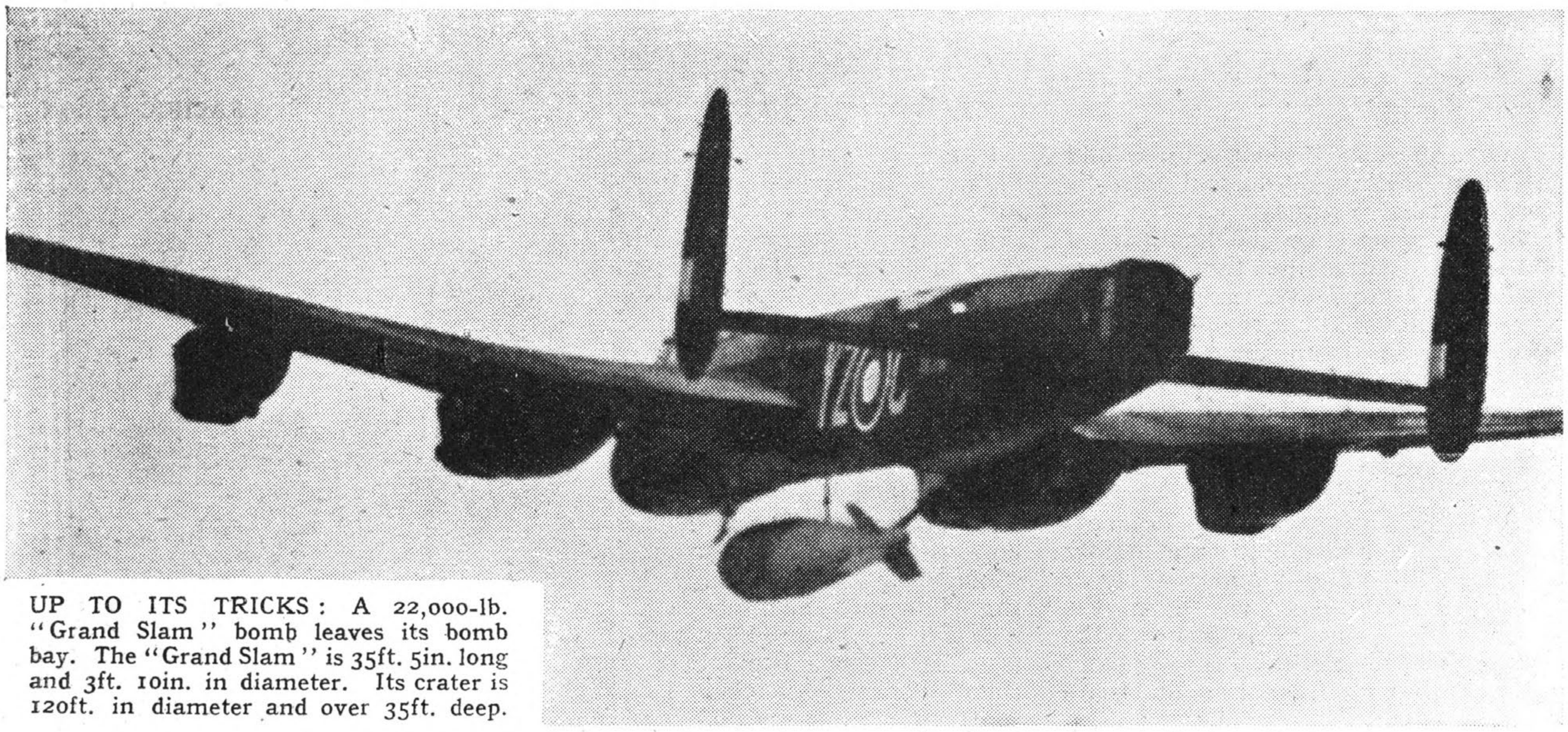
In the European campaign the work of the R.A.F. and U.S.A.A.F. was complementary. The R.A.F. made the towns uninhabitable, and the Americans went in daylight for the factories which had been rebuilt in the countryside. When this arrangement was decided upon, it was essential on the score of accuracy that the bombing of single factories should be done by daylight. The advances in pin-point navigation by radar have been so great that night bombing, and so-called blind bombing, is now as accurate as visual bombing from the great heights at which daylight attacks are carried out.

General Arnold has also announced the U.S. intention of using big bombs. Many photographs of American 4,000 lb. bombs have been published, and it has even been published in this country that the Fortress can carry one of these, on an external rack, under each wing. Actually, of course, the Americans have never dropped anything bigger than 2,000-pounders.

It is reasonable to suppose that the Japanese have taken a leaf out of the Germans' book, and built their dockyard fortifications of ferro-concrete many feet thick. To destroy these works the British 4,000, 8,000, 12,000 and 22,000 lb. bombs are all available. The only requirements are the bomb bays to accommodate them.



FOR TOPMOST COVER: The Westland Welkin which was designed as a very high altitude, single seat fighter. Had the Germans continued their daylight attacks on this country the Welkin would have come into its own. Because of operational tactics changing it never went into quantity production. Span 70 ft., Weight 17,500 lb., Max. Speed 385 m.p.h., Max. Range 1,500 miles.



UP TO ITS TRICKS: A 22,000-lb. "Grand Slam" bomb leaves its bomb bay. The "Grand Slam" is 35ft. 5in. long and 3ft. 10in. in diameter. Its crater is 120ft. in diameter and over 35ft. deep.

WAR in the AIR

The Monsoon in Burma : Okinawa Conquered : Suicide Bombers and the Pacific Fleet

IN the lands affected by the South-West monsoon the middle of June is a time of hope, in which one form of infliction (i.e., extreme heat) is expected to give way to the temporary relief of a delightful drop of temperature as the first burst of rain cools the air; but this relief is soon followed by all the trials of three or four months of great humidity. Breaks in the rains are accompanied by renewed heat of a particularly enervating kind, when the bodies of Europeans suffer mild tortures from prickly heat, and insects seem to dominate existence. The earth grows beautifully green as if by the waving of a magic wand; but the monsoon is an unhealthy time, and its ending in September is as great a relief as its beginning in June.

For the past two years the 14th Army and Eastern Air Command have contrived to fight on through the monsoon, and by doing so they badly upset Japanese calculations. But the airmen must have had a most trying time as they struggled through the great storms of rain, with the mountains of Burma threatening them with disaster if any mistake was made in navigation.

Now that Rangoon has been liberated there will not be the same urgency to defy the monsoon at all costs; though doubtless the retreating Japanese forces must still be harried as they struggle through the Shan hills. Allied eyes now look further afield. Ahead lie Thailand, Malaya, and Singapore, where something (as Kipling once put it) has to be wiped off a slate. Already the aircraft are pushing forward, and last week a Sunderland flew into the Gulf of Siam, sank a barge with machine-gun fire, and damaged a number of other enemy vessels, some of which also probably went to the bottom.

In the Pacific the war is now closing in on the Japanese homeland. The American conquest of Okinawa will give a most valuable air base to the nation which Japan so light-heartedly attacked at Pearl Harbour. It is only 330 miles from the home island of Kyushu and 515 from the China coast. From Okinawa the American aircraft will command the sea communications between Japan and the outside world. The blockade may not be complete in the great spaces which prevail in the Pacific, but the passage of vessels in and out will be severely curtailed. Japan needs many supplies from outside, and she needs to send munitions

MONSOON MUD: R.A.F. Regiment troops manhandling 20 mm. Hispano anti-aircraft guns through a welter of mud on the landing beaches off the Rangoon river.

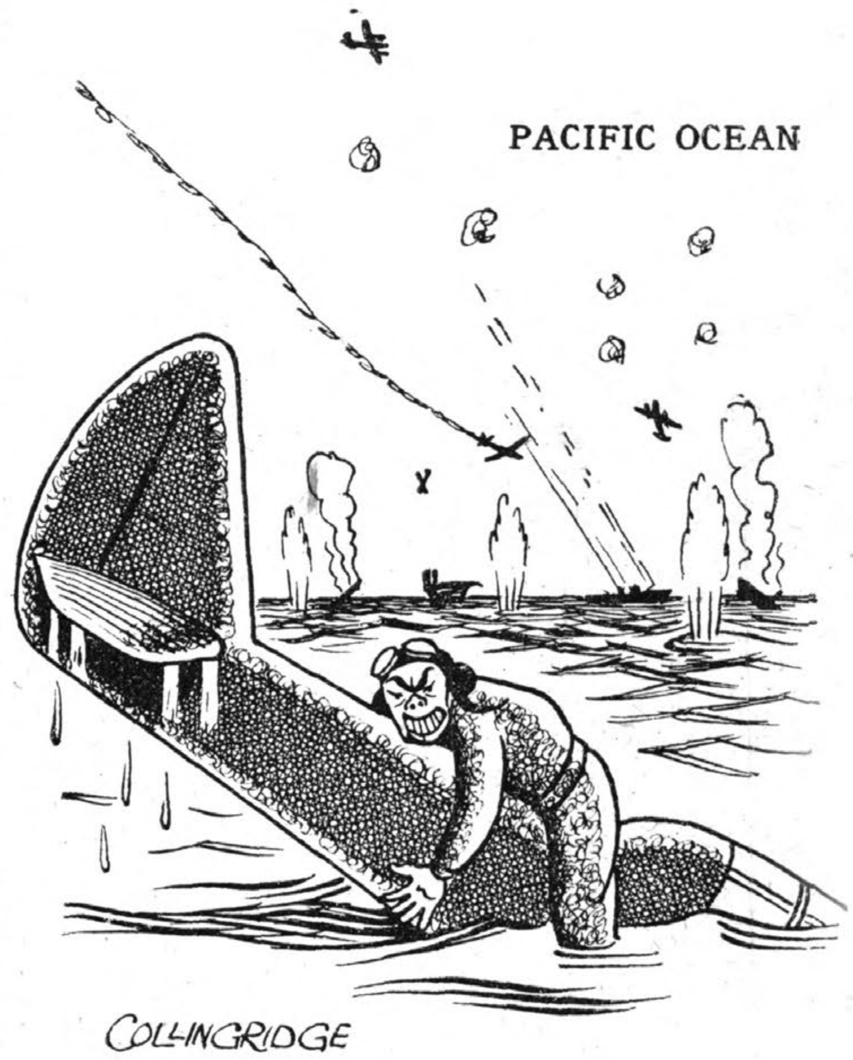
WAR IN THE AIR

to her armies in Borneo, China, and elsewhere. Both needs will now be very difficult to satisfy.

At the same time the bombing of industrial centres in the Japanese islands will grow ever more intense. It may soon become a round-the-clock affair, as American air strength is built up and as more airfields fall into American hands. The time is approaching when the Americans could do with reduced tankage and endurance, but could profitably carry a heavier load of bombs. Japanese factories, we understand, are mainly substantial buildings, and the bigger the bombs dropped on them the better. On the other hand, the homes of the workmen are mostly wooden, and for them fire-bombs are the most effective missiles. It has been found in Europe that to destroy the homes of the workers holds up production to a degree only second to the destruction of the factories themselves.

In modern war oil never loses its importance, and so we rejoice that the Australians have recaptured the great Seria oilfield in Borneo. The Japanese have fired many others, and we must regret the destruction of the fuel, while feeling glad that the enemy cannot use it against the Allies.

The Japanese Air Force is not done with yet. Its machines have made a prolonged attack on the American fleet in the harbour of Okinawa. The losses of enemy aircraft were heavy, but the ships did not escape unscathed. This was to be expected from such desperate fighters as the Japanese, for they know that the loss of Okinawa threatens their whole homeland with destruction from the air. Recently five vessels of the British Pacific Fleet (one of them an aircraft carrier) were hit and damaged by suicide bomber pilots within two months. All ships were quickly in action again.



Operational Sorties

Bomb Tonnage and Aircraft Losses for European and Mediterranean War Theatres, 1939-45

SECURITY considerations precluded the announcement in communiqués and monthly summaries of certain operational losses of Royal Air Force Commands during the course of hostilities. With certain exceptions it was permissible to publish only those aircraft losses of which the enemy could be presumed to be aware—i.e., aircraft lost over enemy or enemy-occupied territory or in sight of enemy vessels. Losses of aircraft now given in these tables below include not only those not previously announced for the above reasons, but the additional losses of aircraft so badly damaged in combat that upon landing at their base or in Allied territory they were unfit for further service. Figures for Bomber Command are incorporated in the account on pages 699-701.

2nd TACTICAL AIR FORCE

	Sorties	Tonnage	Aircraft Lost
1943	23,695	3,627	177
1944	214,592	38,729	1,305
1945	89,426	19,482	633
	327,713	61,838	2,115

FIGHTER COMMAND (including A.D.G.B.)

	Sorties	Tonnage	Aircraft Lost
1939	3,217	—	3
1940	121,079	1	1,186
1941	150,828	129	651
1942	147,087	207	688
1943	136,167	986	569
1944	122,136	1,232	397
1945	19,712	926	64
	700,226	3,481	3,558

ARMY CO-OPERATION COMMAND

Sorties	Tonnage	Aircraft Lost
4,474	63	70

COASTAL COMMAND. (All Bases)

	Sorties*	Tonnage	Aircraft Lost
1939 and 1940	41,001	917 (241)	288
1941	30,544	766 (240)	233
1942	31,676	529 (100)	392
1943	43,231	494 (21)	279
1944	66,362	1,411	305
1945	22,935	661	132
	235,749	4,778 (602) 5,380	1,479

Figures in brackets under tonnage show weight of mines laid.

* Does not include sorties by Bomber Command aircraft which are shown under Bomber Command on pages 699—701.

MEDITERRANEAN AND MIDDLE EAST
Including Dominion and Allied Squadrons
June 1940 to May 1945

Sorties	Tonnage (A)	Tonnage (B)	Tonnage (C)	Aircraft Lost
1940 Bomber ... 5,158 Fighter ... 9,168 Coastal ... 1,304 Tac/R and Army Co-op. 2,032 Misc. ... 49		2,503	22	133
1941 Bomber ... 14,850 Fighter ... 33,211 Coastal ... 4,845 Tac-R and Army co-op. 3,554 Misc. ... 568		12,562	220	671
1942 Bomber ... 19,896 Fighter ... 79,478 Coastal ... 11,116 Tac/R and Army co-op. 2,603 Misc. ... 1,642		22,153	398	1,189
1943 Bomber ... 18,968 Fighter ... 107,671 Coastal ... 21,644 Tac/R and Army Co-op. 2,681 Misc. ... 13,631		32,148	587	1,349
1944 Bomber ... 33,621 Fighter ... 167,008 Coastal ... 7,608 Tac/R and Army Co-op. 16,597 Misc. ... 18,852	636	58,673	1,133	1,853
1945 Bomber ... 15,959 Fighter ... 57,245 Coastal ... 59 Tac/R and Army Co-op. (D) Misc. ... 4,986	1,715	27,932	158	540

(A) Germany, including Austria, Czechoslavakia and Poland. (B) Other Occupied Countries. (C) Targets at sea. (D) Included with fighter. Misc. Sorties include: Special Duties—General Recce. Photo Recce.—Air/Sea Rescue.

NOTE: Certain of the figures given in the above tables must still be regarded as provisional and open to possible revision.

HERE AND THERE

IT NECESSARILY FOLLOWS: Tails with aerofoil fins which set the R.A.F.'s super-heavy bombs spinning ensure even greater accuracy. The method of their attachment is clear from this picture.

Telling the World

THE relationship between jet propulsion and the gas turbine was explained in the simplest possible terms by Dr. Roxbee Cox, chairman of the Government-owned Power Jets (Research and Development), Ltd., in a 15-minute broadcast last Friday evening on the Home Service.

Being intended to interest (and be understood by) the general listening public, the talk was, of course, limited to the most elementary outline of the subject.

"Smithy and Ulm"

FLT. LT. PETER KINGSFORD SMITH, D.F.C., and P/O. John Ulm, nephew and son respectively of that great Australian pioneering partnership, the late Sir Charles Kingsford Smith and the late Capt. C. T. P. Ulm, met in London recently while on leave in this country.

Both pilots were liberated from P.o.W. camps just before VE-Day. Kingsford Smith had had to crash-land his *flak*-riddled Halifax in France in February, 1943, and, eluding capture for twenty-three days, almost escaped into Spain, while Ulm, flying a Spitfire on a train-busting sortie in Italy, was also brought down by *flak* and captured by the Germans.

Missing Aircrews

IN order to establish the fate of aircrews who are still missing from operations during the war in Europe, the Air Ministry has set up a Missing Research and Enquiry Service in conjunction with the Dominion Air Force authorities.

The service is already operating throughout France, Luxembourg and Belgium. Holland will be covered next, then Norway, Denmark and, finally, Germany itself. A similar organisation is at work in Italy and the Balkans.

With the assistance of local people it is often possible to obtain evidence of death and to identify the occupants of unknown graves.

In view of the large number of cases to be dealt with and the large area to be covered, it will be some time before a review of all cases can be completed.

AT THE MIGHTY WURLITZER: The flight-engineer of the B-29 has quite a pretty array of dials, knobs and levers to keep him pleasantly occupied, and his status has just been raised to include commissioned rank.

Rotol Contra-Prop

SOME details, not previously available for publication, are to hand on the Rotol six-bladed contra-rotating airscrew shown fitted to a Tornado in the picture which headed this page in our issue of June 14th.

This airscrew is at present limited to the non-feathering type and has a pitch range of 35 degrees. It is designed for a double, contra-rotating engine shaft in which one shaft rotates within the other.

The front half of the unit is fitted to the inner (No. 4 SBAC) shaft and is left-handed, and the rear half fits on the outer shaft (No. 6 SBAC) and, of course, is right-handed. The swept circle measures 10ft. 4in. and the weight is 405 lb. without the spinner.

R.A.F. Yacht Club

YACHTING enthusiasts in the R.A.F. will be interested to learn that applications for membership of the R.A.F. Yacht Club may now be made without the normal requirement of a proposer and seconder provided the applicant is recommended by his unit or station commander holding a rank not lower than Group Captain.

Subscriptions at the rate of £1 1s. per annum will be reinstated as from July 1st, and two of the "X" boats, *Typhoon* and *Exile*, are now in commission at Calshot and can be used at pre-war charges.

The club's annual meeting has been fixed for 3 p.m. on Friday, July 27th, at the R.Ae.S. premises, 4, Hamilton Place, London, W.1, and the hon. sec. is Capt. A. G. Lamplugh, c/o R.A.F. Club, 128, Piccadilly, London, W.1.

Coventry's Privilege?

GOERING should be handed over to the people of Coventry so that they could mete out justice, said Mr. Leslie Clement Haylen, Labour Member of the Australian House of Representatives, recently.

He was protesting against what he termed "the extraordinary soft-hearted treatment accorded the arch-Fascist, Goering, after his capture."

"Australians, still at war, were hurt and distressed at Goering parading in uniform with medals, posing for photo-

HERE AND THERE

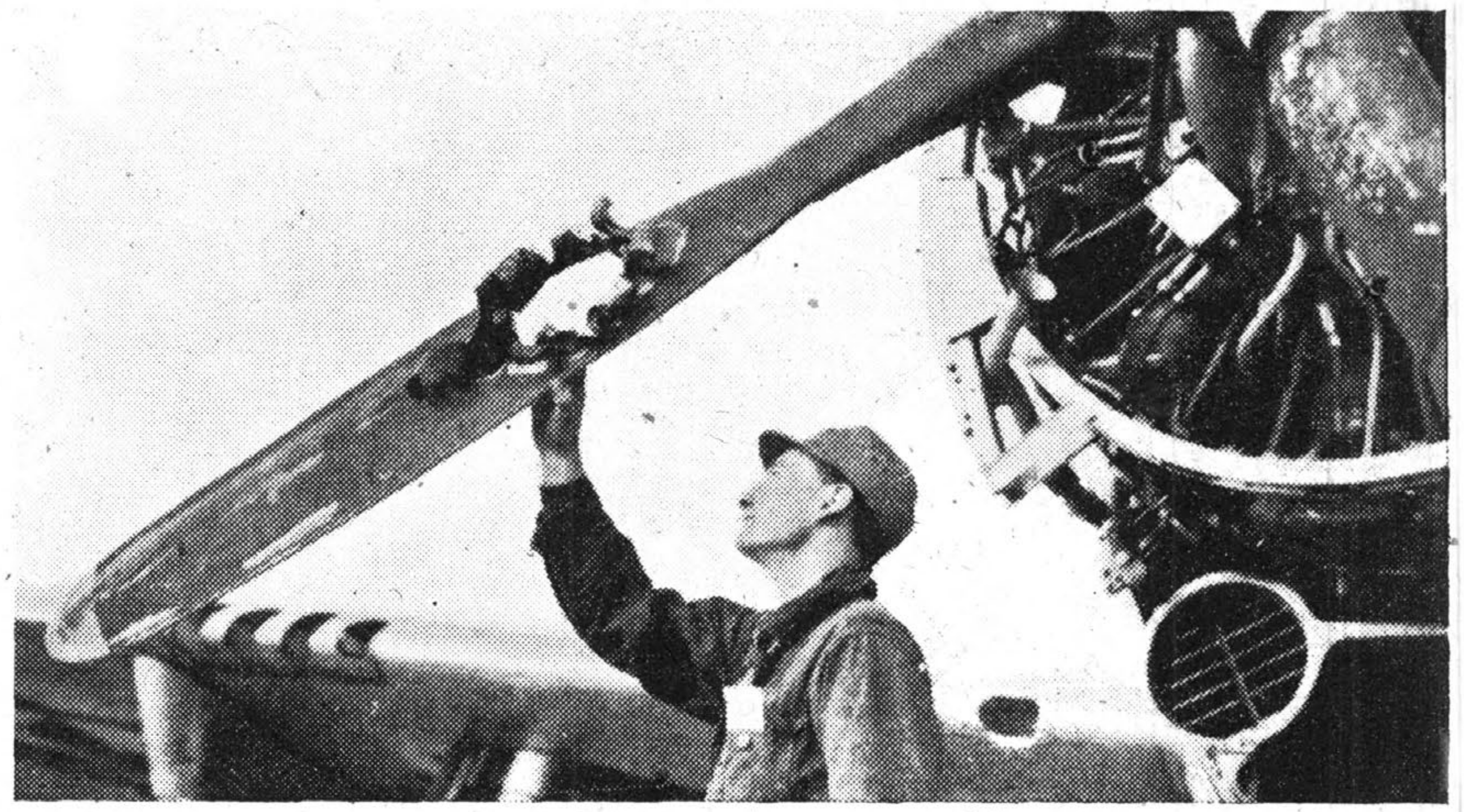
graphers, eating chicken for dinner, and jesting with his good-natured captors," Mr. Haylen said.

The treatment of Goering was particularly hard to understand, as he was the *Luftwaffe* chief who ordered the Coventry raid. "Poetic justice would be to hand Goering over to the people of Coventry."

Luftwaffe's "Dismiss"

THE remains of the *Luftwaffe* is now under Allied control and, like the *Wehrmacht,* has been broken up completely.

Shaef has established a control party at Berchtesgaden (similar to the Army control at Flensburg) composed of British and American air representatives headed by Major Robert W. Harper, Director of the Air Division, U.S. Group Control Council for Germany, who is assisted by Air Vice-Marshal C. R. Steel, of the R.A.F.



IT WHISTLED WHILE IT WORKED : A 40mm. cannon shell is thought to have made this jagged hole in the hollow steel blade of a Thunderbolt's airscrew. The pilot reported "slight roughness" as the only effect on performance.

News in Brief

A LIMITED number of operationally experienced pilots from the R.A.A.F. are to be "made available" to the Fleet Air Arm in the Pacific.

* * *

Dr. H. Roxbee Cox, B.Sc., F.R.Ae.S., a member of the Council of the Royal Aeronautical Society, has been invited to give the Wright Brothers Lecture at Washington, U.S.A., in December, and has accepted.

* * *

Goodyear Aircraft, it is reported, has worked out a scheme for the building of airships in the U.S. for trans-ocean air routes.

* * *

Canadian factories have produced 15,600 aircraft of various types since the beginning of 1940, according to a recent statement.

* * *

Flying Officer Dobson, R.A.F., is among the five members of H.M. Forces to receive literary awards in a competition run by Macmillan and Co., Ltd., to celebrate the firm's centenary. F/O. Dobson's successful work was an autobiographical account of his adventures as a tobacco salesman in China under the title, "China Cycle."

* * *

A one-man exhibition of paintings by Aircraftman David Smith, a young war artist in the R.A.F., was opened at Cooling's Galleries, 22, New Bond Street, London, W.1, last Tuesday by Group Capt. Douglas Bader. Proceeds from the sale of the artist's work at this exhibition are being given to the Soldiers', Sailors' and Airmen's Families' Association.

* * *

Messrs. E. H. Jones (Machine Tools) Ltd., London, N.W.9, have been appointed sole selling agents for this country for the precision dual keyseating machines made by Messrs. Carter and Wright, Halifax.

Air Marshal Sir John Baldwin has been appointed a trustee of the Imperial War Museum in succession to Marshal of the R.A.F., Viscount Trenchard, who has retired on expiration of his term of office.

* * *

Air Vice-Marshal C. M. McEwen, A.O.C. the R.C.A.F. Bomber Group, which operated from a Yorkshire base, left England last week in the last of the Canadian-built Lancasters to fly home. He will command the R.C.A.F. in the Pacific.

* * *

A lecture on the Bendix Stromberg carburettor by Mr. George Strobridge has been arranged by the S.E. Area Council of the S.L.A.E. for 3.30 p.m. on Saturday, June 30th, at the Zenith company's premises, Honeypot Lane, Stanmore, Middlesex.

* * *

The only line-thrower having the official approval of B.O.A.C. is the Schermuly Pistol Rocket Apparatus, made by the company of that name which, during the war, supplied the kite-launching rocket for the wireless in airmen's dinghies, the automatically discharged rocket lines in all lifeboats dropped by the Air/Sea Rescue Service, and rocket devices for naval and other ships.

* * *

Specialloid, Ltd., announce the appointments of Mr. Andrew Graham as engineering representative for Eire, Mr. K. D. West as district engineer for the southern counties operating from Guildford, and Mr. Gordon Ramsden as area manager and engineer for Yorks, Northumberland and Durham operating from Leeds.

* * *

Mr. I. R. Cox, general sales manager of Metropolitan-Vickers Electrical Co., Ltd., has been appointed its managing director, and Messrs. J. F. Perry and F. J. E. Tearle have been appointed general manager and director respectively of Metropolitan-Vickers Electrical Export Co., Ltd. The last-named retains his position as principal representative.

* * *

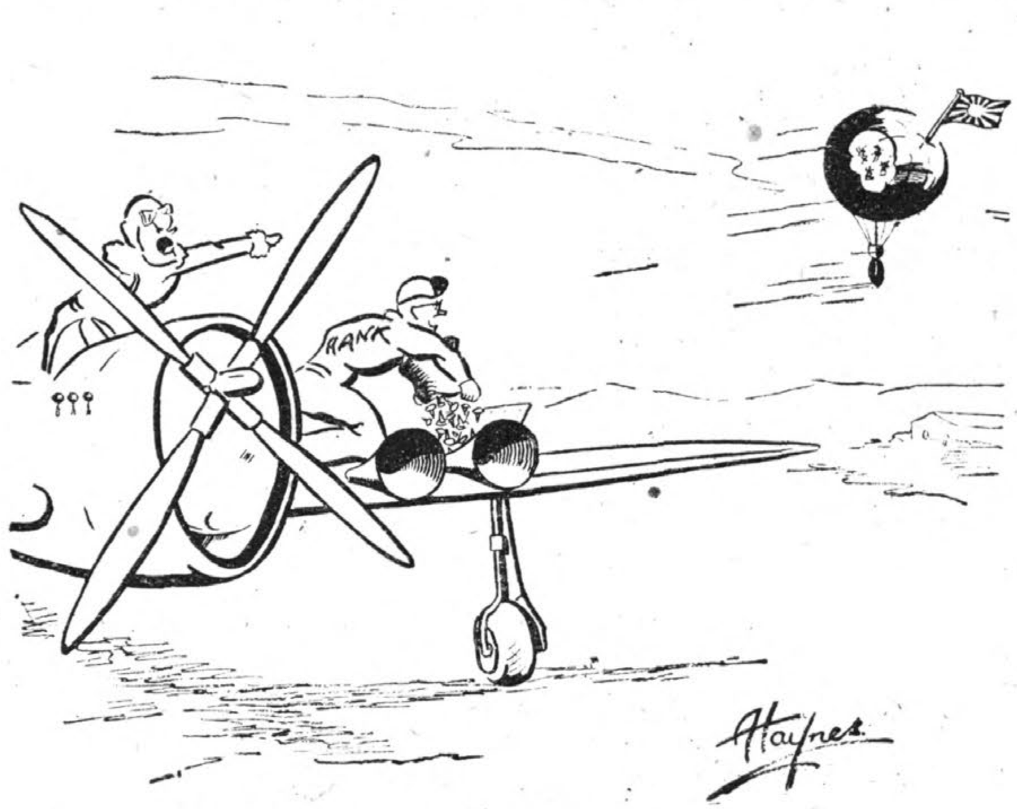
Teddington Controls, Ltd., a subsidiary company of the British Thermostat Co. Ltd., with Mr. W. Martin-Hurst as managing director, will in future handle all that concern's "Teddington" aircraft instruments and equipment from their works at Sunbury, Middlesex. Production, however, will be concentrated at the Belfast factory.

* * *

Air Marshal of the R.A.F. Sir Charles Portal has received a message from Air Marshal S. F. Zhavoronkov, of the Soviet Navy Air Force, conveying "most hearty greetings and congratulations to brave airmen of the R.A.F. who have fought valiantly with us against the Fascist carrion-eagles and have made a great contribution to the common victory."

* * *

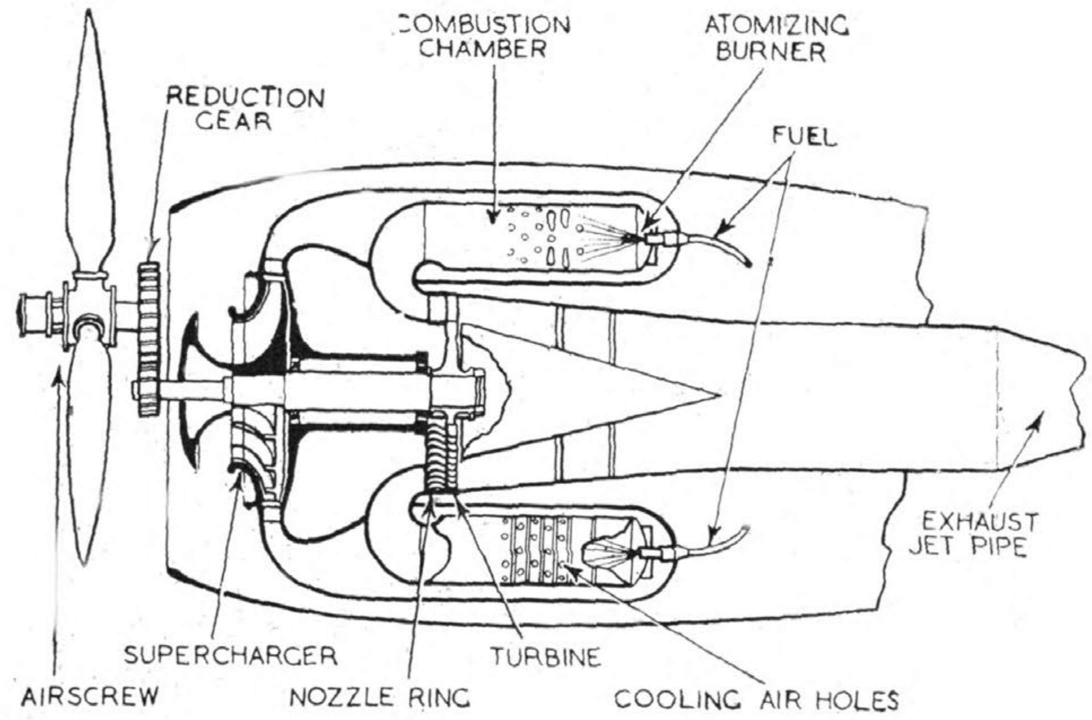
The R.A.F. Association, whose present and post-war role is service to each other, has expanded 25 times during the past year and now has about 50,000 members and 120 branches. This year it hopes to make it 250,000 members and at least 1,000 branches.



Adaptability is the keynote of defence !

Gas Turbines for Aircraft Propulsion

The Meaning of Thrust Power: Comparative Performances: Support for Turbine-driven Airscrews



A diagram of gas turbine unit arranged for combined airscrew and jet propulsion

IN a paper read before the Derby branch of the Royal Aeronautical Society in April last, Dr. S. G Hooker, of Rolls-Royce Ltd., made some interesting comparisons of the performance and consumption of gas turbine compressor units and orthodox reciprocating engines. The general introductory statement included descriptions of the operation of four-stroke piston engines, turbine propulsion units of simple jet and combined jet and airscrew types and necessarily included much material already familiar to our readers by reason of the many articles on jet propulsion which have appeared in "Flight" pages and in book form in "Gas Turbines and Jet Propulsion for Aircraft."

Accordingly, this condensed version of the paper is an abstract including the newer aspects of the subject of jet propulsion as propounded by the author.

THE performance of a jet engine is expressed in lbs. of thrust which the engine develops, and it is worth while considering the relationship which exists between the thrust of a jet engine and the normal brake h.p. The mathematical relationship is simple, viz.:

$$\text{Equivalent b.h.p.} = \frac{\text{Thrust} \times \text{Aircraft Velocity*}}{\text{Airscrew Efficiency}}$$, and leads to the result that at 300 m.p.h. forward speed 1 lb. of thrust is equal to 1 b.h.p. if the airscrew efficiency is 80 per cent., which is a reasonable figure for this condition. On the other hand, at 600 m.p.h. 1 lb. of thrust is equal to 2 b.h.p. for the same 80 per cent. airscrew efficiency, and, due to compressibility effects upon the blade tips, the airscrew efficiency will probably be not more than 53 per cent., in which case 1 lb. of thrust is equal to 3 b.h.p.

Let me elaborate these figures to show the great advantage of jet propulsion at high speeds. Let us consider a fighter aircraft fitted with a 1,000 h.p. piston engine. Such a machine, if of the Spitfire size and drag, will have a sea level speed of 300 m.p.h., and consequently, since at this speed 1 b.h.p. equals 1 lb. of thrust, the thrust on the aircraft will be 1,000 lb., and the fuel consumption will be about 0.5 lb. per b.h.p., or per lb. of thrust per hour. A jet-propulsion engine of 1,000 lb. thrust will also drive this aircraft at 300 m.p.h., but at this condition its estimated fuel consumption will be about 1.3 lb. per lb. of thrust per hour, i.e., more than double that of the piston engine.

* It will be understood that the denominator must also include the factor 550 if aircraft velocity is expressed in feet per second or 375 if the velocity is in miles per hour.—EDITOR.

Cube Law

Now let us consider what we must do in order to give this aircraft a sea level speed of 600 m.p.h. Since the power required varies as the cube of the speed, we shall require 8,000 h.p., even if the airscrew efficiency still stays at 80 per cent. If it falls to 53 per cent., which is more probable, the power required will be 12,000 h.p., and such an engine will weigh at least 12 times the weight of the original 1,000 h.p. engine. On the other hand, the thrust required to double the speed of the machine is only four times as great, so that the jet-propulsion engine will only weigh four times as much as the original 1,000 lb. thrust engine.

Piston engines tend to have a constant specific weight per b.h.p., while for jet engines the weight per unit thrust should remain fairly constant. Comparing fuel consumptions, at 0.5 lb./b.h.p./hr., a 12,000 h.p. engine will use 6,000 lb. of fuel per hour in order to produce 4,000 lb. of thrust, so its fuel consumption will now be 1.5 lb. of fuel per lb. of thrust, whereas the jet-propulsion engine should be approximately 1.4.

In other words, there is now very little difference in the fuel consumption of the two engines, and there is a tremendous advantage in size and weight with the jet-propulsion engine. In fact, whereas the 12,000 h.p. engine will probably weigh at least 20,000 lb. when complete with airscrew and radiators (and would, of course, be prohibitively large for a Spitfire type machine), the jet engine will probably weigh not more than 2,000 lb., and could be accom-

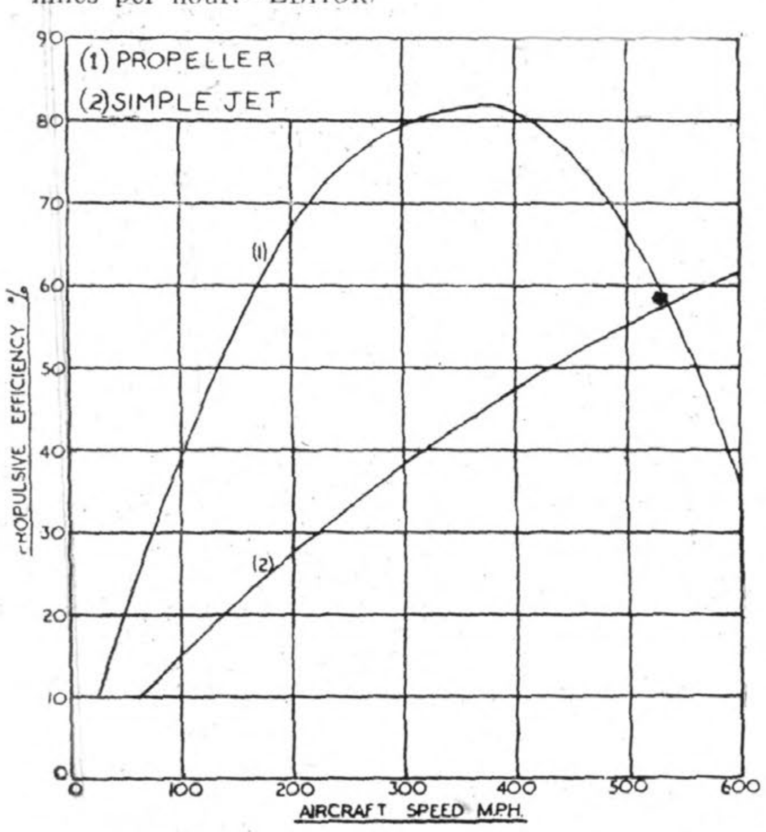


Fig. 1 (Above). Comparative efficiencies of conventional propeller and simple jet unit at various aircraft speeds.

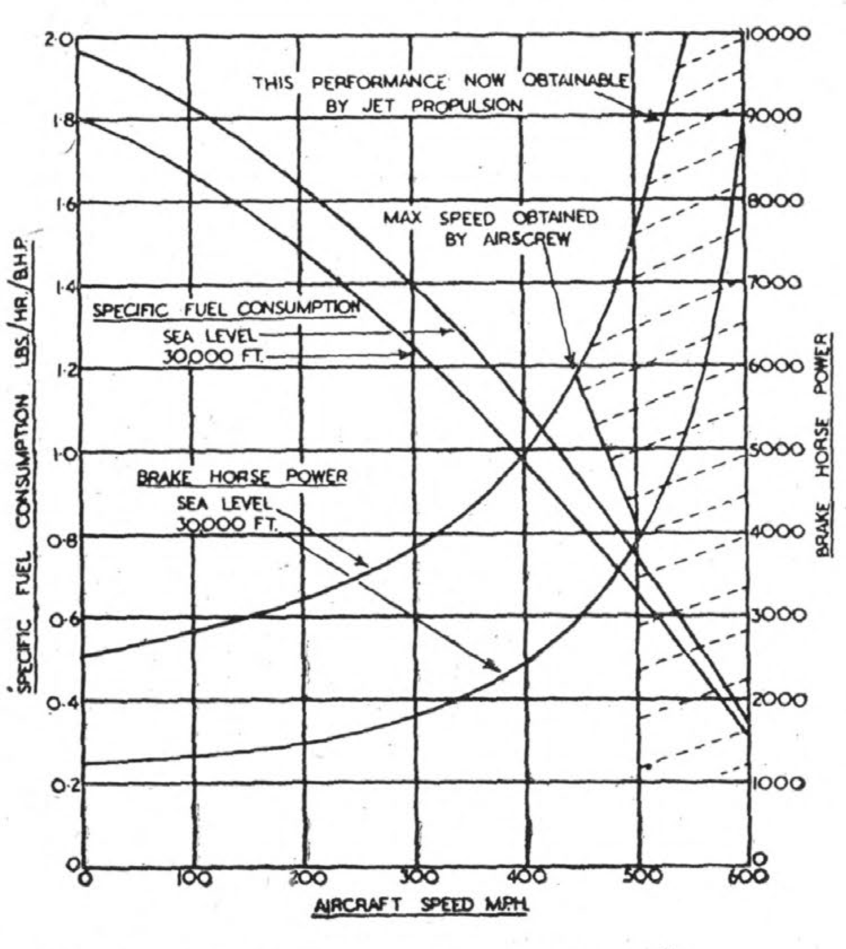


Fig. 2 (Right). Equivalent performances of reciprocating engine and jet unit.

GAS TURBINES FOR AIRCRAFT PROPULSION

modated in a machine of approximately Spitfire size.

The moral of this is that at speeds in excess of 500 m.p.h. approximately, the simple single-stage jet-propulsion engine is far better than the reciprocating piston engine for aircraft propulsion, and is just as economical. Its overall fuel consumption is large simply because it produces enormous powers.

Let us go into this matter a little farther. Fig. 1 shows a comparison between airscrew efficiency and jet-propulsion efficiency. At 300 m.p.h. the airscrew efficiency is double that of the jet, and this accounts to a large extent for the fact that the fuel consumption of the jet engine is more than double that of the piston engine at this condition. At 550 m.p.h. the jet and the airscrew are equally efficient, and, since the jet is so much more simple and lighter than the airscrews, it follows immediately that jet propulsion must be best at this speed.

In the theoretical examples shown in Fig. 1, the airscrew and the jet are equally efficient at 540 m.p.h. This is not the whole story, however, because the airscrew is a heavy piece of mechanism, and its weight is associated with a certain drag on the aircraft. This drag must, therefore, be deducted from the useful thrust which the propeller produces. In addition, the airscrew blows a slipstream over the wings or fuselage of the machine, which again produces an adverse drag. Consequently, the practical cross-over between the airscrew and the jet occurs at a lower speed, probably in the region of 500 m.p.h.

It is apparent that if we are going to consider aircraft in the speed range of 300 to 450 m.p.h., it will almost always pay to propel the machine by an airscrew and not by jets.

It is clear, therefore, that the choice as to whether jet propulsion or airscrew propulsion is the better depends entirely upon the duty the aircraft has to perform.

Fig. 2 shows the estimated performance of a jet-propulsion engine expressed in its equivalent piston engine form. The engine considered has a test bed rating of 4,500 lb. of thrust, so that at take-off it is roughly equivalent to a 2,500 h.p. engine. At 500 m.p.h., however, it is equivalent to a 7,500 h.p. engine, and its fuel consumption per h.p. approaches 0.6 lb. per hour, which is normal for a piston engine. At 600 m.p.h. it exceeds 10,000 h.p. and its fuel consumption is actually lower than can be achieved by any other type of engine. In fact, the performance shown shaded on the diagram can probably only be achieved by jet propulsion, both as regards power and fuel consumption.

It is interesting to study where the fuel goes to in a jet-propulsion unit, and this is shown in Fig. 3. Considering the case of an engine at 500 m.p.h. and 36,000ft., of the 100 units of fuel supplied to the engine, 35 units appear as temperature of the exhaust gases together with the 3.8 and 1.5 units lost in the turbine and the jet pipe respectively as friction. The kinetic energy of the jet wasted to the atmosphere amounts to 16.6 units, leaving 16.4 units as useful work applied to the aircraft. Thus the engine has an overall thermal efficiency of 16.4 per cent.

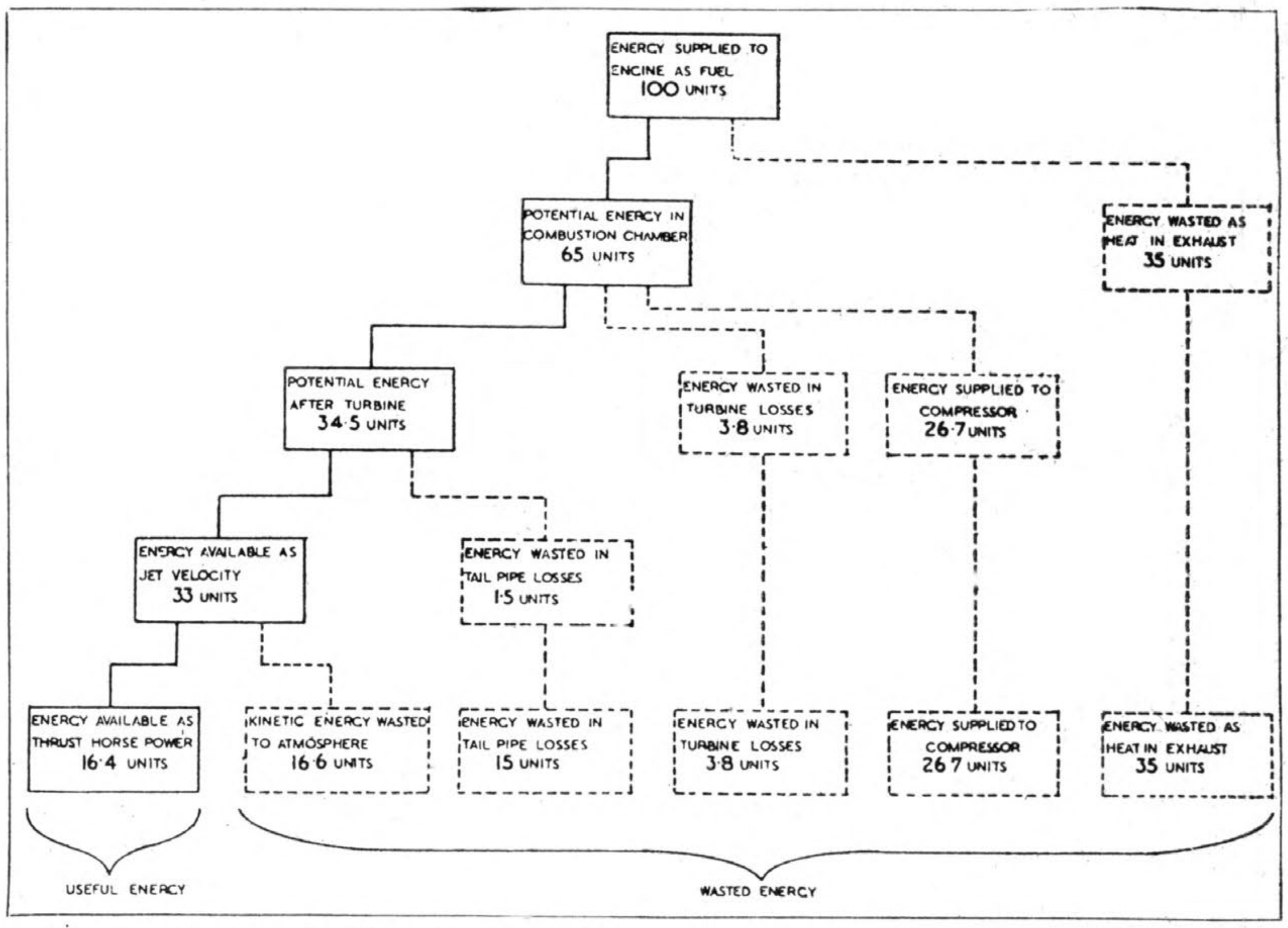


Fig. 3. Fuel expenditure in simple jet-propulsion unit at 500 m.p.h. at 36,000ft.

Further Comparison

Let us again return to the comparison between a jet engine and an airscrew gas turbine. Fig. 4 shows the comparison between two engines, each of which produces 1,000 gas h.p. when regarded as a boiler. If this hot gas be released as a jet, the thrust obtained will be between 500 and 600 lb. depending on the aircraft speed. If, however, 75 per cent. of this gas h.p. is put into an airscrew by means of another turbine and the rest left as a jet, the thrust obtained will be very much increased except at speeds greater than 550 m.p.h. For example, at 300 m.p.h. the total thrust from the airscrew combination will be double that given by the jet, which is really another example of the fact that the airscrew is twice as efficient as the jet at this speed.

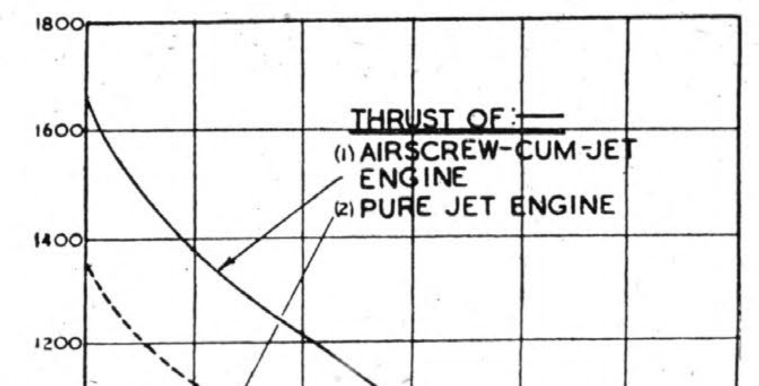


Fig. 4. Comparison of jet engine and airscrew-jet engine Gas horse-power of both units under static conditions = 1,000.

In a supercharged piston engine the charge is compressed through a volume ratio of 6:1 in the cylinder itself, giving an overall compression ratio of 10:1 approx., due to the almost adiabatic compression by the piston. On single-stage gas turbines, however, the compression ratio is limited to about 4:1.

Another important point is that in a piston engine the compression ratio is independent of the engine r.p.m., being dependent on the stroke of the piston only; but in a turbine engine the compression ratio varies rather more than the square of the r.p.m. It follows, therefore, that our next attack on the fuel consumption of turbines must be made by increasing the maximum compression ratio of the cycle, and this can evidently be done by replacing the single-stage compressor by a two-stage compressor.

It would be useless to increase the

compression ratio of the engine without maintaining the compressor efficiency, for otherwise the advantage of the high compression ratio would be lost by the fact that more power would be absorbed by the compressors. To get the full advantage we must, therefore, increase the compression ratio of the engines and maintain the overall compressor efficiency at the same time.

Fig. 5 shows the compressor efficiency which, with modern knowledge, one might expect to get by utilising combinations of two-stage centrifugals, axial-cum-centrifugals, or two-stage axial compressors. Notice that at 6:1 compression ratio the corresponding temperature rise is roughly 250 deg. C., and that as the compression ratio or temperature-rise through the compressor is increased the efficiency does fall, being 80 per cent. at 5:1 compression ratio or 200 deg. C. temperature-rise, and 75 per cent. at 7:1 compression ratio or 290 deg. C. temperature-rise.

Still regarding the gas turbine as a boiler, Fig. 6 shows the effect of compressor efficiency upon the gas h.p. available per lb. of air passing through the engine, and also the fuel consumption in lb. per hour per gas h.p. Each curve refers to a particular constant compressor efficiency, and the basic scale is compressor temperature-rise. Ignoring the dotted curve, it would appear that whatever the efficiency of the compressor the maximum power per lb. of air will be obtained with a temperature rise through the compressor of 250 deg. C. On the other hand, the minimum fuel consumption will be obtained at much higher temperature rises, and the required temperature rise for minimum consumption will increase as the compressor efficiency increases.

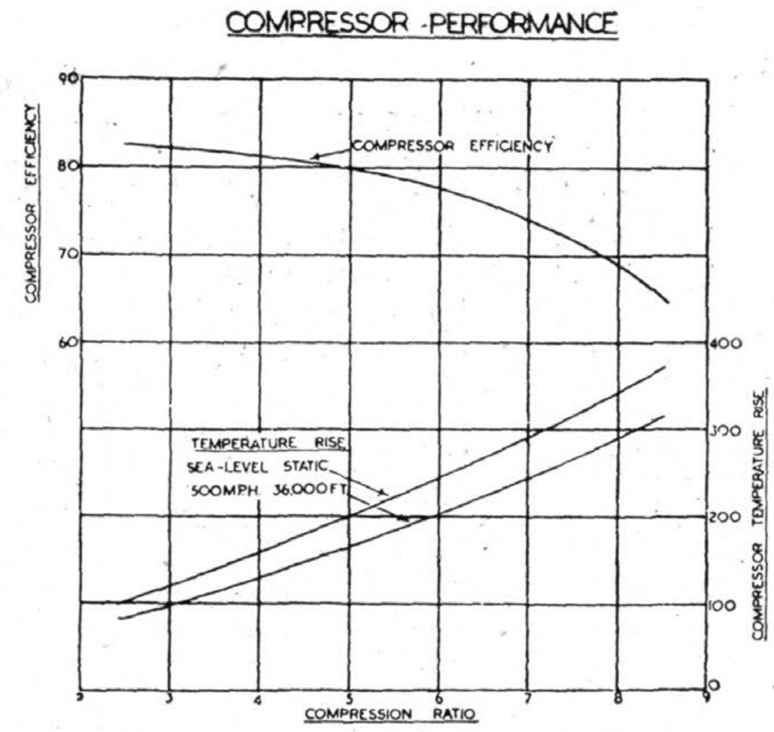


Fig. 5. Temperature rise and efficiency of modern two-stage compressors.

However, this is not the whole story, because one cannot keep increasing the temperature-rise through a compressor and maintain the efficiency of compression constant. As the compression ratio or the temperature-rise increases, so the efficiency of compression will fall as shown in Fig. 5. It does not pay to increase continually the compression ratio of a gas turbine engine because the efficiency of compression is falling, and there appears to be little purpose in going beyond 6 or 7:1 compression ratio at sea level.

Now consider the effect of a two-stage compressor at 6:1 compression ratio upon the performance of a jet-propulsion engine. Both engines have the same static take-off rating of 5,500 lb. thrust, and if as a numerical example we consider the case of 400 m.p.h. at 20,000ft., then the two-stage engine gives a thrust of 2,900 lb. with a fuel consumption of 1.09 lb. of fuel per lb. of thrust per hour, while the single-stage engine gives the same thrust but its fuel consumption is 1.23 lb. of fuel per lb. of thrust per hour. That is to say, the two-stage engine shows an improvement of roughly 14 per cent. in fuel consumption. Since in a two-stage engine the gases are compressed more, it follows that the diameter of the engine will be smaller than that of the single stage for the same thrust.

Let us now consider the effect of combining both a two-stage compressor and an airscrew upon the performance of a gas turbine engine. This is shown in Fig. 7. The comparison shown is that of a single-stage jet-propulsion engine against a two-stage compound engine with airscrew. Again, choosing as a numerical example of 400 m.p.h. at 20,000ft., we see that the jet-propulsion engine produces 2,400 lb. of thrust with a fuel consumption of 1.3 lb. of fuel per lb. of thrust per hour, whereas the (*Continued at foot of page 695.*)

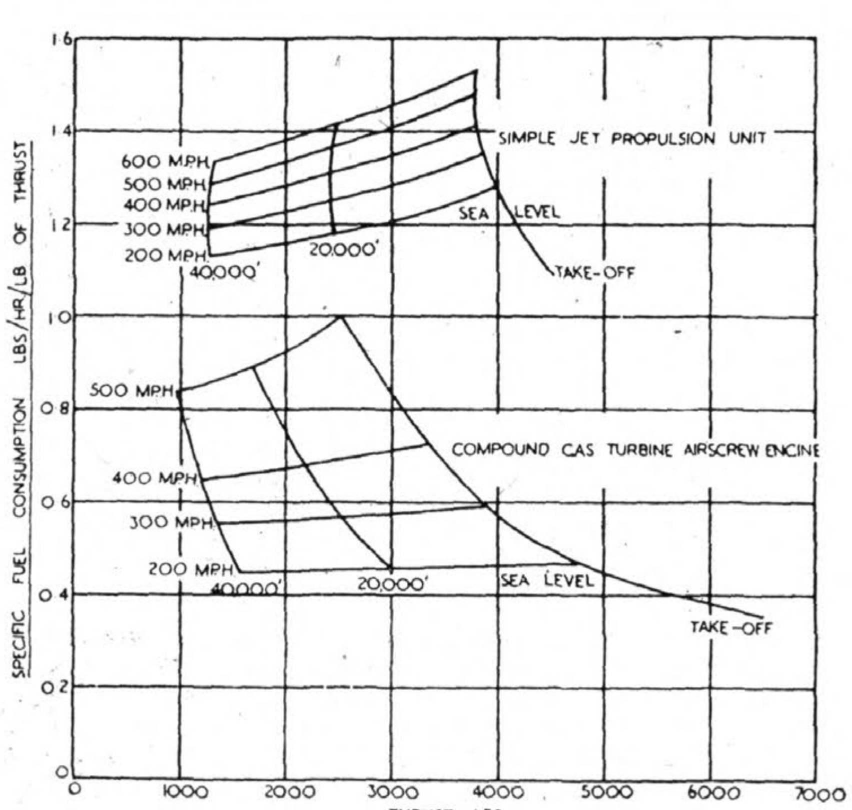
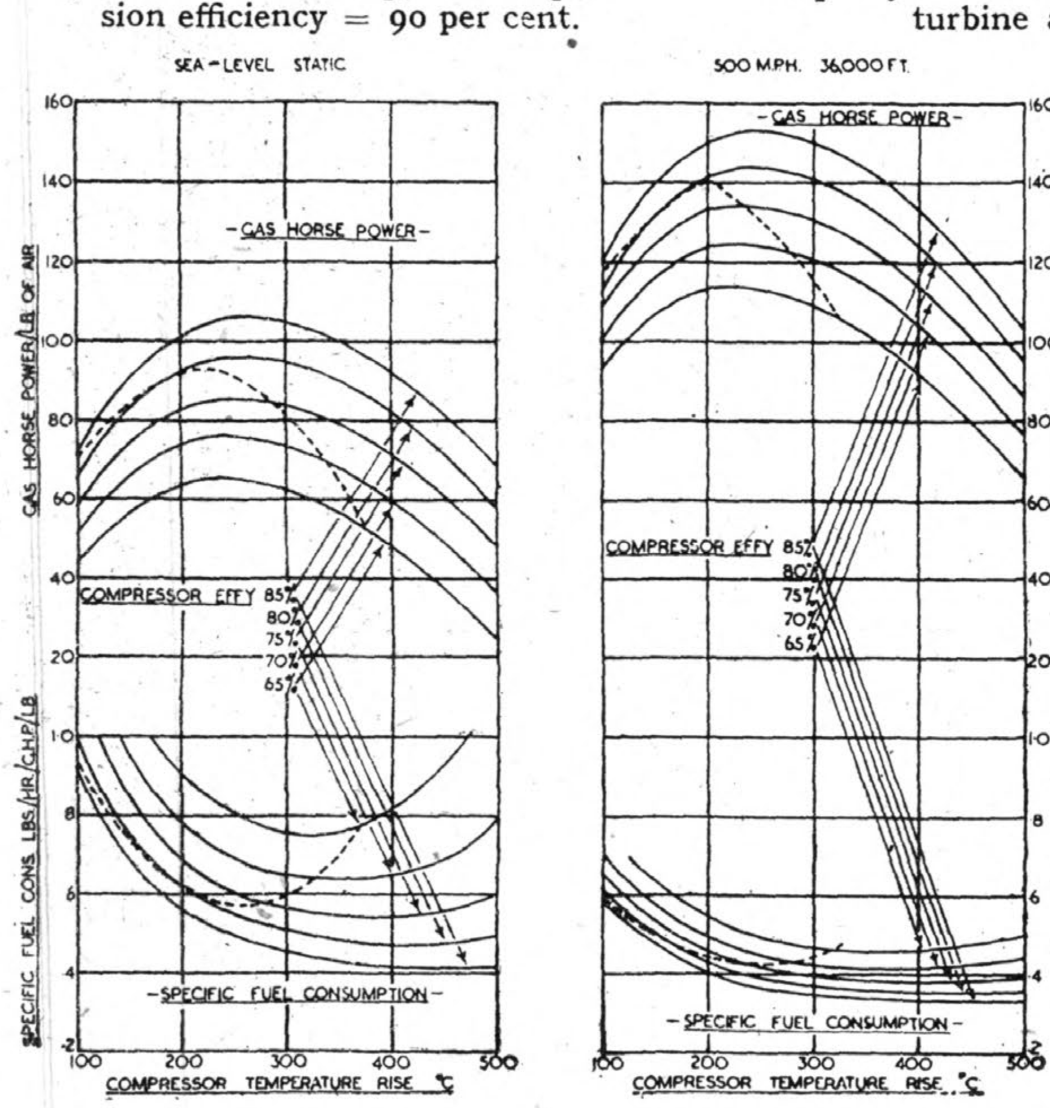


Fig. 7. Comparative fuel consumptions of simple jet unit and two-stage compressor, turbine and airscrew unit.

Fig. 6. The effect of compressor efficiency on gas horse-power and specific fuel consumption. Expansion efficiency = 90 per cent.



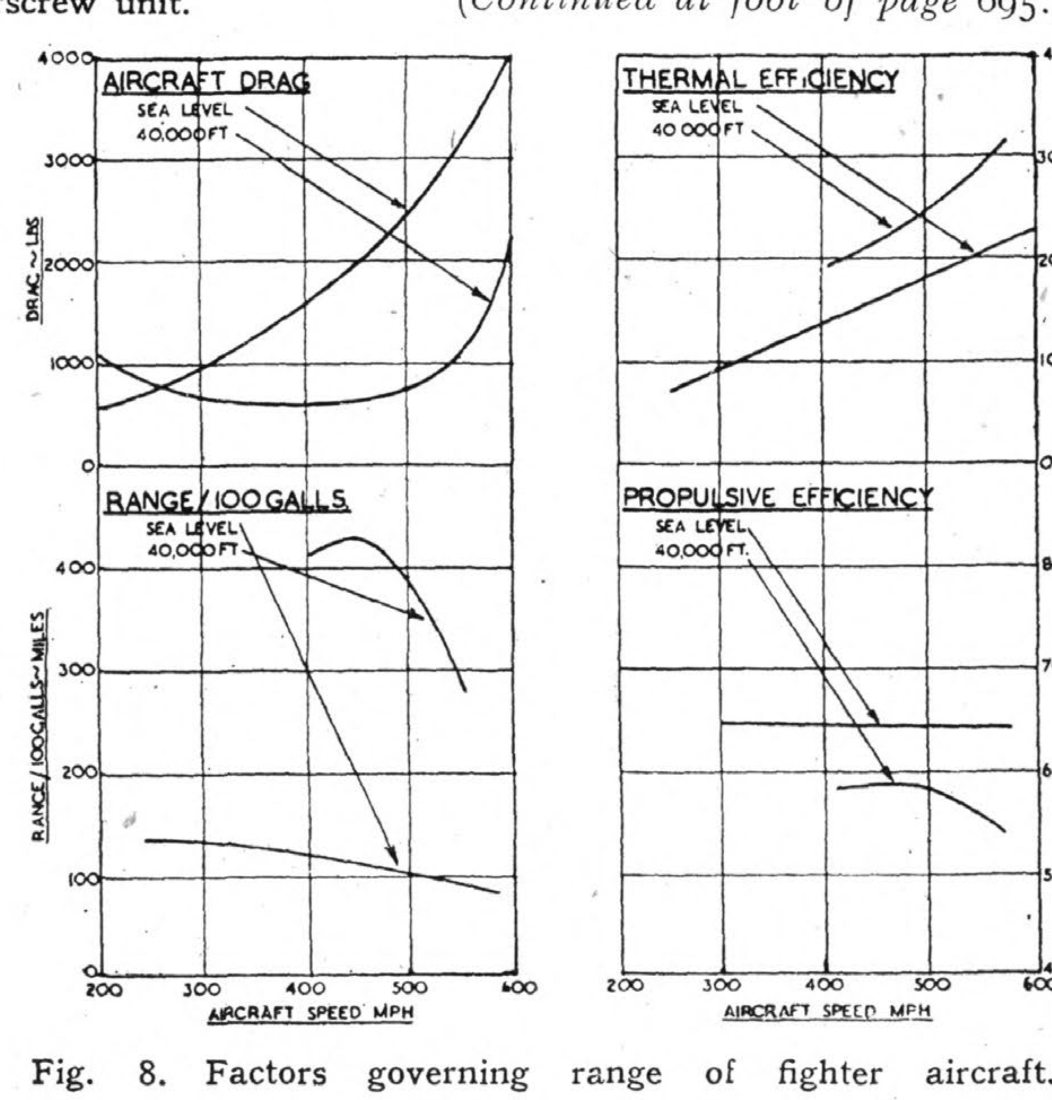


Fig. 8. Factors governing range of fighter aircraft.

M.A.P. Exhibition

Opening Ceremony an Amphibious Occasion : Many Exhibits Were Not Ready in Time

From a gallery you can look through the transparent top of a Lancaster and see all its interior arrangements.

NOBODY who was present on the opening morning of the exhibition staged by the Ministry of Aircraft Production in Oxford Street, London, will be likely to forget the occasion for some considerable time. After several days of ideal, and almost ideal, summer weather, June 21st distinguished itself by timing a miniature "cloud burst" for the opening ceremony of this important exhibition.

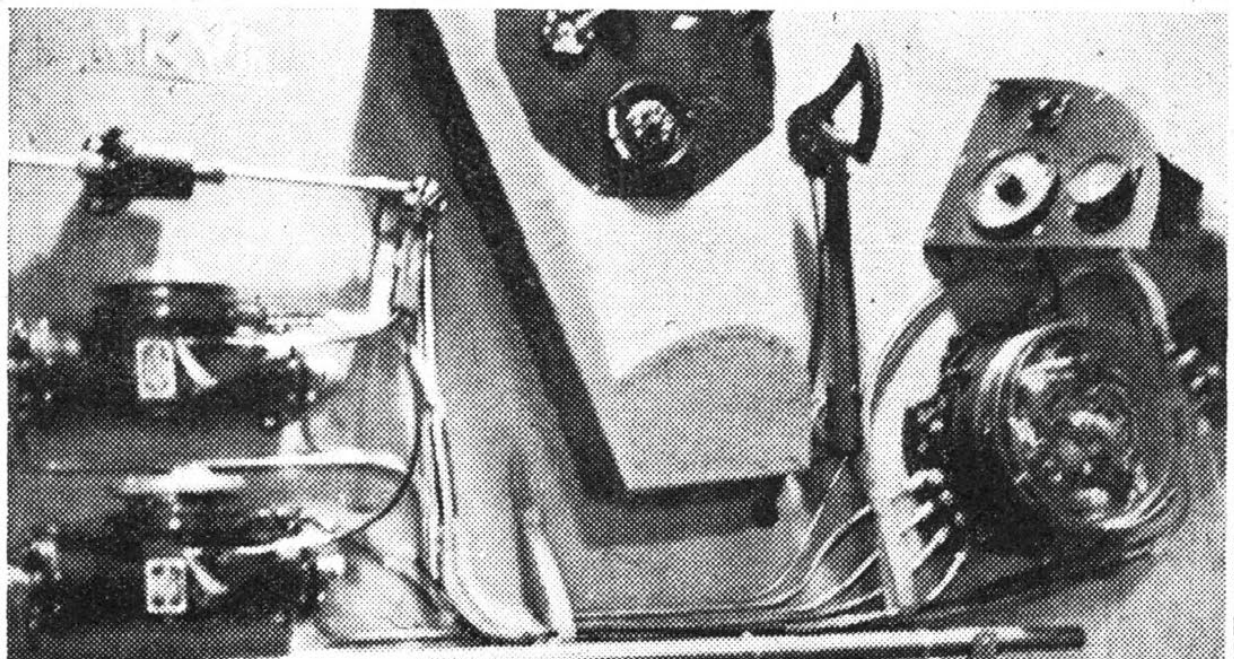
The day began with a B.B.C. forecast of thundery showers, bright intervals, rather warm. How right they were. There had been a little light rain in various London districts about the time when most people were making their way officewards, but after that it showed signs of clearing up. Towards 11 a.m., however, there was a rapidly darkening sky and then, just when the R.A.F., Fleet Air Arm and other contingents were about due to arrive, down it came.

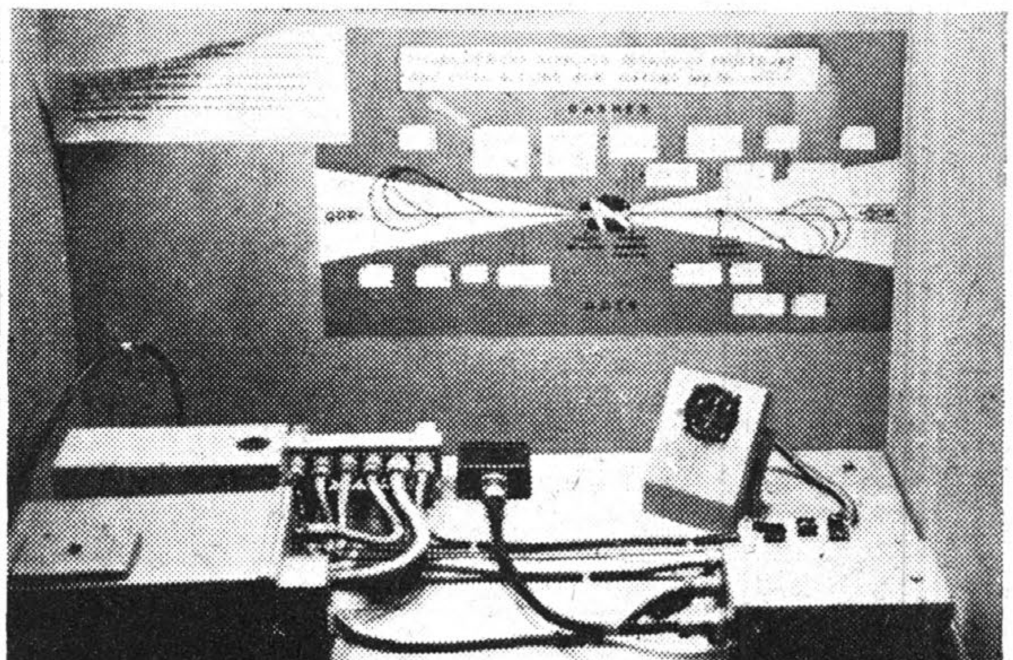
Flight commented, in last week's issue, on the doubtful suitability of John Lewis's blitzed basement as a site for this exhibition. The liquid hour that embraced the opening ceremony can have left little doubt in anyone's mind that in the unfortunate circumstances something a little less like a static water tank would perhaps have been preferable—excepting, of course, for the flying boat and Air/Sea Rescue exhibits, which found themselves literally in their element. Incidentally, many sections were not ready in time, in spite of feverish eleventh-hour efforts.

Triumph Over Shortages

In opening the exhibition, Lord Beaverbrook praised the men and women of the aircraft industry and said that to those who doubted its peacetime future he would say, "You ain't seen nothing yet!" In war the industry had been a story of triumph over shortages by means of improvisation and hasty adjustments. The Mosquito—"this dazzling airplane"—was a monument to improvisation in that it sprang from combining two plenties, wood and skilled woodworkers, to defeat a shortage of aluminium and shortage of work in the furniture trade.

The exhibition itself comprises no fewer than 29 sections, and it is fair to say that it has been laid out in a way that makes the best of the obvious limitations imposed by the nature of the site. But even with a plan as a guide, it is not too easy to make a systematic tour of the exhibits





PALS OF THE PILOT : Many of the latest types of instruments which equip Britain's aircraft today constitute an important section of the exhibition. (Left) A working model of "George," the automatic pilot, and (right) the beam approach exhibit in the same section.

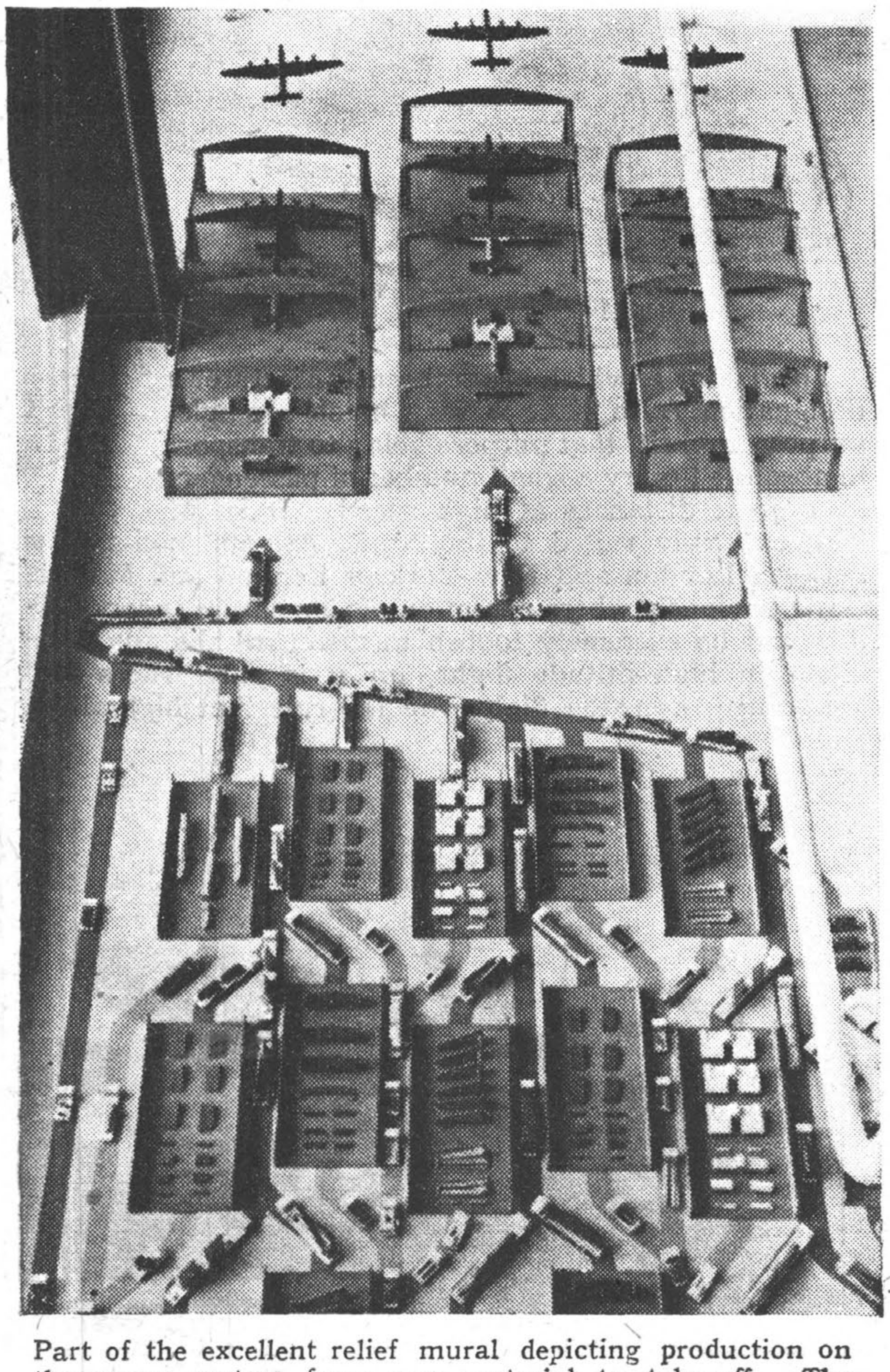
M.A.P. EXHIBITION

and be sure that none has been overlooked. The Air/Sea Rescue (Section 14) for instance, is tucked away in a more or less hidden corner to which access is gained by a narrow opening between the torn remains of blitzed walls and could quite easily be overlooked by the average visitor.

Patently, some part of the exhibition had to be placed here, and since it already provided a miniature lake (irrespective of the weather) in which to float the Walrus and the perfect little model of a high-speed rescue launch, it was a natural spot for this section, which also shows, afloat, the large lifeboat dropped by the Warwick, and a model of the same lifeboat on its way down, i.e., suspended beneath its cluster of parachutes.

Tucked away in the same corner is the experimental Whittle/Gloster jet-propelled aircraft, the E28/39, together with a cut-away model showing the essential simplicity of Whittle's successful unit. The actual aircraft is of such historic importance that one feels it deserved a more prominent display, especially as it has been very nicely finished for the exhibition. Perhaps it is intended to erect a large sign pointing to the "hidden cave," amid the ruins, in which this important exhibit is buried, but no such guide was in evidence on opening day.

Among the full-scale aircraft on show—most of which are already quite familiar, such as the Halifax, Mosquito, Tempest, Beaufighter, Firefly, Auster, etc.—one in particular merits special attention. This is the partly stripped Lancaster with a transparent top to the fuselage and so



Part of the excellent relief mural depicting production on the group system from raw material to take-off. The picture has been "upended" intentionally.

The veteran airline pilot, Capt. O. P. Jones (with beard) and Capt. E. F. Palmer, who flew the first B.O.A.C. Lancastrian to Karachi, inspect the Gloster jet-propelled fighter.

arranged that, from a gallery running alongside, visitors can see practically all its interior equipment. Bomb doors and undercarriage—looking gigantic in that confined space—are demonstrated opening and closing, and there is, along an adjoining wall, a diagrammatic representation of the hydraulic system for their operation.

It is, of course, quite impossible here to catalogue the entire exhibition, which covers almost every phase of Service aviation down to the clothing and equipment of the aircrews themselves, and embraces engines (Merlin, Sabre and Centaurus) sectioned and in real peacetime show finish, airscrews (revolving), armament, bombs (including the towering "Grand Slam"), fuels, repair and maintenance, instruments (including "George" at work), wood, plastics, and numerous diagrammatic exhibits (including a splendid one showing group production from the arrival of raw materials at the docks to the ultimate test flight). Finally, for those who want to know what Back-room Boys look like, there is a row of large portraits of some of our most famous designers.

The provisional run of the exhibition is six weeks, but it is expected to prove of such appeal that it may be even longer.

At the Luncheon

After the opening ceremony there was a Government luncheon at Claridges, at which the Rt. Hon. Ernest Brown, Minister of Aircraft Production, presided and introduced five speakers and mentioned that every former Minister of Aircraft Production was present.

Sir Stafford Cripps recorded that the aircraft industry was at one time the biggest of all industries. During bombing and black-out it never wavered, and despite dilution the customer was never let down, especially on quality. He gave A.I.D. its due credit and also praised Lord Beaverbrook for his efforts at a crucial period of the war. Civil aviation had been held back by the war, he said, but they looked to the industry to send British aircraft into every sky. We led the world in both reciprocating and jet engines.

Marshal of the R.A.F. Sir Charles Portal said the British aircraft industry had been the mainstay of the R.A.F. In the vital matter of quality they were fortunate in being provided with such superlative machines; the later type of bomber carried double the bomb-load six times as far as the original war types. The R.A.F. had flown 7,500,000,000 miles during the war.

Rear-Admiral Thomas Troubridge observed that sea-power could not operate alone, and that there was a great future for ship-borne aircraft. Lord Swinton, Minister of Civil Aviation, said that civil aviation in this country would hold its own in friendly competition with the world, and Major H. R. Kilner, who thanked the speakers on behalf of the industry, remarked that in this war we had always managed to keep one jump ahead and retain mastery, and he paid tribute to the workers in the factories.

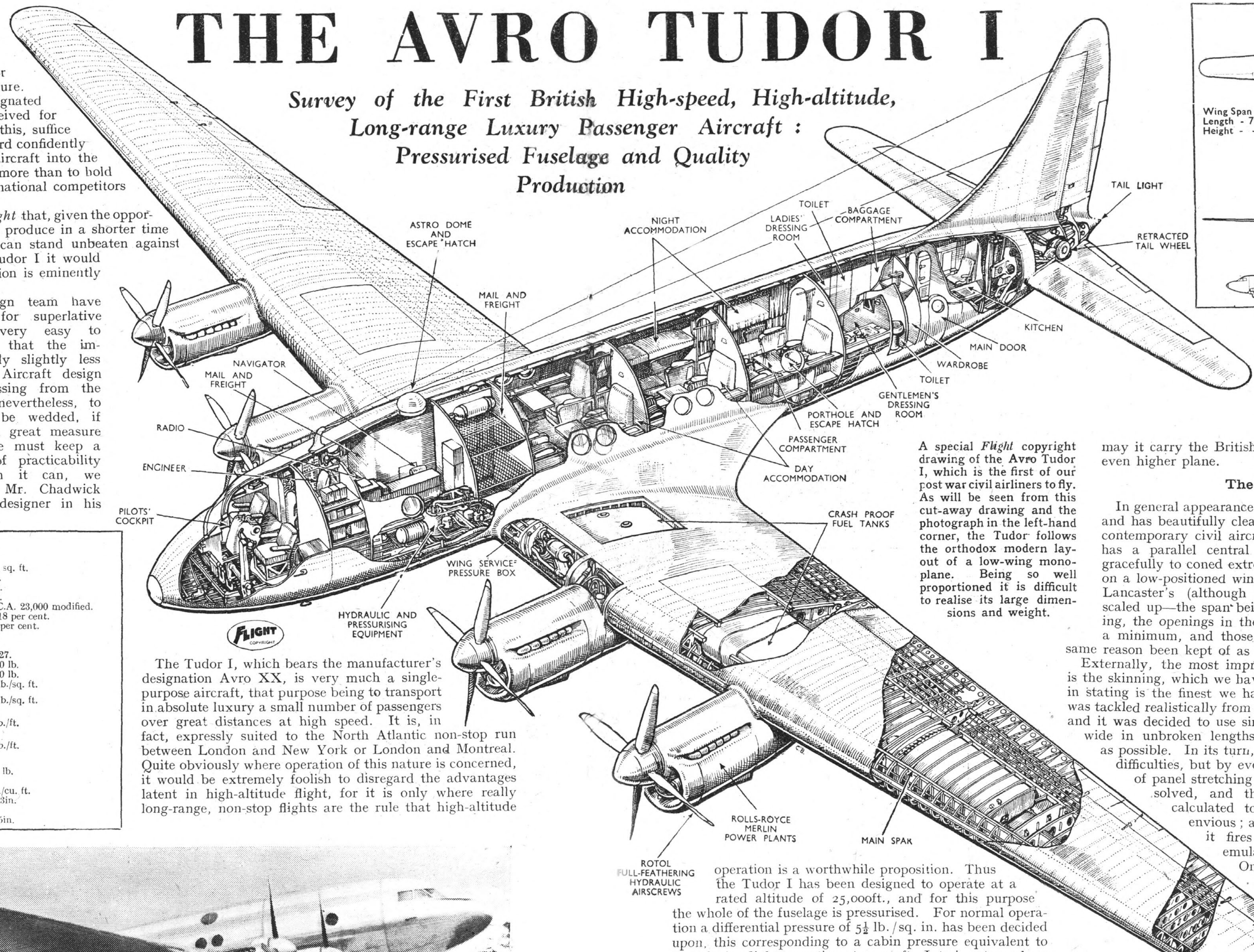
THE AVRO TUDOR I

Survey of the First British High-speed, High-altitude, Long-range Luxury Passenger Aircraft : Pressurised Fuselage and Quality Production

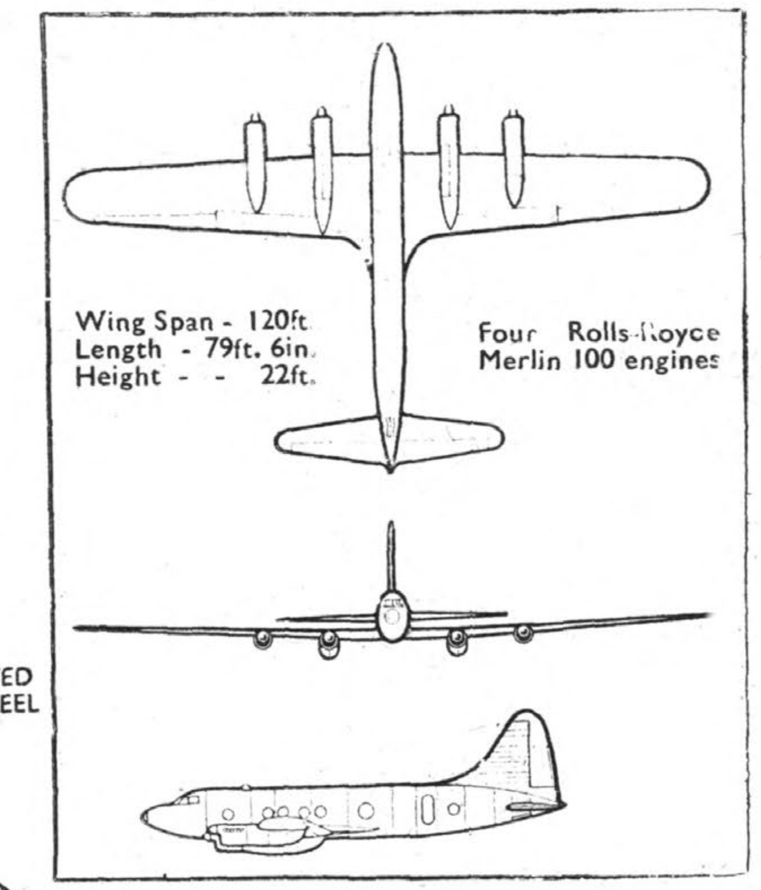
PEOPLE interested in air affairs have for some time past known that A. V. Roe, Ltd., are concerned with producing two separate types of aircraft specifically designed for passenger traffic of the immediate future. The two aircraft are respectively designated Tudor I and Tudor II, but are conceived for different spheres of operation ; beyond this, suffice to say that we in Britain can look forward confidently to getting at least two types of civil aircraft into the air very shortly which can be expected more than to hold their own with anything that our international competitors can produce against them.

It has long been the contention of *Flight* that, given the opportunity, the British aircraft industry can produce in a shorter time than possibly any other, aircraft that can stand unbeaten against all comers. With the advent of the Tudor I it would seem to be established that our contention is eminently justifiable.

Mr. Roy Chadwick and his design team have an outstanding record, not only for superlative aircraft but aircraft which are very easy to produce ; and it must be stressed that the importance of the latter quality is only slightly less vital in peace than it is in war. Aircraft design has for years been steadily progressing from the realm of art into that of science ; nevertheless, to a designer's technical ability must be wedded, if his work is to be of any real use, a great measure of common sense—that is to say, he must keep a very sensitive finger on the pulse of practicability and simplicity. In this connection it can, we think, in all fairness be said that Mr. Chadwick is probably the most common-sense designer in his field.



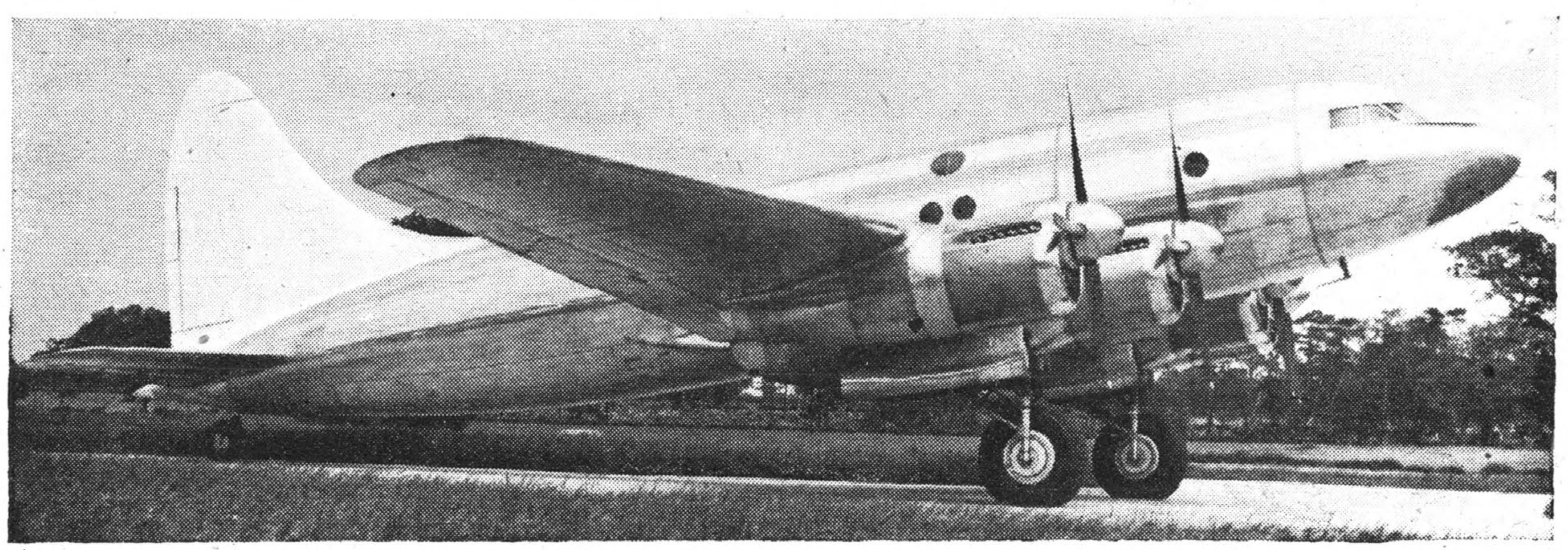
A special *Flight* copyright drawing of the Avro Tudor I, which is the first of our post war civil airliners to fly. As will be seen from this cut-away drawing and the photograph in the left-hand corner, the Tudor follows the orthodox modern lay-out of a low-wing monoplane. Being so well proportioned it is difficult to realise its large dimensions and weight.



DATA

AVRO XX—TUDOR I

Wing area	1,421 sq. ft.
Aspect ratio	10·13.
Dihedral (outer wing panels)	4 deg.
Incidence	4 deg.
Aerofoil	N.A.C.A. 23,000 modified.
T/C ratio	root 18 per cent. tip 9 per cent.
Root chord	16ft.
Tailplane span	43ft.
Tail surfaces aerofoil section	Raf. 27.
Max. all-up weight	76,000 lb.
Max. landing weight	66,000 lb.
Wing loading	53·5 lb./sq. ft.
Span loadings	$\frac{W}{b^2}$ 5·28 lb./sq. ft.
Span loadings (at 76,000 lb.)	$\frac{W}{b}$ 633 lb./ft.
Span loadings (at 64,000 lb.	$\frac{W}{b}$ 533 lb./ft.
Maximum payload—mail, freight, passengers and baggage	5,500 lb.
Disposable load percentage of A-U weight	38·5.
Baggage and freight density	10 lb./cu. ft.
Maximum useful length of fuselage interior	60ft. 3in.
Maximum diameter	10ft.
Maximum internal beam	9ft. 5in.



The Tudor I, which bears the manufacturer's designation Avro XX, is very much a single-purpose aircraft, that purpose being to transport in absolute luxury a small number of passengers over great distances at high speed. It is, in fact, expressly suited to the North Atlantic non-stop run between London and New York or London and Montreal. Quite obviously where operation of this nature is concerned, it would be extremely foolish to disregard the advantages latent in high-altitude flight, for it is only where really long-range, non-stop flights are the rule that high-altitude operation is a worthwhile proposition. Thus the Tudor I has been designed to operate at a rated altitude of 25,000ft., and for this purpose the whole of the fuselage is pressurised. For normal operation a differential pressure of $5\frac{1}{4}$ lb./sq. in. has been decided upon, this corresponding to a cabin pressure equivalent to 8,000ft. for flight operation at 25,000ft. Interior atmosphere is wholly conditioned, and passengers should enjoy a state of cabin aspiration unapproached by aircraft designed to fly at lower levels. It is very well worth stating here that, despite the great amount of talk there has been about pressurising intentions, no aircraft manufacturer either here or in the United States has yet succeeded in efficiently pressurising a large volume fuselage. Small cabins have been pressurised with success, but no large-scale venture has yet been a practicable proposition. There can be little doubt that A. V. Roe will have their share of headaches in making the Tudor I a "pressure" success, and yet the writer, for one, has confidence that this aircraft will prove to be the first practical large-volume example of a pressurised cabin. The eyes of the aeronautical world are on the Tudor—may it carry the British technical standard on to an even higher plane.

The Outline

In general appearance the machine is very graceful, and has beautifully clean lines. As with most other contemporary civil aircraft of its class, the Tudor I has a parallel central fuselage trunk which fairs gracefully to coned extremities, and this is supported on a low-positioned wing of similar plan form to the Lancaster's (although the dimensions have been scaled up—the span being 120ft.). Due to pressurising, the openings in the fuselage have been kept to a minimum, and those that do occur have for the same reason been kept of as small an area as is tenable.

Externally, the most impressive feature of the aircraft is the skinning, which we have not the slightest hesitation in stating is the finest we have ever seen. This problem was tackled realistically from considerations of pressurising and it was decided to use single panels 33ft. long by 3ft wide in unbroken lengths, so incurring as few joints as possible. In its turn, this brought about curvature difficulties, but by evolving a revolutionary system of panel stretching the problem was successfully solved, and the result is a skin plating calculated to make other manufacturers envious ; although it is to be hoped that it fires them with the resolve of emulation.

On the construction side A. V. Roe have generated a system whereby the building of any circular - section fuselage, of any size, can be facilitated simply by setting their special rolling machines to produce frames of a given size and radius, and stringers of a given size and length. This is production of the "sausage machine" order. Truly the Tudor I fuselage structure is simplicity itself, for it consists merely of lipped channel-section circular frames to the outer peripheries of which the top-hat-section stringers are directly bolted, the external skin panels being riveted to the stringers. Internally, the fuselage is "ceiled" above

THE AVRO TUDOR I

floor level with light sheeting riveted to the frames, the inner and outer skins enclosing a fibrous cellular material for temperature and sound insulation. Every joint in the fuselage structure where a pressure leak could directly or indirectly occur is sealed with sandwich and covering coatings of a bitumastic emulsion.

There are four transport joints in the fuselage comprised of a T-section extruded frame to each side of the web of which are riveted and through bolted annular plate extension sub-webs stiffened by L-section annular "booms" riveted to each. At wing spar stations the fuselage frames are of extra deep section and consist of plate webs to which L-section extruded "booms" are riveted. Stringer attachment here and at transport joints is the essence of simplicity; cast butt fittings are riveted to the stringer ends on each side at the particular frame, and the butt fittings on each side are through bolted to each other and the frame.

Tail Diaphragm

In the tail of the fuselage is a diaphragm bulkhead carried within an opened-L-section extruded ring and stabilised vertically with deep-channel strips and heavy L-section extrusions. The cross arms for the elevator and rudder controls are carried in large diameter ball bearings housed in built-up brackets mounted on the front face of this bulkhead. Control transmission linkage throughout the aircraft is by push-pull tubes carried in colloidal graphite impregnated composition guides which are spherically housed for self-alignment.

The fuselage floor is light alloy sheeting carried on a framework of light channel-members comprising thwartships "joists" between which run intercostals, the whole being supported by deep channel-section vertical posts attached to the lower segments of the frames with shear cleats.

Wing to fuselage attachment is ingenious yet simple. Ordinary practice, in view of pressurising, could not be followed so that at the centre-section/fuselage juncture, only the spar booms pierce the skin. Each of these is carried through cast shrouds housing rubber seals, the shrouds being bolted to the booms and riveted to the skin. Both wing spars are of the well-tried Avro pattern, comprising extruded solid booms and heavy gauge diaphragm webs, but the centre-section spar webs are not continuous, each being broken at the fuselage skin line, with a separate length of web correspondingly carried across the fuselage interior on the continuous booms. The centre-section ends immediately outboard of the inboard nacelles, the outer wing panels being attached with short high-tensile steel butt straps on both sides of each spar boom, secured with two 1¾in. diameter 100-ton steel through bolts each, and spar webs at the joint are covered with butt straps on their forward faces.

AFTER THE TUDOR ROSE: Mr. Roy Chadwick, chief designer of Avros, greets Major W. Thorn, test pilot, after the Tudor's first flight. Capt. Orrel, another Avro test pilot, is behind Major Thorn.

PERFORMANCE

Max. all-out level speeds at mean weight of 66,000 lb.: 3,000 r.p.m. + 20 lb./sq. in. boost.

(i) At sea level—MS gear—1,740 b.h.p./eng.—290 m.p.h. T.A.S.
(ii) At 8,000ft.—MS gear—1,840 b.h.p./eng.—320 m.p.h. T.A.S.
(iii) At 20,000ft.—FS gear—1,670 b.h.p./eng.—346 m.p.h. T.A.S.

Max. W.M. cruising speeds at mean weight of 66,000 lb.: 2,650 r.p.m. + 9 lb./sq. in. boost.

(i) At sea level—MS gear—1,080 b.h.p./eng.—242 m.p.h. T.A.S.
(ii) At 12,500ft.—MS gear—1,200 b.h.p./eng.—283 m.p.h. T.A.S.
(iii) At 22,500ft.—FS gear—1,130 b.h.p./eng.—300 m.p.h. T.A.S.

Climb on Max. climbing power. 2,850 r.p.m.; + 12 lb./sq. in. boost.

Rates of climb at 76,000 lb. gross weight.

Height	B.h.p./eng.	4 engines	3 engines	2 engines
S.L.	1,300	990ft./min.	540ft./min.	100ft./min
20,000ft.	1,300	730ft./min.	270ft./min.	—
25,000ft.	1,175	460ft./min.	70ft./min.	—

Ceilings at 76,000 lb.

	Service ceiling (100ft./min.)	Absolute ceiling
4 Engines	30,100ft.	31,500ft.
3 Engines	26,000ft.	24,300ft.
2 Engines	10,000ft.	12,400ft.

Climb on Max. W.M. cruising power. 2,650 r.p.m.; + 9 lb./sq. in.

Rates of climb at 76,000 lb.

Height	b.h.p./eng.	4 Engines	3 Engines
S.L.	1,080	720ft./min.	330ft./min.
15,000ft.	1,085	545ft./min.	150ft./min.
20,000ft.	1,120	500ft./min.	100ft./min.
25,000ft.	1,000	290ft./min.	—

Ceilings at 76,000 lb.

	Service ceiling (100ft./min.)	Absolute ceiling
4 Engines	28,000ft.	29,500ft.
3 Engines	20,000ft.	23,500ft.

Take-off at 76,000 lb.
Ground run, 880 yards.
From rest to clear 50ft., 1,200 yards.

Landing at 65,000 lb.
Ground run, 770 yards.

Landing at 55,000 lb.
Ground run, 660 yards.

Power loadings at 76,000 lb.—Sea Level powers.
1,660 b.h.p./eng. (+ 18 lb./sq. in. boost) 11·45 lb./b.h.p.
1,740 b.h.p./eng. (+ 20 lb./sq. in. boost) 10·92 lb./b.h.p.
2,050 b.h.p./eng. (+ 25 lb./sq. in. boost) 9·27 lb./b.h.p.

Range—Still Air, No allowances.

Max. range on max. fuel tankage of 3,460 gals. ... 4,660 statute miles.
Max. range with max. payload ... ... 4,100 statute miles.
Absolute max. range at 10,000ft. for 500 b.h.p./engine ... ... 4,890 statute miles.

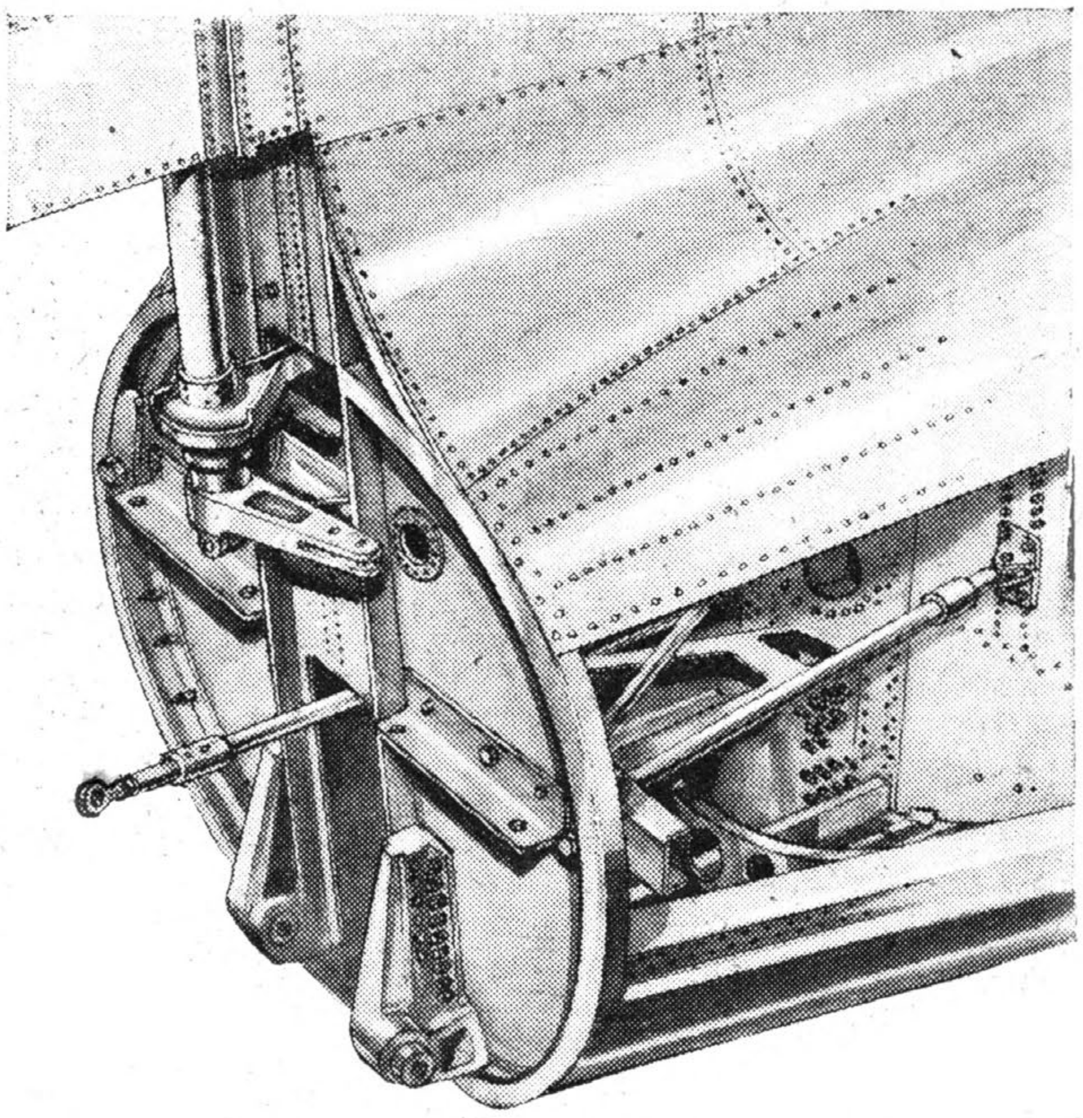
Inboard nacelles are each projected from two massive parallelogram castings bolted on the front face of the centre-section main spar. The engine mounting structure is supported from these castings, and an undercarriage main leg is pivoted at the base of each. Conventional Rolls-Royce tubular triangulated beams are employed for the engine mounting proper, the structure terminating in four points at the firewall, where it is pin joined to the tubular structure of the nacelle mounting aft of the firewall.

As power plants the installations on the Tudor I are worthy of study, but, unfortunately, we cannot expand on this subject which, by itself, is worthy of a separate article. We cannot do more than outline briefly the general characteristics.

The engines are each enclosed in a cylindrical cowling of hinged and removable panels, which is specifically designed as a standard component for various in-line or radial engines. In this instance, where Merlins are used, the front lower segment of each cowling encloses the oil and coolant radiators and embodies the air intake (updraught) for the engine. The central keel panel of the nacelle is arranged as a radiator shutter. Behind the firewall is carried the Rotol gear box upon which are mounted

THE AVRO TUDOR I

the various accessories; the two 15 lb./min. capacity Marshall blowers for cabin pressurising are driven from the inboard engines.



Rudder post and rear diaphragm of the pressurised fuselage.

Wing Layout

Although the Tudor employs a basically similar but scaled-up version of the Lancaster wing, there is noticeably less dihedral. That is probably due to the greater flexibility of the Tudor wing, which is indeed almost fluctuant, the nominal flexural difference at the tip between static and flight conditions being about 2ft. 6in. The most novel feature of the wing is that, between the spars outboard of the centre section in each wing is a tunnel of elliptical section in which are housed three Marston crash-proof collapsible bag-type fuel tanks. These are installed through an access door at the inboard end, laced together and pulled spanwise through the tunnel until all are in place. A further tank of similar type is housed in the centre-section between the inboard nacelles and the fuselage.

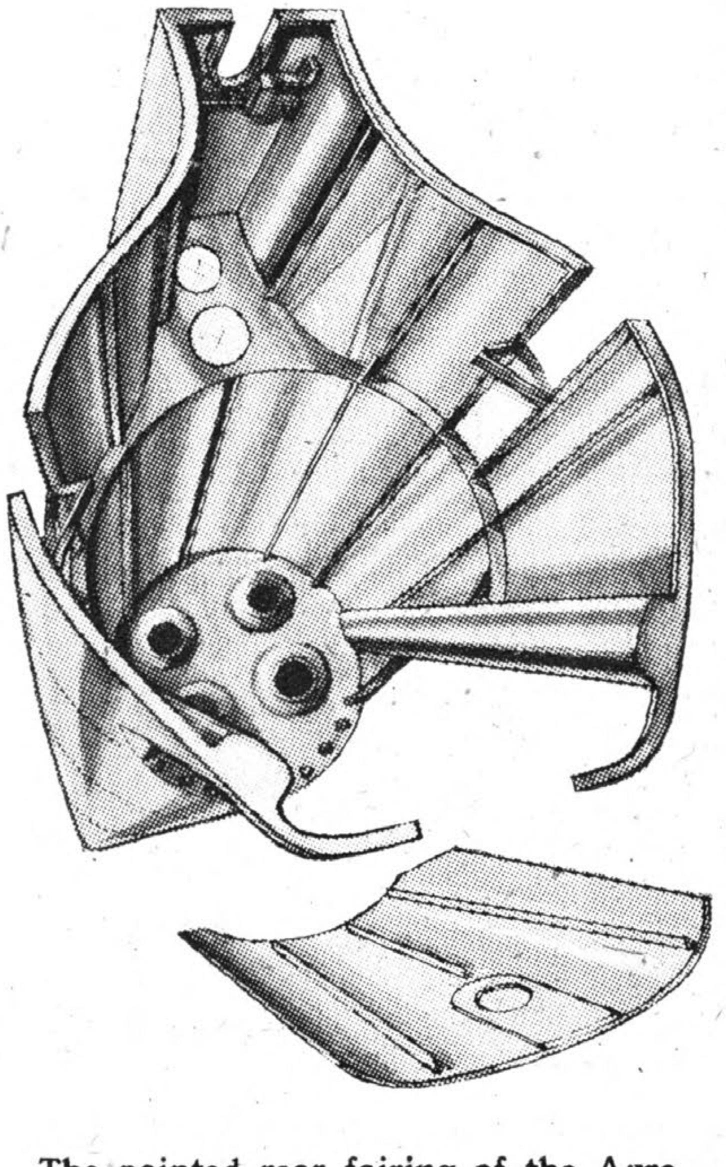
Another feature of the wing is that the nominal outer panels are in two portions, the joint coming at about one-third the span of the ailerons and being of similar form to the centre-section joint. This measure connotes that the ailerons are also in two parts, and the short, cast, torque tube which joins each of the aileron sections is attached at each end with laminated spring-steel leaves which permit positive drive with flexibility. Flaps are hinged at their forward lower edge with a piano-type hinge, and are actuated in a precisely similar fashion to those on the Lancaster.

All control surfaces have servo and trim tabs, but the rudder servo tab is a differential torsion-bar spring type by means of which the initial control force input by the pilot moves the tab, which in turn moves the rudder. If displacement loads are low (i.e., below the torsion spring deflection value) the rudder is directly operated, but at high loads the torsion bar flexes and the tab then moves first until, at peak loads, the torsion bar locks up solid and the control would then become directly manual—this latter would, of course, be a very extreme case.

Tail unit structures are conventional in their use of plate web spars with extruded booms and diaphragm nose, inter-spar, and trailing-edge ribs. The tailplane, however, is worthy of note in that it is of Lancaster origin with the "end-plate" fins and rudders removed and in their place extension tips substituted to increase the span. Additionally, the forward portion of the fin dorsal fillet is built integral with the fuselage, although the fin proper is a separate sub-assembly. The use of the dorsal fillet is a precautionary measure against the incidence of rudder stall at large angles of yaw—an unpleasant penalty which has sometimes to be paid for the use of high aspect ratio vertical surfaces.

Specialisation

At first sight the Tudor I would appear to be a not very well worthwhile effort. It seems essentially wrong that a four-engined 120ft. span aircraft should cater primarily for only 12 passengers (although a 24-seater version is available). But it must be remembered that the machine is a single-purpose type! It has been designed expressly for the high-speed luxury transport of a few people over a very long range.



The pointed rear fairing of the Avro Tudor

Interior arrangement of the fuselage has been carefully thought out and is designed to give the passenger a sense of spaciousness and overt luxury that people who pay for transport on this level will necessarily expect. The cabin proper occupies roughly a third of the fuselage length, but considerable volume is devoted to baggage and toilet accommodation, and to the stowage of express mail and freight.

The control compartment is nicely laid out for the five flight personnel (captain, first officer, flight engineer, radio operator, and navigator), who should benefit from the practical arrangement of their stations. For the pilots, the usual restricted visibility field seemingly beloved by transport pilots is apparent; the effective depth of the windscreen is but 15in., and the pilots' eyes are set well back from the screen. However, in this aircraft there is a very good excuse for the restriction—pressurisation. As it is, in providing the windscreen they have, Avros are being generous in view of the design difficulties with such a high differential pressure as $5\frac{1}{2}$ lb./sq. in.

Instrument layout is characteristically neat and functional, with duplicated blind-flying panels flanking the centrally positioned engine instruments, beneath which is the Sperry autopilot panel. Ancillary to the standard b.f. instruments are the radio altimeter, beam-approach indicator and glide-path control indicator. Centrally placed between the pilots is a clean and workmanlike control pedestal, all the levers and knobs of which can easily be reached by both men. Control columns are in the Lancaster manner with "spectacle" wheels for aileron control, whilst the rudder pedals are suspended from individual cross tubes carrying toggle linkages to operate the push-pull transmission rods through bell-cranks. A convenient feature which pilots will doubtless appreciate are the wide side trays outboard of each seat with lids giving access to spacious lockers.

THE AVRO TUDOR I (CONTINUED)

Behind each pilot is a half-bulkhead partitioning them off from the engineer, navigator and radio operator, the first mentioned of whom sits to starboard facing forward, whilst the other two sit to port facing outboard. The engineer's panel is completely comprehensive for the registering and control of all engine, fuel and ancillary service conditions; in addition he has a complete electrical panel on his right, below and forward of which is the congregation of fuse boxes for all the circuits. Forward of the radio operator—i.e., on the right—are tiered shelves upon which are stowed numerous radio sets, all for specific purposes, as well as other sets mounted above his desk. Due to the fact that British and American radio services for aviation operate on different systems, the rather incredible situation obtains whereby aircraft flying between the two countries require to be equipped with duplicate British and American sets. If anywhere, here exists a first-class case for mutual agreement. A reduction of only 25 per cent. in the sets carried would make a very pleasant present to payload capacity.

The navigator sits on the left side of the radio operator (or in the light of the second pilot being "first officer" should we refer to the radio "officer"?) and has almost all his equipment mounted on a panel over his chart table. Aft of the navigator is a mail and freight stowage compartment of about half the capacity of a similar compartment aft of the flight engineer to starboard. Total volume of these compartments is 158 cu. ft.

At the time of writing only the provisional interior layout of the passenger compartment has been settled, but since this has had a great deal of thought expended upon it and B.O.A.C. have collaborated to the extent of making their wishes on the subject known, there would appear to be little likelihood of its being radically changed. Actually, the arrangement is very well done and the only point we are inclined to question is the choice of colour scheme. This, however, is something which *can* if necessary be easily altered.

Passenger Accommodation

Passengers are seated on each side of a wide central aisle in very comfortable and neatly designed armchairs arranged fore and aft in three sub-compartments. Seat pitching is lavish and there is plenty of leg room. The inboard chair sides are solid and give a sense of being built as part of the aircraft structure, whilst the outboard sides are flanked by a fairly wide shelf running full length and containing cubby-holes for the stowage of papers, magazines, handbags, etc. In the central portion of this shelf midway between the seats is concealed the table which, by opening a lid, can be pulled up vertically and swung down to the horizontal where it remains as a cantilever. The whole of the interior woodwork in the cabin is finished in natural straight-grain walnut—a beautiful wood which itself sets a standard of taste for the decoration. Half-bulkheads, which divide the passenger cabin into the three sub-compartments, and the whole of the interior wall and roof surfaces are covered with beige-pink Vynide, a synthetic leather of excellent appearance, whilst the chairs are upholstered in a deep scarlet moquette and trimmed with scarlet leather.

It is with this colour scheme that we are a little unhappy. The dominant colour is extremely strong—too much so to be restful—and we feel that for psychological advantage, with its effect on comfort, probably the most effective colour schemes are those employing dark neutral shades for a base with contrasting areas of pastel shades as relief. In general, the British aircraft industry, including the airline operators, seem not to be alive to the very real advantages bound up with the judicious and knowledgeable use of colour. The Americans are waking to it and discovering a new field of appeal to the travelling public. There is in existence the British Colour Council, who are very interested in the aviation sphere, and are only too willing to collaborate with the manufacturers and users. We suggest that this source of expert wisdom should not go untapped.

In design the armchairs are ingenious. They are constructed with seat and back frames of light alloy tube to which are attached ribbon and coil springs, and the frames are carried on and against small, cast, hinged blocks which fold away flush when berths are made up and so do not project to cause injury. The chair-backs are pivoted at the top in order that they may be swung up to the horizontal where, bolted together, opposing backs form the frame for the upper berth. Lower berths are formed by the normal chair seats with additional cushions which are stowed beneath the seats during the day, and at night are pulled out to fill the central space between the normal seats. In such a manner sleeping accommodation is available for the same number of passengers as are carried by day.

Switch Ingenuity

A neat feature of appointment is that individual reading lights and steward call buttons are mounted above each seat and thus, at night, are usable only by the occupant of the upper berth. However, similar fittings are installed behind the chair backs for the use of lower berth sleepers, these fittings being concealed during the day. Again, it is possible that the upper-berth passenger might be a sufferer from claustrophobia, and to mitigate in some measure his discomfort, a port light is embodied in the ceiling curvature above each upper berth. Bed linen and blankets, etc., are stowed away during the day in cupboard lockers beneath and behind the chair backs—a very neat arrangement. Owing to the constant radius curvature of the fuselage wall and the positioning of the chairs, a curved cornice runs above the window ports to ensure that there is no gap between the upper berth and the wall. During the night the shelf top of this cornice can be used for the reception of small personal articles by the upper sleeper.

Window treatment is complicated by pressurising the cabin, and we must give the designer credit for providing good fenestration in the light of his structural commitments. Although the prototype is fitted with single, thick Perspex glazing, it is intended to incorporate sealed dry-air sandwich windows throughout in production aircraft. A moulded single-piece sheathing of tinted Perspex is employed internally as a finish to each pair of window posts. In view of the blinding brilliance of sunlight at great altitudes this is a very useful detail. In the aftermost sub-compartments of the passenger cabin the normal two side-by-side window ports give place to a single larger-diameter window, these being escape hatches—there are two additional roof escape hatches, one in the ladies' dressing-room and the other in the front starboard sub-compartment; the astro-dome is also an escape hatch for the crew.

Immediately aft of the passenger cabin is the toilet accommodation, comprising dressing-rooms (furnished with lavatory basins, dressing-table and full- and half-length mirrors), the ladies being accommodated to starboard and the gentlemen to port. Aft of the dressing-rooms are the toilets and, to port, a wardrobe in the roof of which is housed the D.R. Master compass. The dressing-rooms and toilets are fitted with sliding doors opening from the central corridor, which is an extension of the entrance hall immediately to their rear. Again, considered planning is evidenced here, as on the starboard side of the hall is the 115 cu. ft. baggage compartment, and the aforementioned wardrobe is in the port forward wall

The main entry door is to port and, in view of pressurising, has been kept down in size as much as possible; nevertheless, it is of very reasonable dimensions. Framework for the doorway and the door itself is cast Elektron, which material is also used for the escape hatches, and the pressure sealing arrangements to hatches and doorway employ automatically inflatable rubber tubes fed from the pressurising system. The great merit of this is that in the event of a crash—ditching for instance—all hatches and the door are automatically openable.

In the tail of the fuselage is the kitchen, which is well equipped with commodious cupboards, sink, refrigerator, and alternatively an oven and cooker or a hot-lock cupboard. A comfortable folding chair is provided for the steward.

The Pressure System

As mentioned, the complete fuselage is pressurised for a differential operating pressure of $5\frac{1}{2}$ lb./sq. in. at 25,000ft., the conditioning system catering for a complete change of air every three minutes. Pressurising is under the control of the flight engineer and can be pre-set in order to come into operation very gradually and so be imperceptible. Alternatively, the cabin can be conditioned for pressure from the ground up. In this condition the interior pressure will be that of the ground level atmosphere at take-off, the cabin pressure thence being slowly lost until the minimum pressure equivalent of 8,000ft. is reached, after which the interior pressure remains steady. This measure of control is afforded by the very ingenious Westland pressure control valve which is fitted in the after portion of the fuselage. There is always an air spillage from the interior of equivalent volume to the air inducted. It is an interesting point of design that all wing services—engine controls, fuel lines, etc.—are taken through a pressure box at the wing root in the leading edge where they are sealed against pressure leakage. Additionally, all flying control linkages are glanded with synthetic rubber servo-cup rings, the trim control cables having a tie-rod insert for this purpose.

The pressurising system is housed partly in the centre-section leading edges and partly beneath the cabin floor, and comprises two 15 lb./min. (air) capacity engine-driven Marshall blowers, one in each inboard nacelle. Air is entrained through ram heads in the wing leading edges, passes through filters and then gets a hefty pressure rise through the blowers—in addition it gets a large temperature rise, and so is cooled down by having to pass through an intercooler (itself air-cooled) before passing through a silencer. From the latter the air is fed to a non-return and spill valve, which is controllable to govern the amount of air fed to the cabin, after which it is ducted to the mixing chamber. Here the fuselage atmosphere is recirculated and mixed with the fresh air supplied from the blowers; it is then discharged to a 150,000 B.T.U./hour capacity Janitrol heater whence it is ducted to the mushroom distribution vents in the floor (beneath seats) and to the louvre grilles above the window posts.

In the June 14th issue of *Flight* an article on pressurising aircraft drew attention to the primary necessity of conditioning the air supplied. It will be essential that humidifying treatment be given the air, particularly on the North Atlantic route in winter, in order to prevent passengers suffering from parched throats. Should the aircraft be employed on a tropic route the cabin air would, conversely, need to be dried to preclude the interior getting saturated.

Summing up, one can honestly reflect that the Tudor I has every appearance of being an extremely useful and highly successful aircraft. There is nothing about the machine with which one can very well quarrel—the ground angle of $11\frac{1}{2}$ deg. is large (there are very good reasons for it) but it is no larger than that of the Dakota, whilst the colour scheme of the interior is not essentially an *aircraft* matter, although it well might be; other than these there is only the humidifying conditioning for the cabin air which, although not fitted at the moment, will assuredly be fitted when the aircraft start operating. We think that the design of the machine for production is nothing short of brilliant, whilst the quality of the skinning is literally superb. All in all, the Tudor I would seem to be the herald of really great things to come.

GAS TURBINES FOR AIRCRAFT PROPULSION

(*Continued from page 687*)

compound engine produces 2,200 lb. of thrust with a fuel consumption of .67 lb. of fuel per lb. of thrust per hour. The fuel consumption has now been practically halved.

It is a common belief that jet-propulsion engines are only efficient at high altitudes and high speeds. I have tried to show earlier on that this is not really true, and that the gas turbine engine is efficient at high speeds irrespective of altitude. At low altitudes and speeds greater than 500 m.p.h. the jet engine is very efficient, but the power required to drive the aircraft is very high, and consequently the overall fuel consumption is very heavy, and so it would be for a piston engine to perform the same duty.

At high altitudes, however, due to the lower density of the air, the power required to drive the aircraft at 500 m.p.h. is very much reduced and consequently the fuel consumption of the engine is very much reduced.

Fig. 8 shows this effect where at 500 m.p.h. at sea level the range of the aircraft per 100 gallons of fuel is only 100 miles, while at 40,000ft. this has increased to 400 miles. On the right-hand side of this figure we find how this increase in range has been achieved. At 40,000ft and 500 m.p.h., due to the low temperature of the air, the compression ratio of the engine is increased and its thermal efficiency is increased from 18 to 24 per cent., i.e., an overall increase of $33\frac{1}{3}$ per cent. The propulsive efficiency of the engine due to the higher jet velocity at altitude, has, however, fallen from 65 per cent. to 59 per cent., which is a 10 per cent. reduction. Consequently, due to the engine the range will only increase by 23 per cent., whereas in fact it has quadrupled, indicating that the drag of the aircraft has fallen at 40,000ft. to one-third of its sea-level value as indicated on the top left-hand curve.

WESTLAND UNIVERSITY SCHOLARSHIP

THE scholarship awarded to the most suitable apprentice by Westland Aircraft, Ltd., has this year been won by F. J. England. The scholarship is tenable for three years at the University of Cambridge, and the holder is expected to read for an Honours Degree (Mechanical Sciences Tripos). The minimum value of this is £150 per annum, but it may be increased when necessary to £250 per annum.

England also won the Managing Director's Cup, which is awarded each year to the apprentice who shows the highest qualities of citizenship as exemplified by scholarship, workmanship and sportsmanship. Marks for this are awarded by the technical school teachers, by the foremen and apprentice supervisor, and by the apprentices' colleagues in the Apprentice Association, with the final choice made personally by the managing director.

WARWICK WRIGHT

COLONEL WARWICK WRIGHT, D.S.O., whose death was recently announced, was more widely known in the motoring world than in aviation. He was a racing driver in the early days, and in 1919 he founded Warwick Wright, Ltd., as concessionaires for Metallurgique cars. The business was, however, closed down on the outbreak of the first world war, and Warwick Wright joined the Royal Naval Air Service. The business was revived in 1923, and a few years later it was merged into the Rootes Group. During the present war Warwick Wright joined the R.A.F., and for the good work he did in Crete and Greece he was awarded a bar to his D.S.O. His brother is Mr. Howard Wright, who was one of our pioneer aircraft designers.

CONVERSION

TESTS for the conversion of three large transport aircraft from military to civilian use have begun in the United States.

The types tested are the Douglas DC-4, the C-54, a four-engined 44-passenger type used as troop and freight carrier, the Consolidated Model 39, which is a commercial version of the Liberator bomber, and the Curtiss Commando cargo aircraft. The Douglas and Curtiss machines were originally designed in accordance with CAA airworthiness requirements.

CIVIL AVIATION NEWS

PACIFIC TERMINUS

VANCOUVER airport will be enlarged and used by T.C.A. as the Canadian terminus of a Pacific run, W. F. English, the airline's vice-president, recently announced.

BLAIR GOES AHEAD

AN indication that practical steps are being taken to implement British civil air transport plans is the fact that British Latin American Air Lines, Ltd., are calling for applications for a few senior appointments.

British Latin American Air Lines, whose chairman is Mr. J. W. Booth, J.P., propose to operate a route to Buenos Aires from Southampton via Lisbon, Bathurst, Natal, Rio and Montevideo.

TO RANGOON

A DAILY passenger and freight air service from Calcutta to Rangoon marked a step further in the restoration of Burma. After three years the Burmese capital once more takes its place in the vast network of airlines operated for essential war purposes by the Air Command over India and Burma.

The normal journey from Calcutta to Rangoon is approximately five hours.

AMERICAN FIGURES

U.S. domestic airlines had 362 aircraft on April 1st, of which 293 were in service. An average of 525,304 miles is being flown daily on the domestic network compared with 364,445 in 1941, the year before the armed forces took over nearly one half of the operators' fleet.

Airline transport aircraft now spend an average of more than 11 hours a day in the air compared with a little more than six hours in 1941.

CHANNEL ISLANDS SERVICE

EXACTLY five years since German occupation of the Channel Islands forced to a stop their operations, Jersey and Guernsey Airways, Ltd., resumed their services on June 21st.

The scheduled operations on the London-Guernsey-Jersey route consist at present of a twice daily service, including Sundays, in both directions and a week-days only service restricted to freight on the southbound run. All services are operated whenever necessary in duplicate or triplicate.

Flying time from Croydon to Guernsey Airport is 1½ hours, the whole journey from London, Victoria Coach Station, to Jersey terminus takes 3½ hours, including a 15 minutes stop at Guernsey. The return fare for the London-Jersey or London-Guernsey journey is £5 8s. and freight rate is 6d. per lb.

The services are now being used for the repatriation of Channel Islanders returning home after years of exile.

WEATHER SERVICES

THE Eire Government's Meteorological Service, established eight years ago, is to be extended by the establishment of about twenty climatological stations in the near future. At the present time the service has its headquarters in Dublin with met. offices at the Shannon Airport, the Dublin Airport (Collinstown) and Valentia observatory, with seven reporting stations.

SLOW AIR MAIL

THE average transmission time for air mail from London to Colombo is still about six weeks, reports a correspondent. Since Ceylon is on the route to Australia about halfway between London and Sydney, the recent Lancastrian flight has excited hopeful expectations about speedier communications between Britain and the island.

At present, however, the more expensive air mail offers hardly any appreciable advantage over the seaborne mail which takes only very little longer. People in Ceylon are impatiently waiting to benefit from the improved conditions on the Australian service.

AIR REGISTRATION REQUIREMENTS

THE Council of the Air Registration Board announce the publication of the under-mentioned sub-sections of "British Civil Airworthiness Requirements": A.21—Design organisations (radio apparatus) (component parts of radio apparatus). A.22—Specifications (material). A.23—Specifications (instruments) (equipment and accessories). D.9—Emergency exits (Issue 2). D.14—Control systems (Issue 3). D.18—General construction. D.19—Strength and shock-absorption requirements for landing. D.20—Retractable landing gear operation. D.23—General requirements for power plant installation. D.24—Oil and coolant systems. D.25—Power plant instruments, controls and accessories.

These Requirements came into force as from June 21st, 1945.

THE CULINARY SIDE

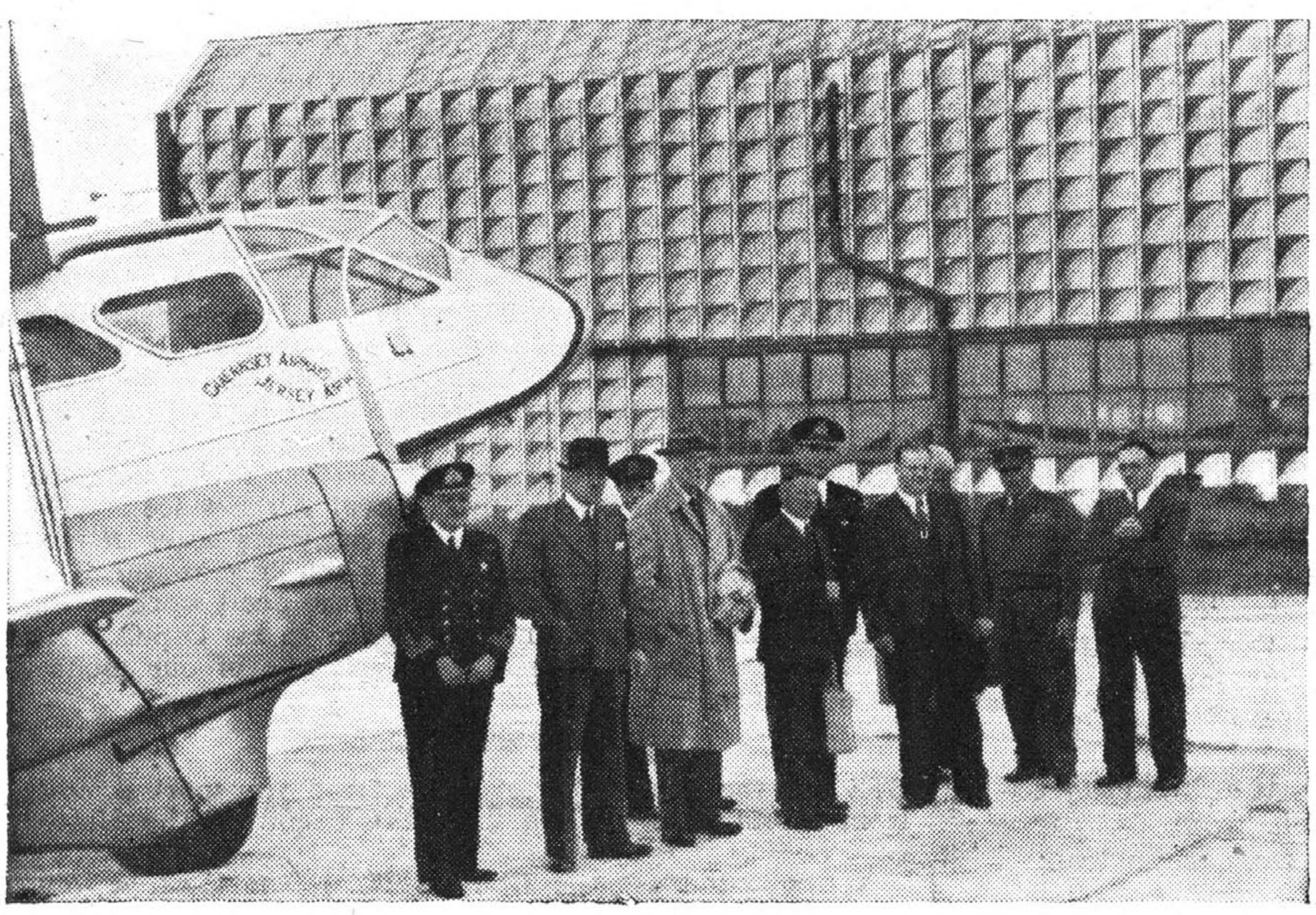
AN ambitious menu was selected for a thorough test of a re-heating apparatus for quick-frozen, re-cooked food on a recent B.O.A.C. survey flight to Biscarosse.

From experienced gained on the flight it was decided that the apparatus needs redesigning to deal adequately with the number of meals required. It was established, however, that food could be used from its completely frozen state within one and a half hours, and preconceived ideas of the necessity for thawing out frozen foods prior to their being cooked were proved wrong.

An immersion heater hot water boiler was also fitted in the aircraft to obviate the necessity for carrying thermos flasks. This proved completely satisfactory, and it was agreed that the boilers could be immediately installed in Sunderlands.

Due to its short duration, the flight was not ideal for the test, but within three-quarters of an hour of take-off freshly made hot soup was served to passengers and crew, and approximately one and a half hours later a meal consisting of three hot courses was served. This was done on both outward and return journeys.

The aircraft used for the test was the modified Sunderland "C" under the command of Captain H. W. C. Alger, and carried Air Chief Marshal Sir William Walsh, Regional Director Europe; Mr. Shaw, assistant manager No. 4 Line; Captain Hedges, of the Catering Branch, and Wing Commander Falke, of R.A.F. Transport Command, as passengers.



SURVEY FLIGHT. The Jersey and Guernsey Airways Ltd. have reopened their services after an enforced interval of five years. The group includes the Company's Chairman, Mr. Grand, Commander G. O. Waters, Managing Director, Mr. R. A. F. Wieland, Traffic Manager, and Capt. E. Jordan, Pilot.

Birthday Honours

A Further List of Military and Civil Awards : O.B.E. for Meteor and Vampire Test Pilots

(Continued from page 665)

ROYAL AIR FORCE

Air Force Medal

Flight Sergeants: G. Bogdanchikoff (now P/O.), R.A.F.V.R.; J. H. Bullock (now P/O.), R.A.F.V.R.; H. A. Coombes, R.A.F.V.R.; E. R. Peirce, R.A.F.V.R.; E. S. Wood, R.A.F.V.R.

Sgt. I. A. Owens, R.A.F.V.R.; L.A/C. T. Jackman, R.A.F.V.R.

ROYAL AUSTRALIAN AIR FORCE

Air Force Cross

Squadron Leaders A. F. McSweyn, E. J. Elliott; Flt. Lt. T. G. D. Roberts; Flying Officers C. W. Dunn, A. L. White.

ROYAL CANADIAN AIR FORCE

Air Force Cross

Wing Cdr. J. G. Stewart; Squadron Leaders J. A. Cook, W. F. Hales, S. C. Tugwell; Flight Lieutenants R. A. Adams, C. G. Harville, C. F. Payne, H. D. Davy; F/O. T. H. Gordon; W/O. W. J. Wright.

ROYAL NEW ZEALAND AIR FORCE

Air Force Cross

Flight Lieutenants A. S. Drew, S. H. Manning; Flying Officers A. A. Appleby, G. W. Kidd.

SOUTH AFRICAN AIR FORCE

Air Force Cross

Lt. A. N. M. Marsberg.

PRINCESS MARY'S R.A.F. NURSING SERVICE

Bar to R.R.C., First Class

Ch. Prin. Matron Miss W. M. Coulthurst; Act. Prin. Matron Miss J. D. Jackson.

R.R.C., First Class

Matron Miss H. W. Cargill; Acting Matron Miss N. Melkies.

R.R.C., Second Class

Acting Senior Sisters Miss P. H. Blackall, Miss E. J. M. Fox, Miss J. M. Higgins, Miss A. M. Honr, Miss G. Jones, Miss L. A. Kay, Miss N. Lawford, Miss F. E. Perry; Sisters Miss C. M. Graham, Miss P. E. Martin, Miss B. Slader; V.A.D. Grade 1 Nursing Members Miss D. L. Boyd, Miss J. F. Whiteside.

DOMINIONS OFFICE LIST

ORDER OF THE BRITISH EMPIRE

C.B.E. (Civil Division)

R. Standish-White, for valuable services as hon. consulting surgeon, Rhodesian Air Training Group.

ORDER OF THE BRITISH EMPIRE

O.B.E. (Military Division)

Cdr. (A.) R. E. Gardner, R.N.V.R.; Lt. Cdr. (A.) J. M. Milward, R.N.; Lt. Cdr. (A.) G. H. G. S. Rayer, R.N.V.R.; Lt. Cdr. (A.) J. M. Scott, R.N.; Lt. Cdr. (A.) M. G. Sedorski, R.N.

ROYAL AIR FORCE

K.B.E. (Military Division)

Air Vice-Marshal Geoffrey Rhodes Bromet, R.A.F.

Air Vice-Marshal Lionel Douglas Dalzell McKean, R.A.F.

Air Vice-Marshal Hugh William Lumsden, Saunders, R.A.F.

C.B.E. (Military Division)

Air Vice-Marshals: D. V. Carnegie, J. W. Jones, R. S. Blucke, N. L. Desoer, T. J. Kelly, M.D., D'A. Power, M.R.C.S., L.R.C.P., and J. R. Whitley all R.A.F.

Air Commodores: G. A. Ballantyne, K. D. G. Collier, H. H. Down, all R.A.F.; R. E. McBurney, R.C.A.F.; S. D. Macdonald, A. R. Wardle, R. Whyte, P. S. Blockey, L. W. Cannon, W. D Disbrey, J. G. Elton, T. N. McEvoy, H. D. McGregor, T. B. Prickman, B. H. C. Russell, R. G. Seymour, all R.A.F.; D. J. Waghorn, R.A.F., with effect from March 31, 1945 (since deceased); G. L. Worthington, R.A.F.

Group Captains: F. G. Cator, R. Cleland, H. J. Gemmel, A. P. Revington, C. S. Riccard, R. S. Sugden, T. F. W. Thompson, W. W. Morgan, all R.A.F.

The Rt. Rev. Mgr. H. Beauchamp, R.A.F.; Col. A. J. M. Mossop, S.A.A.F.; Grp. Capt. D. S. Jillings, R.A.F.V.R.; Grp. Capt. E. A. Warfield, R.A.F.O.; Grp. Capt. L. S. Weedon, R.A.F.V.R.; Grp. Officer Isobel M. Campbell, W.A.A.F.

O.B.E. (Military Division)

Air Commodores: J. G. Byrans, R.C.A.F., and B. A. Chucksfield, R.A.F.

Group Captains: D. J. Alvey, T. B. Cooper, W. R. Cox, C. W. Gore, C. A. Horn, S. P. A. Patmore, R. H. Stanbridge, C. H. A. Stevens, E. H. Stevens, C. M. Stewart, J. A. C. Stratton, P. W. M. Wright, all R.A.F.; J. D. Bisdee, R.A.F.V.R.; J. P. Cave, R.A.F.; P. Y. Davoud, R.C.A.F.; W. Eccles, R.A.F.

Group Captains: P. S. Foss, R.A.F.; Sir Archibald P. Hope, A.A.F.; A. S. Jackson, A.A.F.; R. G. James, R.A.F.O.; J. E. Kirk, R.A.F.; G. K. Lawrence, R.A.F.O.; G. L. S. Lightfoot, R.A.F.V.R.; R. H. Mason, R.A.F.; E. H. G. Moncrieff, R.C.A.F.; T. F. D. Morgan, R.A.F.O.; T. C. Penna, R.A.F.; W. J. Pickard, R.A.F.; H. P. Pleasance, R.A.F.O.; R. C. Vaughan, R.A.F.V.R.; S. G. Walker, R.A.F.; D. W. Williams, R.A.F.; E. N. D. Worsley, R.A.F.

Wing Commanders: R. A. Barton, R.A.F.O.; G. R. Brady, R.A.F.O.; R. St. H. Clarke, R.A.F.; A. E. Clayson, R.A.F.; W. H. Day, R.A.F.V.R.; K. I. Goodman, R.A.F.; D. S. Green, R.A.F.O.; C. D. Griffiths, A.A.F.; V. H. P. Lynham, R.A.F.O.; G. M. Mackie, R.A.F.; E. J. Moule, R.A.F.V.R.; S. Mukerjee, R.I.A.F.; W. F. Murray, R.A.F.; J. A. Robinson, R.A.F.; D. G. Ross, R.A.F.; R. Tibbey, R.A.F.; B. D. S. Tuke, R.A.F.V.R.; C. E. H. Verity, R.A.F.V.R.; J. B. Wallace, R.A.F.; H. R. Withers, R.A.F.; Lt.-Col. G. N. McBlain, S.A.A.F.

Wing Commanders: C. Aldridge, R.A.F.; D. F. Allen, R.A.F.; C. E. Beer, R.A.F.; S. J. Berry, R.A.F.; W. Bradshaw, R.A.F.; W. F. Bryanton, R.A.F.V.R.; R. E. O. Carey, R.A.F.V.R.; C. A. Case, R.A.F.V.R.; M. Cohen, R.A.F.V.R.; G. Cruickshank, R.A.F.V.R.; D. W. Dobson, R.A.F.V.R.; J. J. Dutton, R.A.F.; T. A. F. Elsdon, R.A.F.

Wing Commanders: F. A. B. Fawssett, R.A.F.; W. G. J. Foster, R.A.F.V.R.; W. B. Frampton, R.A.F.V.R.; P. M. A. Green, R.A.F.V.R.; J. A. Hatton, R.A.F.V.R.; W. G. H. Hedges, A.A.F.; E. J. G. Hill, R.A.F.; M. M. Kaye, R.A.F.O.; E. N. Lohmeyer, R.A.F.V.R.; S. Mackenzie, R.A.F.; J. R. Moore, R.A.F.V.R.

Wing Commanders: J. R. Morgan, R.A.F.V.R.; I. McN. Parsons, R.A.F.V.R.; C. W. Passy, R.A.F.V.R.; K. W. Pell, R.A.F.O.; F. J. Powell, R.A.F.V.R.; S. P. Richards, R.A.F.O.; H. H. Rose, R.A.F.V.R.; L. G. Scarman, R.A.F.V.R.; E. A. A. Shackleton, R.A.F.V.R.; H. P. Shallard, R.A.F.V.R.; H. K. Dawson-Shepherd, R.A.F.; P. N. Shone, R.A.F.V.R.; D. G Singleton, R.A.F.V.R.; M. J. Smith, R.A.F.V.R.

Wing Commanders: R. N. Smith, R.A.F.O.; W. D. A. Smith, R.A.F.V.R.; M. J. Thomas, R.A.F.V.R.; C. G. Tipper, R.A.F.V.R.; A. F. Trinder, R.A.F.V.R.; R. C. Udall, R.A.F.V.R.; T. M. Warden, R.A.F.V.R.; D. T. Way, R.A.F.V.R.; R. Williams, R.A.F.; P. H. S. Wood, R.A.F.V.R.

Squadron Leaders: J. E. Ann, R.A.F.; W. Cunniffe, R.A.F.; W. Dixon, R.A.F.V.R.; W. H. Herbert, R.A.F.V.R.; R. H. Johnson, R.A.F.V.R.; H. T. Legg, R.A.F.; P. J. Macduff, R.A.F.V.R.; J. T. Main, R.A.F.

Maj. J. H. R. Eastwood, S.A.A.F.; Maj. W. F. Veitch, S.A.A.F.; Squadron Leaders: J. B. Batchelor, R.A.A.V.R.; E. W. Bloxham, R.A.F.V.R.; S. G. Briden, R.A.F.; R. K. Browning, R.A.F.V.R.; R. G. Clarkson, R.A.F.V.R.; O. C. Craig, R.A.F.V.R.; J. B. A. Fleming, R.A.F.; J. F. Ginnett, R.A.F.V.R.; T. D. Griffin, R.A.F.V.R.; W. T. Harrington, R.A.F.; H. E. Howard, R.A.F.; H. O. Hughes, R.A.F.V.R.; E. M. John, R.A.F.V.R.; F. Jullion, R.A.F.V.R.; S. N. Kettle, R.A.F.V.R.; A. H. Lodge, R.A.F; H. H. Loveday, R.A.F.V.R.; A. H. W. MacBean, R.A.F.V.R.; D. N. Matthews, R.A.F.V.R.; A. Russell, R.A.F.V.R.; R. J. Sills, R.A.F.; W. Sykes, R.A.F.; P. F. Trotter, R.A.F.V.R.; R. B. Waller, R,A,F.V.R.; C. W. F. Wavell, R.A.F.V.R.; N. Wilson, R.A.F.

Grp. Officer E. Barrie, W.A.A.F.; Sqn. Officer L. H. Rankin, W.A.A.F.

CANADIAN LIST

ORDER OF THE BATH

C.B. (Military Division)

Air Vice-Marshals G. Howsam, T. A. Lawrence and F. S. McGill, R.C.A.F.

ORDER OF THE BRITISH EMPIRE

O.B.E. (Military Division)

Wing Cdrs. R. S. Cross and J. E. Sharpe, R.C.A.F.

Air Force Cross

Grp. Capt. J. B. Harvey, R.C.A.F.

Wing Commanders: K. Birchall, R.C.A.F.; E. O. W. Hall, R.C.A.F.; M. Lipton, R.C.A.F.; E. R. Pounder, R.C.A.F.; C. C. Taylor, R.C.A.F.

Squadron Leaders: W. R. Brown, R.C.A.F.; F. G. Cooke, R.C.A.F.; A. E. Evans, R.C.A.F.; H. C. Forbell, R.C.A.F.; K V. Gilling, R.A.F.O.; G. W. Gooderham, R.C.A.F.; W. R. F. Grierson-Jackson, R.C.A.F.; R. Hewitt, R.A.F.; D. J. MacLean, R.C.A.F.; E. H. McCaffrey, R.C.A.F.; S. E. McDonald, R.C.A.F.; A. R. L. McNaughton, R.C.A.F.; D. C. Nasmith, R.C.A.F.; R. E. Porter, R.C.A.F.; J. B. Sparling, R.C.A.F.; W. E. Taylor, R.C.A.F.; G. R. Truemner, R.C.A.F.; B. C. Ward, R.C.A.F.; T. A. Wiseman, R.C.A.F.

Flight Lieutenants: G. D. Aitken, R.C.A.F.; K. A. Alexander, R.C.A.F.; A. W. Barton, R.C.A.F.; P. M. Bicket, R.A.F.V.R.; F. W. Hallwood, R.C.A.F.; M. MacM. Hay, R.C.A.F.; H. C. Herder, R.C.A.F.; J. E. Hicks, R.C.A.F.; W. J. Higgins, R.N.Z.A.F.; J. R. F. Johnson, R.C.A.F.; W. E. Kjellander, R.C.A.F.; A. G. Lawrence, R.C.A.F.; R. H. Manson, R.C.A.F.; H A. McLachlin, R.C.A.F.; R. F. Minnikin, R.A.F.V.R.; G. E. Moore, R.C.A F.; R. V. Morton, R.A.F.V.R.; D. O. Norcott, R.A.F.V.R.; S. O. Partridge, R.C.A.F.; J. C. Snyder, R.C.A.F.; R. J. Sweeney, R.C.A.F.; W. A. Warren, R.C.A.F; G. A. Webster, R.C.A.F.; W. R. Wilson, R.C.A.F.

Flying Officers: J. D. Anderson, R.C.A.F.; H. E. Jones, R.C.A.F.; S. J. Kernaghan, R.C.A.F.; P H. Ludlow, R.A.F.V.R.

Pilot Officers: W. C. K. Crick, R.C.A.F.; C. A. Haskett, R.C.A.F.; H. O. Murphy, R.C.A.F.

W/O. Cl. 1 J. E. M. O'Connor, R.C.A.F.

SOUTH AFRICAN LIST

ORDER OF THE BRITISH EMPIRE

O.B.E. (Military Division)

Col. J. A. B. Sandenbergh, S.A.A.F.

Air Force Cross

Capt V. E. Andries, Maj. C. H. Beyers,

BIRTHDAY HONOURS

Lt. E. P. Bottaro, Maj. B. Brain, Capt. C. P. Hobbs, Capt. J. A. Pietersen, and Capt. D. G. R. Wheatley, all S.A.A.F.

AUSTRALIAN LIST

ORDER OF THE BRITISH EMPIRE

O.B.E. (Military Division)

Wing Cdr. C. O. Fairbairn, R.A.A.F.; Wing Cdr. A. B. MacArthur, R.A.A.F.

Air Force Cross

Wing Commanders: G. Eyres, C. A. J. Lum, S. W. Martin; Squadron Leaders: J. D. Balfe, K. S. Brown; Flight Lieutenants: J. J. Leahey, W. J. Rehfisch, H. E. Teede.

NEW ZEALAND LIST

ORDER OF THE BRITISH EMPIRE

C.B.E. (Military Division)

Air Cdr. R. B. Bannerman, R.N.Z.A.F.

O.B.E.

Wing Cdr. M. A. F. Barnett, R.N.Z.A.F.

Air Force Cross

Squadron Leaders: V. D. Gain, K. G. King, A. G. Sievers; Flight Lieutenants: D. L. Bade, L. A. Lawton, R. F. Watson.

CIVIL AWARDS

O.B.E.

F. C. Achurch, Director and General Manager, Civilian Repair Organisation, Ministry of Aircraft Production; W. C. Andrews, Director, Aircraft Production Factories, Ministry of Works; J. W. Binge, Chief Engineer, Iraq and Persia Command, R.A.F.; O. E. Brenner, Chairman, Local Reconstruction Panel Emergency Services Organisation, Ministry of Aircraft Production; Ald. M. Campbell, Chairman, Management Committee, Wembley Wing, A.T.C.; Observer Cdr. C. G. Cooke, Group Commandant, R.O.C.; M. Daunt, lately Chief Test Pilot, Gloster Aircraft Co., Ltd.; G. de Havilland, Chief Test Pilot, de Havilland Aircraft Co., Ltd.; B. G. Dickins, Superintendent, Operational Research Section, Bomber Command, Ministry of Aircraft Production; F. C. Frank, Principal Scientific Officer, Air Ministry; Ald. Mrs. E. J. Gregory, Chairman, West Ham Wing Committee, A.T.C.; F. J. W. Hedgcock, Assistant Director of Inspection, Ministry of Aircraft Production; Capt. O. P. Jones, Senior Captain, B.O.A.C.; Capt. H. S. Leverton, Knights Cross of the Order of Orange Nassau, Traffic Director, K.L.M., Royal Dutch Airlines; Cdr. R. C. Morgan, Chief Technical Officer, A.T.A.; Cdr. R. Wardle, O.C. No. 14 Ferry Pool, A.T.A.

IMPERIAL SERVICE ORDER

Home Civil Service to be Companions

H. J. Rabbin, Assistant Director of Contracts, Ministry of Aircraft Production; R. S. Read, Principal Technical Officer, Air Ministry.

M.B.E.

J. W. Affleck, Senior Flight Engineer, Transport Command, R.A.F.; J. E. Airey, Senior Technical Officer, Ministry of Aircraft Production; G. A. Arthur, Labour Manager, Rolls-Royce, Ltd.; E. G. Barton, Senior Staff Officer, Air Ministry; R. E. Beard, Head of Statistical Section, Air Equipment Department, Admiralty; Miss L. J. Cahill, Staff Officer, Air Ministry; Observer Cdr. E. H. Davis, Group Commandant, R.O.C.; Miss L. V. Drury, Personal Secretary to the Chairman, Rootes Securities, Ltd.; Observer Lt. Q. Dunlop, Administrative Officer, Scottish Area, R.O.C.; G. R. Edwards, Experimental Manager, Vickers-Armstrongs, Ltd.; C. Goudy, Supervising Engineer, B.O.A.C.; J. W. Gray, Officer in Charge, W/T Maintenance Transport Command, R.A.F.; R. P. Hackett, Chief Inspector, Aircraft Department, Lep Transport, Ltd.; C. E. Hibbert, Works Manager, Fairey Aviation Co.; H. J. Horn, Senior Technical Officer, Ministry of Aircraft Production; C. V. Jelfs, Senior Staff Officer, Ministry of Aircraft Production; E. C. Knight, Works Manager, Wellworthy Piston Rings, Ltd.; W. E. Lewis, Superintendent Engineer, D. Napier and Son; J. McLarty, Works Manager, Nuffield Mechanisations, Ltd.; Capt. H. C. Mason, Second-in-Command, Air Movements Flight, A.T.A.; Flt. Capt. C. E. Oake, Engineer-in-Charge, Thame Airfield, A.T.A.; W. J. Pickett, Chief Draughtsman and Designer, K.L.G. Sparking Plugs, Ltd.; Capt. G. S. Pine, Second-in-Command, No. 2 Ferry Pool, A.T.A.; H. L. Satchell, Manager, B.T.H. Co., Ltd., Rugby; A. E. Staines, lately Superintendent (Propeller Manufacture), de Havilland Aircraft Co., Ltd.; J. A. Stronach, D.F.C., J.P., lately Flight Lieutenant Commanding 1177 (John Peel) Squadron, A.T.C.; The Rev. H. Wardle, Chaplain, R.A.F. Station, Middle Wallop; J. A. Wharton, Civil Assistant, Headquarters, Fighter Command, R.A.F.; Sqn. Ldr. M. T. Whinney, R.A.F.V.R., employed in a department of the Foreign office.

B.E.M.

S. H. Anderson, A.T.C. Warrant Officer, Southend Wing, London Command; C. R. Appleby, General Foreman, B.T.H. Co., Ltd.; J. B. Aust, Foreman, Telecommunications Research Establishment, Ministry of Aircraft Production; J. E. Ballard, Detail Fitter, Parnall Aircraft, Ltd.; Miss N. L. Barron, Observer, R.O.C., H. V. Batchelor, Chief Observer, R.O.C.; W. E. Betteridge, Assistant Foreman Instrument Maker, Telecommunications Research Establishment, Ministry Aircraft Production; Mrs. E. Bleach, Member of Tarmac Crew, A.T.A.; Miss M. S. Blundell, Women's Personnel Officer, Rootes Securities, Ltd.; Miss I. Braycott, Group Leader and Inspectress Instructor, Lockheed Hydraulic Co., Ltd.; H. Britton, Efficiency Engineer, Blackburn Aircraft, Co., Ltd.; H. L. C. Butler, Chief Assistant to the Repair Co-ordination Officer, Bristol Aeroplane Co., Ltd.; W. J. Cadden, Sectional Manager, Dunlop Rubber Co., Ltd.; W. H. Chandler, Fitter and Erector, Bristol Aeroplane Co., Ltd.; W. F. Coleman, Principal Foreman, Woodworking Shop, Royal Aircraft Establishment; H. A. Cooper, Toolmaker, Short Bros. (Rochester and Bedford), Ltd.; E. A. J. Cracknell, Foreman, Rotol, Ltd.; F. A. Fossey, Section Leader, Drawing Offices, British Thomson-Houston Co., Ltd.; Mrs. E. Foster, Aircraft Assembler, Dobson and Barlow, Ltd.; E. G. Goldsmith, Chargehand Rigger, Telecommunications Research Establishment, Ministry of Aircraft Production; H. W. Grantham, Principal Foreman, Telecommunications Research Establishment, Ministry of Aircraft Production; J. H. Hastings, Senior Foreman, Vickers-Armstrongs, Ltd.; A. J. Hazell, Shop Manager, Machine Shop, Royal Aircraft Establishment; E. C. Housley, Machine Shop Foreman, Marconi-Instruments, Ltd.; E. F. Hughes, Foreman, Machine Shop, Royal Aircraft Establishment; A. E. P. Irish, Cartographical Draughtsman, R.A.F. Staff College; G. James, Superintendent of Stores, No. 3 Maintenance Unit, R.A.F.; Miss H. Jurquet, lately toolsetter, Imperial Chemical Industries (Metals); Miss B. M. King, Leading Hand, Northern Aluminium Co., Ltd.; J. J. Kirkham, Foreman Fitter, Radio Transmission equipment, Ltd.; A. Lamb, Principal Foreman of Stores, No. 2 Maintenance Unit, R.A.F.; G. R. Laurenson, Station Engineer, Royal Air Force Station; J. A. Lee, Station Engineer, Royal Air Force Station; Miss S. G. Lusty, Driver, Training Unit, A.T.A.; W. Maxwell McCall, Chief Observer, Royal Observer Corps; E. D. McLaurin, Aircraft Woodworker Chargehand, Telecommunications Research Establishment, Ministry of Aircraft Production; R. K. McLean, Chief Observer, Royal Observer Corps; Miss E. Marlow, Bench Worker, K.L.G. Sparking Plugs, Ltd.; J. Mayo, Shop Manager, Instrument Shop, Royal Aircraft Establishment; M. R. Sarai, Civilian Clerk, Iraq and Persia Command, R.A.F.; R. Melton, Superintendent, B.T.H. Co., Ltd.; C. J. Mills, Clerk of Works, Royal Air Force Station; W. Palmer, Chief Observer, R.O.C.; E. T. Perkins, Chief Observer, R.O.C.; W. Price, Instrument Maker, Aeronautical and General Instruments, Ltd.; L. Rafferty, Sub-Inspector, Air Ministry Constabulary; H. W. Redford, Established Messenger, Air Ministry; E. E. J. Reeve, Chief Supervisor of Aircraft Repairs, Admiralty Outstation; H. E. Roberts, Chargehand, Taylorcraft Aeroplanes, Ltd.; Miss S. Roberts, Assistant Forewoman, Imperial Chemical Industries (Metals), Ltd.; W. E. Roberts, Foreman, Ford Motor Co., Ltd.; T. Robinson, Assembly General Foreman, Metropolitan Vickers Electrical Co., Ltd.; M. Rowlands, Chief Observer, R.O.C.; W. H. A. Sanders, A.T.C. Warrant Officer, No. 1F (1st City of Leicester) Squadron; E. H. J. Scasbrook, Station Warden, H.Q. Maintenance Command, R.A.F.; L. W. Scott, Foreman, Lyneham, B.O.A.C.; E. C. Smith, Deputy Officer Keeper, Ministry of Aircraft Production; J. Taylor, Technical Assistant II, Marine Aircraft Experimental Establishment, Ministry of Aircraft Production; E. W. Thompson, A.T.C. Warrant Officer, No. 1278 (Gateshead) Sqn. N.E. Command; Miss R. Thornton, Capstan Operator, General Electric Co., Ltd.; R. N. Vickers, Blade Shop Turner, de Havilland Aircraft Co., Ltd.; P. C. Walker, M.M., Superintendent of Traffic, No. 3 Maintenance Unit, R.A.F.; G. W. Waring, Principal Foreman (Technical), No. 1 Maintenance Unit, R.A.F.; R. L. Wheeler, Principal Foreman, Works Maintenance, Royal Aircraft Establishment; A. R. Wink, Signalling Instructor, Grade III, Royal Air Force Radio School; H. Worrall, Staff Foreman of Structure Building, Austin Motor Co., Ltd.

Mr. Geoffrey de Havilland who, with Mr. Michael Daunt, gets the O.B.E. Mr. de Havilland flew the prototype D.H. Mosquito and Vampire and Mr. Daunt did some of the test-flying of the Gloster Meteor.

Commended for Valuable Service in the Air

Capt. M. J. R. Alderson, B.O.A.C.; Flt. Capt. Philippa Mary Bennet, Ferry Pilot, No. 15 Ferry Pool, A.T.A.; Capt. G. R. Buxton, B.O.A.C.; D. Ewert, Radio Officer, No. 45 Atlantic Transport Group, R.A.F.; First Officer E. P. Hicks, Ferry Pilot, No. 9 Ferry Pool, A.T.A.; G. L. Johnsen, Radio Officer, No. 45 Atlantic Transport Group, R.A.F.; Flt. Capt. W. L. S. K. Jopp, Ferry Pilot, No. 1 Ferry Pool, A.T.A.; First Officer E. A. D. Kempster, Pilot, Air Movements Flight, A.T.A.; Sqn. Ldr. M. V. Longbottom, D.F.C. (deceased), Test Pilot, Vickers, Ltd.; D. P. Marvin, Radio Officer, No. 45 Atlantic Transport Group, R.A.F.; D. N. Rennie, Second Radio Officer, B.O.A.C.; Capt. J. Shoesmith, Second in Command, No. 6 Ferry Pool, A.T.A.; Capt. W. L. Stewart, B.O.A.C.; Capt. A. G. Store, B.O.A.C.; H. Vallance, Pilot, Scottish Airways, Ltd.; A. M. Wood, First Radio Officer, B.O.A.C.; Capt. H. O. Wrigley, Second in Command, No. 16 Ferry Pool, A.T.A.

CANADIAN CONTRIBUTION

The 750th Mosquito to be built in Canada was recently completed by the de Havilland Co. factory near Toronto. Mosquito aircraft have been built in Canada since 1942; sub-assemblies, from all parts of the country, converge on the D.H. plant for final assembly.

Altogether, Canada produced 4,178 aircraft during 1944, most of them combat types. During the present year 2,261 combat types will be built.

Bomber Command's Offensive

Part II of the Official Story of Britain's Heavy Bombers

(*Continued from page 671*)

IN spite of the great successes of 1942, the further development of navigational aids, and the formation of the Pathfinder Force during that year, it was not until 1943 that Bomber Command was sufficiently strong in four-engined aircraft to begin the main offensive against German war industry. It was also in 1943 that the U.S.A.A.F. was ready to begin its strategic bombing campaign against targets in Germany. The joint plan of campaign was largely dictated by the equipment and training of both Air Forces and, as is well known, the obvious decision was made to attack the large industrial areas by night and the single war factories by day.

A particular instance of the complementary role played by the two Air Forces in 1943 was in the attack on the German aircraft industry as a whole, when the R.A.F. attacked large industrial areas in which were many aircraft component factories, while the U.S.A.A.F. bombed the assembly plants which had been built outside the towns in order to be immune from the attacks on industrial cities. It is known that this double attack proved a complete surprise to the enemy. He had anticipated losing factories in towns, but not outside them, and he therefore subjected his aircraft industry to the great strain of dispersing the larger plants. A Focke-Wulf aircraft factory in Bremen, for example, was largely destroyed by Bomber Command in 1944, and under the new plan was set up again in open country in East Prussia. There it was destroyed by the U.S.A.A.F., rebuilt, destroyed again, evacuated back to Bremen with the approach of the Russian armies, and hit again by the R.A.F. when it got there.

Strain on Industry

By such exertions—and the history of many German synthetic oil plants is one of even more frequent catastrophies—the enemy was able to keep production going in some of the major war industries—V-weapons, aircraft, synthetic oil—to which he decided, or was compelled, to give first priority. Not only the dispersed factories, but all the more important factories in towns were repaired as often as they were damaged. All this was subjecting the enemy's war industry to an enormous strain, towards which the destruction of large industrial areas by Bomber Command, with all their factories and public utility services and the consequent loss of many millions of man-hours of skilled labour, contributed a very great deal.

Clear proof of the strain to which the German aircraft industry was subjected by strategic bombing is provided by the enemy's decision, made in 1943, to concentrate almost exclusively on single-engined aircraft, which naturally could be produced more economically than two-engined or four-engined aircraft. Their single-engined aircraft were to be used, not only for the air defence of Germany but for protection of the army, and for ground attack on the Allied armies and their communications. There were to be few, if any, actual bombers. It is also a significant fact that even in 1945 two-engined aircraft for use as night fighters were still on the production list.

TONNAGE

		Bombs	Mines
1939	..	31	—
1940	..	13,033	510
1941	..	31,704	707
1942	..	45,561	6,367
1943	..	157,457	9,136
1944	..	525,518	13,170
1945	..	181,740	3,373
		955,044	33,263
Grand total	.. ..	988,307 tons	

Both Von Rundstedt and Kesselring have said that the main reason for Germany's defeat was the complete air superiority of the Allies. Their opinion may be tendentious, in that it is in the interest of the German General Staff to argue that the German army was undefeated in the field, and only collapsed under the strain of bombing behind the lines.

Enemy No. 1

In 1944 General Model, however, in a *most secret* order issued by the Supreme Command of Army Group B, for distribution only down to Divisions, said: "Enemy No. 1 is the hostile air force, which because of its absolute superiority tries to destroy our spearheads of attacks and our artillery through fighter-bomber attacks and bomb carpets, and to render movements in the rear areas impossible." There could be no question of such a statement being made for any tendentious reason in a document of this nature. Goering himself gave it as his opinion that the chief reason why Germany lost the war was the "uninterrupted Allied air offensive." In fact, German military opinion of all shades of mind is and has been, that one of the main factors contributing to the defeat of Germany was, in Von Rundstedt's own words, "the smashing of the home industrial areas by bombing."

The effect of strategic bombing on the actual fighting capacity of the enemy was not a matter of regular progress. Production of weapons was not cut in the same proportion as the acres of devastation in the industrial areas increased. On the contrary, the end of production in most war industries came with a rush at the end, as the whole industrial organisation suddenly broke under the strain. This is what one would have expected, and captured figures of production show that this is exactly what happened. The bombing of the Ruhr in 1943 caused a general decrease of about 20 per cent. of production in the steel industry of that area, but by 1945 production in the great Vereignigte Stahlwerke had become almost negligible.

During 1943 Bomber Command was largely concerned with perfecting its tactics in the bombing of large industrial

BOMBER COMMAND'S OFFENSIVE

areas, but there were some significant exceptions. It was of such exceptional importance to destroy the Peenemunde V-weapon experimental station that a new technique for precision attack by night was used, and a master bomber directed the main force by radio-telephone. This was planned as a special measure for exceptional attacks, or even for this attack alone.

There were several reasons why it was not thought practicable to use such tactics repeatedly. The Germans might jam the radio-transmission, they might broadcast misleading instructions—as they did attempt on later occasions—and there were other objections to using these tactics against heavily defended targets deep in Germany. It was the master bomber's task to come down low and assess the position of the target indicators dropped to guide the main force, a dangerous mission, and while he was making his check the main force would have to orbit the target, waiting for his instructions to attack. This might mean a considerable delay, during which night fighters would have time to arrive in strength, and there was also, of course, the chance that both the master bomber's aircraft and that of his deputy would be shot down and the main force left without instructions.

AIRCRAFT LOST

1939	*40*
1940	*509*
1941	*985*
1942	*1,543*
1943	*2,474*
1944	*2,904*
1945	*708*
Total	***9,163 aircraft***

In the first months of 1944 Bomber Command had to prepare for the liberation of Europe, and it was realised that precision bombing of small targets would be essential for this task. During the first stages of the operation the greater number of targets would be in France, and there would not be the same objection to the use of master bomber tactics against these as against targets in Germany. Small forces of picked crews accordingly attacked a number of factories in France, which in any case had become of great importance to the German aircraft and other war industries at this stage of the war, and the new tactics were perfected in a short time. Everything was ready by March of 1944 for the bombing of French railway centres, which was to prevent the German army from getting its reserves up to the beachhead in time to prevent the Allied armies from building up their strength.

TONS OF BOMBS PER AIRCRAFT

1939	*0.052*
1940	*0.6*
1941	*1.01*
1942	*1.42*
1943	*2.45*
1944	*3.22*
1945	*2.74*

Average for whole war, 2.52 tons

Flexibility of Attack

Master bombers were very thoroughly trained so as not to keep the main force waiting. Equipment for radio-transmission was perfected, a system of giving instructions by code-words was worked out, and the flexibility of the striking force was proved when it passed immediately from attacking Berlin, the largest target in Germany, to the saturation by bombing of a single marshalling yard.

A General Staff Officer in charge, up to October, 1944, of the Office of the General des Transportwesens West, has given his account of the difficulties experienced by the German army as a result of our air attacks on the French railways. He said that the air offensive against the French railways, in his opinion, made a greater contribution to the defeat of the *Wehrmacht* in France than any other single factor.

The first effect of the offensive, according to the German Staff Officer, was to block lines along the Franco-Belgian frontier, roughly from Sedan to St. Omer. The first effect of this was upon French war industry working for the German army. From the beginning of May north-east to south-west traffic had been so paralysed that coal could not be brought from France but had to be got from the Saar and brought by east to west lines, then needed for military traffic. Before the offensive began in March, German military rail traffic into France, including traffic for the Todt organisation building V-weapon sites and the defences of the Atlantic Wall, was at the rate of more than 100 trains a day. Sixty or 70 of these went through the network of railways round Paris, which, of course, was particularly heavily bombed.

	SORTIES	***Under Coastal Command***
1939	*591*	—
1940	*22,473*	—
1941	*32,012*	—
1942	*35,338*	*1,088*
1943	*65,068*	*1,240*
1944	*166,844*	—
1945	*67,483*	—
	389,809	*2,328*
Grand total		***392,137 sorties***

1,000 Trains Held Up

By the end of April only 48 trains a day were getting through the Paris network, and by the end of May only 32, of which 12 were Saar coal trains. Purely military traffic was at the rate of only 20 trains a day. At the end of April the normal accumulation of trains in France held up because of air attack was 1,000 trains. Previously the normal accumulation was never more than 120 or 130 trains. The circular railway round Paris, the Grande-Ceinture, was so disorganised that for some time it was not possible to move even one division through the Paris area.

The Staff Officer gave a list of railway targets attacked, in order of their importance to the German army. These were:—

(I) Major railway bridges.

(II) Railway centres, containing essential railway facilities in the following order of importance:—

- (a) Locomotive servicing facilities, round-houses, turntables, coaling facilities.
- (b) Switching gear.
- (c) Signals systems, including telephones.
- (d) Marshalling and shunting facilities.

(III) Trains and railway lines attacked singly by fighter-bombers.

This is precisely the order of priority in which the targets were set out for air attack when the offensive was planned by the Allied air staffs; the aiming points in marshalling yards were always chosen to cause the maximum damage to locomotive servicing facilities. The German Staff Officer also said that supply to the V-weapon sites was seriously interrupted by the disorganisation of French railways.

The most severe test of Bomber Command's tactics of precision bombing came when the R.A.F. was asked to lay what Model calls a "bomb carpet" on enemy troop concentrations within a short distance of our own troops, in order to check a counter-attack or prepare for an Allied advance. Such attacks were most often made by day, but also by night, and experience showed that both were equally accurate. The bomb line behind which our own troops were to keep was no nearer the target area by day than by night. The importance which General Model attached to such attacks has already been shown, and in this instance Allied commanders were as well able to judge the effect of bombing as the enemy himself.

Describing an attack on July 18th, when more than a thousand heavy bombers attacked German positions east of Caen to prepare for the Allied advance to Tilly and Vaucelles, Field Marshal Montgomery said that "the effect of the air bombing was decisive and the

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spectacle terrific." When the enemy were trapped in the Falaise-Argentan pocket, after Bomber Command had dropped 4,000 tons of bombs on German troop concentrations, armour and guns, Field Marshal Montgomery said: "As has been the case throughout the whole of this campaign, the air forces have been quite magnificent and have operated with the greatest intensity."

MINE LAYING

During the war Bomber Command laid 47,250 mines weighing a total of 33,263 tons. More than a 1,000 enemy ships sunk or damaged

After D-Day the commitments of R.A.F. Bomber Command were greater and more varied than ever before, and the flexibility of its tactics was taxed to the utmost. A major campaign against V-weapon sites and supply depots had to be fought, and the Command joined in the campaign, begun by the U.S.A.A.F. a month or two before, against synthetic oil plants in Germany. Naval targets multiplied and had to be frequently attacked to protect our convoys across the Channel, a new U-boat offensive threatened and had to be checked by minelaying and bombing, airfields had to be cratered to prepare for airborne landings and German industrial towns became tactical targets. Germany's main waterways had to be drained if railway interdiction inside Germany was to be effective; Walcheren had to be flooded in preparation for the battle for the port of Antwerp, direct support for the Russian offensive had to be given by bombing industrial areas in Saxony, block ships had to be sunk out of harm's way before they could obstruct ports which the Allied armies needed for their supplies and railway viaducts had to be broken down before the Ruhr could be completely cut off from the rest of Germany.

Square Yards or Square Miles?

The targets ranged in size from a single gun emplacement or a ship to an industrial area of several square miles. The Command began to operate with equal strength in daylight and by night, and efficient Pathfinder tactics had to be worked out for bombing through cloud in daylight, or when the target was covered by dust and smoke. Improved methods of bombing large areas by night were also devised, and it proved in the end possible to use a master bomber many hundreds of miles inside Germany.

Bomber Command's first and last targets of the war were naval, and the German navy itself and its bases have been constantly attacked for five and a half years, as well as war industries producing for the German navy. The following major German naval units have been sunk or damaged by R.A.F. Bomber Command—

TIRPITZ (Battleship).—After suffering damage in Naval and Fleet Air Arm attacks, was sunk at Tromso by 12,000-lb. bombs on November 12th, 1944.

GNEISENAU (Battle Cruiser).—So heavily damaged by bombs and mines dropped by R.A.F. Bomber Command in 1942 that she was beyond repair and was dismantled at Gdynia.

SCHARNHORST (Battle Cruiser).—Damaged by bombing when in Brest and at La Pallice. Afterwards again damaged by mines dropped by Bomber Command. Sunk by the Navy on December 26th, 1943.

KOLN (Light Cruiser).—Damaged in Oslo Fjord by bombs dropped by Bomber Command. Then forced to Wilhelmshaven for repair, where she was sunk on March 30th, 1945, by 8th U.S. Army Air Force.

ADMIRAL SCHEER (Pocket Battleship).—Sunk by Bomber Command in an attack on Kiel on the night of April 9th, 1945.

LUTZOW (Pocket Battleship).—Sunk at Swinemunde by Bomber Command on April 16th, 1945.

ADMIRAL HIPPER (Heavy Cruiser).—Wrecked in dry dock at Kiel by four direct hits during attack by Bomber Command in April, 1945.

EMDEN (Cruiser).—Damaged by bombs and beached in Kiel Fjord.

PRINZ EUGEN (Heavy Cruiser).—Bomb damage.

SCHLESIEN.—Damaged by mines dropped by Bomber Command and beached at Swinemunde.

During the war 47,250 mines were dropped by Bomber Command. Over 40 per cent. of the German naval personnel were employed in minesweeping and mine-watching. As a result of Bomber Command's minelaying operations more than a thousand ships are known to have been sunk or damaged, and the number of ships sunk exceeds that of ships damaged. These were vessels of all types; the more important of them, apart from U-boats, are listed below:—

	Sunk	*Damaged*
Destroyers	1	3
Torpedo boats	3	2
Speerbrechers	15	78
M-class minesweepers	15	31
Merchant vessels over 15,000 tons ..	4	3
Merchant vessels between 4 and 10,000 tons	46	37
Merchant vessels between 1 and 4,000 tons	123	76

At least 135 naval and naval auxiliary craft were destroyed or damaged in Le Havre and Boulogne in the course of three attacks.

E-boat shelters in enemy-occupied ports were also effectively attacked with 22,000-lb. and 12,000-lb. bombs.

BOOK REVIEWS

Ocean Front. H.M. Stationery Office. 1s. net.

THIS publication tells the story of the war in the Pacific from the foul blow on Pearl Harbour to the eve of the American invasion of the Philippines. It has not been an easy campaign for the ordinary observer to follow, but the letterpress in this brochure does much to make it clear. The descriptions are short and pithy. Most of the space (and it is not a book of pocket size) is devoted to photographs. Many of them are very good, but some have been over-enlarged, and it is hard to see what they represent. The maps and charts are excellent, and there are plenty of them. Broad black arrows with labels and dates point out the various stages of naval advances from bases at Pearl Harbour, Australia, and S.E.A.C. They show the conquest of the islands and the approach to Tokyo; and they tell the story better than words could do.

"The Wing," by Rom Landau. Faber and Faber, Ltd., 16s.

ALTHOUGH not written in diary form this book is the fruit of detailed daily entries. Consequently it conveys much of the intimacy and directness so often lost when time has exercised its sometimes distorting influence on the memory. After a comprehensive training, in most branches of the work of a Bomber Squadron, the author's experiences cover a wider field than those of many members of the R.A.F. The book thus gives a real and personal picture of Air Force life in a bomber squadron among air-gunners, air battles "reflected" in the Ops. Room, giving English lessons to Polish officers, and a contrast of life during the Battle of Britain and among the moors of Scotland.

Fire Extinguishing in Aircraft Engines.

A VERY useful handbook published by the Air Registration Board, Brettenham House, Lancaster Place, London. W.C.2, price 5s., should find a place on the bookshelf of every aircraft and aircraft engine designer, constructor and operator.

Recommended practice for the installation of anti-fire equipment, including arrangement, warning devices, smothering agents and capacities is given for diverse types of radial and in-line air-cooled engines as well as for liquid-cooled units.

Fires in aircraft engines during flight and fires ensuing from a crash landing present different problems, but recommendations for each of these contingencies are given.

Although only a small book, the price of 5s. is very low indeed when it is appreciated that the subject is dealt with very completely and that the recommendations given embody the results of research and development work done both in this country and in the U.S.A. and represent the present state of knowledge of the subject.

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.

PRIVATE-OWNER DESIGNS

Why Not a Competition in Britain?

I WAS very interested in the article "Private Owner Designs" in *Flight*, May 3rd, and wondered why a similar competition could not be held in this country.

Failing to find any reference to the above in your correspondence pages up to the present time does one assume that nobody is interested? R. MARSH.

AIRSCREW QUIZ

Anything May Happen—and Did

WITH reference to Denis G. Cook's letter (*Flight*, June 14th) regarding what happens to the airscrew when it parts company with the engine in flight, may I offer the suggestion that his experience of the behaviour of the "prop" does not necessarily apply.

Whilst under training in Canada we lost the starboard airscrew from an Anson; the offender in this case cut the nose off the aircraft.

I would suggest that the cause of the departure of the "prop" may have some bearing on the question. In my opinion the centrifugal force would only be equal at all points if the "prop" became freed in its true line of flight. If this is not maintained, anything can happen and it probably will.

H. GOODALL (R.A.F. Obs.).

Two More "Detached" Examples

IN reference to Flt. Lt. Skinner's letter in *Flight*, May 17th, I know of a case where the airscrew, complete with reduction gear, became detached from a R.-R. Eagle engine and climbed rapidly for a short period while the aircraft passed underneath. When the airscrew revs. had subsided it fell a considerable distance behind the aircraft which was a Handley Page 0/400; it was climbing fairly steeply at the time.

On the other hand, I have seen a single-engined aircraft shed its airscrew which was drawn a short distance ahead of the aircraft and fell to the ground almost immediately; in both cases safe landings were made and the airscrews showed no tendency to deviate to right or left; in the latter case the aircraft was flying level.

In Part II of "Lessons of the Air" (*Flight*, May 24th) Major Robertson states the power-operated gun turret was first installed in a flying boat. Is he not in error here, as I always thought the Boulton & Paul turret which was fitted to the "Overstrands" with which No. 101 Squadron of the R.A.F. was equipped in 1935 was the first application? The prototype turret was fitted to a "Sidestrand" and was flight-tested by me in November, 1933; the power was compressed air supplied by a Reavell compressor. C. A. REA.

GRADING THE AMATEUR

Post-war Pupils and Conditions Will be Better

I AM very pleased to read in *Flight*, June 14th, that "Indicator" is prepared to relax some of his conditions which savour of the Gestapo.

I should like to point out that although one or two passengers have committed suicide by hiring or using aircraft, I have yet to hear of a private owner or club pupil who has done so.

Secondly, compared with pre-war flying, we now have airfields every few miles, undoubtedly more reliable aircraft and engines, more experienced ground engineers, better weather forecasts, possibly more experienced instructors and thousands of experienced pilots who will, I'm sure, be only too willing to advise and help the novice and act as a deterrent to those who might otherwise be inclined to "show off."

Furthermore, our embryo post-war "club pupils" have, most likely, during the last few years, been members of the R.A.F., W.A.A.F., Fleet Air Arm, W.J.A.C. and A.T.C., and should therefore have a greater knowledge of flying than did the pre-war club pupil, so don't let us put obstacles in the way of their interest, even before civil flying club activities are again permitted.

In answer to "Indicator's" first paragraph, I was instructing in flying in 1918 and have acted as chief instructor at various flying clubs during the last 27 years.

V. D. DICKINSON.

PILOT VERSUS ENGINEER

Attack and Counter-attack

I DON'T know whether "Indicator" was trying to emulate Mr. Winston Churchill's recent broadcast, in his article "A Pilot's Job is no Sinecure" (*Flight*, June 7th), but I seem to have heard before that the best method of defence is attack! I think a better heading for the article would have been "Pilot versus Engineer."

Very bad taste, sir, very bad taste!

Perhaps he is of the opinion that pilots need moral support now that the individuality of "piloting" is becoming more generalised, and the poor fellow who has to pull his chocs away realises that the pilot is not quite the superhuman individual he had thought him to be.

We have all heard of the apprentices being sent to the stores for sky hooks, engineers going to the same place for a long stand, but don't forget the pilot who landed his flying boat on the airfield, etc.

Am I an engineer or a pilot—I'll give you *three* guesses.

"UPSTART"!

DESIGNERS SHOULD FLY

Third-hand Information Not Enough

I WAS particularly interested to read in "Test Pilot's" letter, in *Flight*, May 3rd, that, in his opinion, members of design staffs not only should fly in their own products, but should be in possession of current "A" licences.

It is high time that the various managements of aircraft and engine manufacturers came to realise the value of designers making personal contacts, both with the actual machines and with those who fly them.

I know that there are liaison personnel who are supposed to look after these matters; but why rely on second- or third-hand information? Why not let the man responsible for a particular job get to know at *first hand* those qualities necessary to make a first-class job?

During my eleven years in drawing offices engaged in the design of various aircraft engines I can state that the attitude of employers is to keep their drawing office staffs shut up in their offices and "chained" to their drawing boards, let alone encouraged to fly—heaven forbid!

The only flight possible being a flight of fancy in the imagination of the servile designer. T. E. G. GARDINER.

HIGH, FAST AND HEAVY

Defence Advances to Meet Attack

YOUR editorial comments ("High, Fast and Heavy") in the issue of May 10th, 1945, make excellent reading and yet are rather disquieting, for they tend to mislead.

You refer to "very large jet-propelled bombers able to operate in the region of 50,000ft., each carrying one 15-ton bomb," and then go on to infer that the chances of location or interception are negligible. But for this inference you offer no explanation!

By the time this Super-Lincoln carrying a super-super bomb is ready, why should not radiolocation be sufficiently advanced to plot them? After all, this form of "radio science" is only in its earliest infancy—just a suckling, in fact.

Furthermore, these aircraft of the 21st century (I hope, for all our sakes!) will be constantly harassed by radio-controlled rockets from below and, possibly, radio-controlled pilotless "rammer" aircraft from every direction.

Their bases, wherever they are, will be under continual long-range rocket bombardment, anyway, unless they can be housed in underground hangars.

No! In glimpses into the future one should have *both* eyes open. Defence—in spite of its name—can and does advance to meet Attack and has killed many such dragons in the form of tip-and-run raiders, the magnetic mine, etc.

Italy. FREDERICK BRUNDLE (CAPT. R.A.).

[For the sake of old England, we hope Capt. Brundle is right. We would remind him, however, that contemporary defence was completely unable, throughout the whole war in Europe, to stop either day or night sorties by very high- and fast-flying Spitfires and Mosquitoes. Our forecast is for the immediate future—not for the 21st century.—ED.]

LUFT WITHOUT LIFT: Immobilised *Luftwaffe* aircraft parked on Gardermoen airfield, near Oslo. All the elevators have been removed.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News and Announcements

Appointments

THE Air Ministry announces the following R.A.F. appointments:—

Air Vice-Marshal John Whitworth JONES, C.B., to be Director General of Organisation, Air Ministry.

Air Vice-Marshal Cyril Bertram COOKE, C.B.E., to be Air Officer Commanding No. 43 Maintenance Group.

Air Vice-Marshal Ernest John CUCKNEY, C.B.E., D.S.C., to be Chief Maintenance Officer, H.Q., M.A.A.F.

Air Commodore John Auguste BORET, C.B.E., M.C., A.F.C., to be Air Officer Commanding a R.A.F. Group in Norway, with the rank of Air Vice-Marshal.

Air Vice-Marshal Jones has been Assistant Deputy Chief of Staff, South-East Asia Command, since the end of 1943, before which he was Air Officer Commanding at the H.Q. of Fighter Groups Nos. 9 and 84.

In 1929 the Air Council expressed their appreciation of his efforts to improve the equipment of the R.A.F. and made an award to him in connection with his invention relating to the calculation of the height of aircraft.

Air Vice-Marshal Cooke has been at M.A.A.F., H.Q., as Chief Maintenance and Supplies Officer for the past six months and from 1942 he was in command of an R.A.F. station in Britain.

He was in command of a night flying flight of the Air Defence of Great Britain in 1929 and the following two years, after which he was engaged in engineering duties in Iraq.

Returning to England he was engaged in similar duties at the No. 1 school of Technical Training and was in command of No. 3 school at the outbreak of the war.

Air Vice-Marshal Cuckney has been at an R.A.F. maintenance group in Britain for the last 18 months and from 1942 was Principal Deputy Director of Servicing and Maintenance at the Air Ministry.

He served in the Dover Patrol in 1916 and in 1917 was awarded a D.S.C. and Bar.

From 1936 until the outbreak of the war he was serving at R.A.F. Training Command H.Q., going to Flying Training Command H.Q. as Senior Engineering Staff Officer in 1940.

Air Vice-Marshal Boret, who, as A.O.C. of a Fighter Group since January, 1944, carried the war to the Nazi fortress of Norway, has now entered that country as Joint Head of the Allies' Liberation Force and Air Officer Commanding the R.A.F. Group based there.

He heads the Air Component of the Joint Navy-Army-R.A.F. Force in Norway which is disarming and evacuating the Germans and assisting the rehabilitation of the country.

He took a course at the office of the Judge Advocate General in 1937 and in September, 1939, was at H.Q. Fighter Command on Air Staff operations duties.

Awards

THE KING has been graciously pleased to approve the following awards in recognition of gallantry and devotion to duty in the execution of air operations:

Second Bar to Distinguished Service Order

Group Capt. J. E. FAUQUIER, D.S.O., D.F.C., R.C.A.F., No. 617 Sqn.—Since assuming command of the squadron, this officer has taken part in almost all the sorties to which the formation has been committed. Early in February, 1945, Group Capt. Fauquier led the squadron in an attack on the U-boat pens at Poortershaven. Photographs obtained showed that the bombing was accurate and concentrated. Since then, this officer has participated in a number of sorties during which the railway viaduct at Bielefeld, a railway bridge over the river Weser at Bremen and a viaduct over a flooded meadow near to Ardbergen bridge were all rendered unusable by the enemy. By his brilliant leadership, undoubted skill and iron determination this officer played a good part in the successes obtained. He has rendered much loyal and valuable service.

Distinguished Service Order

Act. Air Comdre. D. G. MORRIS, C.B.E., D.F.C., R.A.F.—Since the award of the D.F.C., this officer has flown on a large number of operational sorties. By his leadership and personal example he has brought his wing up to the highest standard of operational efficiency. Air photography and intelligence sources confirm the exceptional successes consistently achieved by the squadrons in his wing against important and heavily defended targets. Air Comdre. Morris has himself participated in many of the more hazardous of these operations, as well as leading frequent attacks against enemy transport and railways.

Act. Wing Cdr. J. B. GRANT, D.F.C., R.A.F., No. 58 Sqn.—Wing Cdr. Grant has been commander of his squadron for a long period and has completed an impressive record of operations. During his first tour of duty he acted as flight commander with much success, and, during his second, he has flown many hours on anti-submarine patrols by night and on attacks on enemy shipping, many of them in the vicinity of the enemy coast. Early in 1944, this officer pressed home an effective attack on an enemy U-boat in the face of considerable anti-aircraft fire and in June, 1944, he led a formation against a U-boat in St. Annes Harbour in the heavily defended Channel Islands. On several occasions Wing Cdr. Grant has taken part in attacks on shipping, making repeated runs over the targets in the face of bad weather and severe enemy opposition. In August, 1944, his aircraft was destroyed by an anti-aircraft shell and crashed at sea. Wing Cdr. Grant was rescued only after 10 hours in the water. Since then he has continued to show the greatest keenness and devotion to duty on all his sorties. His leadership and courage have been an inspiration to all who serve under him.

Act. Wing Cdr. C. N. FOXLEY-NORRIS, R.A.F.V.R., No. 143 Sqn.—This officer has a long and distinguished record of operational flying. He has completed numerous sorties on his third tour of duty during which period he has operated against a wide range of enemy targets. For several months this officer has commanded the squadron. During the period numerous attacks have been made against enemy targets. By his brilliant leadership, exceptional skill and determination, Wing Cdr. Foxley-Norris has contributed in good measure to the successes obtained.

Bar to Distinguished Flying Cross

Sqn. Ldr. R. B. COLE, D.F.C., R.A.F.V.R., No. 3 Sqn.—This officer has a splendid record of war service. He has completed a very large number of sorties in various battle zones. He is a skilful and fearless fighter, whose brilliant leadership has contributed materially to the success of the squadron he commands. Sqn. Ldr. Cole has personally destroyed six enemy aircraft; he has also put out of action a good number of locomotives and trucks, and effectively attacked several barges and numerous mechanical vehicles.

Flt. Lt. E. L. WILLIAMS, D.F.C., R.A.F.V.R.—This officer has displayed outstanding keenness, and his determination to inflict loss on the enemy on every possible occasion has set an example of the highest standard. Highly skilled, brave and resolute, Flt. Lt. Williams has obtained much success, including the destruction of ten enemy aircraft in the air; he has also most effectively attacked others on the ground. In addition, he has executed many good attacks on a number of enemy locomotives. His devotion to duty has been unfailing.

F/O. M. C. P. SMITH, D.F.C., R.A.F.V.R., No. 640 Sqn.—This officer has set a fine example of determination and devotion to duty in operations against the enemy. He has participated in very many sorties and has invariably pressed home his attacks with great accuracy. One night in March, 1945 F/O. Smith piloted an aircraft detailed to attack an oil refinery at

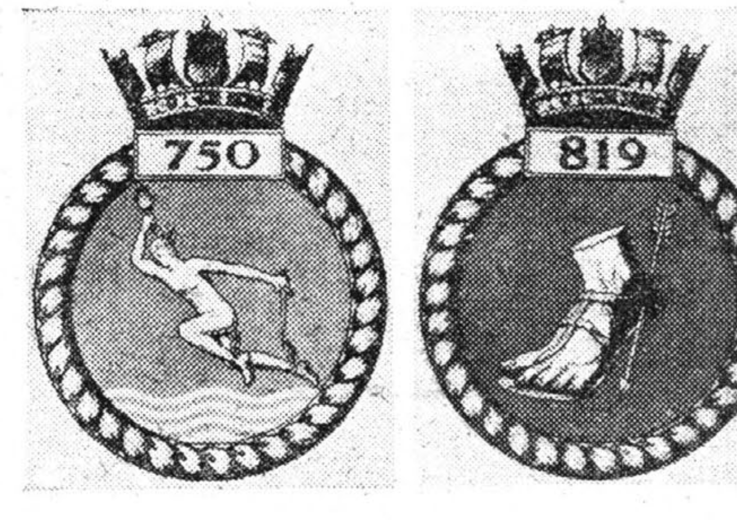
SERVICE AVIATION

When nearing the target area the port outer engine became unserviceable. Some height was lost. Even so, F/O. Smith continued to the target and pressed home his attack. His determination on this occasion was characteristic of that which he has shown at all times.

Act. Sqn. Ldr. J. J. ALLEN, D.F.C., R.A.F.V.R., No. 107 Sqn.—Sqn. Ldr. Allen has displayed the greatest keenness for air operations, and has taken part in a large number of varied sorties. On one occasion he attacked a goods train, setting many trucks on fire. On another occasion Sqn. Ldr. Allen machine-gunned a number of mechanical vehicles and, afterwards, numerous barges, with good results. He has invariably pressed home his attacks with the greatest determination.

Distinguished Flying Cross

Group Capt. I. B. NEWBIGGING, R.A.F.
Flt. Lt. J. A. E. GAGNON, R.C.A.F., No. 23 Sqn.
Act. Flt. Lt. H. G. H. MEADOWS, R.A.F.V.R., No. 101 Sqn.
F/O. J. R. DREWERY, R.C.A.F., No 101 Sqn.
F/O. J. W. PAINE, R.A.F.V.R., No. 90 Sqn.
F/O. D. J. PHILLIPS, R.N.Z.A.F., No. 78 Sqn
F/O. J. L. WALLACE, R.C.A.F., No. 12 Sqn.
F/O. G. WITHENSHAW, R.C.A.F., No. 101 Sqn.
Flt. Lt. G. C. CHAPMAN, R.A.F.V.R., No. 85 Sqn.
Wing Cdr. B. A. C. WOOD, R.A.F., No. 240 Sqn.
Act. Sqn. Ldr. J. M. BETTS, A.F.C., R.A.F.V.R., No. 226 Sqn.
Act. Sqn. Ldr. N. J. DURRANT, R.A.F.V.R., No. 198 Sqn.
Flt. Lt. R. HADLEY, R.A.F.V.R., No. 156 sqn. (since deceased).
Act. Sqn. Ldr T. W. A. HUTTON, R.A.F.V.R., No. 35 Sqn
Act. Sqn. Ldr. E. B. LYONS, R.A.F.V.R., No. 222 Sqn.
Act. Sqn. Ldr. P. A. S. THOMPSON, R.A.F.V.R., No. 177 Sqn.
Act. Sqn. Ldr. H. M. H. TUDOR, R.A.F.V.R., No. 140 Sqn.
Act. Sqn. Ldr. R. H. WOOD, R.A.F.V.R., No. 177 Sqn.
Flt. Lt. R. L. BEVERLEY, R.A.F.V.R., No. 264 Sqn.
Flt. Lt. A. G. BROWNSHILL, R.A.F.V.R., No. 179 Sqn.
Flt. Lt. K. BURBIDGE, D.F.M., R.A.F.V.R., No. 542 Sqn.
Flt. Lt. J. W. HARPER, R.A.F.V.R., No. 177 Sqn.
Flt. Lt. H. T. HERBERT, R.A.F.V.R., No. 541 Sqn.
Flt. Lt. R. B. JACKSON, R.A.F.V.R., No. 42 Sqn.
Flt. Lt. P. T. PRATT, R.A.F.V.R., No. 544 Sqn.
Flt. Lt. W. G. POTTER, R.A.F.V.R., No. 107 Sqn.
Flt. Lt. R. J. RYLEY, R.A.F.V.R., No. 42 Sqn.
Flt. Lt. A. SEAGER, R.A.F.V.R., No. 80 Sqn.
Flt. Lt. J. A. C. SCOTT, R.A.F.V.R., No. 88 Sqn.
Flt. Lt. B. H. F. TEMPLER, R.A.F.V.R., No. 540 Sqn.
Flt. Lt. C. THORNTON, R.A.F.V.R., No. 98 Sqn.
Flt. Lt. G. H. WILLIAMS, R.A.F.V.R., No. 544 Sqn
Flt. Lt. R. E. ROBINSON, R.A.F.V.R., No. 58 Sqn.
Act. Flt. Lt. P. BARBER, R.A.F.V.R., No. 35 Sqn
Act. Flt. Lt. D. C. BORLAND, R.A.F.V.R., No. 266 Sqn
Act. Flt. Lt. C. F. HORNER, R.A.F.V.R., No. 156 Sqn.
Act. Flt. Lt. W. H. L. S. WAY, R.A.F.V.R., No. 35 Sqn.
F/O. R. K. APPLEBY, R.A.F.V.R., No. 181 Sqn.
F/O. A. H. BLACKMORE, R.A.F.V.R., No. 49 Sqn.
F/O. A. G. BOYD, R.A.F. No. 97 Sqn.
F/O. K. G. BRAIN, R.A.F.V.R., No. 137 Sqn.
F/O. H. G. CURRELL, R.A.F.V.R., No. 98 Sqn.
F/O. N. J. DIXON, R.A.F.V.R., No. 261 Sqn.
F/O. T. DONALD, R.A.F.V.R., No. 60 Sqn.
F/O. J. W. FOSTER, R.A.F.V.R., No. 144 Sqn.
F/O. E. H. GRENNAN, R.A.F.V.R., No. 544 Sqn.
F/O. L. E. LOVELOCK, R.A.F., No. 180 Sqn.
F/O. A. B. MCKEOWN, R.A.F.V.R., No. 236 Sqn.
F/O. G. S. MELLOR, R.A.F.V.R., No. 60 Sqn.
F/O. D. R. PERRIN, R.A.F.V.R., No. 35 Sqn.
F/O. K. A. PULL, R.A.F.V.R., No. 280 Sqn
F/O. H. REES, R.A.F.V.R., No. 75 Sqn.
F/O. H. SHAW, R.A.F.V.R., No. 56 Sqn.
F/O. B. J. SPRAGG, R.A.F.V.R., No. 257 Sqn.
F/O. D. WIMMERS, R.A.F.V.R., No. 107 Sqn.
P/O. R. J. CHILD, R.A.F.V.R., No. 35 Sqn.
P/O. W. L. COLLINS, R.A.F.V.R., No. 58 Sqn.
P/O. C. M. HANDLEY, R.A.F.V.R., No. 156 Sqn.
P/O. S. L. MCCAUL, R.A.F.V.R., No. 224 Sqn.
F/O. R. D. WALKER, R.A.F.V.R., No. 140 Sqn.
P/O. R. E. WYATT, R.A.F.V.R., No. 144 Sqn.
W/O. J. F. BRYDEN, R.A.F.V.R., No. 357 Sqn.
W/O. W. G. HOUGH, R.A.F.V.R., No. 357 Sqn.
W/O. V. N. LONNEN, R.A.F.V.R., No. 66 Sqn.
W/O. R. W. PETTY, R.A.F.V.R., No. 49 Sqn.
W/O. G. SKIDMORE, R.A.F., No. 224 Sqn.
W/O. R. K. SOMERVAILLE, R.A.F.V.R., No 540 Sqn.
Maj. L. G. HAMLET, S.A.A.F., No 21 (S.A.A.F.) Sqn.
Maj. H. BRAITHWAITE, S.A.A.F., No. 12 (S.A.A.F.) Sqn
Capt. D. DAKERS, S.A.A.F., No. 104 (S.A.A.F.) Sqn.
Capt. G. A. EVANS, S.A.A.F., No. 12 (S.A.A.F.) Sqn.
Capt. R. T. HUTCHINSON, S.A.A.F., No. 12 (S.A.A.F.) Sqn.
Capt. R. H. JACOBS, S.A.A.F., No. 145 Sqn
Capt. P. H. NICOLAY, S.A.A.F., No. 21 (S.A.A.F.) Sqn.
Capt. N. P. PRINSLOO, S.A.A.F., No. 40 (S.A.A.F.) Sqn



(Left) Badge of No. 750 Squadron, Naval Air Arm. "Teach and Strike." On a blue field a Greek runner white, in his dexter hand a torch fired proper, in his sinister hand a sword white, over water barry wavy white and blue. (Right) Badge of No. 819 Squadron. (No motto). On a blue field a foot in a sandal gold, pierced through the heel by an arrow white.

Capt. D. VAN DER BYL, S.A.A.F., No. 15 (S.A.A.F.) Sqn.
Lt. L. J. RABIE, S.A.A.F., No. 34 (S.A.A.F.) Sqn.
Maj. C. J. ANDERSON, S.A.A.F., No. 16 (S.A.A.F.) Sqn.
Maj. E. T. DESMARAIS, S.A.A.F., No. 34 (S.A.A.F.) Sqn.
Maj. G. C. H. FREEMAN, A.F.C., S.A.A.F., No. 25 (S.A.A.F.) Sqn.
Maj. H. E. PLATT, S.A.A.F., No. 16 (S.A.A.F.) Sqn.
Capt. B. G. BENSEN, S.A.A.F., No. 25 (S.A.A.F.) Sqn.
Capt. J. LOUW, S.A.A.F., No. 16 (S.A.A.F.) Sqn.
Capt. R. S. PARSONS, S.A.A.F., No. 34 (S.A.A.F.) Sqn.
Capt. R. G. SANDFORD, S.A.A.F., No. 34 (S.A.A.F.) Sqn.
Capt. J. N. SMITH, S.A.A.F., No. 34 (S.A.A.F.) Sqn.

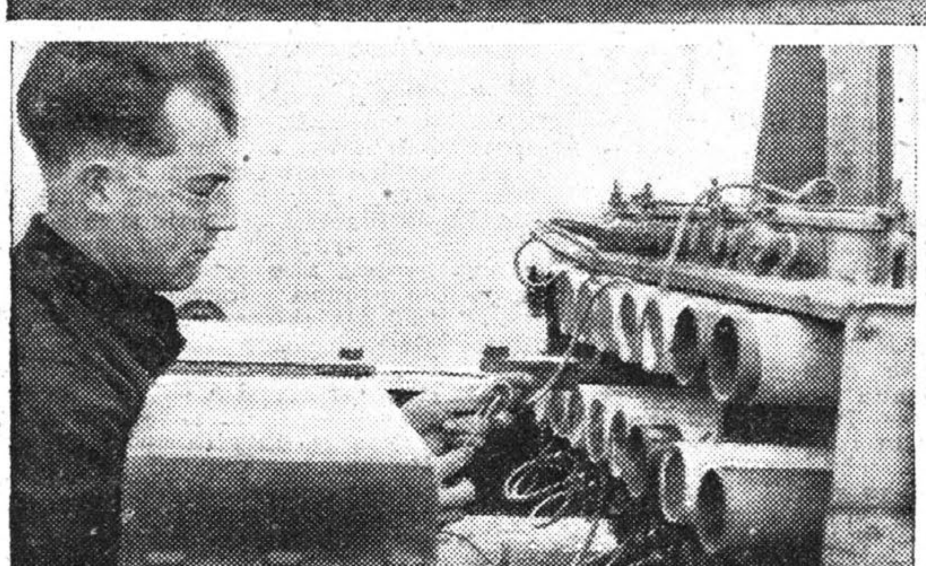
THE KING has been graciously pleased to approve the following awards:—

Bar to Air Force Cross

Act. Wing Cdr. T. W. KEAN, A.F.C., R.A.F.
Act. Sqn. Ldr. S. R. HINKS, A.F.C., R.A.F.O.

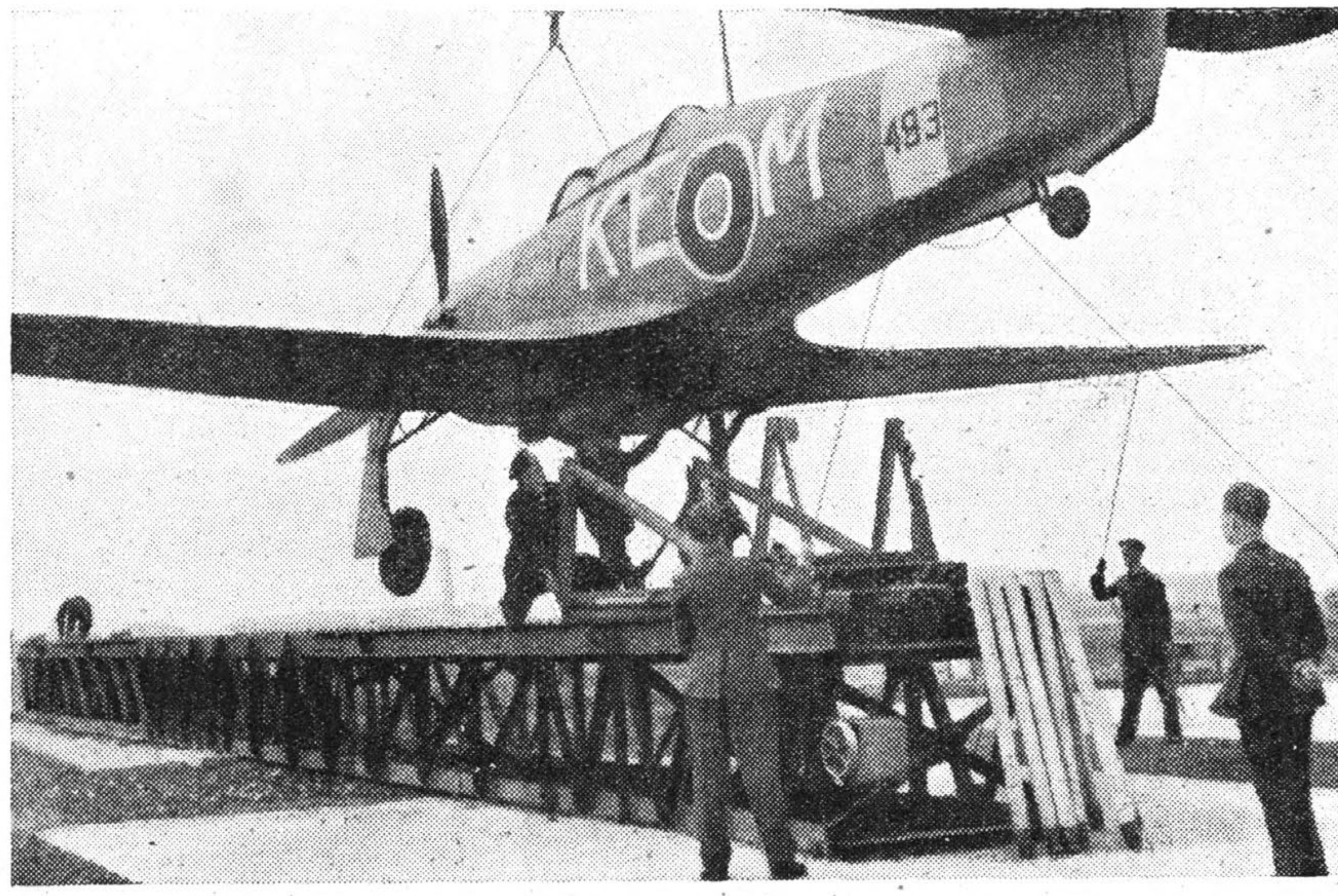
Air Force Cross

Act. Group Capt. J. A. NEWTON, R.A.F.O.



SHOT-OFF: How the Hurricanes were rocketted from C.A.M. ships to deal with long-range bombers attacking convoys. On the left, a mechanic is checking and attaching the firing fuses to the eighteen rockets which provide the motive power of the catapult.

(Left) Badge of No. 1772 Squadron, Naval Air Arm. "Tenax Proposite" (Steadfast of Purpose). On a field per fesse red and blue, a bow white, strung with an arrow white winged and flighted gold. (Right) Badge of No. 1830 Squadron, Naval Air Arm. "Force On." On a blue field, barry wavy in base white and blue, two torches in saltire gold, inflamed proper.



TRY-OUT: Putting a Hurricane on a rocket-propelled catapult at a C.A.M. ship training airfield. The size of the rockets, of which there are 18, can be judged from those standing against the catapult.

Wing Cdr. K. SLATER, R.A.F.
Act. Wing Cdr. F. P. R. DUNWORTH, R.A.F.
Act. Wing Cdr. P. J. HALFORD, R.A.F.O.
Act. Wing Cdr. E. W. S. JACKLIN, R.A.F.V.R.
Act. Wing Cdr. C. E. F. RILEY, R.A.F.O.
Sqn. Ldr. W. BENTLEY, D.F.C., R.A.F.V.R.
Sqn. Ldr. J. R. JOHNSON, R.A.F.
Sqn. Ldr. E. W. MURRAY, D.F.C., R.A.F.
Sqn. Ldr. W. E. OGLE-SKAN, R.A.F.O.
Sqn. Ldr. A. B. J. PEARSON, R.A.F.O.
Act. Sqn. Ldr. D. J. BELLINGHAM, D.F.C., R.A.F.V.R.
Act. Sqn. Ldr. J. F. BENTLEY, R.A.F.V.R.
Act. Sqn. Ldr. J. B. CHINNERY, R.A.F.
Act. Sqn. Ldr. D. H. L. FARMER, D.F.C., R.A.F.
Act. Sqn. Ldr. R. E. H. FENDER, R.A.F.V.R.
Act. Sqn. Ldr. R. L. FULLER, R.A.F.
Act. Sqn. Ldr. H. V. C. FUNNELL, R.A.F.V.R.
Act. Sqn. Ldr. C. N. HAGUES, R.A.F.V.R.
Act. Sqn. Ldr. K. HENSMAN, R.A.F.V.R.
Act. Sqn. Ldr. W. D. W. KNIGHT, R.A.F.V.R.
Act. Sqn. Ldr. L. C. LAMBERT, A.F.M., R.A.F.
Act. Sqn. Ldr. H. W. LEACH, R.A.F.V.R.
Act. Sqn. Ldr. B. J. NORRIS, R.A.F.
Act. Sqn. Ldr. P. W. PETERS, D.F.C., R.A.F.O.
Act. Sqn. Ldr. C. H. PRINCE, R.A.F.V.R.
Act. Sqn. Ldr. E. B. H. ROBERTON, R.A.F.V.R.
Act. Sqn. Ldr. J. S. SIMSON, D.F.C., R.A.F.O.
Act. Sqn. Ldr. I. G. STEWART, D.F.C., R.A.F.
Act. Sqn. Ldr. D. F. TOUCH, R.A.F.V.R.
Flt. Lt. J. F. W. ADAMS, D.F.C., R.A.F.V.R.
Flt. Lt. S. ANSON, R.A.F.V.R.

THE KING has been graciously pleased to approve the following awards in recognition of gallantry and devotion to duty in the execution of air operations:—

Distinguished Flying Medal

Flt. Sgt. R. R. BROWNE, R.C.A.F., No. 429 (R.C.A.F.) Sqn.
Flt. Sgt. D. H. LANCTOT, R.C.A.F. No. 419 (R.C.A.F.) Sqn.
Flt. Sgt. P. RAYNER, R.A.F.V.R., No. 582 Sqn.
Flt. Sgt H. G. SMITH, R.A.F.V.R., No. 35 Sqn.
Flt. Sgt. E. J. SELF, R.A.F.V.R., No. 186 Sqn.
Flt. Sgt. G. WALKER, R.A.F.V.R., No. 582 Sqn.
Flt. Sgt. I. O. D. WATERS, R.A.F.V.R., No. 7 Sqn.
Flt. Sgt. C. B. S. WATTS, R.A.F.V.R., No. 10 Sqn.
Flt. Sgt. W. G. WHALE, R.A.F.V.R., No. 7 Sqn.
Flt. Sgt. J. B. WHITEHOUSE, R.A.F.V.R., No. 405 (R.C.A.F.) Sqn.
Flt. Sgt. J. H. WILKINS, R.A.F.V.R., No. 51 Sqn.
Flt. Sgt. G. L. WOODS, R.A.F.V.R., No. 405 (R.C.A.F.) Sqn.
Act. Flt. Sgt. T. W. D. KELLY, R.A.F.V.R., No 7 Sqn.
Act. Flt. Sgt. G. B. SHARPE, R.A.F.V.R., No. 35 Sqn.
Sgt W. ATKINS, R.A.F.V.R., No. 578 Sqn.
Sgt. J. I. BURGESS, R.A.F.V.R., No. 405 (R.C.A.F.) Sqn.
Sgt. R. F. CHAPMAN, R.A.F.V.R., No. 90 Sqn.
Sgt. H. E. DAVEY, R.A.F.V.R., No. 7 Sqn.
Sgt. K. T. DORSETT, R.A.F.V.R., No. 15 Sqn.
Sgt. (now P/O.) J. A. GILL, R.A.F.V.R., No. 166 Sqn.
Sgt. T. E. HEWITT, R.A.F.V.R., No. 101 Sqn.
Sgt. S. JOULES, R.A.F.V.R., No. 77 Sqn.
Sgt. (now P/O.) P. MYERS, R.A.F.V.R., No. 578 Sqn.
Sgt. (now P/O.) G. E. REAY, R.A.F.V.R., No. 149 Sqn.
Flt. Sgt. A. J. CLARK, R.A.F.V.R., No. 101 Sqn.
Flt. Sgt. E. L. PEARSON, R.A.F.V.R., No. 101 Sqn.
Flt. Sgt. R. F. UPCOTT, R.C.A.F., No. 101 Sqn.
Sgt. J. CORNER, R.A.F.V.R., No. 101 Sqn.
Flt Sgt. (now F/O.) E. O. CHARLTON, R.A.F.V.R., No. 97 Sqn.
Flt Sgt. (now P/O.) L. J. ETHERIDGE, R.A.F.V.R., No. 107 Sqn.
Flt. Sgt. W. M. FARISH, R.A.F.V.R., No. 357 Sqn.
Flt. Sgt. E. LANCASHIRE, R.A.F.V.R., No. 502 Sqn.
Flt. Sgt. F. R. BURKE, R.A.A.F., No. 12 Sqn.

Badge of No. 1840 Squadron, Naval Air Arm. "Allied and Avenging." On a white field, a wild cat winged, issuing from flames proper.

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

B.E.M. (Mil.)

L.A/C. S. PURKAYASTA, R.I.A.F., No. 8 (R.I.A.F.) Sqn.—In October, 1944, an aircraft with overload petrol tank developed an internal glycol leak whilst taking off from a R.A.F. station and crashed near the end of the runway, immediately bursting into flames. L.A/C. Purkayasta, who was working in the M.T. yard, saw the aircraft crash and, taking the nearest vehicle, drove to the scene of the accident. He was the first person to arrive and found the aircraft enveloped in flames, with the pilot, whose clothing and parachute were on fire, lying half out of the cockpit in an unconscious condition. Disregarding the flames, this airman endeavoured to drag the pilot clear, but found that he was held by his tangled harness. L.A/C. Purkayasta was then obliged to retire before the intense heat. He secured a knife from a native labourer who had arrived on the scene and with this he returned to the rescue. He cut the retaining straps of the equipment, dragged the pilot clear and proceeded to extinguish his burning clothing. Unfortunately the pilot died on the way to hospital. L.A/C. Purkayasta displayed great gallantry and complete disregard for his own safety

Roll of Honour

Casualty Communiqué No. 519.

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, 93 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Flt. Sgt. K. Freakes; F/O. E. Harrop; Flt. Sgt. R. D. Heppenstall; Sgt. J. M. Johnston; Sgt. R. Macgowan; Sgt. J. W. Hodder; Sgt. K. R. Moore; Sgt. G. Needham; Sgt. J. O'Donnell; Flt. Sgt. C. Ramsden; Flt. Sgt. J. L. Russell; P/O. W. R. Smith; Sgt. D. H. Widdows; Flt. Sgt. P. Woollatt; Sgt. G. Sanderson.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. J. A. Buckley; Sgt. C. E. Hansford; Sgt. J. R. Wallis; F/O. J. H. Ward.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—W/O. R. J. Andrews; Flt. Lt. W. G. Barnes, D.F.C.; Wing Cdr. O. J. M. Barron, D.F.C. and bar; P/O. M. H. Bender; W/O. T. Birch; Sgt. G. W. Boswell; F/O. H. R. Briggs; W/O. A. Brown; Flt. Sgt. R. E. Brown; F/O. B. G. D. Bujac; F/O. L. M. S. Butler; Sgt. R. E. Clay; W/O. R. H. Cook; F/O. H. W. Cooper; F/O. A. V. Cormack; Flt. Sgt. K. Cowley; F/O. W. M. Crook; F/O. G. A. Davey; Flt. Lt. R. F. Dunn; Sgt. D. A. Eld; Sgt. J. R. Ellis; F/O. R. A. Fuller; Sgt. G. B. Gaunt; Sgt. H. T. Gregory; Flt. Sgt. C. C. Hardy; Sgt. T. E. Hardy; Sgt. H. R. Hill; Flt. Sgt. L. H. Hood; Flt. Sgt. J. Horsford; Flt Sgt. D. N. Howarth; Sgt. G. T. Howe; Sgt. R. F. Howell; Flt. Sgt. S. B. Howell; Sgt. A. L. Jamieson; Sgt. J. A. Jillings; Sgt. G. K. Jones; Sgt. S. D. Keenen; Sgt. M. T. Kelly; Flt. Sgt. V. S. Lacey; Sgt. A. Latham; Sgt. D. J. Lewis; Sgt. J. McGahey; F/O. J. Mackinnon; P/O. P. J. McManus; Sgt. J. Maguire; Sgt. N. Marley; Sgt. K. G. Mason; Sgt. C. E. Mayne; F/O. H. M. Murray; Sqn. Ldr. M. Negus, D.F.C.; Flt. Lt. D. R. Neilson; Sgt. E. Norris; Flt. Sgt. C. C. Payne; Sgt. H. G. Price; P/O. J. Rathbone; P/O. W. T. A. Regan; Sgt. K. F. Rice; Sgt. C Roberts; W/O. D. H. Royle; Sgt. E. G. Scott; Flt. Sgt. D. J. Sims; P/O. P. G. Skuce; Sgt. A. Smith; Sgt. D. L. Smith; Flt. Sgt. J. A. Smith; Flt. Sgt. G. E. Snelling; Flt. Sgt. W. F. Stockwell; Sgt. J. A. Surridge; F/O. J. B. Thompson; Sgt. E. S. Tickle; Flt. Sgt. K. R. Turner; Sgt. M. J. Tyler; Sgt. A. J. Walker; Sgt. G. W. Ward; Sgt. J. M. Watson; Sgt. D. R. Williams; Flt. Sgt. J. M. Withers; Sgt. A. R. Wood; Sgt. D. G. Wood; F/O. R. T. Woodcraft; Sgt. F. H. Worthington; Flt. Sgt. W. Worthington.

MISSING, BELIEVED KILLED IN ACTION.—P/O A. L. Briand; Sgt. R. B. Bright; Sgt. D. C. N. Burton.

MISSING.—Sgt. G. Ansell; Sqn. Ldr. A. H. Baird, D.F.C.; Sgt. A. Balloch; Sgt. D. P. Bannister; F/O. R. S. Bastick; Sgt. E. E. Bemrose; P/O. W. G. Bennett; Sgt. D. H. Beckett; Flt. Sgt. W. V. Bibby; Sgt. A. T. Blackshaw; Sqn. Ldr. R. A. Boddington, D.F.C.; P/O. T. O. Bolton; Sgt. R. S. R. Booker; Flt. Lt. J. Boyle; Sgt. S. J. Bowden; Sgt. J. G. Brown; Flt. Lt. J. J. Buning; F/O. D. J. Butcher; W/O. C. C. Caesar; Flt. Sgt. H. E. Chalmers; F/O. H. N. Cheeseman; Flt. Sgt. J. Coates; Flt. Lt. J. D. F. Cowden, D.F.C.; Flt. Lt. J. F. Craik, D.F.C.; Flt. Lt. K. A. Creamer; Sgt. A. H. Croll; Flt. Lt. J. S. Davidson; Sgt. L Davies; F/O. J. R. C. Donohue; F/O. P. B. Doran; F/O. W. Dron; Sgt. R. I. P. Eckford; F/O. L. F. Edmonds; Sgt. A. Edwards; Sgt. E. R. Edwards; Flt. Sgt. E. Ellis; Sgt. F. R. Flesch; Sgt. W. Forbes; W/O. C. E. Foster; Flt. Sgt. J. M. Freeman; F/O. W. Gabbott, D.F.M.; Sgt. H. A. J. Gage; Flt. Lt. S. R. Galloway; F/O. T. A. Gill; F/O. P. Glenville; Sgt. M. J. F. P. Goddard; Sgt. K. G. Greathead; P/O. R. M. Hallett; Flt. Sgt L. S. Harper; P/O. J. C. Harris; Sgt. W. Harvey; F/O. F. J. Hegan; Sgt. T. W. Heron; Sgt. S. Hoggett; F/O. D. L. Howell, D.F.C.; F/O. S. Humblestone; Sgt. W. Hastings; Sgt. G. R. James; F/O. R. T. Johns; Sgt. P. R. Jones; P/O. R. E. Jones; Sgt. W. B. Keal; F/O. G. W. A. Kidd; Sgt. H. Lewis; Sgt. J. McAfee; Sgt. A. McQuilkin; Flt. Sgt. J. T. McQuillan, D.F.M.; Sgt. F. G. Martin; Sgt. F. G. Maunder; Sgt. L. Moore; Flt. Sgt. D. W. Muggeridge; Flt. Sgt. P. A. Murphy; Flt. Lt. H. D. Michell; W/O. R. Newsam; Sgt. R. B. Newton; Sgt. N. W. Nightingale; Flt. Sgt. J. L. Nolan; F/O. G. J. North, D.F.C.; Sgt. F. Pallister; Flt. Sgt. L. A. E. Papworth; P/O. T. J. Perry; Sgt. W. G. Potter; Flt. Sgt. H. Botterill; Flt. Sgt. L. Randall; Flt. Lt. O. G. Richards; Flt. Sgt. D. G. Rodwell; F/O. R. J. Rowe; Sgt. H. A. Sargent; Sgt. L. J. Sims; F/O. E. A.

SERVICE AVIATION

Slogrove; W/O. J. Stewart; Sgt. R. L. Swaffer; Sgt. M. E. Taylor; Sgt. H. E. Ward; Sgt. E. W. Webb; Flt. Sgt. T. M. White; Flt. Lt. E. L. Williams, D.F.C.; P/O. H. Wright; F/O. R. R. J. Young.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—F/O. A. Appleby; L.A/C. J. Chicken; W/O. W. Wright.

KILLED ON ACTIVE SERVICE.—P/O. J. A. Clarke; F/O. J. E. Hamer; Group Capt. P. S. Jackson Taylor; Sgt. D. G. Mackenzie; L.A/C. B. D. Mays; Sgt. D. C. Smith; Flt. Sgt. A. C. Tredd; Flt. Sgt. A. C. J. Walker.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Flt. Lt. D. A. Bourne; Sgt. R. G. P. B. Dyer; L.A/C. A. H. Fancourt; L.A/C. J. McNaught.

WOUNDED OR INJURED ON ACTIVE SERVICE.—L.A/C. T. Dickie; L.A/C. H. Price.

DIED ON ACTIVE SERVICE.—A/C.1 E. R. Hignett; L.A/C. J. Lightfoot; L.A/C. H. Lockwood; Sgt. J. Marnock; L.A/C. W. J. Nolan; Flt. Sgt. N. A. Smith; A/C.2 P. T. Wadman.

Royal Australian Air Force

KILLED IN ACTION.—Flt. Lt. R. D. Boyd; Flt. Sgt. F. B. Elliott; Flt. Lt. F. W. G. Tropman, D.F.C.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—P/O. K. Moreton; P/O. D. J. Munro; Flt. Sgt. R. K. Watson.

MISSING.—F/O. J. L. Beeson; P/O. H. S. Nickless; Flt. Lt. A. R. Cocks; P/O. N. W. Curtis; P/O. N. W. Everett; Flt. Sgt. W. G. Frost; F/O. J. Maguire; P/O. M. H. McVey; W/O. D. B. May; P/O. L. J. Nichols; Flt. Sgt. E. T. Summerson.

Royal Canadian Air Force

KILLED IN ACTION.—F/O. S. G. Arlotte; Flt. Sgt. A. G. Bradley; F/O. D. A. Buchanan, D.F.C.; Flt. Sgt. J. A. Chisamore; W/O. C. E. Cruickshank; F/O. J. A. Gibbs; P/O. J. Gingrich; F/O. T. R. Hailstone; F/O. W. R. Kearns; W/O. E. F. Knibbs; Flt. Sgt. J. Leeming; F/O. J. A. McLennan; Flt. Lt. J. D. Ross; F/O. J. R. Seeger; W/O. J. M. Soucie; F/O. D. W. Spence; F/O. J. M. Styles; F/O. J. P. Talocka; P/O. W. G. Whitton; F/O. M. Wilbee; W/O. F. C. Wrynn.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. F. J. Conway; F/O. K. G. Johnson; F/O. R. L. McMillan; F/O. G. L. Passmore; F/O. W. G. Schroeder; P/O. R. Talbot; P/O. J. F. Warrell; F/O. N. Zakow.

MISSING.—F/O. O. W. Armstrong; Flt. Lt. J. P. Barlow; Flt. Sgt. L. H. Beaumont; Flt. Lt. D. E. Berry; F/O. S. B. S. Bishop; F/O. H. Bloch; P/O. W. E. Blunderfield; Flt. Sgt. E. C. Dufresne; Flt. Sgt. P. F. English; F/O. K. G. Fenske; Flt. Lt. T. E. Gallivan; P/O. K. M. Hammond; F/O. R. W. Hodgson; P/O. F. E. Hogan; F/O. C. H. Howald; P/O. W. J. Jackson; Flt. Sgt. D. W. Johnson; W/O. A. M. Jones; F/O. J. A. F. McDonald; F/O. W. E. McLean; Flt. Lt. E. A. Magee; Flt. Lt. N. D. Mara, D.F.C.; P/O. B. W. Martin; Sgt. W. H. Haryett; F/O. W. L. Melbourne; P/O. N. A. Hurst; Flt. Sgt. R. A. Nisbet; Flt. Lt. C. J. Ordin; F/O. J. T. Robinson; Flt. Sgt. D. G. Russell; W/O. B. T. Sheeran; Sgt. R. G. E. Silver; Flt. Lt. G. H. Thomson; F/O. A. J. Tyrrell; Sgt. R. R. Vallier; F/O. C. Walford; Flt. Lt. C. A. Walker.

KILLED ON ACTIVE SERVICE.—F/O. H. G. Christie; Sgt. A. W. Heard; Flt. Lt. C. T. H. MacIntosh; F/O. W. H. Matheson; F/O. K. M. Pridham; F/O. A. J. Snetsinger; Flt. Lt. A. B. Summers; F/O. E. D. Tait.

DIED ON ACTIVE SERVICE.—Sqn. Ldr. J. S. Rutherford.

Royal New Zealand Air Force

MISSING, BELIEVED KILLED IN ACTION.—F/O. W. D. Ross.

MISSING.—Flt. Lt. S. S. Davies; W/O. C. J. Gallagher; Flt. Sgt. C. C. Greenough; Flt. Sgt. I. A. Horsley; Flt. Lt. W. L. Miller; P/O. F. Moresby.

South African Air Force

MISSING.—Lt. C. C. Botha; Lt. A. G. Hill.

Casualty Communiqué No. 520

Of the names in this list 148 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—W/O. T. H. Bashford; Sgt. A. P. Beatson; W/O. A. Brown, D.F.M.; Sgt. J. H. Bull; Sgt. R. C. Burton; Flt. Sgt. K. A. I. Day; Sgt. W. Fowler; Flt. Lt. K. H. French; Sgt. W. A. George; F/O. L. Mooney; Sgt. E. Mulpeter; Sgt. H. K. Norton; Flt. Sgt. G. A. F. Panzer; F/O. V. C. Parker; Flt. Sgt. W. H. Payne; Sgt. C. Scurr; Sgt. D. Stott; Flt. Sgt. W. E. Strachan; Flt. Sgt. C. Sunderland; W/O. K. V. Thomas; Flt. Sgt. J. Thompson; P/O. W. Walker.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—P/O. H. H. Adams; Flt. Sgt. A. W. Cooper; P/O. E. F. Crossley; P/O. T. F. Cusson; W/O. T. Davison; F/O. J. A. Glen; Sgt. A. L. Green; Sgt. J. W. Johnson; Sgt. W. D. Kinnes; Sgt. R. M. McClure; Sgt. P. F. G. Pearsall; Sgt. M. B. Pelham; P/O. H. R. Pizzey; Sgt. J. S. Richards; Sgt. R. A. W. Roberts; Sgt. G. A. Stonham; Sgt. T. E. Stubbs; Flt. Sgt. J. W. Wagstaffe; F/O. R. H. Wilton; F/O. R. H. Winter.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. O. L. Albutt; Flt. Lt. W. F. Anderson; Sgt. D. Atkinson; Sgt. E. Bake; Sgt. R. W. Ball; Sgt. C. Banks; Sgt. W. Bingham; Flt. Sgt. W. E. Blake; Sgt. R. J. Bocking; Flt. Lt. F. N. Boulton; F/O. S. Boyle, D.F.M.; F/O. F. B. Brandwood; Flt. Sgt. I. A. Buchanan; F/O. A. D. Bull; Sgt. L. J. Carey; P/O. E. A. Colborn; F/O. D. L. Cramp; Sgt. W. Crory; Sgt. A. Diggle; Sqn. Ldr. T. E. Dodwell, D.F.C.; Flt. Sgt. T. Duff; Sqn. Ldr. A. R. Dunn, D.F.C.; Sgt. R. A. Eastman; Sgt. R. Ellerslie; Sgt. H. F. Eveleigh; Sgt. R. V. Fairley; F/O. G. W. Fairweather, D.F.C.; Sgt. H. Gibbs; Sgt. J. H. Gilbert; P/O. C. E. Girling; Sgt. W. Haden; Sgt. J. E. Hammond; F/O. J. Hardman; Sgt. E. E. J. Harris; Sgt. F. Hawksworth; Sgt. W. J. Hayman; Flt. Sgt. F. W. A. Head; Sgt. D. Henderson; F/O. F. Henderson; Sqn. Ldr. M. J. Herrick, D.F.C.; Flt. Lt. K. C. Hoad; Flt. Sgt. D. J. Hoddinott; Sgt. S. C. Holmes; Sgt. H. Hull; Sgt. R. Hutcheon; Sgt. P. Jack; Sgt. A. J. N. Jamieson; P/O. S. A. Jeapes; F/O. M. Jenkins; Sgt. R. G. Johns; Flt. Sgt. D. M. Jones; Sgt. H. Kendrick; Sgt. J. H. Kensett; P/O. F. G. Leahy; F/O. P. E. Legard; Sgt. C. Lister; F/O. J. McCartney; Sgt. T. McFadden; Sgt. J. McInroy; Flt. Sgt. S. E. W. Marshall; Sgt. L. Miles; F/O. J. Miller; Sgt. L. H. Milligan; Sgt. C. A. Mills; Sgt. R. S. Mobbs; Sgt. J. F. Molloy; P/O. F. A. Moody; P/O. W. P. Moroney; Sqn. Ldr. E. H. Moss; Sgt. G. E. Motts; Sgt. L. V. Norton; Flt. Sgt. H. G. J. O'Bree; P/O. R. G. Odden; Sgt. J. Ord; Sgt. P. A. Parsons; Flt. Sgt. V. L. Perry; Flt. Sgt. R. J. Powell; Sgt. E. W. Roberts; P/O. D. W. Ryan; Flt. Sgt. D. G. Scarff; Sgt. G. Scholefield; Flt. Sgt. J. E. Sharpley; Sgt. H. E. W. Simpson; Sgt. J. A. E. Skeat; Sgt. L. L. J. Smith; Sgt. W. J. R. Smith; F/O. H. Spencer; Sgt. M. M. Stilliard; Sgt. R. F. Taylor; Flt. Sgt. R. Thomas; Sgt. J. Todd; Sgt. J. A. Tooley; Sgt. T. N. Usher; P/O. T. E. Vipond; Sgt. B. R. G. Walker; Flt. Sgt. E. G. Walker; Flt. Sgt. P. F. Walker; Flt. Sgt. J. E. Waltham; Sgt. J. R. V. Walton; Flt. Lt. H. J. L. Webb; Sgt. R. T. Wevill; Flt. Sgt. A. Whitehead; Sgt. G. Williams; Flt. Lt. G. W. Williams, D.F.C.; P/O. T. Wilson; Sgt. G. F. Witty; Flt. Sgt. G. F. Wood; Flt. Sgt. L. V. Woodfield; Sgt. T. S. Woodford; F/O. F. W. Woods.

WOUNDED OR INJURED IN ACTION.—Flt. Sgt. J. A. B. Ayers; Flt. Sgt. L. Williams.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Flt. Sgt. F. Human; F/O. E. G. Paddick; Sgt. D. A. Pressley; Flt. Lt. E. A. Wood.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. F. J. Flattery; Sgt. W. T. Jeffries.

MISSING.—Flt. Sgt. L. Adams; Flt. Lt. G. P. Alexandra; Flt. Lt. R. W. Bartlett; Flt. Lt. D. G. Bates; Flt. Sgt. L. Bellingham; Flt. Lt. K. R. Bingham, D.F.C.; Flt. Sgt. W. P. R. Boobyer; Sgt. H. Bowden; Sqn. Ldr. J. W. Bradley, D.F.C.; F/O. R. P. Bulman; Sgt. S. L. Cameron; Sgt. G. F. A. Clapton; Flt. Sgt. F. W. Cotton; Sgt. S. Courtney; Flt. Sgt. L. W. Cromarty, D.F.M.; Flt. Lt. J. O. Davies; Sgt. H. W. N. Drawbridge; Flt. Sgt. B. Edwards; Sgt. V. A. Edwards; F/O. T. O. E. Ellis; Sgt. R. R. Etherton; Sgt. E. L. Evans; Flt. Sgt. J. R. Farrow; P/O. D. D. Finlayson; F/O. J. Fletcher; Flt. Sgt. F. A. Fox; Sgt. N. C. Gordon; P/O. G. Gray; Flt. Sgt. D. Hancock; Flt. Sgt. A. E. Hector; Sgt. S. W. Herring; Sgt. G. W. Higginson; F/O. F. S. Holly; Sgt. R. Holmes; Sgt. J. Howarth; P/O. A. M. B. Hughes; Flt. Sgt. L. R. Ironmonger; Flt. Sgt. A. L. James; Sgt. W. J. James; F/O. A. G. Jeffrey; Sgt. F. W. Jones; Sgt. M. Jones; Sgt. E. D. Keeling; Flt. Sgt. T. C. King; F/O. G. Langmead; F/O. J. H. Lascelles, D.F.M.; P/O. J. B. Leslie; F/O. W. J. J. Lowery; Flt. Sgt. A. McIvor; Sgt. T. McKnight; Sgt. A. McSkimming; Sgt. P. H. Malkin; Sgt. C. A. Matthews; F/O. K. Middlemast; Sgt. J. Montague; F/O. E. J. Mortis; Sgt. A. R. Newby; Sgt. R. F. Niles; Flt. Sgt. N. T. Nuttall; F/O. B. J. O'Regan; F/O. N. P. W. Pedersen; Sgt. J. R. A. Ramsay; Flt. Sgt. E. A. Rex; Flt. Lt. J. E. Shannon; Sgt. N. E. A. Sharpe; F/O. P. C. Smith; Flt. Sgt. R. J. Snelling; Sgt. R. Stennett; W/O. P. Styles; Sgt. L. M. Tannen; Flt. Sgt. H. H. Teggart; Flt. Sgt. P. Turner; Sgt. P. H. Voller; F/O. E. Walker; F/O. D. F. Warren; Flt. Sgt. J. D. Woodage; Flt. Sgt. S. J. Woodbridge; Sgt. L. Young.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Flt. Sgt. L. T. M. Dowding; Sgt. A. D. Gash; F/O. R. M. Leeming; Flt. Sgt. F. E. Morgan.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. P. B. Allen; W/O. G. P. Brown; P/O. G. J. Browning; L.A/C. E. W. G. Burnell; L.A/C. R. S. Chappell; W/O. G. A. Clowes; Sgt. R. G. Crump; Flt. Sgt. W. Dougal; Cpl. J. H. Elvidge; Sgt. J. B. Field; Sgt. D. Garner; Flt. Sgt. C. G. Grubb; Sgt. J. A. Haddow; L.A/C. R. B. Halliday; Sgt. G. E. W. Hodge; Sgt. W. J. Holberry; Flt. Sgt. J. Jones; Flt. Lt. W. W. Lake; Flt. Sgt. D. O. Lane; W/O. J. A. McCowan; L.A/C. G. G. McRobert; Sgt. J. L. Mathias; Sgt. H. Nielsen; Cpl. W. C. Noad; Sgt. A. E. Oliff; Sgt. T. J. Reardon; F/O. M. G. St. J. Seelly; Sgt. C. W. Souden; A/C.2 W. Walker; Flt. Sgt. L. Wall; Flt. Sgt. G. K. Wheeliker; Sgt. J. A. Woodgate.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. F. B. Bates; Flt. Sgt. W. L. Hill.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED ON ACTIVE SERVICE.—Cpl. F. Johnson.

DIED ON ACTIVE SERVICE.—Sgt. S. C. M. Ames, B.E.M.; Sgt. A. E. Goulding; L.A/C. R. Nicholson.

Royal Australian Air Force

KILLED IN ACTION.—Flt. Sgt. W. A. Cunningham; W/O. J. M. Harris; P/O. J. G. T. Killen; Flt. Sgt. R. K. McKasgill; Flt. Lt. R. Ordell; P/O. I. R. Osborne; Flt. Sgt. K. K. Reynolds; Flt. Lt. F. R. Normoyle.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. L. Mutton.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. E. A. Canty; P/O. S. A. Edmonds; P/O. J. R. Jones; Flt. Sgt. A. H. Lawry; Flt. Sgt. L. J. P. McCoy; Flt. Sgt. L. R. Pearson; F/O. J. R. Vowles.

MISSING.—Flt. Lt. G. O. Cameron; Flt. Sgt. J. Harper; Flt. Sgt. K. R. Hendren; F/O. W. D. Kelly; Flt. Sgt. R. M. McKenzie; F/O. B. S. Tasker; Flt. Sgt. I. A. West; W/O. A. R. Williams.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—F/O. D. H. R. Evans.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. C. H. Gerner; F/O. M. W. Moon.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Flt. Sgt. W. J. Marris.

Royal Canadian Air Force

KILLED IN ACTION.—Flt. Lt. W. G. Hodges.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. C. A. Campbell; P/O. C. B. Lamb.

WOUNDED OR INJURED IN ACTION.—P/O. W. C. Broad.

MISSING, BELIEVED KILLED IN ACTION.—F/O. R. J. Webb.

MISSING.—Flt. Sgt. J. P. Brown; P/O. F. A. Coombs; P/O. J. Kenny; P/O. D. C. McNie; Flt. Lt. E. Spankie.

KILLED ON ACTIVE SERVICE.—F/O. T. H. R. MacAulay; P/O. R. E. MacDonald; W/O. B. H. McLellan.

WOUNDED OR INJURED ON ACTIVE SERVICE.—W/O. B. Propas.

Royal New Zealand Air Force

KILLED IN ACTION.—W/O. L. J. Hutson; Flt. Lt. M. Spinley; F/O. W. R. Tinker, D.F.C.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Lt. J. G. Clouston; F/O. D. A. Goulden; Flt. Lt. W. M. Harris; Flt. Lt. J. V. Patrick.

MISSING.—F/O. R. J. Clark; W/O. J. H. Grubb; P/O. R. B. Knight; Flt. Sgt. J. Lamont; Flt. Sgt. J. M. M. McGinn; Flt. Lt. K. Mangos; F/O. D. G. L. Taylor.

KILLED ON ACTIVE SERVICE.—F/O. J. N. Beattie; P/O. J. H. Young.

South African Air Force

MISSING.—Capt. C. Jenkinson.

KILLED ON ACTIVE SERVICE.—2/Lt. M. Flax; Capt. H. N. Honey; Lt. W. F. Howat; Lt. G. C. Stephens.

Official Corrections

Casualty Communiqué No. 515.

Under KILLED IN ACTION, Sgts. Chappell and Daynes should read as Flt. Sgts.

Under PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION, Sgt. Spencer should read Flt. Sgt.

Under MISSING delete: Flt. Sgt. W. G. Cheeseman, Sgt. E. H. Copley, Flt. Sgt. S. E. Hanson, Sgt. N. S. Levick, F/O. T. Lowe, Flt. Lt. J. S. B. Wright, F/O. R. W. Young.

Under the heading PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR, delete all three names.

Under R.C.A.F. MISSING delete: Flt. Sgt. W. K. Bradley, F/O. C. F. Bryce, Flt. Sgt. P. E. O. Morissette, Flt. Sgt. K. D. Reid, Flt. Sgt. R. J. Wilson.

Under the heading PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR, delete both names.

Under the heading of South African Air Force, MISSING, Lt. Col. M. Branby should have read Lt. Col. M. Barnby.

Casualty Communiqué No. 516.

Under MISSING delete Sgt. A. E. Bradshaw, Sgt. C. W. Gordon, Sgt. J. Gough, Flt. Lt. W. W. Hodnett, Flt. Sgt. D. I. Humphrey, Flt. Sgt. N. G. Jones, Sgt. T. F. Morgan; Sgt. J. Sherry, F/O. D. H. Smithers, and Flt. Sgt. R. D. Story.

Under KILLED ON ACTIVE SERVICE, Sgt. L. R. Wilkins should read Flt. Sgt.

Under R.A.A.F., MISSING, delete P/O. R. S. Ebert. Fairburn alter to read Fairbairn.

Under R.C.A.F., MISSING, BELIEVED KILLED IN ACTION, transfer Flt. Lt. H. Byers to KILLED IN ACTION.

Under MISSING delete Flt. Lt. F. H. Richards, Flt. Lt. E. S. Smith, and P/O. W. B. Whitmore.

Under S.A.A.F., MISSING, BELIEVED KILLED IN ACTION, delete Lt. A. L. Spafford.

THE DE HAVILLAND AIRCRAFT CO. LTD.

ACHIEVEMENTS IN WAR

TECHNICAL PREPAREDNESS FOR PEACE

JET AIRCRAFT PROSPECTS

MR. ALAN S. BUTLER, the Chairman, presiding at the ANNUAL GENERAL MEETING of The de Havilland Aircraft Co., Ltd., said :—

Explanations of various items on the accounts have been given in the notes accompanying the accounts, already in your hands. I shall therefore confine myself now to a review of the Company's achievements and prospects.

The year ended September 30, 1944, has once again shown the largest turnover in the Company's history. By reason of E.P.T., however, the profit, £49,215, is almost identical with that of the previous year.

It is with great sorrow and regret that I record the passing of Mr. T. P. Mills, for 18 years a sound counsellor in the Board Room of our Company. His general common sense and trained legal mind are much missed by us all.

Let us take stock of our position to-day. Within the compass of our numerous and widespread activities we have been able to make an outstanding contribution to the war effort. In the past three years our deliveries of aircraft, engines and propellers have had an aggregate value of fifty-nine million pounds. It is interesting to observe that after paying for materials, labour, taxation, etc., the balance left for dividends to shareholders and for ploughing back into the business by way of reserves during these three years has been £140,000.

SUCCESS OF THE MOSQUITO

The Mosquito, conceived independently out of the lessons of our own experience, has proved an exceedingly efficient weapon and was the fastest aircraft in the war for two and a half years. It is certainly the most versatile.

The idea behind the Mosquito was that it should use speed for its protection and should be just large enough to fly a long distance carrying a useful destructive load yet just small enough to hold its own against fighters. By realising these aims it has achieved a significant economy of life and labour.

Had the Mosquito served in no other function but reconnaissance it would be said to have done a fine job for the Allied cause, for photographic intelligence has in a large measure been responsible for our victory over the enemy. The Mosquito has undertaken the major part of all the long-range photographic and meteorological reconnaissance of the continent of Europe, and of vast areas of south-eastern Asia. It has been extensively used by the United States Air Force for similar work.

On the other hand, if the Mosquito had been used as a pathfinder and nothing else it would have made a great contribution to the defeat of Germany, for the Mosquito has been carrying the most important of all the remarkable pathfinding apparatus, and did most of the target marking which made possible the destruction of the great arsenals of Germany. All the primary marking for D-Day was done by Mosquitoes.

Besides reconnaissance and pathfinder duties, the Mosquito has served in many other important roles. As a pin-point day bomber, sufficiently fast and manœuvrable to attack at roof-top height, it has struck many precise blows, picking out individual factories and installations, German military and Gestapo headquarters buildings, often among other houses in the streets of occupied cities, and destroying them with a minimum of surrounding damage.

As a night bomber it has proved especially effective and economical, carrying to Berlin as big a load as some contemporary four-engined bombers requiring large crews and a fighter escort, yet with an exceptionally low casualty rate. In the final 36 consecutive night bombings of Berlin Mosquito losses, in thousands of sorties, were about one-half of one per cent.

As a fighter, the Mosquito has, since 1942, taken over the main responsibility for the night defence of the British Isles. Its high speed not only baulked every German attempt to raid this country, even using fast aircraft with a small load (in emulation of the Mosquito bombing technique) but enabled Mosquitoes to shoot down 600 flying bombs in the first and worst 60 nights of the menace. As a fighter and fighter-bomber the Mosquito has also done valuable intruder work against enemy night-fighter defences, communications, and troop movements, especially during the great retreats across France and across Germany, and against the Japs in Burma.

Against U-boats and shipping and their defending aircraft, both on ocean patrol and in defended coastal waters, the Mosquito has accomplished much destruction with 20 mm. and six-pounder guns, with bombs, and with rocket projectiles. Its speed and manœuvrability make it effective for low-level minelaying in narrow waters, such as the Kiel Canal.

For high-speed military communications as well as for civil air-line duty across enemy territory it has done work that no other aircraft could perform, making many remarkable flights. It has lowered the time for the Atlantic crossing progressively down to about five and a half hours. It has flown to Egypt in five and a half hours, and to India in 12½ hours. It has frequently flown to Russia and back in a day, and during the Moscow conference Mosquitoes made 21 single trips between England and Moscow in 11 days, each taking only about five hours. Also during the Yalta conference the Prime Minister's correspondence and his London newspaper were delivered to him every morning by Mosquito aircraft.

Mosquitoes have been in action against the Japs for two years, and, in still more advanced versions, will take a leading part in the final Pacific campaign. About 6,000 Mosquitoes have so far been built.

POWERFUL PURE-JET TURBINE

Of the other projects which I am allowed to mention doubtless our jet fighter and our gas turbine engines constitute the most important new development that we have made. Both are entirely de Havilland achievements. Led by Major Frank Halford, who designed the engine for the prototype D.H.4 bomber in 1916 and with his team has designed every de Havilland Gipsy engine, the de Havilland Engine Co., Ltd., has created a highly powerful pure-jet turbine for very fast flight.

Development work on this turbine has gone auspiciously from the first. The prototype engine ran at its maximum designed thrust only two months after its very first run on a test bed, and early this year the engine completed the official type-approval test ; thereby history was made, for it is the first gas turbine to run the full period of this arduous test.

Around this engine, which is called the Goblin, our Company has designed a small interception fighter of outstanding performance. This aircraft, named the Vampire, was the first aeroplane in the world handsomely to exceed 500 m.p.h. in level flight and has, so far as we know, recorded the fastest speed of any fighter in the world over a considerable altitude range. The Vampire and its Goblin turbine engine are both in full production. We also are particularly glad to have been able to provide the American aircraft industry, as long ago as October, 1943, with our gas turbine for flying in their aircraft, and it has been a pleasure to assist them in every possible way until they could develop jet engines of their own.

A third aircraft type which we have designed and put into production within the period of the European war is the Hornet long-range fighter. On lines generally resembling the Mosquito but smaller and faster throughout, this aircraft, with its Rolls-Royce Merlin engines and de Havilland high-efficiency propellers, flies at over 470 m.p.h. and is we believe the fastest propeller-driven aircraft in the world. The prototype was designed, built and flown in just 12 months.

Speaking now of a very different but very necessary aeroplane, we are proud to have provided in the little Tiger Moth trainer the aircraft on which the great majority of all the pilots in the Empire has learned to fly.

The engine of the Tiger Moth, our Gipsy Major, is the only aero engine in the world which runs 1,500 hours between overhauls.

Our Dragon Rapide twin-engine transport, famed for its simplicity and economy with light and variable traffic, has served valuably throughout the war.

VARIABLE-PITCH PROPELLERS

Turning now to another side of our activities, we have seen the justification of our foresight which led us to initiate the manufacture of variable-pitch propellers in Great Britain in 1934, for by the time war broke out we had developed a great productive capacity in this essential component—indeed the only full-scale manufacture of variable-pitch propellers in the Empire—so that we stood in readiness for the world emergency. We have now built well over 100,000 propellers, the major share of all the propellers used by the Royal Air Force for the war.

Thanks to the vision manifest in our early years when we were striving for export markets, the threat of the Munich talks in 1938 found us with establishments of some solid technical worth in Australia, Canada, India, and Africa, strategically disposed to serve in a war which has swept both hemispheres.

OVERSEAS COMPANIES' CONTRIBUTION

Our overseas companies in these Dominions, now mostly of 15 to 20 years' standing, have contributed notably to the main cause. Our Canadian company has built a large quantity of Tiger Moths and has long been in full production with Mosquitoes, which have been flight-delivered to the European war theatre since August, 1943.

Our Australian company has produced Tiger Moths by the thousand, also a quantity of Dragons for navigational training, and turned over to the Mosquito after Pearl Harbour. Australian Mosquitoes have been in action against the Japanese for about a year. In 1940 this associated company also was able to arrange for the manufacture of the Gipsy Major engine in the Commonwealth. Earlier still it organised the making of variable-pitch propellers in large quantities to serve the Australian aircraft production — a formidable undertaking. Directly after Munich we set up a factory in Wellington to build Tiger Moths for the Royal N.Z. Air Force.

Our Indian company has expanded its repair and overhaul organisation and has undertaken the manufacture of spare components for Mosquitoes and other aircraft operating in the East. Our South African and Rhodesian establishments were taken over by the authorities and absorbed usefully into the war effort of those Dominions.

The organising of repair capacity for our own products, including Mosquitoes, Tiger Moths, Dominies, Gipsy engines, and propellers, has been a widespread, responsible and intricate undertaking, and in addition we have been able from the grave days of 1940 to develop departments for the repair of Hurricane and Spitfire aircraft, and a further organisation in which we have overhauled 10,000 Rolls-Royce Merlin engines.

Throughout the war we have devoted particular study to the advancement of the de Havilland Aeronautical Technical School, which was formed away back in 1928. Our system of providing technical instruction for trade apprentices and upgrading them by scholarship opens the door of opportunity by which any apprentice can rise to the top of the industry.

Our Flying Training School, started in 1923, has, of course, been very hard at work for the past 10 years, in which we have turned out thousands of initially trained pilots.

PHENOMENAL EXPANSION

From all that I have said you will appreciate that our organisation has undergone a phenomenal expansion.

What has made possible this considerable achievement by our company during the war ? It can without a doubt be traced to the fact that we faced this emergency as a virile and imaginative organisation, the outcome of having for 20 years stood upon our own feet and made our way with enterprise and self-reliance. Ours has been a healthy growth. Indeed, if there is one lesson to be learned from the vigour and inventiveness with which industry as a whole has responded in the hour of need it is that encouragement should be given to initiative wherever it appears, and true ability must be rewarded with opportunity.

What is the outlook for British aviation ? Surely our Empire must possess a strong and always up-to-date air force, supplied with aircraft of a quality such as will be obtainable only if personal initiative and skill are fostered, and only with a minimum of administrative participation in the direct contact between the designers and the squadrons.

The airways will be operated by a small number of large companies and up to a point this may prove to be a good thing. Let us hope, however, that the transport concerns which purchase our products may not become too few and too huge to allow practical judgments to prevail, and that the element of straight and amicable competition may never be lost.

A wide network of services is needed, with varied fields of operation which will call for many different categories of aircraft, so that there may be no danger of any unnatural excess of standardisation, or of any tendency to shirk the venture of either new technical ideas or the more speculative operational possibilities. We believe that there is an immense field for the small operator of branch lines and charter traffic.

We may hope that the light aeroplane clubs will be encouraged to develop flying for the people along safe and well-conducted lines.

Despite our company's war responsibilities we have made progress in the civil field. Already you know a little about the new Dove aircraft. Embodying all our experience and the latest technique it has been specially designed for the branch airways, charter services, administrative travel, and private ownership.

PROJECTED DEVELOPMENTS

Needless to say, our plans go beyond this, and we have in study further aircraft, both military and civil, of the highest potentialities. On the engine side you will be pleased to hear that, notwithstanding our efforts in gas turbine development we have also been able to produce a series of new piston engines, worthy successors of our world-famous Gipsy Major and Gipsy Queen units, for the lighter aircraft categories. As regards our turbines, it will be evident that a vast future lies ahead for this revolutionary type of power unit, in which we occupy a position in the forefront of progress.

The turbine is likely to be used as a pure jet in the fastest aircraft, such as we are building, and such as may become familiar in civil as well as military flying, whilst for aircraft of more moderate speeds and altitudes the turbine will drive propellers to augment the diameter of the thrust column. Thus the advent of the turbine does not put an end to the demand for propellers. On the contrary it will give great scope for propellers of high aerodynamic efficiency, in which we specialise.

Meanwhile, for piston engines also our propeller division is working far in advance of even the latest present-day needs.

COMPANY'S LEADING POSITION

From what I have been able to say you will, I hope, appreciate that the de Havilland Enterprise occupies a very strong, indeed a leading position in all the technical aspects of aviation. Given the opportunity, there need be no fear whatever of Britain falling level with any other country in the world in the matter of technical advancement.

In the course of our company's healthy rise to maturity we have built up highly skilled self-reliant teams of design, research and production engineers, and commercial organisers. We are virtually unique in the world in our combination of creative capacity in military and civil aircraft, turbine, and piston engines, and propellers, and provided that the intrinsic qualities of skill, imagination, and initiative are to be given a fair opportunity we may face the new age with confidence.