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and
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The Outlook

What the Army Thinks

FUTURE historians will certainly choose 1939 as the year in which the novelty of air power began to exert a serious influence in war, for in 1918 that power had not really got into its stride. The fair-minded historian (admittedly a *rara avis*) will not accept as authoritative the enthusiasm which declares that the air is the dominant arm, any more than he will be affected by the grief of old cavalry soldiers that the horse no longer rules the battlefield. Probably the best estimate of the effect produced by air power in the defeat of Germany could be given by a highly placed and candid German authority. Next to that, it is most useful to hear the opinion of an authoritative Allied officer who is not a member of the flying Services. Field Marshal Sir Harold Alexander has given his opinions in a very frank interview to *The Times,* which did not deal exclusively with the air, but gave some most important reflections on its part in the Italian campaign from the Army's point of view.

Perhaps the remark of Sir Harold's which will attract most attention is the one in which he said that the atomic bomb is unlikely to be a sufficient deterrent to the natural bellicosity of man, but he added that what we want is a small staff of experts to watch the latest developments of science, and he ended by saying that if our Navy and our air pilots kept abreast of the latest developments of science we should be able to stand up to anything. We take it that he did not mean to exclude the Army from the need to benefit from science.

The importance of airfields in modern war is shown by the discovery of a German document which explained that one reason why the enemy did not shorten his lines in the Apennines was that it was advantageous to fight as far away from the homeland as possible, so that fighter-bombers could not bomb the Reich. That fear of bombing should force an enemy to fight in a disadvantageous position is most significant. But the Field Marshal did not consider that our "overwhelming superiority in the air," our greater strength in guns, or our far greater mobility was the decisive factor in the German defeat in Italy; but the fact that the Germans had their backs to the Po, and when defeated could not withdraw. There are, in fact, times when air supremacy is not decisive.

On airborne troops Sir Harold was most interesting. The use of them, he said, could obviously be carried much further. Once a commander had to search for his enemy's exposed flank; now he could go over the top and plant a force in the enemy's rear. Previously this could only be done by sea, and then command of the sea was all-important. Now command of the air had become even more important (of course, from the Army General's point of view). The ordinary student can see for himself that command of the sea remains of the utmost importance in a world war, but Sir Harold was evidently thinking of the effect of air and sea on a specific land campaign. We have all heard already of what marvels Admiral Mountbatten was able to perform in Burma once he had gained command of the air. The importance of that is now obviously well recognised by the leading personalities in both Navy and Army.

Luxury and Economy

WE have always rather regretted the tendency towards reviving names of aircraft types. The practice makes for a certain amount of confusion, and more often than not there is no similarity between the original bearer of a name and its modern namesake. A case in point is the Vickers Viking, an article on which appears in this issue. The original machine was an amphibian flying boat of all-wood con-

struction, of which several versions appeared. So far as comfort was concerned, it was somewhat primitive, whereas the modern Viking is by way of being the last word. One might also argue the inappropriateness of the name on the grounds that comfort was not only unknown to the vikings; it was actually discouraged.

However, that is by the way. The new Viking is by all accounts something out of the ordinary both in the matter of comfort and from the economic point of view. "Riding on Air" has been used as an advertising slogan, but with the orthodox fixed wing the riding has not always been as smooth as might have been imagined! The wing of the Viking does not absorb bumps, but its flexible mounting does definitely relieve the passenger of nearly all of the mechanical vibration normally transmitted from the engines to the cabin. One's first flight in the new Viking takes one back to the days of the change-over on London buses from solid to pneumatic tyres. The difference is as great as that, and the improvement in noise isolation is comparable, to remain in the simile, with the difference between the old open-top-deck buses and the present enclosed-top models.

It might have been expected that all this extra passenger comfort would have detracted from the operational economy to the dismay of potential operators. This appears very far from being the case. A member of our editorial staff attempts in this issue to evaluate the economics of operating the Viking. True, he has had to make certain fundamental assumptions, but they do not appear unreasonable, and if they are anywhere near correct, the Viking is a remarkable aircraft from every point of view. The L/D ratio at cruising speed is high, and the cost per ton-mile and per passenger-mile is remarkably low. Although he bases his calculation on maximum rather than on recommended cruising power and speed, the final result is not likely to be wildly wide of the mark. Just under one shilling per ton-mile and just over one penny per passenger-mile are figures which cause a raising of the eyebrows, especially when, as in the case of the Viking, they are coupled with a satisfyingly high cruising speed. Costs will obviously vary widely on different routes and in different circumstances, but these basic figures—assumed though they be—hold out hopes for a bright future for commercial aviation, if the Government will give it a chance to develop as it should and car

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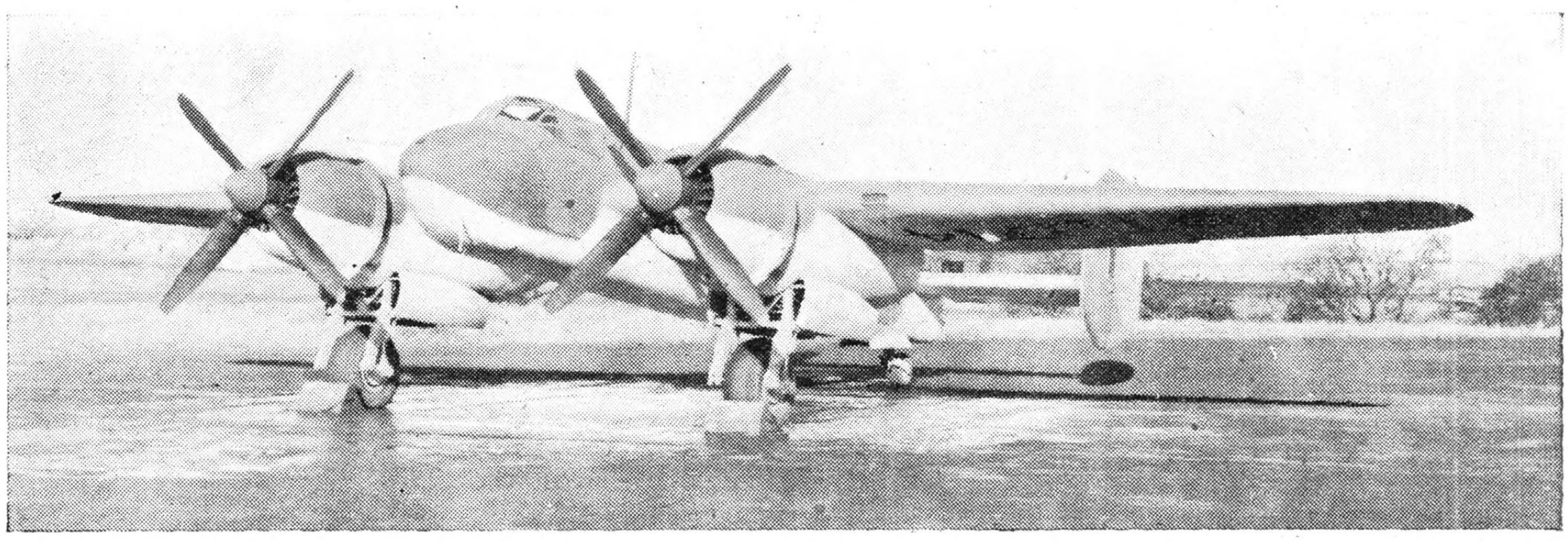
The Winster of Our Discontent

POINT is lent to the question in Parliament which Mr. Gandar Dower is addressing to Lord Winster (concerning the deadlock in civil aviation) by the purposeful way in which our American friends are forging ahead. At the time of going to press the Skymaster is well on its world-circling flight, and there is every prospect that it will complete its journey to-day according to schedule. Concurrently it is announced that Pan American Airways intends to resume regular transatlantic services in the near future with Douglas machines without waiting for the completion of its fleet of Constellations. Other American companies are pressing forward with their plans, and in the near future we shall see American air lines operating very efficient services over routes on which British aircraft ought to be "showing the flag."

The fact that B.O.A.C. and R.A.F. Transport Command are carrying on does not alter the fact that this country is, so far as commercial aviation is concerned, in a state of suspended animation, pending the announcement of a Government policy. There is so much to be done and so little time in which to do it if the world in general is not to form the opinion that Great Britain and the Empire are negligible quantities. The new Government has not given any hint as to its intentions, and until it does no one can begin even to plan, let alone getting staff together against the time when aircraft become available from the British industry.



ADVANCED TRAINER: The Bristol Buckmaster I, which is equipped as a three-seater trainer: pupil, instructor and wireless operator. The instructor's seat is on the starboard side and dual controls are fitted for the throttle, airscrew speed and feathering, undercarriage and flaps. A lever on the control column enables him to take control of the brakes. The Buckmaster is of all-metal, stressed-skin construction and is powered by two Bristol Centaurus VII engines. Four-blade Rotol airscrews are fitted. Span 71ft. 10in., length 46ft. 5in., height 15ft. 10in.

In Germany Today

A temporary bridge at Cologne spans the Rhine beside the wrecked Hohenzollern bridge.

Part II—Ruhr Aluminium Works Intact : Summary of German Jet Propulsion Activities : Comparisons and Consensions

By G. GEOFFREY SMITH, M.B.E.

DURING the tour of devastated Ruhr manufacturing centres and the coal district we visited at Grevenbrücke, near Essen, the *Vereinigte Aluminium Werke* which, exceptionally, was little damaged, though the village suffered badly. Here aluminium scrap is melted down by the hot rolling process to strip thicknesses in ten processes and re-used. For stressed parts 40 to 50 per cent. virgin metal is added. This factory would be able to get going at once with a little assistance, particularly electric power. In the works we saw miles of tin foil used to confuse our radar. Adjoining was the largest of the many dumps of damaged aircraft I inspected, mostly German, but including American, British, French and Italian. Some instruments have been removed and undercarriages of the big bombers collected together, but there must be thousands of aircraft in this huge field for the works to draw upon. At Cologne the famous Hohenzollern bridge lay crumpled in the Rhine, a temporary affair taking the lines of traffic. Lines of lorries carrying much-needed coal for the north-west frequently checked progress, and constantly there were warnings of mines by the roadside. Side streets in the Ruhr cities remain just rubble; traffic cannot negotiate them. Cologne, Dortmund, Dusseldorf and Essen vied with one another as claimants for the worst damage. Most of the huge Krupp works are a mass of twisted girders with only the outer shell remaining. Not so Villa Huegel, the grandiose palace of a hundred rooms formerly occupied by the Krupp family and now one of the headquarters of the Control Commission. When negotiable the *Autobahn* proved a real relief, but frequent craters, only hastily filled, caused sudden decelerations as well as discomfort. Bailey bridges have proved of enormous help in restoring communications, following wanton damage.

The predicament of Germany can be gauged by the fact that 40,000 railway wagons are not available as they are blocked by destroyed bridges. The number of locos. is sufficient to meet restricted requirements, and railway services are gradually being extended; three bridges are now available over the Rhine. Road and air services are extremely hard pressed because of the shortage of railway facilities.

THE first instalment of this article, published in last week's issue of "Flight," gave a general review of conditions in Germany and briefly sketched the administrative set-up under the Allied Control Commission. It then went on to detail some of the chief facts gleaned by the author from officials of the Military Government on the country's present position in regard to supplies of various industrial essentials.

The earlier phases of the itinerary were followed, and the activities, past and present, of such organisations as the B.M.W. concern and the Hermann Göring Institute were described.

Coal production has grown to approximately 100,000 tons a day.

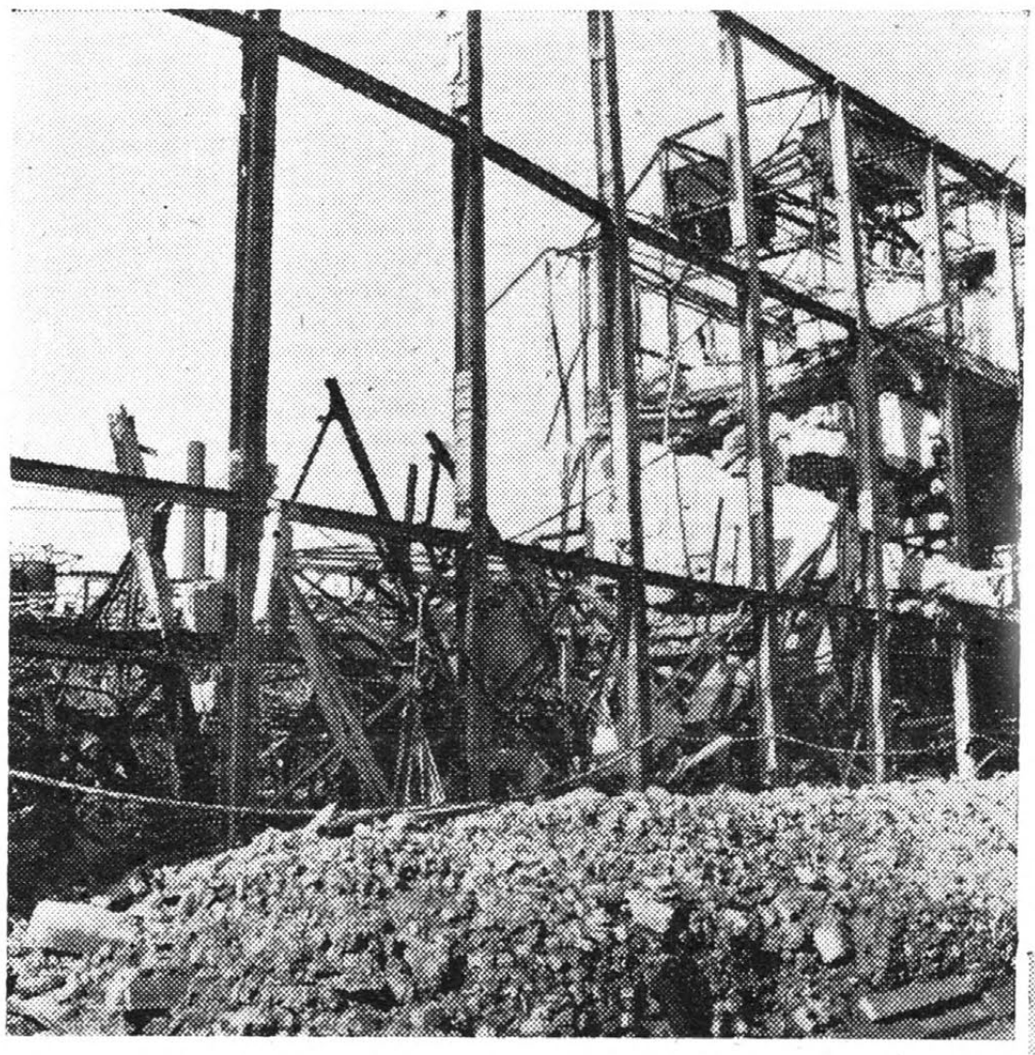
We entered the American zone at Frankfurt by Avro Anson, lunching in the huge offices of the I.G. Farben Industries, now U.S. headquarters, which only one bomb had disturbed. We jeeped uncomfortably to Wiesbaden. Our hotel was not too bright—no towels, no hot water, no bed clothes, no glass in the windows, no service; but, after all, there was no charge!

IN GERMANY TO-DAY (Continued)

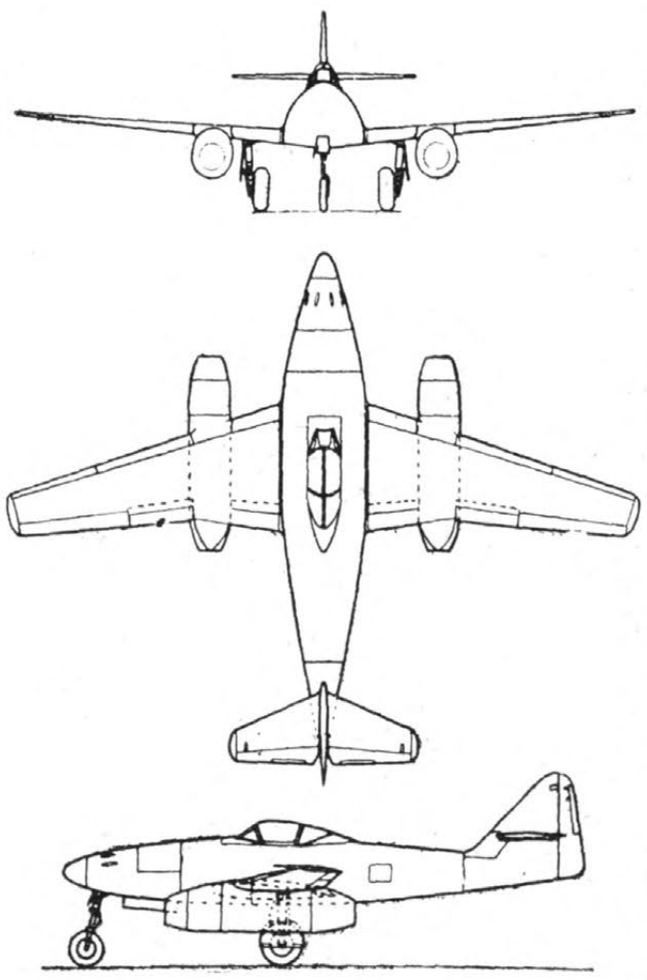
Many Road Deviations Necessary

From this point we progressed to Worms, Speyer and Landau, over execrable bomb-damaged roads skirting the French zone. Crossing the solitary pontoon bridge hereabouts over the Rhine we enjoyed free beer with the U.S. troops at Karlsruhe. *En route* to Stuttgart we were frequently on and off the *Autobahn,* damage to bridges being the cause of the deviations. We stayed at the once-splendid Graf Zeppelin hotel, now badly damaged, but the section that remains is comfortable. We noted the King of Wurtemburg's palace in ruins from a raid on the city in July, 1944. Scores of porcelain enamel tiles of striking design lay among the rubble. Onward to Ulm and Augsburg we heard frequent groans from the rear seat of the jeep as we bounced over *pavé* and hastily filled shell craters. We encountered several long lines of lorries crammed to capacity with happy 8th Army men on leave, practically the only cheery souls we encountered. At Augsburg we talked with the engineers of the damaged M.A.N. Diesel Works—but that is another story. At Munich particular difficulty was experienced in finding our quarters—all normal direction signs in towns and villages are lacking and street "corners" have mostly gone. The B.M.W. aircraft engine, car and motor cycle works proved particularly interesting, though little work is being done in the few shops remaining intact. Already the high-altitude test tunnel previously referred to is being put to good use by Britain, as we were able to see. A thick frost crustation appeared on the engine under test, as its power reading and consumption were recorded.

German activities in the production of turbine-jet-propelled service aircraft have previously been reviewed in articles in the June 14th and September 13th issues of *Flight.* In addition, much that was revolutionary was on the way, including high-powered turbines driving airscrews. Endurance, largely due to the lack of time in developing suitable heat-resisting materials, was the main weakness of German turbines, which are complicated in design. Hollow turbine blades of sheet steel were adopted only because of the time factor in evolving suitable material to withstand the extremely high temperatures. As a result German jet aircraft were extremely fast but required constant overhaul—about 25 hours was the average "life." I counted 22 replaced blades in a single B.M.W. turbine wheel. The Junkers



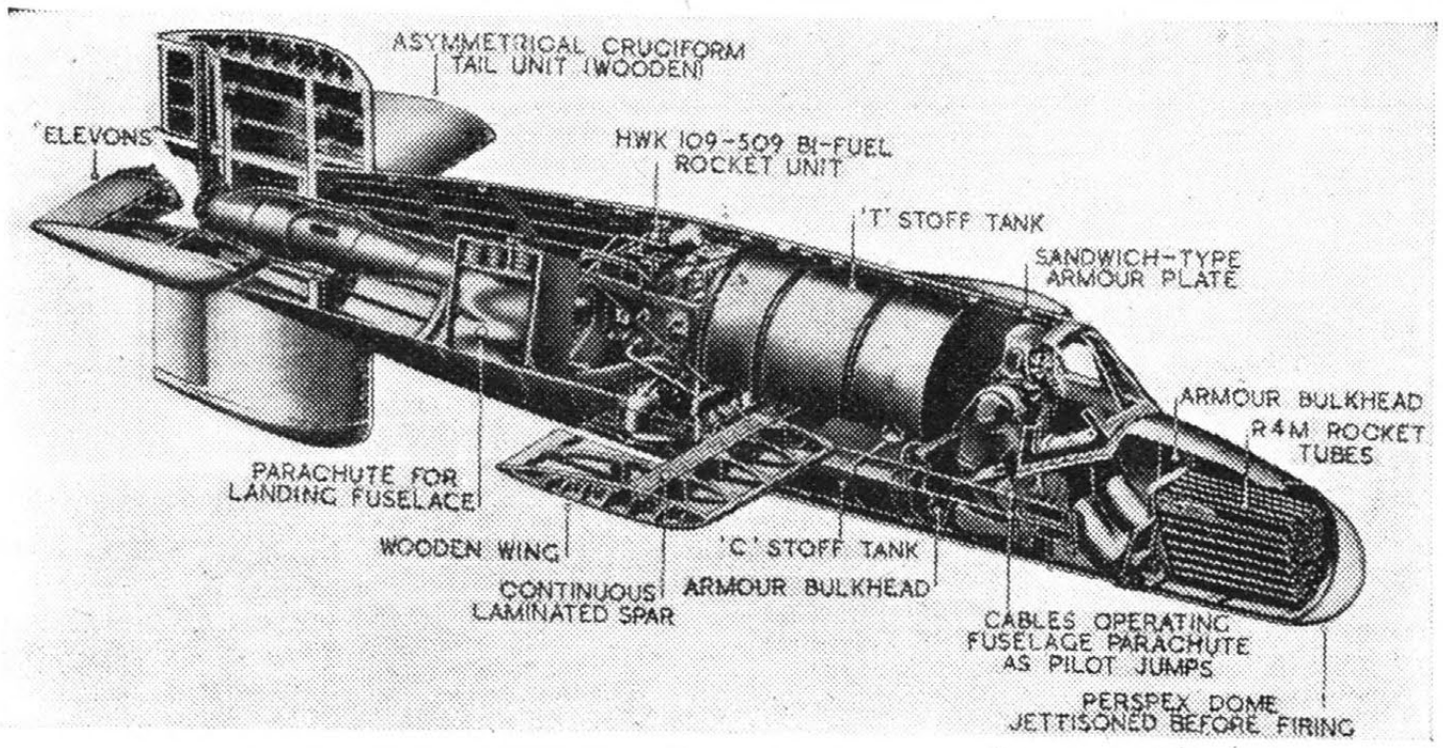
A corner of the huge Krupp works at Essen as it is to-day.



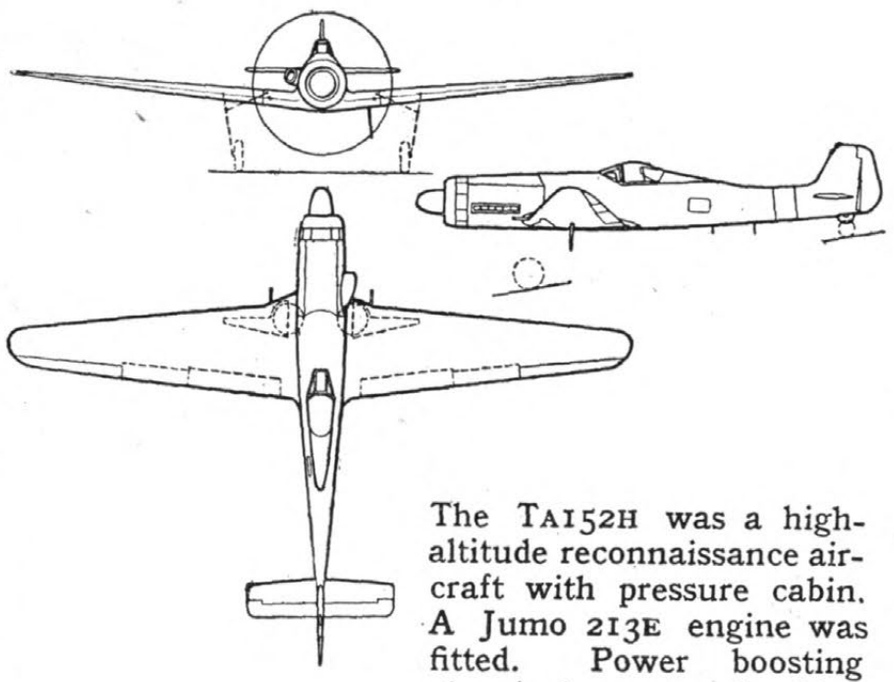
(Above) Three-view general arrangement drawing of the jet-propelled Me 262. Span 41ft., length 34ft. 9in. (Left) About to embark on a U.S. Dakota troop transport at Munich for the flight to Paris.

unit also had austenitic steel hollow blades for the turbine. In each case the multi-stage compressors were fitted with duralumin blades. It was reported to me that certain German axial flow turbine-compressors tended to stall, and cut out altogether, due to instability of combustion. A number of aircraft have been lost from this cause. Most of them were of the 10,000 r.p.m. order. The HE/Hirth, of 2,860 lb. thrust, was the most powerful turbine, but it was not ready for service. Only twenty had been produced.

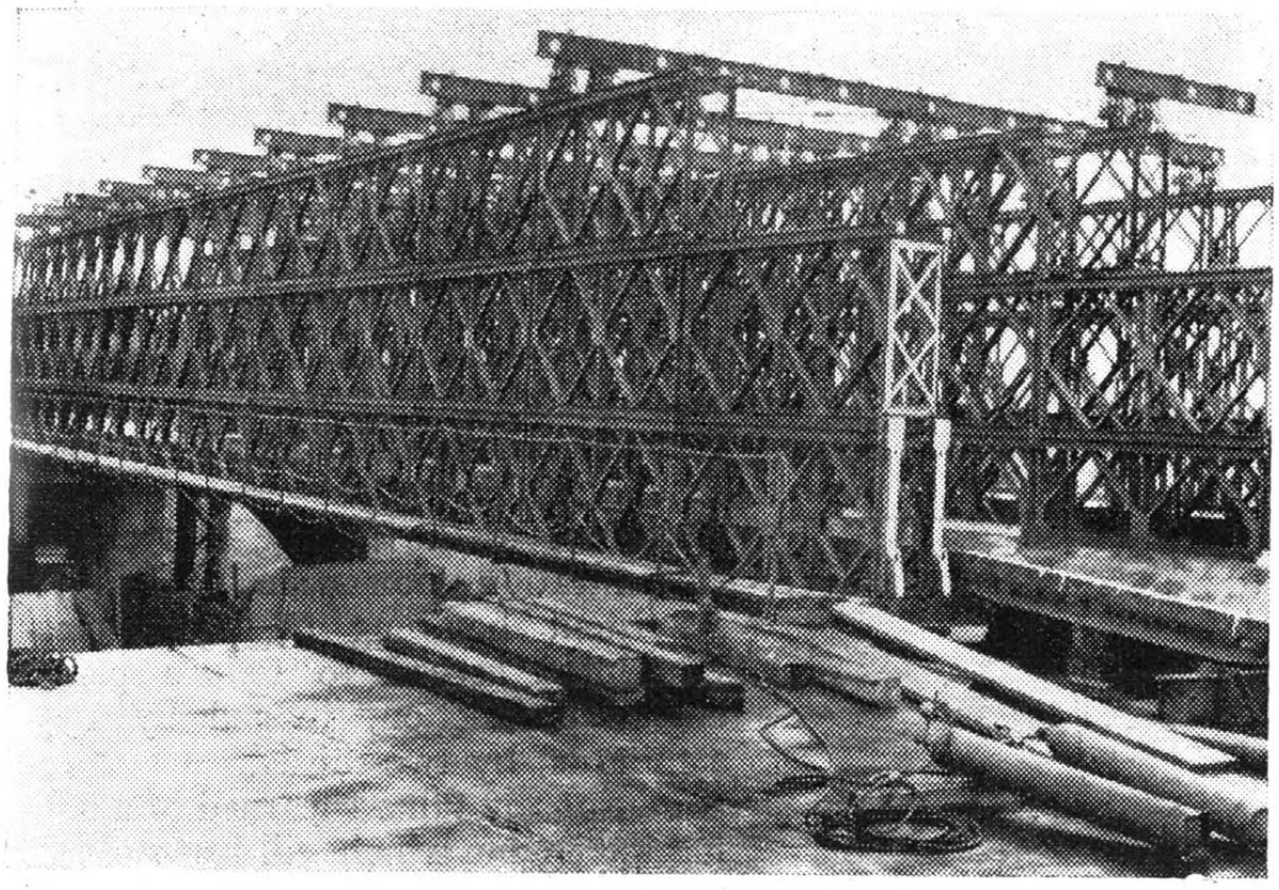
Projected types of turbines and those under development were to be far more powerful. One B.M.W., for example, had a 12-stage axial flow compressor, an annular combustion chamber and a three-stage turbine, not unlike the design envisaged in my book, "Gas Turbines and Jet Propulsion for Aircraft," two years ago. It was hoped to attain 7,500 lb. static thrust. Brown Boveri were developing a closed circuit turbo unit. Junkers, too, had a unit of some 6,000 lb. thrust on the way, with a weight of 4,400 lb. and also a turbine unit driving contra-rotating airscrews. B.M.W. likewise adopted airscrew drive for one of its latest turbo-units. Some notable experiments had been started on ceramic turbine blades—an extremely important development which should be continued.



The Natter was a rocket-propelled interceptor intended for attack on bomber formations. The rockets in front formed the missiles.



The TA152H was a high-altitude reconnaissance aircraft with pressure cabin. A Jumo 213E engine was fitted. Power boosting chemicals were used, which gave a maximum speed of 472 m.p.h. at 41,000ft.



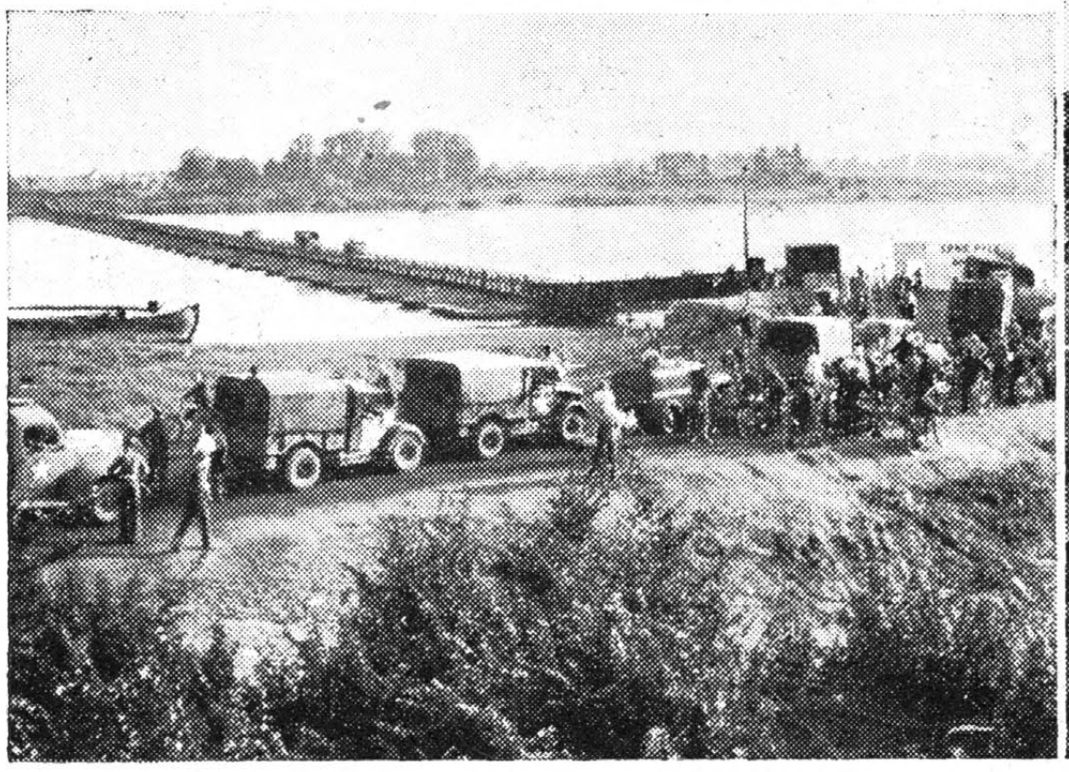
The ingenious British Bailey bridge has proved of enormous value in restoring communications. This is a 3-tier type on the Autobahn near Bielefeld.

A glimpse of the Maschinenfabrik Deutschland, typical of Ruhr factory devastation.

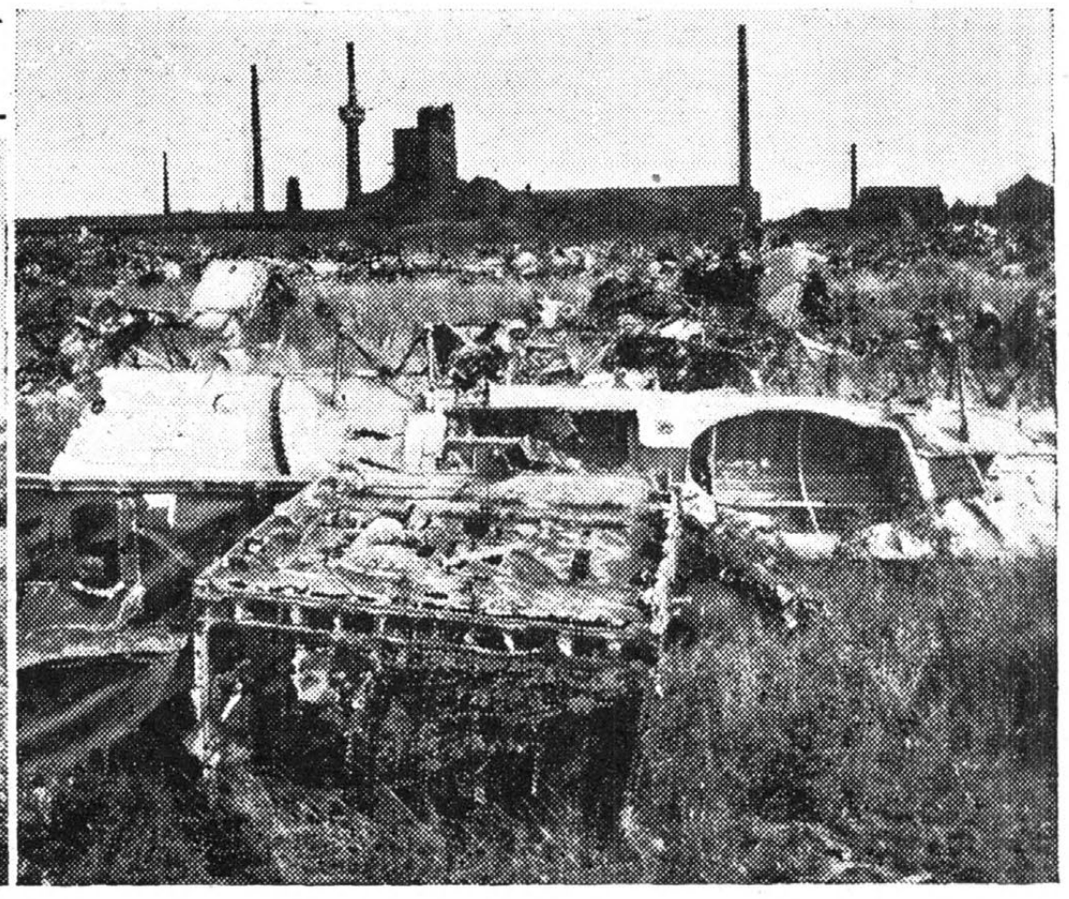
Rockets and Jet Helicopters

Possibly it was in rocket propulsion that the German technicians showed the greatest advances. The consumption of fuel was phenomenal and the range short, but the speeds were extremely high—up to 600 m.p.h. The HWK2509 unit installed in the Me 163B weighs only 365 lb. and develops a thrust of 3,300 lb. Fuel consumption exceeds 1,000 lb. per minute, but the unit can be throttled back to give a maximum thrust of 220 lb. To increase range, the pilots resorted to gliding between high-altitude speed bursts. Looking ahead, a

IN GERMANY TO-DAY



A single-line pontoon bridge leads to Düsseldorf.

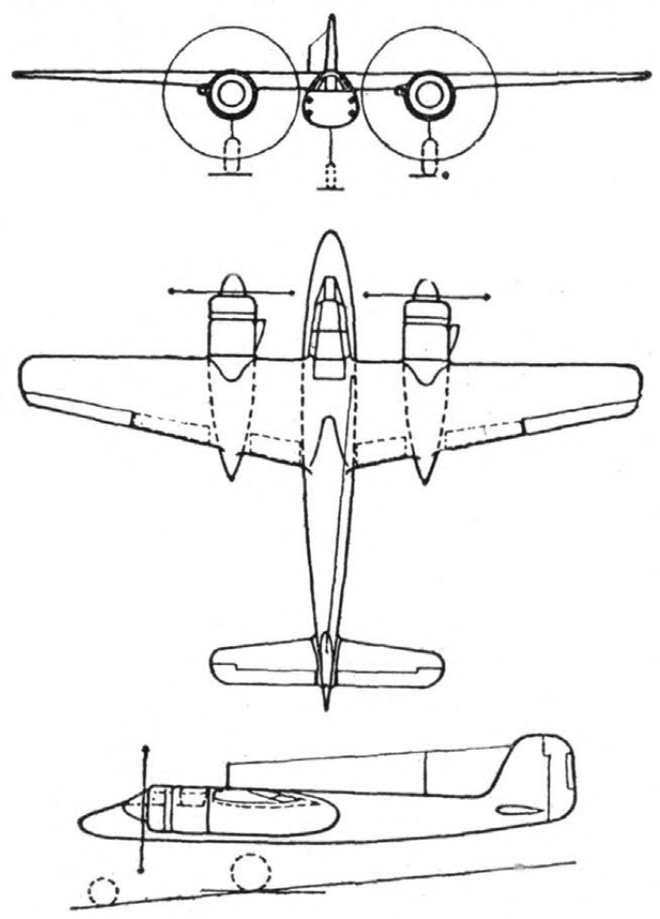


An immense dump of damaged aircraft adjoining the aluminium plant at Grevenbrücke.

German scientist estimated that mails from Europe to America can be delivered by rocket in 25 minutes.

A development of particular interest is a small helicopter with a jet-actuated rotor. The aircraft has an all-up weight of only 1,400 lb. An engine of 135 h.p. drives an ordinary centrifugal supercharger which delivers a petrol vapour mixture through the hollow rotor blades to burners at the tips. The burnt gas is ejected through tangential nozzles causing the rotor blades to rotate by reaction. Other helicopters under development included an FA 284 with two B.M.W. 801 engines, all-up weight 33,000 lb., and an FA 282 as a small observation helicopter. Its engine of 150 h.p. drove two rotors mounted with the axes close together and turning in opposite directions.

Another remarkable and unique "find" is a most complicated Zeiss stereoplanagraph for photogrammetry. This term embraces the art of constructing maps from aerial photographs, performs all its own corrections during the process and enables rapid and mathematically correct results. Its possibilities for town planning in peacetime are obvious.



The TA 154 bad weather and short-range night fighter. First produced in 1943. Length 41ft. 3in. Span 52ft. 6in. Height 12ft.

A Novel Twin-engined Fighter

Of several notable fighters under development, possibly the Do 335 was the most remarkable. It had a 1,900 h.p. D.B. 603 engine in the nose driving a tractor airscrew and a similar engine in the tail of the fuselage driving a pusher propeller. Its speed was over 470 m.p.h. There was a project for installing a turbo-jet unit in place of the rear engine.

Another larger type of missile under development in Germany, the BP20 *Natter* (Viper) carried a pilot to control its brief course during the final stages of an attack on bomber formations, and provision was made for the pilot of this interceptor to bale out by parachute. The initial flight was to be directed from radar detectors.

Still another missile to protect ground targets was a Heinkel rocket with wings. It was just on the point of production at the German collapse. Clearly our persistent bombing attacks were seriously disturbing to the enemy, and caused concentration upon means of defence. Persistent bombing of communications had served to reduce piston engine production, judged by 1943 standards, by two-thirds.

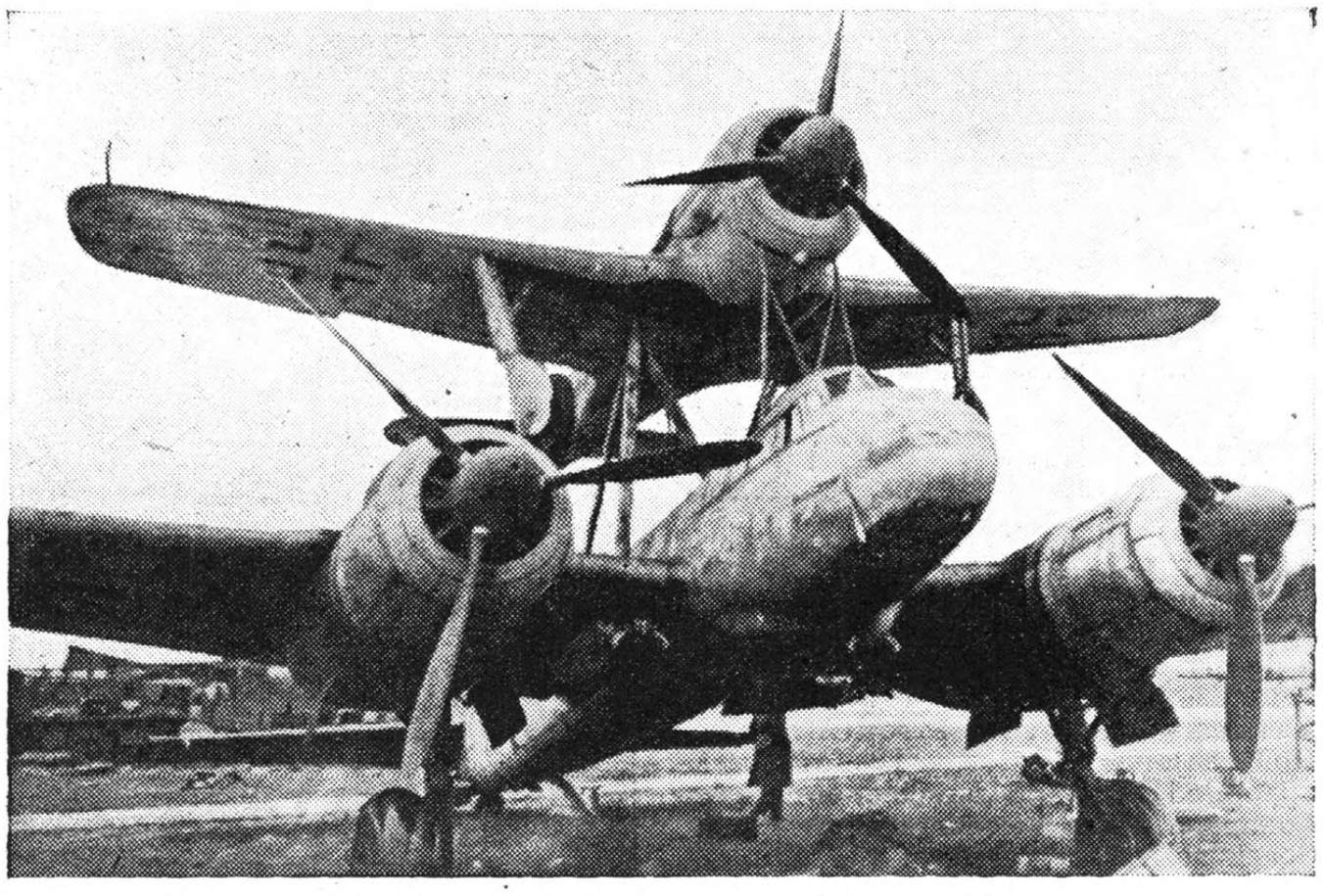
During my talks I learned of a submarine engine which will run successfully under water. It is a closed-circuit type, that is, the exhaust gases are reused. It is necessary to introduce a small amount of oxygen, and push a little of the exhaust into the water—that was the German technician's explanation of the engine he termed the Kreislauf. I have no doubt the Admiralty know all about it.

British and Allied technicians in their investigations have unearthed much equipment of this character and are making a special study and detailed reports with the assistance of German technicians. There is no denying that technical progress in Germany was most marked, and enormous strides had been made in the perfection of diabolical controlled missiles, mostly rocket-propelled, for use from ground to air and air to air. Fortunately the Allies were always a jump ahead and the essential thing is that we won the war. Allied day and night bombing and the destruction of communications prevented, just in time, the final use of the later German weapons.

German progress with atomic bombs seems to have been effectively checked by the daring British-Norwegian Commando raid on the heavy-water plant at Vermork.

In armament and radar, Air Chief Marshal Sir Sholto Douglas told the writer in a general discussion at his headquarters at Buckaburg that unquestionably we were ahead. The captured liquid-rocket types, the Air Commander-in-Chief of the Air Force of Occupation regarded as too risky to flying personnel and they were being used only for special tests. In normal piston engine fighters, fighter-bombers and bombers, Britain and the Allies for

years past were in the ascendancy. Our piston engines were always on the top line. The Fw 190 and the various bomber types were not really a success, he added. But in the opinion of British technicians with whom we discussed the subject, Germany was more advanced in the production of turbine jet-propelled aircraft, not only in designs but in quantity also. Three thousand per month were reported to be in production. Jet propulsion was very attractive to the Germans because of the speed of manufacture, and therefore it received high priority; but the machines were more complicated than British designs, heavier and relatively less efficient. Jet fighters of the 600 m.p.h. class were in prototype form. Day fighters, night fighters, and even a couple of four-engined bombers were turbine-equipped, though latterly German energies were diverted from bombers to means of defence. In rocket-assisted take-off Germany evolved many novel designs revolutionary in performance; but their life was brief.



The Fw 190/Ju 88 composite aircraft. The Ju 88 was flown under the control of the Fw 190 and released over the target. In the Ju 88 was a heavy load of explosive and the aircraft became, in effect, a guided bomb.

In most applications of jet propulsion, materials of suitable quality, denied to them by reason of constant bombing and the urgency of the deteriorating situation, would have provided much improved results. They were forced to utilise hollow turbine blades of sheet metal, for example, save for the Schmidt turbine, which had water-cooled blades. Panic decisions by Nazi leaders led to frequent changes in leading personnel and their production plans, which seriously handicapped German output. "Hitler was our best ally" is a good method of describing the final phases of the war, after studying the ever-changing Nazi plans which hampered production. Co-ordination and strong direction was completely lacking, and high Nazi officials frequently over-ruled the judgment of experienced technicians.

By contrast, this country pursued a definite policy without deviation or interruption, and scored thereby. This did not prevent desirable modifications and up-to-the-minute changes dictated by experience to ensure the finest aircraft for Service use. The biggest German factories were gradually driven underground by persistent bombing, but curiously this was not a bar to production as it was found that due to more settled mentality, even temperature and better conditions generally, more work was achieved. Metal stocks were large. The largest underground factory was at Nordhausen, Saxony, now in the Russian zone. Here in a tunnel over a mile in length, with shafts on either side, some 30,000 workers—Russians, French, Italian, Poles and Germans—were employed on V1 and V2 weapons and Ju and B.M.W. turbine jets. The output of V2s was 900 per month. Twenty-five thousand machine tools were used in the factory, which had no lifts; it is possible to drive straight in like entering a railway tunnel.

But never again will such diabolical weapons leave these factories and tunnels. The combined fighting forces of the Allied Nations have rendered their account. Butter, not guns, will be Germany's cry for many years.

FUTURE OF ROLLS-ROYCE FACTORY

MR. ARTHUR WOODBURN, M.P., Parliamentary Secretary to the Ministry of Aircraft Production, recently visited the Rolls-Royce factory at Hillington, Glasgow, and entered into a full discussion with the management and workers on the question of redundancy. Mr. Woodburn said that the Government policy was to release workers from wartime production in order that they might be absorbed as speedily as possible into peacetime development.

Dealing with the suggestion that the Government should utilise Hillington for the production of peacetime goods, he said there was not time to wait until legislation gave such powers to the Government. It was essential that factory space should be available for enterprises with plans, preparations, and markets ready. The Government appreciated the fears of the West of Scotland arising from experiences in the black period between the wars, and was, therefore, designating Clydeside as a development area. This meant that private enterprise seeking to begin production would be diverted automatically to this area. So far as it was possible, the Government intended to give preference to industries likely to prove a permanent acquisition to Scotland.

Alarm was expressed by the workers at the apparently mounting figures of unemployment. Mr. Woodburn emphasised in his reply that it was important to distinguish between the registered figures of unemployed, representing workers absorbed into peacetime production in the space of a few days, and the figure of unemployed which referred to the pre-war period and was on a somewhat permanent basis.

The Ministry of Labour, he said, had given assurances that there was still an urgent demand for labour. A great part of our housing production was actually being held up for lack of the very skill that was being set free in Hillington.

R.A.F.'s WARTIME EXPANSION

FACTS and figures issued to-day graphically illustrate the tremendous growth of construction necessitated by R.A.F. expansion and the enormous burden of work thrown upon the Directorate-General of Works of the Air Ministry.

The total cost of meeting the U.S.A.A.F. works programme carried out by the Works Directorate amounted to more than £100,000,000. Total works expenditure (excluding maintenance) at home and abroad was, from 1939 to 1944, over £570,000,000. In 1942, the peak year, £145,000,000 was spent. The normal sum expended on Air Ministry works before 1935 ranged between £750,000 and £1,250,000.

Up to the end of March, 1945, a total of 430 airfields in use by the R.A.F. and U.S.A.A.F. in the U.K. had been provided with paved runways. The areas of paved runways, perimeter tracks and hardstandings totalled approximately 175,000,000 sq. yds., or 36,000 acres. This area is greater than that of all the land within the boundary of the city of Edinburgh (32,000 acres) and is the equivalent of a 30ft. wide road stretching for nearly 10,000 miles.

HERE AND THERE

Appointments

AIR VICE-MARSHAL SIR HARRY BROADHURST, who commanded a fighter group of the 2nd T.A.F. in the Normandy campaign and before then was commander of the Desert Air Force from Tripoli onwards, has now been appointed administration chief of Fighter Command. Air Vice-Marshal C. B. S. Spackman, who served in the 1914-18 war, has been appointed A.O.C. No. 19 Group, Coastal Command, R.A.F.

Congratulations

MR. WAYNE W. PARRISH, editor of our contemporary, *American Aviation*, has won first place in the magazine section of the annual aviation writing and photographic competition run by Transcontinental and Western Air Inc.

He was chosen as the winner for his weekly column in *Liberty Magazine*, and was also the winner in this section last year.

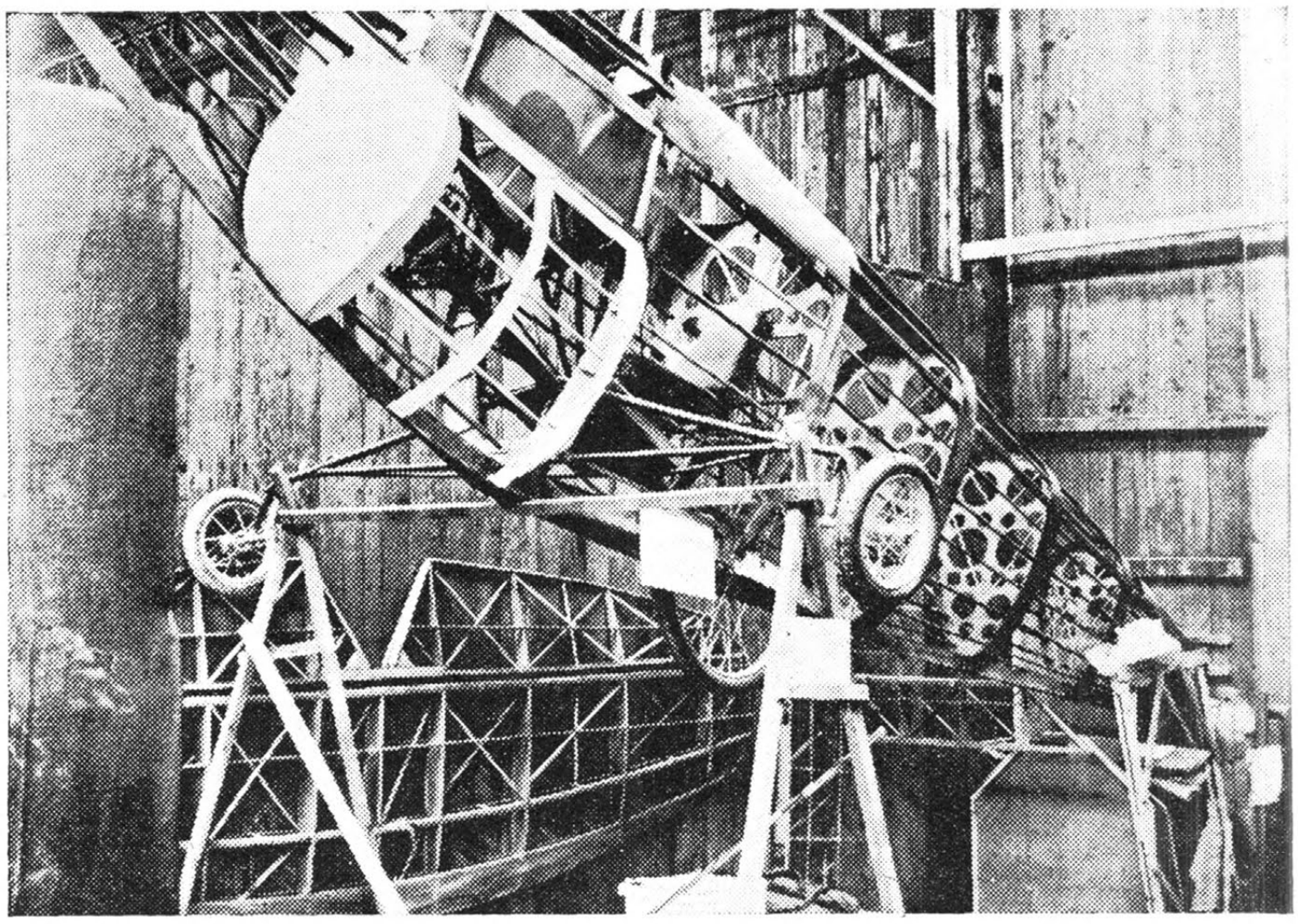
The prize is a commemorative plaque and a cheque for $250.

Nice work, Mr. P., and here's wishing you luck in pulling off "the hat trick" with another first next year.

U.S. Carrier Strength

IF resolutions recently brought before Congress are implemented—which is probable—the U.S. Navy will have a peacetime carrier strength of three large aircraft carriers (42,000 tons), 24 aircraft carriers (27,000 tons), ten light aircraft carriers (11,000 tons), and 79 escort carriers.

The only change from the present carrier strength of the U.S. Navy shown in these figures is a reduction of three in the 27,000-ton class.



STILL THEY COME: Attempts to evolve an aircraft operated by pedalling gear almost date back to Icarus. This "bikeplane" is among the novel inventions shown at the Paris Fair recently. No performance figures have been released for publication!

Record Parachute Drop

A RECORD "delayed" drop from 42,000ft. by Maj. Vassili Romaniuk, the celebrated Russian parachutist, was reported from Moscow by Reuter last week.

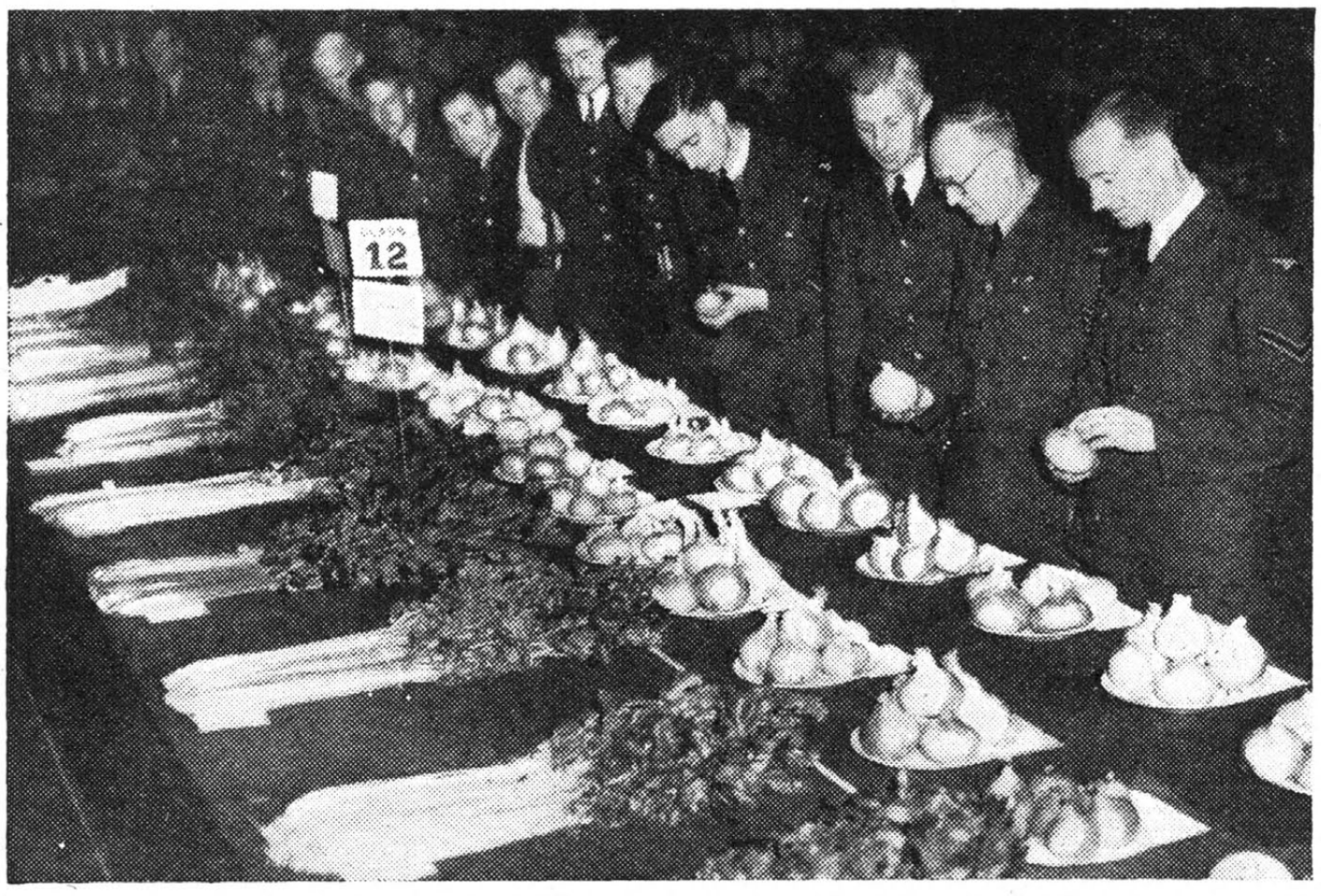
According to this report, the Soviet airman, clad in fur and equipped with recording instruments, delayed opening his 'chute for an interval of four minutes, during which he dropped to within 2,600ft. of the ground—a free fall of some 7½ miles! The recorded temperature at 42,000ft. was −53 deg. C.

One imagines that four minutes never seemed longer.

The Dove Takes Wing

THE prototype of the D.H. 104—the de Havilland Dove—was successfully test-flown for the first time last week.

The first brief description of this attractive post-war feeder-line type was published in *Flight*, April 12th, and was illustrated by two artists' drawings showing the Dove to be a particularly well-proportioned low-wing type powered by a pair of the new supercharged six-cylinder inverted air-cooled D.H. Gipsy Queen engines, and distinguished by wings of a high aspect-ratio, and a tricycle undercarriage. Three-bladed D.H. reversible-pitch c.s. airscrews are just one indication of the up-to-the-minute design of this all-de Havilland newcomer, which seats from eight to eleven passengers according to requirements in the way of toilet and baggage accommodation.



LACHRYMATORY LAY-OUT. A fine display of leeks and onions at the R.A.F.'s third fruit and vegetable show staged in the Royal Horticultural Society's Hall, Westminster. In 1944 food to the value of about £300,000 was grown on some 6,330 acres of "land surplus to Service requirements."

Pathfinders Forgather

MEMBERS of the Pathfinder Association met for the first time in their newly acquired premises at 115, Mount Street, London, W.1, one evening last week and were welcomed by their first president, Air Vice-Marshal D. C. T. Bennett, founder and commander of the famous Pathfinder Force until his recently announced retirement from the R.A.F. to take up a post in civil aviation.

The premises, which contain the Association's registered offices as well as providing a meeting place for its members, are at the Berkeley Square end of Mount Street (a point to remember when visiting them for the first time by bus or tube!) and have that friendly personal atmosphere which is so much better than

HERE AND THERE

mere sumptuousness. Soon all the usual amenities of a club will be provided here, and it is also hoped to open up similar facilities in the provinces.

A.V-M. Bennett, in his informal speech of welcome, stressed that the chief object of the Association was to continue into civil life that admirable spirit which had grown up in the Pathfinder Force during the war. Finding suitable jobs for demobbed members of the Force was also an important function and, although this was not always very easy these days, more than 100 had already been found.

The Association hopes ultimately to swell its membership to about 10,000.

Pistons Plus

ONE U.S. Navy Squadron is reported to be using a new fighter, the Ryan Fireball, powered by both jet and piston engines.

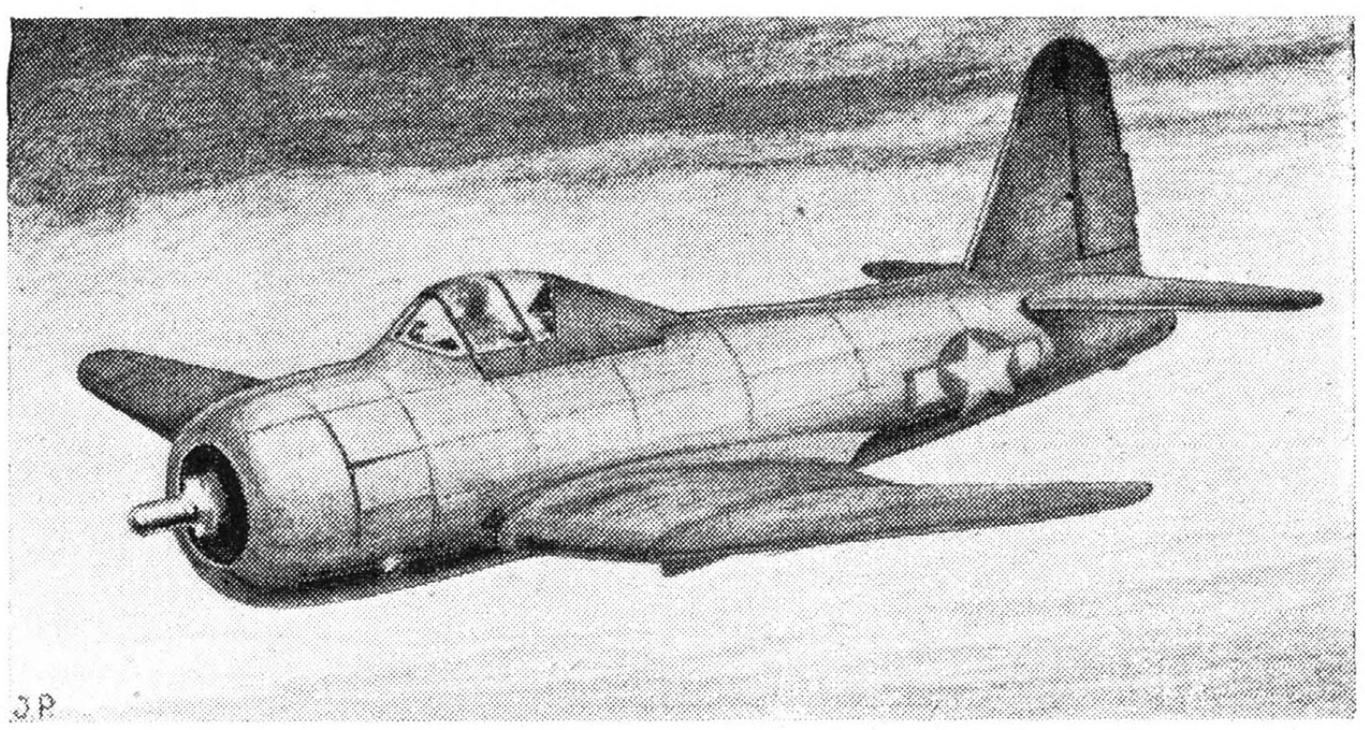
The Fireball has a 1,350 h.p. Wright Cyclone engine in the nose, and a thermal jet in the tail. The machine can fly on either form of power or use both together, the jet being really intended to give extra boost in combat. (See adjacent sketch.)

A.T.C. in Scotland

WING COMMANDER LORD MALCOLM DOUGLAS-HAMILTON, D.F.C., who was recently appointed Commandant of the A.T.C. in Scotland, carried out his first inspection of a cadet unit when he recently visited the 49th Squadron at Greenock.

He said that with the end of the war the A.T.C. had finished the first phase of its work. That phase was exceedingly well done, for the cadets served as a recruiting centre when men and more men were needed for air crews.

The next phase was the establishment of the A.T.C. on a permanent basis. So long as there were air services, both civil and military, said Lord Malcolm, the need for air crews would continue to exist, and boys were more likely to get into these services by joining the A.T.C.



RYAN FIREBALL : An artist's impression of the new U.S. Navy fighter, some details of which, recently released, are given in the adjoining column. It has both piston and jet power units.

News in Brief

GROUP CAPT. G. S. M. INSALL, V.C., who was appointed to the command of No. 3 R.A.F. Depot, Padgate, Lancs, in 1939, has retired from the Service at the age of fifty-one. He won his V.C. as a pilot in the 1914-18 war.

* * *

Air Chief Commandant Lady Walsh, Director of the W.A.A.F., who arrived in Karachi from England in a B.O.A.C. flying boat recently, has begun a month's tour of R.A.F. units in south-east Asia where W.A.A.F. personnel are employed.

* * *

Group Capt. J. Noakes, who thrilled the Hendon crowds in pre-war R.A.F. displays, has now joined Folland Aircraft, Ltd., at Hamble, Southampton.

* * *

Sir Frederick Handley Page is to deliver his presidential address to the Institute of Transport on Monday, October 8th. The meeting will be at 5.30 p.m. in the lecture theatre of the Institute of Electrical Engineers, Savoy Place, Victoria Embankment, W.C.2.

Sunderlands of the Indian Ocean Air Force have been converted into air ambulances each capable of accommodating twenty-five stretcher cases. They are engaged in evacuating sick ex-prisoners of war from Singapore direct to Ceylon, and make the 1,600 miles' ocean crossing between dawn and dusk. Medical orderlies travel on each flying boat.

* * *

Mr. Herbert L. Wyneken, A.S.A.A., A.C.W.A., has been appointed secretary and chief accountant to Edgar Allen and Co., Ltd., consequent upon the election of Mr. W. H. Higginbotham to the chairmanship of the company.

* * *

The sports activities of Guest, Keen and Nettlefold will be supervised by Messrs. Patsy Hendren and Bill Hitch, who have recently been appointed welfare officers at this firm's Midland and Cardiff factories respectively.

* * *

Dr. J. H. Chesters, of the United Steel Companies' central research department, has been awarded the degree of Doctor of Technical Science by the University of Sheffield for his outstanding researches in refractories. He is now engaged on work in the field of open-hearth furnace design.

* * *

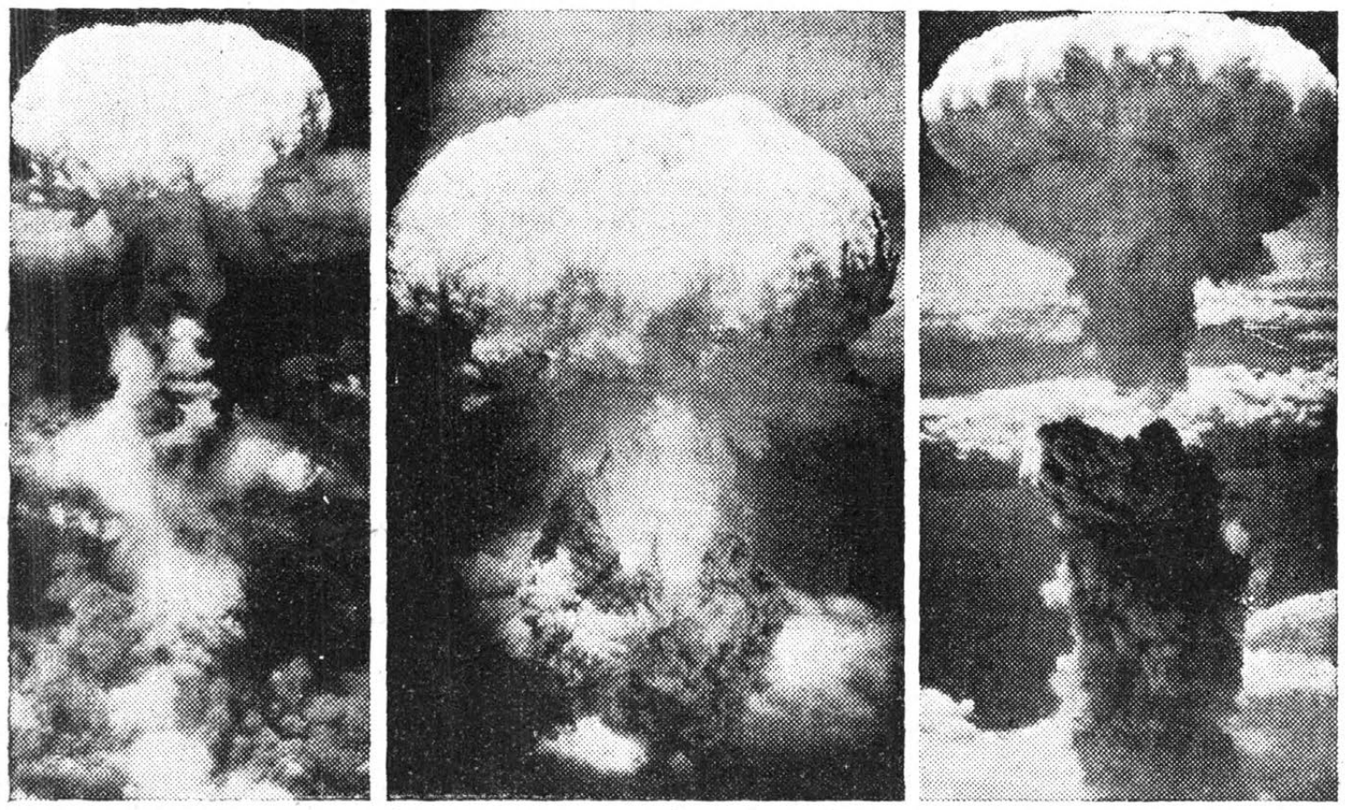
The first British aircraft to be sold to Chile for eight years are now on their way to Valparaiso. They are fifteen Miles Magisters.

* * *

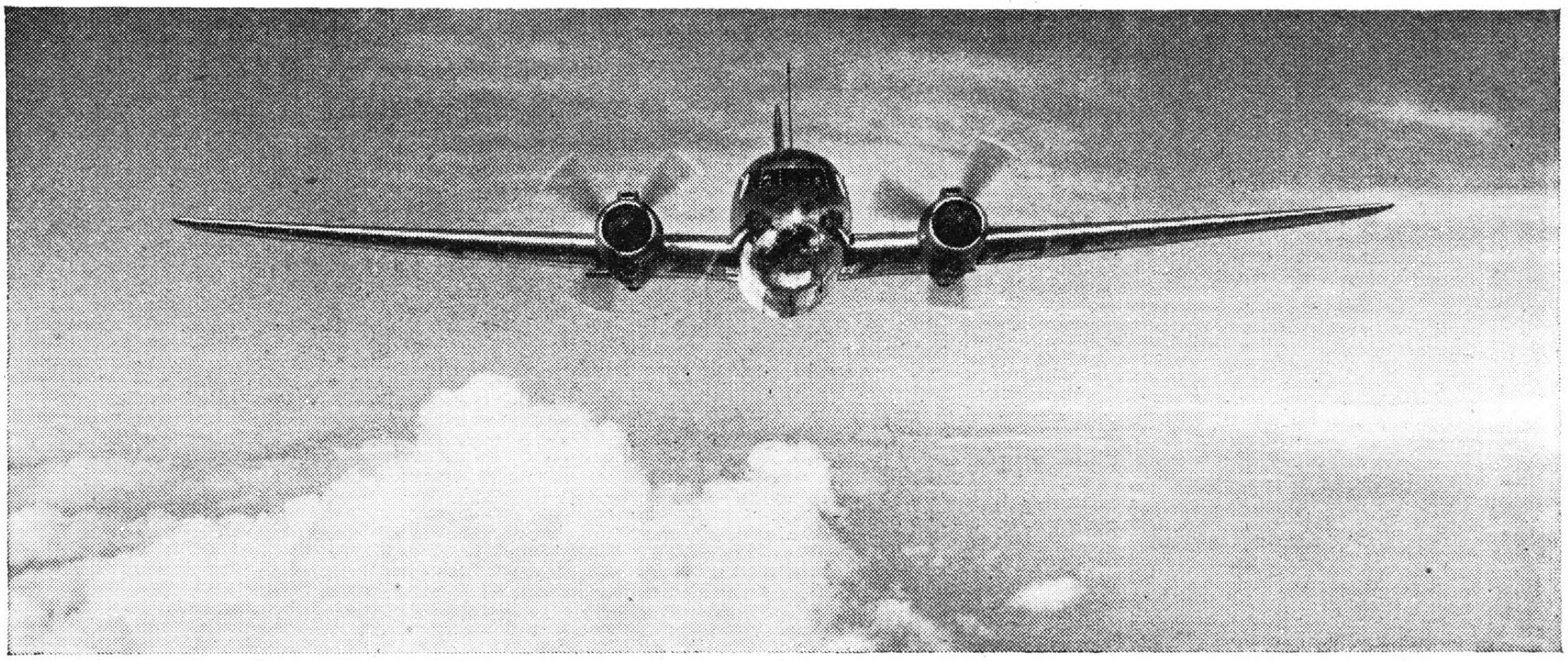
The War Savings Group of the Ford shadow factory at Manchester, where Merlin engines are produced, recently reached the £1,000,000 mark. The parent plant at Dagenham attained this distinction last year, and the total savings for the whole Ford group now approaches £2,750,000.

* * *

The aviation department of the Dunlop Rubber Co., Ltd., has been transferred from Birmingham to the firm's Coventry works, and will be under the control of Mr. J. Wright. Mr. H. E. Price, appointed manager of this division at the start of the war, remains at Fort Dunlop as sales manager of the equipment division.



THE FATAL HOUR : These three pictures were taken over Nagasaki, in the sequence shown from left to right, the first a few moments after the atom bomb was dropped and the other two at 20 min. intervals.



Vickers Viking

Remarkable Passenger Comfort Coupled with Economical Operation at High Speed in Latest Weybridge Production

By C. B. BAILEY-WATSON

IN the May 24th, 1945, issue of *Flight* a review of the Vickers Viking was given together with a special cut-away drawing, cabin plans, detail sketches and various tabulations of data. That some discrepancies may be found to exist between the latest figures and those given in May is due to the fact that in estimating the performance of this most attractive and very useful aircraft, Vickers erred on the side of pessimism, which, one must agree, is better than suggesting goals beyond factual attainment.

There is not very much point in reiterating a description of the aircraft, but having recently flown in it for about two and a half hours I must emphasise my original contention that the employment of a flexibly mounted wing places the machine in a class of its own. This innovation by Vickers (or some variant of it) seems likely to become general practice for, once having experienced the quietness and smoothness of a ride in the Viking, passengers will not willingly go back to rigidly attached wings, no matter how great a degree of alternative luxury is offered. This smoothness will not be particularly noticed as an outstanding feature to the casual air traveller, but to the person who flies regularly its impact is striking.

Further, the quality of interior appointment is very high; the seats are admirably comfortable and the interior finish is of a standard that exudes an air of quiet good taste coupled with a feeling of spacious ease. When this cradling in comfort is allied to an almost complete absence of vibration and a very low level of noise—one can converse in ordinary tones—then there is virtually no forward progress left in the quality of comfort which may be given. Development will, of course, go on, but it is pleasant to think that the optimum—for a given passenger volume—has been achieved as near as makes no matter.

It is really extraordinary that this aircraft was created in $7\frac{1}{2}$ months, from drawing board to first flight, and on the precedent of the Mosquito one is apt to think that the quicker a machine is evolved the better it is. Production of the Viking is already in hand, all the aircraft at present being destined for B.O.A.C. and R.A.F. Transport Command; however, when the scale of production is advanced, the aircraft will be available for export, and this should coincide roughly with autumn next year, whilst peak production at the end of 1946 is envisaged as between 25 and 30 aircraft per month. The first 20 aircraft now being constructed are to be equipped with fabric-covered wings, tailplane and fin, but succeeding machines will be of normal stressed-skin construction throughout—that is, with the exception of control surfaces, which will remain fabric-covered.

Aerodynamic Efficiency

No matter how attractive a new aircraft may be æsthetically the criterion of its future is naturally its ability to earn money for the operators who employ it. The æsthetic appeal of the Viking both externally and internally is great but, more important still, its appeal economically is even greater. The maximum cruising speed at 10,000ft. is 252 m.p.h. for a power expenditure of 2,080 h.p. which, allowing for an airscrew efficiency of 80 per cent., gives a thrust of 2,468 lb. This, allied to an all-up weight of 33,500 lb., produces a lift-drag ratio of 13.56; for a mean weight of 31,600 lb. the L/D is 12.8. Alternatively, cruising at 210 m.p.h. with 1,500 h.p. the

TABLE I.—Assumed approximate operating costs.
247 m.p.h. B–B — annual flying time of 2,527 hours — 1,000 miles S.A.R.

Item.	Per hour.	Per A/C mile.
	£	d.
Crew salaries per aircraft	1.998	1.943
Depreciation	1.979	1.921
Insurance—A/C	1.584	1.540
Crew	0.099	0.096
Passengers and freight	0.297	0.289
Fuel—435 gall. at 2/- per gall.	10.074	10.043
Oil —20 gall. at 5/- per gall.	1.235	1.200
Tyres	0.438	0.426
Landing fees	0.432	0.410
Maintenance and renewals—A/C	0.792	0.771
Engines and airscrews	3.540	3.440
Other expenses	2.970	2.885
Totals	£25.438	24.964d

L/D at 33,500 is 14.85 and at 31,600 lb. is 14.02. Figures which bespeak an aerodynamic efficiency of an extremely high order.

A determination of the probable direct operating costs of the Viking is, I think, worth while. It is not easy since Vickers themselves are not prepared to state what the purchase price of the machine is likely to be, and one cannot cavil at this considering the unfortunate state of flux which obtains at present. Nevertheless at the risk of being quite mistaken, and purely for the purpose of evolving some sort of approximate operating cost, I hazard a guess that the figure may be somewhere about £40,000. This figure is, I believe, pessimistic, but equally is not beyond the bounds of future standards.

Normal Range

It would appear probable that the 1,000 miles still-air range might be the more representative field of work for the Viking, this embracing most of the Continent as well as being a norm for the majority of air routes in other parts of the world. Such being the case, it is felt that the adductions of cost are best made upon this basis.

For a still-air range of 1,000 miles and a cruising speed of 252 m.p.h., we may assume a block-to-block airspeed of 247 m.p.h., which produces a flight time of 4.05 hours for the 1,000-mile trip. If, then, we base our estimate of the machine's working life upon its doing one return trip per day, six days a week, we find that it flies 8.1 hr./day, 312 days/year, giving an annual flying time of 2,527 hours. Crew are assumed to work an average of six flying hours per day giving a yearly total of 1,650 hours and making 1.53 crews/aircraft/year. Salaries are taken as being: Captain, £1,500 p.a.; first officer, £1,000 p.a.; radio officer, £600 p.a.; and stewardess £200 p.a., this totalling £3,300, and resulting in a crew cost per aircraft per annum of £5,050.

PERFORMANCE.

Maximum W.M. cruising speed at 10,000ft. ..	252 m.p.h.
Cruising power/engine for 252 m.p.h.	1,040 h.p.
Recommended cruising power/engine	790 h.p.
Cruising power as proportion of m.e.t.o. power ..	51 per cent.
Cruising consumption	91 g.p.h.
Still-air range, 435 gall. fuel, 210 m.p.h.	1,000 miles.
Still-air range, 650 gall. fuel, 210 m.p.h.	1,500 miles.
Minimum cruising speed at 10,000ft.	160 m.p.h.
Take-off distance to clear 50ft.	850 yards.
Time to climb to 10,000ft.	8 min.
Service ceiling	25,000ft.
Total distance to stop with engine failure at T.O. ..	1,700 yd.
Landing distance from 50ft.	850 yd.

Depreciation is reckoned on a basis of 12½ per cent. per annum of the first cost and works out at £4,000, thus connoting that the normal life of the aircraft is eight years. Maintenance, repairs, etc., for the aircraft is assumed to cost £2,000 p.a., and for engines and airscrews every 400 hours to total £8,844 p.a. Insurance for the machine is based on an annual premium of 10 per cent. of the first cost and equals £4,000, whilst for the crew it is assumed to be £5 per cent. of salary and so totals £252.5 p.a.; additionally, for passengers and freight the overall premium is taken to be £750 p.a. Four sets of tyres are allowed for each year and £1,120 is set aside for them, whilst landing fees are assessed at 35s. per landing, totalling £1,092 p.a. In addition to these qualified assessments the sum of £7,500 a year is included for other expenses.

From the maker's tabulation of typical operational loadings for the de luxe version at 1,000 miles s.a.r., we derive the fuel load of 435 gall., and oil load of 20 gall., and pricing these respectively at 2s. and 5s. per gallon, we are able finally to construct a table of estimated operating costs as in Table I.

We have adduced the approximate direct operating cost of the Viking to be £25.438 per flying hour, and on the basis of the passenger and his personal luggage costing the same sum per pound weight as freight and mail, we can thus assess the payload cost per aircraft mile as being 0.0035d. per pound. At this figure the cost per passenger and baggage (225 lb.) is 0.8d. per aircraft mile, and that of mail and freight 7.95 pence per ton-mile. These figures are, of course, extremely low but, demonstrably, are not so low as to be impossible.

To carry the assumption to a logical end we should, of course, make allowance for the use

TABLE II—LOADINGS—21-Seat De Luxe Viking.

	lb.	lb.
Empty weight	23,158	
Flight crew (3) at 170 lb. each	510	
Stewardess at 130 lb. ..	130	
Crews' baggage at 25 lb. each	100	
Fuel—435 gall. at 7.2 lb./gall.	3,132	
Oil—20 gall. at 9.0 lb./gall.	180	27,210
Passengers (21) at 170 lb. each	3,570	
Passengers' baggage at 55 lb. each	1,155	
Freight and mail ..	2,300	payload: 7,025
Take-off weight ..	34,235 lb.	34,235 lb.

The discrepancy from the total weight of 33,500 lb. is due to the reduced amounts of fuel required relative to the original assessment.

The Vickers Viking is as graceful as it is economical. The return to a burnished silver surface is a joy after the dull-painted military types of the last six years.

WEIGHT PERCENTAGES.

21-Seat De Luxe Version	lb.	Per cent. Gross Wt.
Structure	10,637	32.0
Power plants	6,588	19.36
Fuel and oil supply ..	1,052	3.09
Power services	594	1.74
Furnishing, accommodation and fixed equipment ..	3,712	10.92
Fixed protection ..	180	0.52
Removable equipment ..	395	1.16
Empty weight ..	23,158	68.80

VICKERS VIKING

of the aircraft at below its full capacity, and if we assume the average payload factor to be somewhere in the region of 65 per cent., then the cost basis must be increased by 35 per cent. Again, we must allow the operator some margin of profit, and purely for the sake of fixing on some figure we might take the profit margin to be 10 per cent. Thus, to the basic standard we have to make an increase of 45 per cent., which, in actual fact, might prove to be 30, 50 or 60 per cent.; however, we will take the figure of 45 and re-cast the cost accordingly. The result is 11.13d. per ton mile, and 1.12d. per passenger mile.

Such a suggested operating cost level appears to be remarkably low, but unless some of the items are very inaccurately assessed, the results we have seen should serve as a rough guide. It is, of course, up to Vickers to ensure that the quality and performance of the Viking is as high as possible, and I firmly believe that they have achieved something quite out of the usual rut. Again, the operator must be prepared to forgo a leaning towards voraciousness if the sum the passenger or despatcher is called upon to pay is to be brought really low. Frequency of service is another powerful factor influencing operating costs.

To sum up, I must emphasise that the Viking is probably the most useful commercial aircraft in its class that we shall see for some years and one that may well take the vanguard position in the future march of British aviation.

After the "Cease Fire"

Disbanding the Luftwaffe : Feeding the Vanquished

By MAJOR F. A. de V. ROBERTSON, V.D.

SOME people may have imagined that once the "cease fire" had been sounded over Europe, the Royal Air Force would have nothing to do except evacuate prisoners of war and invalids and for the rest put in training as every unit has to do in peacetime. Such a view, if held, was certainly wrong. Ever since the fighting ended the R.A.F. has been exceedingly busy. Our prisoners of war in Europe were all brought back to England some time ago. The evacuation of sick must be a duty which never entirely ends, though now there are no more men being wounded.

The British Air Force of Occupation has so many other jobs to do, that it must have been quite a relief when the prisoners of war and wounded had all been dealt with. First and foremost among these jobs, the R.A.F. has been put in charge of all the personnel and *materiel* of the *Luftwaffe* in the British zone of occupation. The men of the G.A.F. (German Air Force, as official notices now prefer to style the *Luftwaffe*) cannot all be simply disbanded and turned loose upon the countryside. A good many have been discharged, and the figure amounted to 130,000 by the end of August. It is of primary importance that German agricultural workers should get back to the farms as quickly as possible. Germany has to feed herself so far as possible, for widespread famine might (and still may) cause epidemics, which would have serious results for the occupying troops as well as for the German people. The gathering in of the harvest was therefore a matter of the greatest urgency.

Hitler's aggression has brought such manifold disasters on all Europe that even humanitarians may well feel some satisfaction that Germans are now having to swallow some of their own medicine. But even criminals may excite some pity when their punishment reduces them to an excess of misery; and all Germans are not criminals. Mr. Geoffrey Smith, the Managing Editor of *Flight*, has recently made a tour of Germany, and his account has told stories of families wandering miserably along the roads in search of food and habitations, stories which must be admitted to be pitiable. From every point of view, the victor nations must do what they can to restore Germany to a reasonable condition of prosperity—though, of course, the peoples of Greece, Norway, Holland, and the other countries which the modern Huns overran and ruined deserve first consideration. Göring once said, in the days of German mastery, "If anybody goes hungry, it will not be the Germans." Now the position is just the opposite of that; but still we must try to feed the Germans reasonably.

So the G.A.F. men who were recruited in the British zone of occupation are being discharged to their home addresses, where they register as civilians. Those who were enlisted in the Russian zone are temporarily released on a sort of "ticket of leave" which requires them to report back to the British authorities when summoned.

Many G.A.F. men are still required to work for the R.A.F. For one thing many airfields need to be put in order again, and German gangs work on them under their own officers. The R.A.F. naturally occupy the huts while the Germans live in tents. The tents are more commodious than the bell pattern, which has housed so many British soldiers on manœuvres and active service, and which sometimes accommodated as many as 13 men per tent. The Germans are not nearly so tightly packed. The men seem apathetic but obey orders without demur. One of the parties of which I heard was commanded by a Colonel who was shrewdly suspected of having been mixed up in the bomb attempt on Hitler's life. The British naturally bear him no excessive ill will on that account.

Bomb Disposal

Another big job which the B.A.F.O. (British Air Force of Occupation) has to tackle is disposing of German aircraft and ammunition. The Germans are masters in the art of dispersal, and much hunting has to be done. No fewer than 600,000 tons of bombs have been found in the British zone of occupation, and of these 40,000 tons were gas bombs. We cannot use their bombs in our machines because the loading and fusing methods are different, so we have to destroy them. Sometimes they are blown up in dumps; sometimes they are thrown into the sea. It is a delicate and dangerous proceeding to withdraw the charges, and it is better not to attempt it, though the metal casings would be welcome to us as scrap. Phosphorous bombs are particularly hard to destroy. All the gas bombs go into the sea. For H.E. bombs we often drive shafts into a convenient hill, fill them up with bombs, and touch them off from a safe distance. In the largest operation of that sort 800 tons were stacked inside one hill.

Another and very different job which the B.A.F.O. has to undertake is the charge of *Luftwaffe* hospitals. German Army hospitals are the business of the R.A.M.C., and it works very harmoniously with the R.A.F. Medical Branch. Of course, the Allied Control Commission is over all, and would settle any matters in which arbitration was necessary. The R.A.F. has handed over 13 *Luftwaffe* hospitals to the R.A.M.C. Many have been retained for its own use, for it is recognised now that a medical officer is not just a doctor. The M.O.s of the R.A.F. have to make a special study of the effect of flying especially at great heights, on different constitutions, and knowledge on that subject is not normally necessary for an officer of the R.A.M.C. In days to come, when it may be fashionable for the rich of the United Kingdom to spend their week-ends in New Zealand, perhaps all general practitioners will need some expert knowledge of the effects of flying on aged dowagers.

THE LAST WORD in Spitfire design is embodied in the Mark XXI and XXII, making up this formation. Only visible difference in these Griffon-engined types is the Mark XXII's bubble canopy (nearest the camera).

Last of a Famous Line

Supermarine Spitfire Mark XXI and XXII

THE only fighter aircraft to be in continuous production for the R.A.F. throughout the war, the famous Spitfire, has now reached the end of its long line of type numbers with the Mark XXI and its variant, the Mark XXII.

Already in production when war was declared, the beloved "Spit" was being flown by the two Scottish Auxiliary Air Force squadrons—No. 602, City of Glasgow and No. 603, City of Edinburgh—whose pilots fought off the very first enemy aircraft to attack the British mainland; this was an attempt to bomb shipping in the Firth of Forth.

But it was in the Battle of Britain that the Spitfire proved its mettle alongside its equally gallant ally, the Hurricane.

As the war years went on new fighter names began to appear, but the Spitfire kept pace with every advance in technical development, so that it easily held its place in the front row. Mark followed mark in a mounting scale, and one began to speculate just how high the final figure would be—if one lived to see it reached! The improvement in performance and fighting quality since the first rash Jerry was downed over the Firth of Forth has been truly outstanding. Top speed, now over 450 m.p.h., has gone up by nearly 100 m.p.h., representing a 25 per cent. increase, the rate of climb has been doubled, and 11,000ft. has been added to the service ceiling; an achievement well worth recording.

A great deal of redesigning has been carried out on the Spitfire XXI. The fuselage has been strengthened and a new type of undercarriage fitted. The 2,050 h.p. Rolls-Royce Griffon 61 engine, with its five-bladed Rotol airscrew, has the benefit of twin radiators of sufficient size to permit the aircraft to operate in the tropics. The wing area has been slightly increased, and additional armour provided for the pilot's protection. Every effort has been made to reduce drag to a minimum, notably by the new engine cowling, a fairing flap for the undercarriage wheel-housing, a retractable tail wheel and a whip aerial. But in spite of the increased power and speed, this latest type of Spitfire retains all the old ease of handling which made the very first of the line so popular with its pilots. Increased range is obtained by the use of extra tanks carried in the wing's leading edge and behind the pilot, supplemented when required by drop tanks of various capacities. Armament consists of four 20 mm. cannon mounted in the wings.

The Mark XXII is essentially the same type as the Mark XXI, and differs only in having a bubble-type hood in place of the conventional Spitfire cabin-top, and a 24-volt electrical system instead of a 12-volt system.

Span	37ft. 1in.
Length	32ft. 8in.
Height	13ft. 6in.
Wing area	244 sq. ft.

Refuelling in Flight

A Possible Solution to Many Post-war Air Transport Problems

By C. H. LATIMER NEEDHAM
M.Sc.(Engineering), D.Sc.(Engineering), F.R.Ae.S., F.Z.S.

APPLICATIONS of the principle of transferring fuel from one aircraft to another during flight are numerous, but all can be grouped under two main functions:—

(a) Assisted take-off, as a means of getting heavily loaded aircraft into the air; and

(b) The extension of range: Obviously the range of aircraft may be made infinite if fuel is added in flight as required.

Both aspects are of the utmost importance, but the greatest benefits will accrue by the employment of a combination of both.

The flight-refuelled transatlantic service, provided by Imperial Airways in 1939 with the Empire type flying boats, marked the first occasion on which refuelling in flight was exploited for the purpose of assisted take-off. Wing loadings, however, are still on the upgrade with the consequence that a continued increase in the length of take-off distance is required, and thus more and more airfield space is demanded. There are those who claim that, so long as sufficiently lengthy runways are provided, the question of wing loading is of little consequence; but the time must come when accidents during the take-off of large passenger airliners will assume such serious proportions that attention *must* be directed towards the problem of assisted take-off.

Even to-day the weight carried per square foot of wing area on certain American aircraft attracts the notice of the more thoughtful members of our aircraft industry. In some instances the wing loading is more than 80 lb. per square foot. For example, the Boeing 377 Stratocruiser is credited with a wing loading of 75 lb. per sq. ft., which enables the extraordinarily high cruising speed of 340 m.p.h. to be obtained, but this can only be achieved at the expense of take-off and climb performance, and it may well be that some form of assisted take-off will prove essential.

Apart from the question of hazards it is perhaps not fully realised how great is the wear and tear on engines, undercarriages, and, in fact, the whole structure of an aircraft due to taking off in a heavily loaded condition. Here it may be noted in passing that by far the greater portion of the wear on engines and airframe takes place during landing, take-off and climb, and, by flight refuelling, the saving brought about in the elimination of each landing, due to the prolongation of engine and airframe life, maintenance, reduction of hazards and insurance premiums, can be shown to be considerable.

IN our issue of August 23rd, 1945, we published an illustrated description of Sir Alan Cobham's system of refuelling in the air. In the present article, the author of which is the chief engineer of Flight Refuelling, Ltd., certain operational and economic aspects are dealt with.

That refuelling in the air has a great contribution to make in future long-distance air transport appears obvious.

In the case of flying boats, if they are to keep up with landplanes as regards cruising performance and, therefore, make use of correspondingly high wing-loadings, assisted take-off may be of still greater importance on account of the high water resistance to which the hull is subjected.

Also to be considered is the contingency that may be brought about on the occasions when large airliners may be forced to alight at airfields other than those which have been specially prepared to accept trans-ocean types, or when it may be particularly desirable for them to land at airfields with relatively short runways. In the case of military aircraft, the addition of most of the fuel after take-off enables heavy bomb loads to be lifted from small, hastily constructed airfields.

In concluding this section it may be stated that flight refuelling offers the most advantageous form of assisted take-off on account of its flexibility, ease of operation and cheapness.

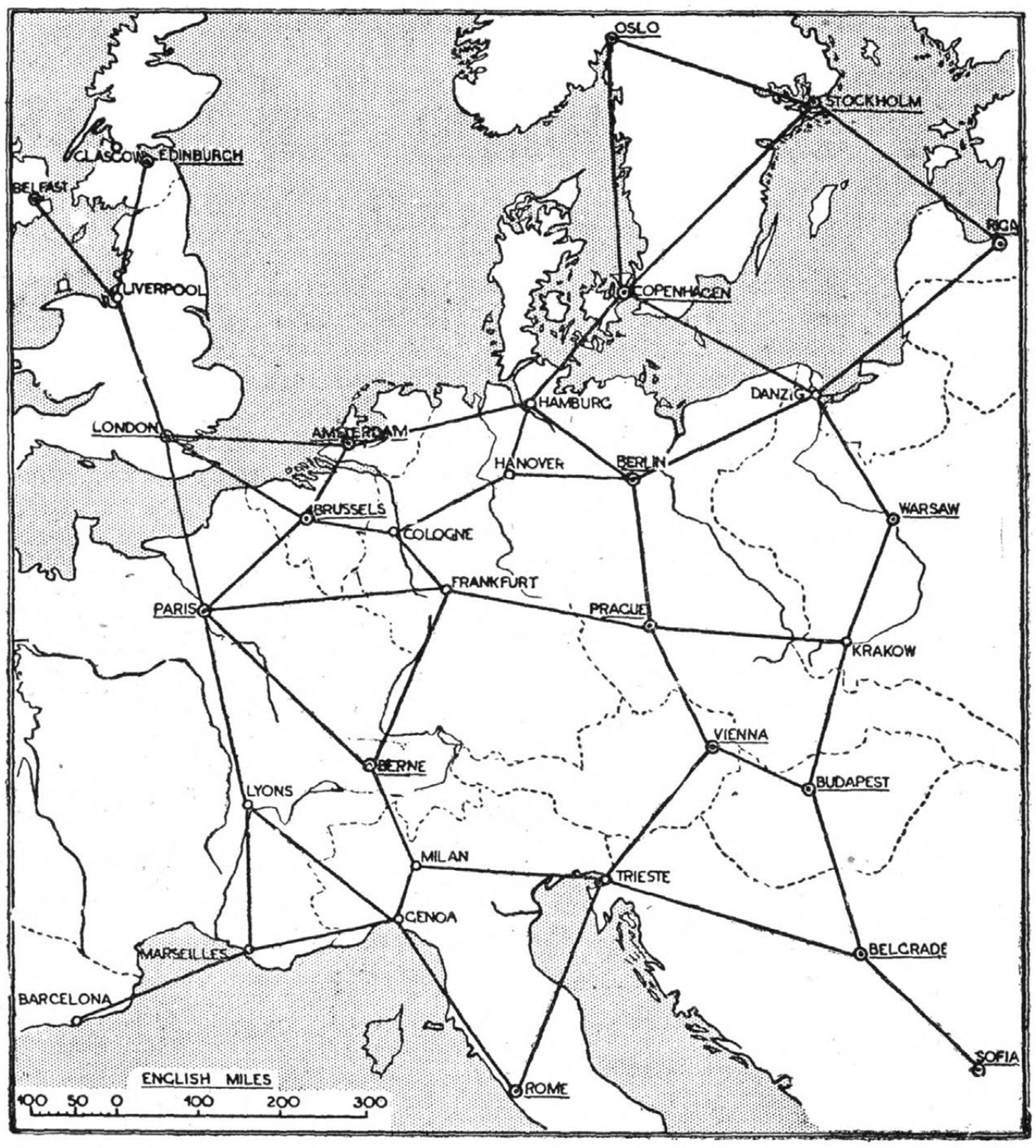


Fig. 1. This map of Europe illustrates the relative shortness of the various distances between capitals and primary cities.

The Long Non-stop Flight Problem

Our thoughts are being turned to-day towards long-distance air transport. During the inter-war period, before the aerial conquest of the Atlantic, we were concerned mainly with relatively short distances such as the routes connecting the capital cities of Europe. A glance at Fig. 1 shows how short are the distances between capital and capital. For example, the distance from London to Paris is only 215 miles, but the air line takes the place of the train-ship-train service with great saving of both time and

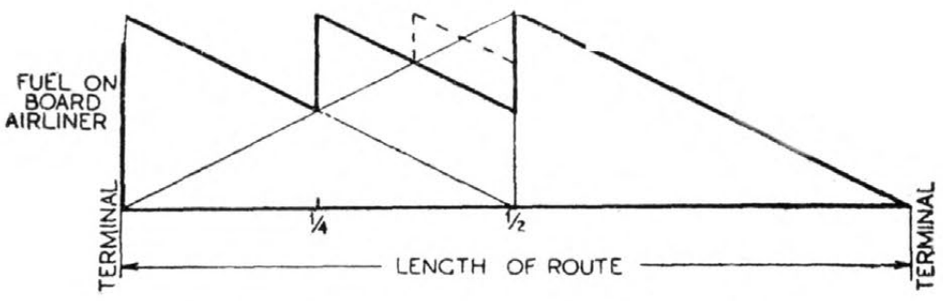


Fig. 2. Diagram showing that the optimum point of all refuellings should take place within the second quarter of the route distance.

trouble, and the fare can be kept surprisingly low.

But when we come to really long distances, and in particular long-distance non-stop flights, we are presented with a very different picture. It is fairly safe to say that a non-stop flight from London to New York, without refuelling in flight, will not be an economic proposition for several years to come, because the payload must be such a small proportion of the total weight. No doubt some non-stop air expresses will be run, but such services will, to some extent, be for a few wealthy passengers prepared to pay the very high fares required, or the fare may be kept to a reasonable figure by means of subsidisation in some form or other.

By landing in Ireland and Newfoundland, or in the Azores and Newfoundland, or the Azores and Bermuda in order to avoid the poor atmospheric conditions generally associated with Newfoundland, a very considerable reduction in fares will result. The cost of the through non-stop service will almost certainly be nearly double that of a service with one or two intermediate landings.

A Cold Douche

Major R. H. Mayo states*: "When we turn to the longer-haul service stretching across the world we find, unfortunately, a very different picture . . . and the fare-load factor table is not pleasant reading," and again, "For a service such as a direct London-New York service with a stage length of nearly 3,500 miles, the payload capacity will be such a small percentage of the all-up weight that expenditure per capacity ton-mile will soar up to a much higher level."

The realisation of the fact that fares must be very high for long non-stop flights comes as a cold water douche to many air transport enthusiasts to-day, and it is extremely doubtful whether the problem can be solved by any reasonably practical solution other than refuelling in flight.

Any short or medium-range aircraft can easily be converted for long-range work by means of flight refuelling. On the other hand, long-range aircraft which are compelled to carry vast quantities of fuel cannot be an economic proposition; instead, the fuel should be taken on board at suitable points along the route.

Clearly it could not be a paying proposition to refuel at too frequent intervals and the most economic stage must be somewhere between the two extremes. The world's geography, together with the various factors governing the design of present-day aircraft, determine this distance as approximately 2,000 still air miles, or between 1,000 and 1,500 statute miles depending upon wind and other conditions. It will also be seen that the requirements of over-land and oversea routes are not the same, and should be considered separately.

In the case of refuelling over land routes, long non-stop flights are possible with the following benefits:—

(a) Intermediate landings between the main termini are avoided.

(b) The maximum quantity of fuel carried is considerably reduced with a corresponding increase in payload.

By avoiding intermediate landings the time taken to fly between main termini is greatly reduced, as the time saved includes that required for circling, descent and landing, refuelling on the ground and the re-climb to operational height. The essence of flight is speed. Normally the cost of increments of speed becomes progressively greater, since the power required is proportional to speed cubed. Hence it is easily seen that the achievement of a small increase in speed, at considerable cost, may be completely nullified by the effects of one intermediate landing. This factor becomes of far greater importance with the introduction of the various forms of jet propulsion.

The resultant reduction in the accident rate due to the elimination of hazards associated with intermediate landings and wear and tear of engines, landing gear, etc., has already been discussed. In many cases suitable intermediate landing grounds are not available.

As a simple example of the payload increase due to flight refuelling, the fuel required by an aircraft such as the York for a distance of 2,000 miles at an average consumption of 1.0 m.p.g. is 2,000 gall. or 14,400 lb. By refuelling once *en route* the fuel carried is halved and 7,200 lb. is therefore available as additional payload, which approximately doubles the normal payload.

For trans-oceanic flights two cases may be considered:—

(a) Where no intermediate islands offer possible landing grounds, refuelling may be made by one or more tankers using the same bases as the air-liners.

(b) Where intermediate landings are available as tanker stations.

In both cases the maximum fuel load is reduced by means of flight refuelling and payload is increased accordingly.

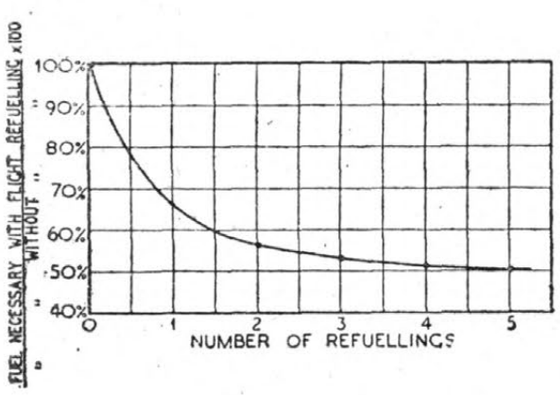
Guarding Against "Misses"

All over-water flight plans are based on the inflexible rule that it shall be possible for the airliner to return to a suitable base in the unlikely event of the rendezvous with its tanker not being realised. It may be mentioned that wherever possible the two aircraft are arranged to fly together in loose formation, the "escort" method, as opposed to the "encounter" method in which the tanker flies out to meet the liner.

Where no islands occur on the route, if the airliner is to be refuelled once only, the optimum point is one-third of the total distance from the starting base, and the maximum fuel carried by the liner at the start and after refuelling is sufficient for two-thirds of the total distance. Obviously the payload capacity is a maximum if the fuel load is kept to a minimum, and this is achieved by equalising the fuel carried at the start and after refuelling.

No matter how many times refuelling takes place there is nothing to be gained by refuelling beyond half-way, because at the half-way point the liner must have sufficient fuel for an emergency return to its starting base in case of failure to contact the tanker, and therefore it also has sufficient fuel to complete the course. Similarly, there is no advantage in

* "Some Aspects of Air Transport Economics," *The Shipping World*, 10th January, 1945. Also *Flight*, of Jan. 25th, 1945.



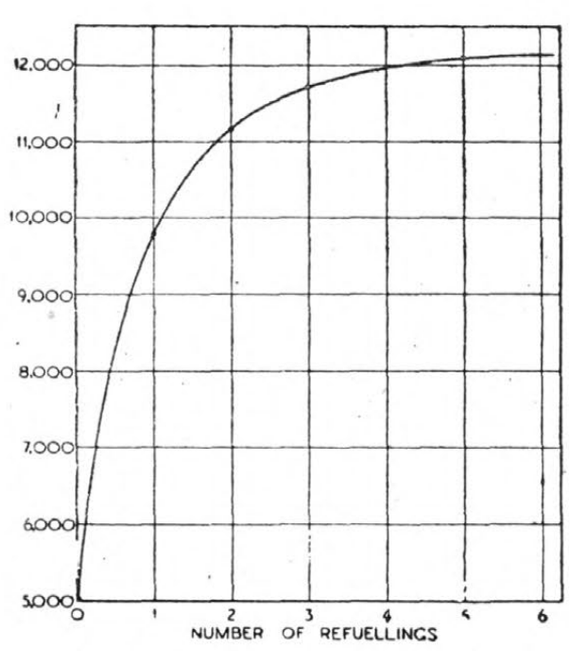


Fig. 3. (Above) Reduction in required fuel capacity by means of flight refuelling over-water routes. Fig. 4. (Right) Potential increase in payload for refuellings in flight. Aircraft is assumed to have 2,000 miles range, a normal payload of 5,000 lb. and a fuel consumption of one gallon per mile.

REFUELLING IN FLIGHT

refuelling before a point at a distance one-quarter of the total distance from the start, because it has been seen that the maximum fuel capacity must be sufficient for half the total distance. Hence, all refuellings should take place within the second quarter of the route, and it is therefore obvious that little is to be gained by refuelling more than twice.

The reduction in the fuel capacity requirement due to refuelling over a water route is shown in Fig. 3. The reduction amounts to 33 per cent. for one refuelling, 43 per cent. for two refuellings, and 47 per cent. for three refuellings. In most cases more than one refuelling would not be worth while, but in some instances a further 10 per cent. reduction of the fuel capacity due to a second refuelling might be economic, though seldom, if ever, would the third refuelling be worth while.

A one-third reduction of the large quantities of fuel required for long sea routes is very considerable and may easily double or treble the payload. As an example, consider an aircraft which has a payload of 5,000 lb. for a route distance of 2,000 miles, and has a fuel consumption of 1 gallon per mile. If it is to be refuelled once *en route* the full payload will be reduced by one-third, or 667 gallons weighing 4,800 lb., so that the payload is increased to 9,800 lb., or nearly double.

The following table and Fig. 4 show how the fuel load is decreased and the payload increased by means of additional refuellings:—

No. of Refuellings.	Fuel load. lb.	Payload. lb.
0	2,000	5,000
1	1,333	9,800
2	1,143	11,170
3	1,066	11,720
4	1,033	11,970
5	1,015	12,090
6	1,008	12,140

Where islands are available, however, only in exceptional cases are they ideally placed for refuelling stations; but by means of aerial tankers based on such islands, the airliner can be met at the most economic points. If the island is beyond the halfway point on a direct route, refuelling would normally take place over the island. There is nothing to gain in the tanker flying to meet the receiver since the latter must be capable of reaching the island in an emergency; but where the island is located at less than half the distance, the rendezvous is arranged at some point beyond the island for which the fuel carried at the airliner's take-off is sufficient to carry it beyond the island to the rendezvous and back to the island, and the quantities of fuel at take-off and after refuelling are again equal.

Formulæ have been evolved for use in all possible cases and they take account of all such factors as number of islands, offset of islands from route, winds, fuel, and all other allowances including the extension of flight to alternative airfields in the event of an emergency.

One of the airline operator's biggest problems is the provision of sufficient fuel to avoid premature descent due either to headwinds, or to enforced detours for avoiding storms and bad weather. This inevitably results in generous fuel allowances being made for such contingencies which, in turn, means that vital payload is sacrificed; but even so, forced landing due to fuel shortage cannot entirely be ruled out. All this is changed with flight refuelling. A reasonable allowance for wind is made and on the few occasions when a headwind is encountered of velocity higher than that allowed for, the pilot summons a tanker from the most convenient refuelling base.

Existing aircraft may be adopted for use on a flight refuelled service, but for preference, specially designed aircraft should be employed.

Little modification is generally necessary for converting an airliner for flight refuelling, but short- or medium-range aircraft are the most suitable. In general, long-range machines have very limited payload capacity, so that if flight refuelling is resorted to no accommodation is available for the additional payload. In any case long-range aircraft are not economic.

Maximum Economy

The value of an air transport service between two given termini is measured in ton-miles, and for this to be a maximum the weights of freight and fuel load should be roughly equal. In some instances an airline may find it expedient to use a particular aircraft for carrying greater weight of freight over a shorter distance, or a smaller payload over, say, a long ocean crossing, but this can be done only at the sacrifice of economy.

Where the payload comprises passengers instead of freight, or a combination of both, the passenger seats, berths, furnishings, etc., should be included in the disposable load, i.e., the furnishings are regarded as part of the comforts carried for the use of the passengers *en route*, and as such they are considered as payload in the same way as crates and packing are included with freight.

For a given set of engine cruising conditions, Fig. 5 shows how the freight load varies with range, together with the variation of disposable load-distance units against range. If passengers are carried in place of freight the broken line curves apply, the difference between the full and broken lines being accounted for by the weight of furnishings, etc.

In other words, for an airliner to be suitable for any particular route, it should possess a capacity for fuel and oil equal roughly to half the disposable load, and the accommodation for passengers and freight should be such that its own weight plus the payload account for the remaining half of the disposable load. This is the fundamental consideration. It may be affected to some extent by consideration of frequency of service, but the fifty-fifty fuel-payload rule can be departed from only with loss of efficiency.

Actually, the available passenger or freight capacity, in terms of weight, should be somewhat in excess of the fuel capacity in order to allow for what is termed the payload factor, i.e., the average payload. This varies according to the route, season, and other factors, but a figure of 80 per cent. may be taken as a rough guide.

With a flight refuelled service the same conditions apply, except that the fuel load is taken as the normal fuel tank capacity and not the total fuel required

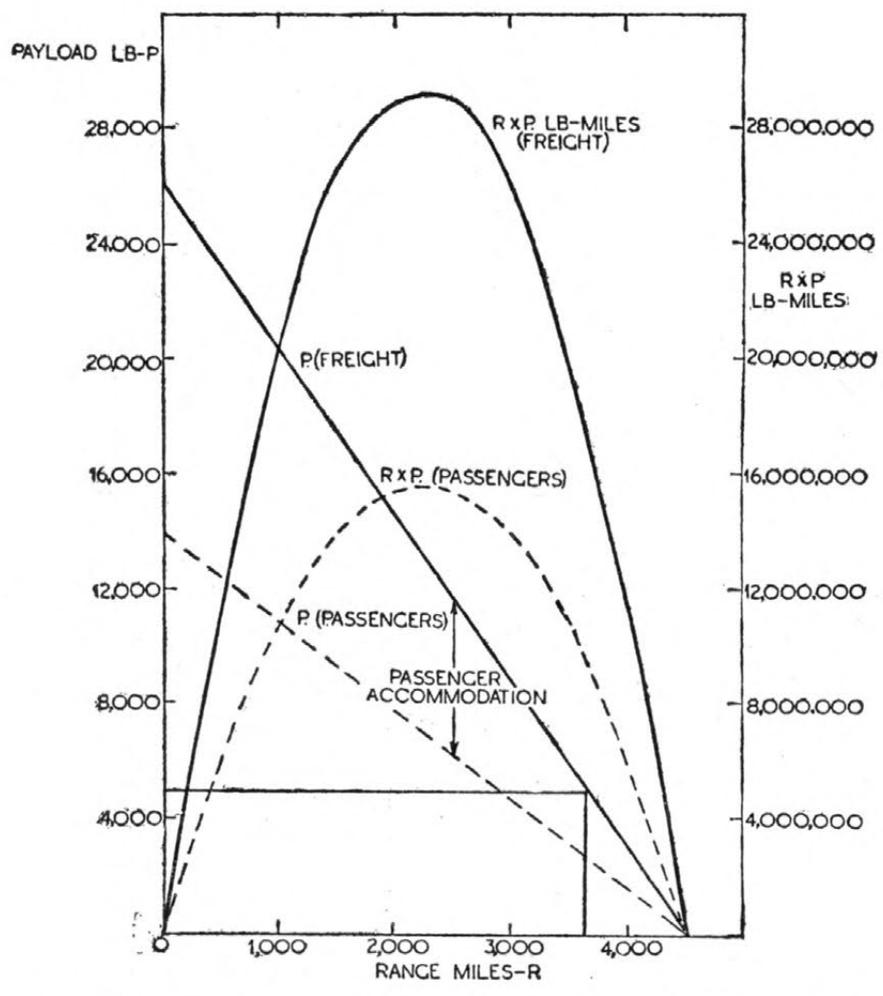


Fig. 5. Variation of freight load with range for given cruising conditions: if passengers are carried only, the broken line applies, if freight only, the full line, the difference being due to furnishings, galley equipment, etc.

REFUELLING IN FLIGHT

for the route. When a design is being prepared to meet a given specification the relative weights of fuel and freight (or passengers plus accommodation) should be checked, and in the event of there being any considerable difference between the two values, the question of some re-adjustment of the disposable load should be carefully considered. Unfortunately ranges depend on geography, whilst the demand for carriage of passengers and goods can be moulded only within certain limits. Nevertheless, balancing out may be largely achieved by adjustment of the frequency of the service, whilst the lowering of fares made possible by economic operation will create demand.

An analysis of the component weights of present day large aircraft, built or being built, enables one to construct a diagram as depicted in Fig. 6. From this it will be noticed that the structural weight accounts for roughly 30 per cent. of the gross weight and the power plant absorbs a further 20 per cent. of the total weight, leaving 50 per cent. for disposable load. All aircraft conform reasonably to this pattern, but uniformity breaks down beyond this point.

The remaining 50 per cent may be divided between fuel (and oil) and what may be termed "useful load," or freight. Analysis shows, however, that there is no consistent proportion between these two components, and points for the various aircraft are scattered haphazardly between the extremes. It has already been seen that for efficiency the fuel and freight loads should be equal, and the ideal diagram can now be completed by apportioning 25 per cent. of the gross weight to each component.

The "useful load" item needs a little further explanation. When it consists of freight only, say, for instance, a cargo of steel girders, the full 25 per cent. total weight may be represented by such freight, but if eggs are to be transported, part of the "useful load" will be absorbed by the necessary packing cases and sawdust. Similarly, if we are dealing with passengers, then stewards and such items as soundproofing, furnishings, seats, bunks, food and water

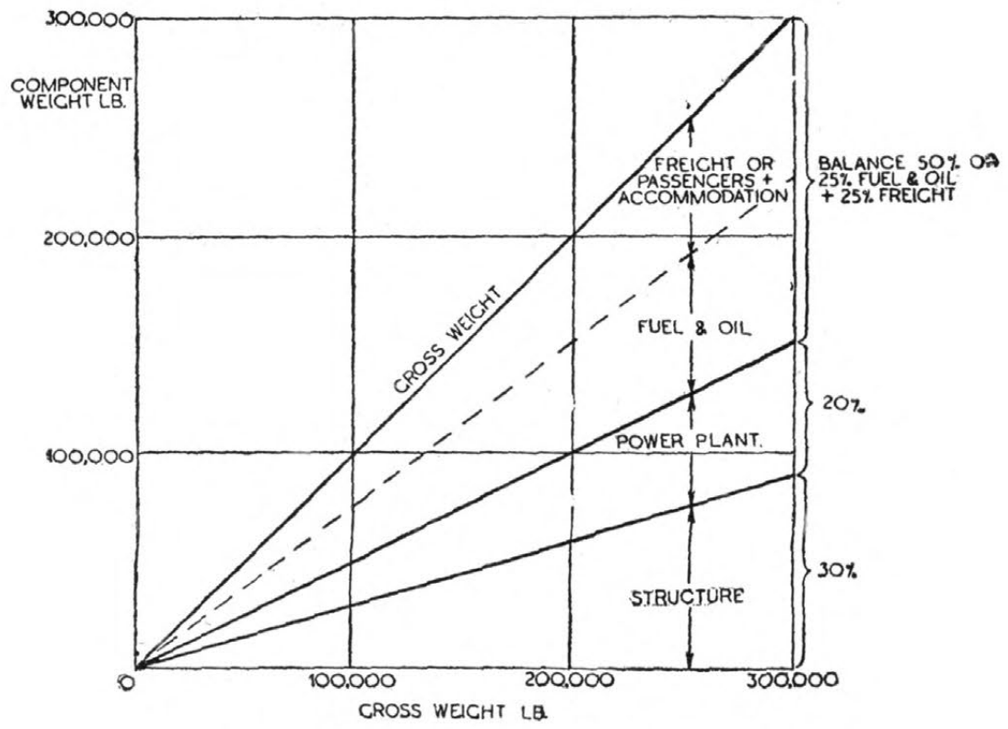


Fig. 6. Graphic representation of percentage weights for modern aircraft, illustrating that approximately 50 per cent. of the total weight is available for disposable load.

must be included, since they comprise the packing for the passengers in exactly the same way as cases and sawdust provide protection for the eggs. Unless this is done true comparisons of aircraft weight components cannot be made.

The conception of "planned design" is now clear. As soon as the project office has prepared the weight budget for a new design, the freight and fuel loads should be scrutinised and, if it should be found that the fuel weight preponderates, the designer should think seriously of adjusting the weights, or of flight refuelling.

This study brings us to the conclusion that aircraft should be designed in ranges of progressively stepped-up sizes, so as to cater for, say, 50, 100, 150 passengers, etc. The fuel load being equal to the "useful load," will be found to give an unassisted range of approximately 2,000 still-air miles, and this can be extended to any desired distance by means of refuelling in flight.

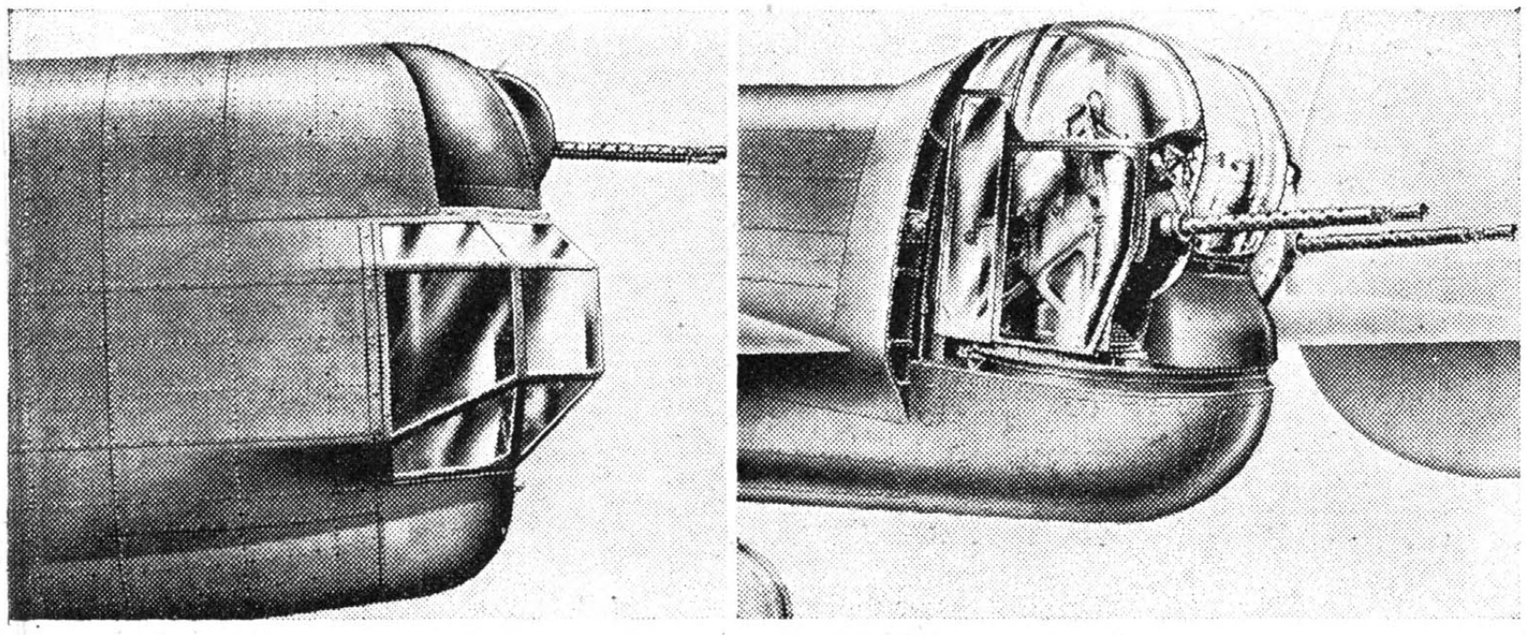
Defending the Lincoln

Boulton Paul "F" and "D" Types of Power-operated Turrets in Latest British "Heavy"

NOWADAYS one rather takes power-operated gun turrets for granted. They became so much part and parcel of the war in the air that one is apt to forget the part they played. The information just released that the latest British heavy bomber, the Avro Lincoln, is equipped with nose and stern turrets of Boulton Paul design is thus a useful reminder that it was this firm, while it was still a section of Boulton and Paul, Ltd., which pioneered the power-operated gun turret and first installed it in the nose of an Overstrand biplane bomber shown at one of the R.A.F. Displays at Hendon.

Great progress has been made and many improvements incorporated in gun turrets since those early days, and the Boulton Paul "A," "C" and "E" types have given excellent service during the war. In the Lincoln the tail turret, known as the "D" type, employs an electro-hydraulic system similar to that of the earlier turrets, with the exception that a hydraulic motor is used instead of a hydraulic ram for elevation and depression of the guns. These are two Browning 0.5in., each gun being fed from ammunition boxes in the fuselage, the belts being assisted by electric motors on the ducts in the fuselage and in the turret. The nose turret of the Lincoln is a Boulton Paul "F" type, also mounting two Browning 0.5s. It is designed to allow both turret and bomb sight to be operated by one member of the crew from his position in the nose. The power system is the usual Boulton Paul, but instead of the usual control stick there are duplicate control handles, one on each side, to leave a central space free for bomb sighting. The turret can be rotated 45 deg. on each side of the centre line, and the vertical movements are 40 deg. elevation and 40 deg. depression.

The guns, ammunition boxes and power-drive components are located above the level of the mounting ring, which is immediately above the bomb-sighting position.



Nose and stern turrets of the Avro Lincoln heavy bomber. The front turret is operated by the bomb aimer. Both carry two 0.5in. Brownings.

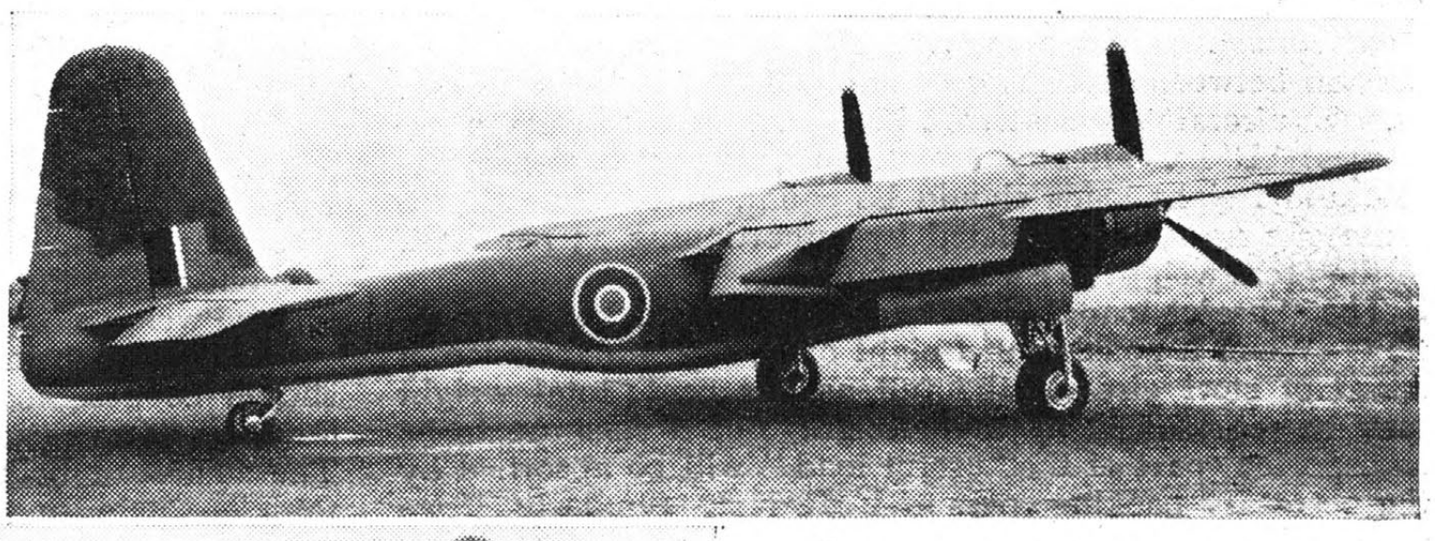
The Miles Monitor

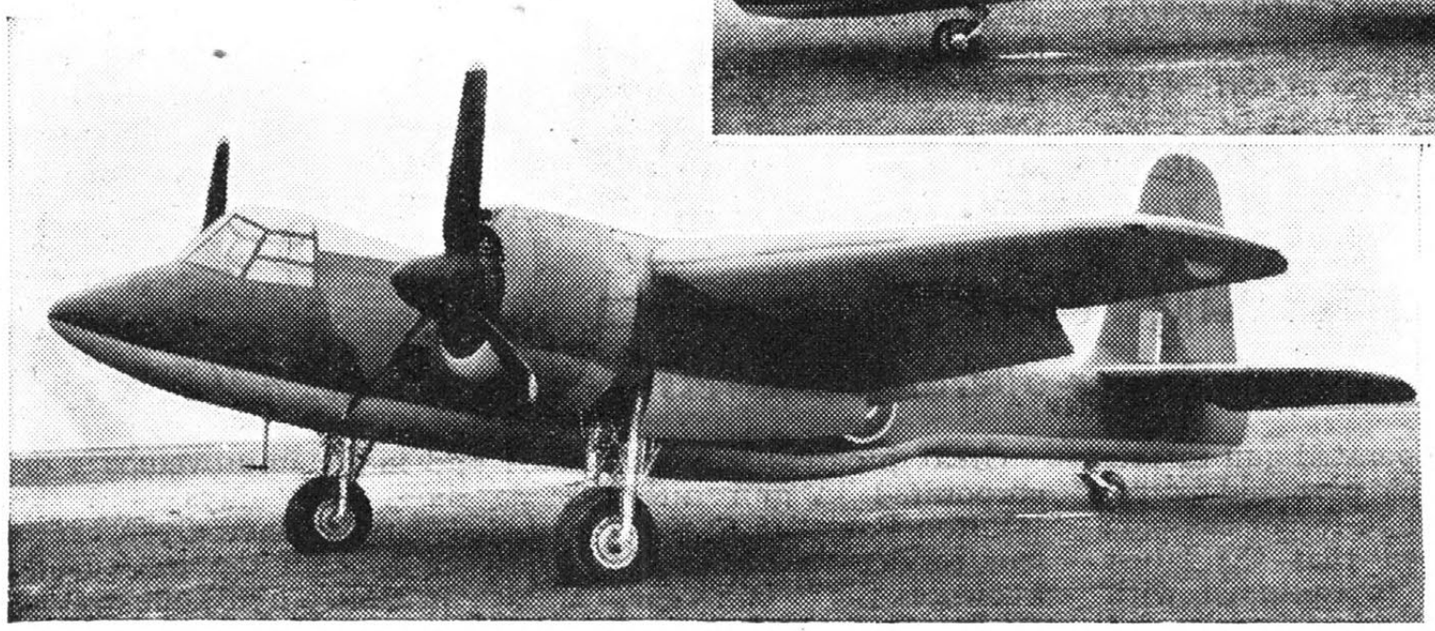
First Target-towing Twin-engined Aircraft to be Specifically Designed for the Work

IN 1942 it was decided by the authorities that gunnery training, both for air-to-air and ground-to-air, was becoming a rather serious bottleneck, and that existing types of aircraft for carrying targets were obsolete. Accordingly a specification was issued for an aircraft to be designed for the specific purpose of towing targets; an unprecedented step, since all existing target-towing aircraft had been obtained by converting aircraft originally intended for other duties, e.g., the Boulton Paul Defiant converted from a night fighter; the Miles Master trainer converted to the Martinet target-tower.

A consideration which probably led to this decision was that the speed, range and operating altitude of the then modern fighter had far outstripped the corresponding advances in target-towing aircraft. A Martinet target-tower at 150 miles per hour, for instance, was for all practical purposes a stationary target for a Tempest flying at 450 m.p.h.

The result of these deliberations was specification for a target-tower which would cruise at 300 m.p.h., reach an altitude of 20,000 feet and possess an operational endurance period of 3/4 hours. The aircraft would also be required to simulate dive bombing attacks: hitherto no target-tower could hope to provide practice in this relatively new form of attack.





With two Wright Cyclone engines the Monitor will tow a drogue at 300 m.p.h.

Thus was born the Miles Monitor. Designed and built with the utmost urgency, the Monitor does everything which the specification demanded. It has two Wright Cyclone GR.2600-31 air-cooled radial engines of 1,750 h.p. each driving 3-bladed, constant-speed, fully feathering airscrews, giving a top speed of 360 m.p.h. Cruising at 20,000 feet with a target the speed is 300 m.p.h.

Composite Construction

As the Monitor was also fitted for use by the Royal Navy it was intended that it should be of all-metal construction. Dictates of urgency, however, brought about a decision to fit Beaufighter wings to a fuselage of Miles Aircraft design. Unfortunately for this arrangement Beaufighter wings were in short supply, and Miles Aircraft were obliged to design specially and build very quickly a wing of wooden construction. The Monitor, therefore, is of composite construction.

Briefly, the wing is a one-piece all-wooden structure consisting of two spars with orthodox rib formation and ply covering. Dive brakes are fitted to the wing and are hydraulically operated. Tankage is also provided within the wing for 480 gallons of fuel. Ailerons are of conventional construction, and the remainder of the wing is fitted with slotted-type flaps, which give the Monitor a stalling speed of 90 m.p.h.

The all-metal fuselage has been designed specially to permit the ejection of targets with a minimum possible effort on the part of the crew. This represents a considerable advance upon previous methods of launching in that the operator merely places a target on an endless conveyor belt and, after connecting the target halyard to the cable, pulls a lever. By this means the target is automatically ejected from an aperture in the fuselage, thereby minimising the amount of draught and discomfort usually associated with the opening of doors whilst an aircraft is flying. Indeed, this facility for automatic ejection is particularly important to the pilot and his operator when flying at extreme altitude, where the external temperature may be something like 20 degrees below zero.

The Monitor fuselage is also fitted with a rotating Perspex cupola, which enables the operator to observe his target and to take photographs whilst gunnery practice is in progress. Housed within the fuselage is a 10 h.p hydraulic winch of a completely new type designed by Miles Aircraft. It draws its power from three hydraulic pumps driven by the starboard engine. (These pumps also provide the power for the normal hydraulic system of the undercarriage and the flaps.) Towing targets at speeds in excess of 250 m.p.h. made all existing winches ineffective, since there were none which could exceed 6 h.p. The Monitor required something in the region of 9 h.p. for use with the standard sleeve targets at the speeds envisaged.

Monitor tail surfaces are of all-metal construction and embody a very large tailplane and a large single fin and rudder, giving a big margin of positive stability—essential when launching targets.

In the interests of rapid production, Miles Aircraft adapted the standard Beaufighter undercarriage, which consists of two main wheel shock absorber units with retracting mechanism of conventional design. The Beaufighter tail wheel, automatically self-centring and retracting with the main wheels, was also used.

For a target-towing aircraft the Miles Monitor is a large aircraft: the use of two large engines, the carrying of specialised target-towing and radio equipment gives it an all-up weight of 21,000 lb. Its span is 55ft., length 47ft., and wing area 500 sq. ft. Wing loading is 42 lb. per square foot, and whilst this may appear high, it is quite acceptable when it is realised that the power loading is only about 6 lb. per h.p. The Monitor can climb to 25,000ft. in 30 minutes.

CIVIL AVIATION NEWS

TO SOUTH AFRICA

A TRUNK air service between Britain and South Africa using York aircraft is expected to start operating in the middle of next month.

The announcement was made at the first meeting of the Southern Africa Air Transport Council by Mr. F. C. Sturrock, Union Minister of Transport, who said that in the initial period the service will have a frequency of one aircraft in each direction.

MORE ATLANTIC SURVEY

TWO more landplane survey flights by Douglas Skymasters were scheduled to be made over the transatlantic route—the first by T.W.A. and the second by American Export Airlines. Both aircraft will carry company personnel and inspectors of the U.S. Civil Aeronautics Authority.

The T.W.A. flight is scheduled to call at Iceland on the journey from Newfoundland to Ireland. Although T.W.A.'s route is to by-pass Britain, it is understood that on this occasion a call will be made at an English airport.

STUDIES IN ICING

NORTH-WEST AIRLINES will use the summit of Mount Washington, in the State of New Hampshire, as the site for studying methods of preventing the formation of ice on aircraft.

The research will supplement similar studies conducted for the U.S. Army Air Forces at Minneapolis, Minnesota. Mount Washington is 6,284ft. high and can be reached in winter only by skis or snowshoes, and wind velocities of 239 miles an hour have been recorded there.

EIRE'S PROGRAMME

WORK on the big new base for flying boats at Rynanna, eight miles up the River Shannon from Foynes, is to proceed, but it will not be completed for two years.

Plans had been prepared for the erection of permanent buildings, but it would be a very big job and involve five or six years' work and a large amount of money.

On the position of Rynanna as a stopping point on the transatlantic route, Mr. Lemass, Eire Minister for Industry and Commerce, explained that the companies specified in the Irish-American Air Treaty were bound to stop at Rynanna, but British Overseas Airways might, if they wished, "leap frog" over the Shannon airport as the Corporation's aircraft flew over Eire on a permit renewed yearly by the Irish Government.

The permit system existed because of the war, but was only a temporary arrangement, and a regular agreement would have to be drawn up with Britain when this country begins to operate a transatlantic commercial service.

TRANSATLANTIC AIRSHIPS

AMERICAN plans for the construction of dirigibles for transocean and transcontinental transport focus on a 950ft. $8,000,000 airship that would carry 288 passengers in day comfort, or 100 in the luxury of first-class ocean travel, at 75 to 90 m.p.h., with a non-stop range of 7,000 miles.

Passenger fares of 5 cents (3d.) a mile are considered possible, 10 to 15 cents per ton-mile for cargo. The airships would be slow by comparison with modern aircraft, and less economical than water-borne commerce, but the Goodyear Tire & Rubber Co., who have prepared the plans, assume that there is a profitable field between.

Airship selling points, as outlined by the designers, are: Smooth, silent travelling. New York subway noise registers 91 decibels; ocean liners 71; airships 51. "A 950ft. airship would float like a white summer cloud in ordinary weather and would be as weather-safe as an ocean liner."

Safety, since the lifting gas would be helium. Stability, exhaust gas from six 1,100 h.p. engines would be used to condense water for ballast, about a pound of water for each pound of fuel consumed.

Construction of the lighter-than-air liners will take two years from the time detailed drawings are begun.

The designers recognise that they will have to match technical advances in materials and engineering against a past record of airship disasters. Of fourteen rigid dirigibles built between the last war and this one, two were used only experimentally (R-36 and R-80), four were dismantled (Bodensee, Nordstern, R-100 and Los Angeles), three failed structurally in flight and were lost (Shenandoah, Macon and R-38), two crashed (R-101 and Akron), the Hindenburg was destroyed in 1937 when its hydrogen lifting gas ignited, and two (Graf Zeppelin and LZ-130—sister ship of the Hindenburg) are presumed to have been destroyed by R.A.F. bombing.

SOLD

IN July Canadian War Assets Corporation, the Government war surplus disposal organisation, sold 207 aircraft and 56 engines for $402,972 to purchasers in Canada, Mexico, Colombia and Costa Rica.

FLYING BUS

BLACKPOOL CORPORATION is considering a proposal for running the world's first air-bus service. The plan envisages a shuttle service along the beach covering the four miles sea front of the town and operated every five minutes in both directions.

Miles Aerovans are proposed to be used for this service and would pick up ten passengers at a time.

CANADA - AUSTRALIA

MR. DANIEL McVEY, Australian Minister of Aircraft Production, stated that an air service from Vancouver to Sydney would operate as soon as airfields and equipment in the South Pacific were released by the Services.

Travel time between Vancouver and Sydney is expected to be 42 to 48 hours or possibly less. Flights to Auckland, New Zealand, would probably branch off at Suva, Fiji Islands.

AIR MAIL

THE heavy requirements of official priority traffic on the air service to Australia and New Zealand continue for the present to preclude normal facilities for commercial traffic. Pending, therefore, the re-establishment of unrestricted air mail services to Australia and New Zealand, arrangements have been made for the introduction as from September 25th, 1945, of a limited air mail service to those Dominions for the benefit of business firms to supplement the present service by air to North America and thence by surface route.

The service is restricted to legitimate business correspondence and limited to letters not exceeding half an ounce in weight.

U.S.S.R.—U.S.A.

THE establishment of a regular service between Moscow and the U.S.A., which began in 1941, is considered to be the most notable achievement of Soviet civil aviation. The route traverses Northern Siberia, Kamtchatka, and Alaska across nearly 4,000 miles of little-explored territory.

Many airfields had to be constructed, and Russia's experience of polar flying was of great assistance in these operations under most difficult climatic conditions.

CONSTELLATIONS COMING

ACCORDING to a statement by the president of American Export Airlines which is the overseas operating division of the American Airlines System, the fleet of four-engine Constellations recently purchased by the company will be placed into operation early this autumn.

American Export Airlines which has employed on the transatlantic service four-engine flying boats previously announced the inauguration of a landplane service to Europe on or before October 15th with four-engine Douglas Skymasters.

When the Lockheed Constellations are put into service it is expected that substantial reductions in fares and flying time will be possible. New York-London is to be reduced to twelve hours, London-Moscow five hours, New York-Moscow 16½ hours, New York-Copenhagen 14 hours. From the co-terminal point from Chicago two hours will be added to these schedules, and from Boston half an hour will be subtracted.

The Constellations will have pressurised and air-conditioned cabins accommodating 40 to 50 passengers and equipped with individual temperature control, etc.

Revolutionary methods of heating, ventilation, insulation, and sound-proofing are said to have been introduced and vibration dampened by a "floating cabin."

CIVIL AVIATION NEWS

FAR EAST LINK

THE Indo-China Division of the U.S. Air Transport Command has started a service between Calcutta and Singapore and Calcutta and Shanghai.

The first service leaves Calcutta three times a week for Singapore and Batavia, stopping at Bangkok and Saigon, and the second service leaves every other day, calling at Kunming and Peishiyi, the principal airport serving Chungking.

FROM IRAQ

AN air transport company is reported to have been formed by the Government of Iraq. To be known as Iraq State Airlines, the company is to establish internal services and gradually extend its operations to the neighbouring Middle East countries.

A CRITIC

MR. E. C. GORDON ENGLAND, the aircraft engineer, told Hackney Rotary Club that while America has gone steadily ahead, Britain has always taken a very narrow view of civil aviation. America had gone on producing civil aircraft throughout the war, but civil types now being made in Britain, Mr. Gordon England said, were "lash-up jobs" produced not from a clean drawing board but military aircraft converted for civil use.

AMERICAN SURPLUS

ALLOCATION by the United States Surplus Property Board of 20 four-engined transport aircraft to three U.S. airlines, designed to fly inter-continental air routes, brought the realisation of peacetime air services between the United States and Europe, the Middle East and Far East, one step closer.

Airline engineers estimated that the C-54 (DC-4's) used by the Army Air Transport Command to carry as many as 100 soldiers in bucket seats, could be converted within a few months into airliners carrying at least 40 passengers in peacetime comfort. The aircraft were originally designed by the Douglas Aircraft Company as peacetime airliners, but were acquired by the Army for cargo and troop carrying.

The three airlines designated to fly international routes already have been making elaborate plans for tourist air travel which, it is expected, will take residents of the United States to all parts of the world within the next few years.

Eight of the transports were allocated to Pan American Airways, which was authorised by the Civil Aeronautics Board to fly an intercontinental route linking the United States with Central Europe, Turkey, Iran and Karachi and Calcutta on the West and East Coasts of India.

Six of the aircraft were turned over to Transcontinental and Western Air for use on the proposed service from the United States through southern Europe and North Africa to Cairo, and from Cairo through Iraq and Saudi Arabia to Bombay.

The other six were allocated to American Airlines System, which has been authorised to fly a northern intercontinental route to Scandinavia. The airline hopes eventually to fly to Soviet Russia.

FARES AND SCHEDULES

PASSENGER fares of $275 and 15-hour schedules on the New York-London service are envisaged by Pan American World Airways for the initial period of their operations. These interim schedules and fares are based upon the most economical use of the Douglas C-54E recently released by the U.S. Army and which are to be put into service on the first land plane operation.

According to Mr. Harold M. Bixby, who is in charge of Pan American's trans-ocean services, a second interim step will have been achieved when his company receives delivery in about two months of 21 Lockheed Constellations. The operating programme aims at an 8½-hour schedule and a fare of $100 for the New York-London service.

NEW YORK–AMSTERDAM

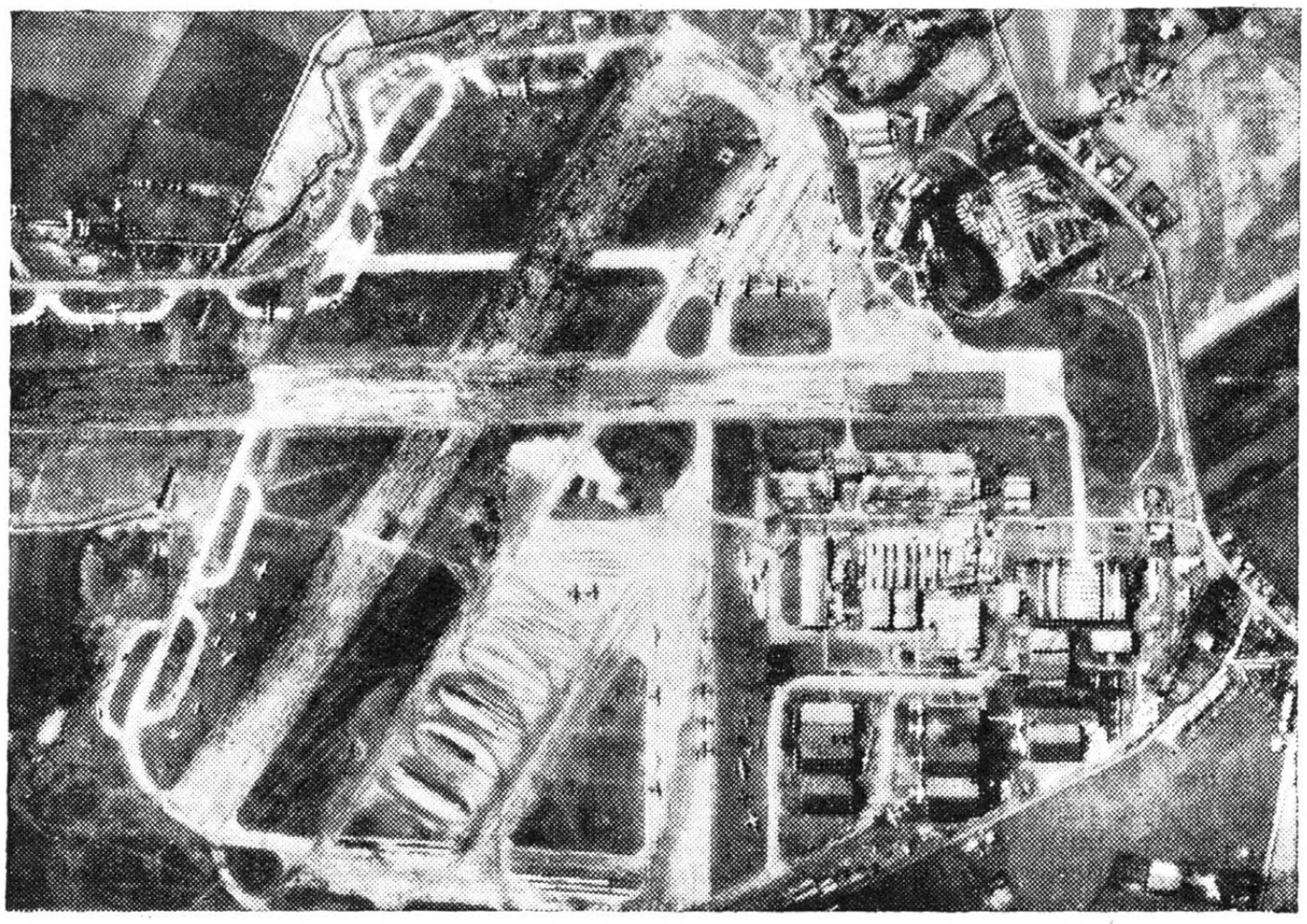
FOLLOWING the authorisation of three American companies (Pan American Airways, American Export Airlines and the T.W.A.) to operate services to Europe, the U.S. Government is rapidly moving to secure for these designated operators the necessary landing rights. Persistent in securing a wider adherence to the Five Freedom Agreement to which only three European countries (Sweden, Denmark and Turkey) originally subscribed, the Federal Government has now succeeded in opening yet another door to the European continent.

In an agreement now concluded between the U.S.A. and Netherlands, the Netherlands Government has granted American operators full rights under the Chicago Five-Freedom Agreement. This is a step towards the American Export Airlines programme of operating a service New York-Ireland-London-Amsterdam-Stockholm-Russia or Amsterdam-Poland Russia. And although the absence of an agreement between the U.S. and Britain prevents an American operator setting down or picking up traffic in this country, the granting of facilities to American flag operators by Eire, Denmark, Sweden, Holland, and Spain might enable them, at least temporarily, to by-pass Britain in their endeavour not to lose any time in girdling Europe with their services.

A MODEL

THE agreement on European transport reached between this country, Russia, France and other western powers setting up a European central inland transport organisation might well provide a model for a possible co-ordination of air transport.

The agreement provides for allocation of vehicles, priority and nature of cargo to be moved, etc. The co-ordination of air transport on similar lines between European powers might be beneficial to the equipment-starved countries of Europe and accelerate the re-establishment of normal air transport facilities.



ATLANTIC BASE : Prestwick airport from where the B.O.A.C. North Atlantic Return Ferry operates their services to Montreal.

EXPANSION–

SCOTTISH Airways are to increase their network of air ambulance services over as many islands in the Western Highlands as possible. Argyll County Councillors have discussed with the company the question of landing strips on the islands of Coll and Mull and surveyors are to make a report on the provision of suitable landing grounds.

–AND REDUCTION

A PUBLIC meeting at Lochmaddy, North Uist, unanimously agreed to make strong representations to the Air Ministry, Scottish Airways, the Secretary of State for Scotland and to the proprietor of the island, the Duke of Hamilton, against Scottish Airways' decision to stop calling at the airport in North Uist.

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.

GAS TURBINE DEVELOPMENT
A Further Tribute to Mr. Stern

I AM most glad to see in *Flight*, September 13th, Sir Roy Fedden's tribute to the careful study made, 25 years ago, into the practicability of internal combustion turbines by Mr. W. J. Stern, then working at the Air Ministry Laboratory in the Imperial College of Science.

As at that date I was superintendent of the Laboratory, I can testify to the amount of work that task involved, which was carried out with exemplary efficiency and skill. Sir Roy thinks that Mr. Stern's report, published, he says, by the A.R.C. in 1920, should be far better known. I agree, but it is fair to the Air Ministry to add that, if published reports are overlooked, that Department of State cannot be blamed for any lack of complete thoroughness in their search by those interested in this subject.

H. E. WIMPERIS.

GLOSTER METEOR IN ACTION
No Smoking To-day

H. M. ABSOLON, in *Flight* of September 27th, states that Meteors always smoke. I suggest that he has not seen Meteors recently. Early in the year observers on our post used to look more for the smoke than the aircraft when locating a Meteor: on one occasion an observer was startled into reporting a Meteor as a totally different aircraft "on fire." He quickly corrected his error, but this indicates the amount of smoke then present.

At the moment of writing I am sitting in front of a window: every few minutes a Meteor flies past. I have seen a dozen "plots" in half an hour, but not the slightest suggestion of any smoke—and my eyesight is pretty good!

The Vampire at Hyde Park was so smokeless that many people mistook it for a type with piston engines.

FREDERICK H. COATES.

THE TUNE HAS CHANGED
"Raw Deal" to A.T.C. Officers

AS a further enlightenment on your leading article in *Flight* dated September 6th there are one or two items which, I think, should be made known as to the "raw deal" given to Officers of the A.T.C.

Perhaps it is not generally known by the great B.P. that most of these officers have worked hard, unceasingly almost, putting in three to four evenings and most of Sundays every week giving instruction to the cadets, and helping them in every possible way with their studies; also they have looked after their general welfare, organised and controlled their sports, to fit them for the tasks they would be called upon to perform.

This has been going on since February 1st, 1941, and after 4½ years of hard work, voluntarily done, the Air Ministry tell these officers that they are not entitled even to the Defence Medal, neither can they, on resigning, be allowed to keep their honorary rank.

These—shall I call them privileges?—have already been granted to Home Guard officers, who, in my opinion, have done no more to help the country in its need than the A.T.C. officers; in fact, having regard to a large proportion of the "material" on which they had to work, it would appear that the A.T.C. officers have had a very uphill job.

Is it surprising that the majority of them were glad to be able to resign their commissions after V.E. day and leave the organisation which they had built up, with few or no regrets. The Air Ministry did not even bother to write them a letter of thanks, in many cases, for the services rendered, but they, the officers, have a certain satisfaction in the knowledge that a real job of important work (*vide* A.M. statement in the early days), has been done.

Some officers are still carrying on the good work, but there is not the same enthusiasm or spirit at present, owing to the A.M.'s attitude, and I venture to state there will be many further resignations in the near future unless something is done to encourage further sacrifices by the aforesaid officers and instructors. May I say many thanks for publishing the article in question?

"ONE OF MANY."

CIVIL AIRFIELD SAFETY
Helicopter Fire Tenders Suggested

I READ with particular interest the very sound proposals put forward by "Klaxon" in your issue dated July 19th for dealing with fires and crashes at or near airfields which, while far less frequent than in the early days, nevertheless occur from time to time and result in very serious casualty lists.

Might I suggest that authorities concerned with airfield organisation should seriously consider the possibility of using helicopter-propelled craft fitted out as fire and crash tenders. Such craft, one or several of them according to the importance of airfields and traffic, could be fully equipped and manned and kept flying low near the edge of airdromes, ready to rush to the scene far more quickly than any motor vehicle. In the case of fire these "heli-tenders," by means of generous foam tanks and adequate flooding apparatus, could dowse the stricken aircraft before the fire had taken a full hold—thereby reducing the number of casualties. The danger of fire having been so reduced, first-aid crews carried on the craft could be lowered to render immediate assistance.

It must often have happened that crashes have occurred some little distance away from the airdrome proper in spots where roads were either non-existent or so circuitous as to render it impossible for ambulances and fire tenders to operate in time.

That is where helicopter craft would be invaluable; in fact, given efficient crews working in shifts throughout operational hours on constant watch, it is possible that many impending catastrophes may be foreseen and, through prompt action, be reduced to mere incidents.

"ALL FOR AIR SAFETY."

DOES THE PRIVATE OWNER WANT THEM?
"Indicator" Takes a Contributor to Task

ALTHOUGH Mr. Brodie, in his article of September 13, has generally clarified the pre-war and possible post-war position from his own point of view, I could hardly agree less with his recommendations of suitable types for "flow production." Furthermore, he has omitted or misplaced one or two very worthy pre-war types which might well reappear.

Surely the most important and saleable class of all is the cabin two-three-seater, with ample room for legs and luggage, with a reasonable power-reserve, and which is easy to handle. This class, typified in pre-war days by the Monarch and the Hornet Moth, has been entirely omitted. Instead, the unfortunate owner is made to choose between a possibly cramped and certainly under-powered baby, and an expensive four-seater affair which would not be really practicable when powered with anything much less than 200 h.p I agree that both the alternative types, in modernised form, would be saleable—the first to people who don't like flying by themselves and who want something as inexpensive as possible, and the second, as before, to the wealthier people. But the Leopard-Monarch-Hornet-Messenger class will still, I feel, form the backbone.

In the single-seater class something with a reasonably sporting performance, yet easy enough for early circuit flying, is needed. We don't want any powered packing-cases at cut prices; if a man can afford to fly he can afford something good—otherwise, it will obviously be cheaper for him to hire an aircraft. An aircraft not mentioned in his chart, the Chilton, was, in my opinion, the most practical and pleasant in this class; the original Tipsy single-seater, though fun, was just a shade too temperamental for casual ownership.

Mr. Brodie's "big" class seems to be too big and has entered the charter and feeder-line class. No owner wants to carry eight passengers, though one or two might like the space available for other purposes. The type known in America as a "commuting ship," with cocktail bar, resident typist, and gentleman's gentleman in attendance, is really a professional's aircraft and does not concern us at the moment.

Of course, I am biased, since I have flown all but half-a-dozen of the types mentioned in the table of pre-war types. Of the others, I would have considered purchasing very few indeed. The statistics of actual sales are proof enough of average tastes and requirements—and these are not likely to alter greatly.

"INDICATOR."

SPITFIRES ON THE COCOS : R.A.F Spitfires of the highest-scoring squadron in S.E.A.C. lined up on their airstrip on the Cocos Islands.

SERVICE AVIATION

Royal Air Force and Naval Air Arm News and Announcements

Awards

Royal Air Force

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 Service Order

Act. Wing Cdr. J. G. KEEP, D.F.C., R.A.F.V.R., No. 121 Wing.—This officer has completed numerous operational sorties. In May, 1944, whilst attacking targets in Normandy, his aircraft was shot down and he was wounded. Since returning to operations in February, 1945, he has led his wing with great gallantry and distinction, inflicting much damage on the enemy's lines of communication, Radar installations, close support, targets and Headquarters. Much opposition from the enemy has been encountered during this period. Wing Cdr. Keep has, at all times, displayed outstanding courage, and has achieved excellent results.

Act. Wing Cdr. W. L. THOMAS, D.F.C., R.A.F. (Lt., The Manchester Regt. (T.A.)), No. 136 Wing.—This officer has operated in North Africa, Sicily, Italy and Europe. In Sicily and Italy he attacked enemy road and rail transport, often in difficult mountainous country. In October, 1944, he participated in an attack on the Gestapo barracks at Aarhus, Denmark. His aircraft was badly damaged and was forced to make an emergency landing. On another occasion, in April, 1945, he attacked Pritzwalk railway yards and destroyed two trains by hitting an ammunition train. His aircraft was damaged, and Wing Cdr Thomas was forced to return to base with only one engine functioning. He has at all times shown a high standard of courage and devotion to duty.

Act. Sqn. Ldr. P. Y. H. SMITH R.A.F.V.R., H.Q., Special Air Service Troops.—This officer has been attached to H.Q., Special Air Service Troops, since its formation, as R.A.F. Liaison Officer. He accomplished most valuable work during the preparatory stages in training the Special Air Service troops for parachuting. In June, 1944, Sqn. Ldr. Smith operated with the French Special Air Service troops in Brittany, where he achieved notable success in liaison with the French units. Subsequently he put an American Armed Division in contact with the French Battalion operating in that district. In August, 1944, this officer set out from Normandy and delivered ten armoured jeeps to a French Parachute Battalion operating south of the Loire. This entailed penetrating the enemy lines, and it was largely through his initiative and skill that the mission was accomplished successfully. More recently Sqn. Ldr. Smith has served with the Belgian Special Air Service troops and has accomplished most valuable work with them. Throughout all these operations this officer has been the sole British representative working with Allied units, and by his courage and coolness in action he has gained the admiration of all those with whom he has served.

Act. Sqn. Ldr. W. P. KEMP, D.F.C., R.N.Z.A.F., No. 487 (R.N.Z.A.F.) Sqn.—Sqn. Ldr. Kemp has participated in many hazardous sorties. He has destroyed much enemy road and rail transport, and has always volunteered for the most dangerous and difficult missions, in spite of enemy opposition and adverse weather. Since the award of the D.F.C., Sqn. Ldr. Kemp has completed many day and night intruder sorties. He is now on his third tour of operational duty, and, throughout, has displayed high qualities of courage, leadership and devotion to duty.

Badge of No. 804 Squadron, Naval Air Arm. On a blue field, a Tiger's face proper, holding in the mouth a dagger fessewise also proper. Pommel and hilt gold.

Distinguished Flying Cross

F/O. J. W. PATTERSON, R.A.F.V.R., No. 83 Sqn. (with effect from July 25th, 1944) since deceased).

F/O. J. B. RICHARDSON, R.A.F., No. 228 Sqn.
F/O. P. C. SMITH, R.A.F.V.R., No. 144 Sqn.
F/O. G. W. W. SMITHSON, R.A.F.V.R., No. 524 Sqn.
F/O. G. YEATS, R.A.F.V.R., No. 540 Sqn.
F/O. S. WATSON, R.A.F.V.R., No. 502 Sqn.
P/O. R. R. J. GENNO, R.A.F.V.R., No. 248 Sqn.
P/O. R. H. THOMAS, R.A.F.V.R., No. 524 Sqn.
W/O. P. BRETT, R.A.F.V.R., No. 144 Sqn.
W/O. D. COULTER, R.A.F.V.R., No. 179 Sqn.
W/O. C. H. EYRE, R.A.F., No. 540 Sqn.
W/O. H. B. OFFORD, R.A.F., No. 224 Sqn.
W/O. G. RANKIN, R.A.F.V.R., No. 119 Sqn.
W/O. A. E. SMITH, R.A.F.V.R., No. 489 (R.N.Z.A.F.) Sqn.
W/O. A. K. J. WILLAMS, R.A.F.V.R., No. 502 Sqn.
Wing Cdr. R. J. M. BANGAY, R.A.F., No. 570 Sqn.
Act. Wing Cdr. H. E. ANGELL, R.A.F.O., No 295 Sqn.
Act. Wing Cdr. F. B. SUTTON, R.A.F.O., No 61 O.T.U.
Sqn. Ldr. C. V. BEADON, R.A.F., No. 215 Sqn.
Sqn. Ldr. H. G. HANNAH, R.A.F.V.R., No. 297 Sqn.
Act. Sqn. Ldr. W. W. GUNTON, R.A.F.V.R., No. 161 Sqn.
Act. Sqn. Ldr. D. H. SEATON (Lt., the Wiltshire Regt.), R.A.F., No. 611 Sqn.
Act. Sqn. Ldr G. A. R. UNDRELL, R.A.F.V.R., No. 165 Sqn. (since deceased).
Flt. Lt. J. F. ANDERSON, R.A.F.V.R., No. 356 Sqn.
Flt. Lt. L. S. ANDREWS, R.A.F.V.R., No. 45 Sqn.
Flt. Lt. D. A. BAILEY, R.A.F.V.R., No. 47 Sqn.
Flt. Lt. J. E. BRUNNER, R.A.F.V.R., No 122 Sqn.
Flt. Lt. A. M. CHARLESWORTH, R.A.F.V.R., No. 124 Sqn.
Flt. Lt. F. C. COLLIS, R.A.F.V.R., No. 161 Sqn
Flt. Lt. D. L. COX, R.A.F.V.R., No. 25 Sqn.
Flt. Lt. F. A. DISMORE, R.A.F.V.R., No. 356 Sqn.
Flt. Lt. C. K. GRAY, R.A.F.V.R., No. 124 Sqn.
Flt. Lt. D. A. HAIGH, R.A.F.V.R., No. 125 Sqn.
Flt. Lt. J. W. HARDER, R.A.F.V.R., No. 64 Sqn.
Flt. Lt. A. C. W. HOLLAND, R A.F.V.R., No. 611 Sqn.
Flt. Lt. J. L. W. INNES, R A F.V.R., No. 611 Sqn.
Flt. Lt. E. R. LIVINGSTONE, R.A.F.V.R., No 215 Sqn.
Flt. Lt. W. C. MARSHALL, R A F.V.R., No. 91 Sqn.
Flt. Lt. D. T. P. O'D. MCGLORY, R.A.F.V.R., No. 47 Sqn.

Flt. Lt. J. C. MINTO, R.A.F.V.R., No. 65 Sqn.
Flt. Lt. J. S. SAUNDERSON, R.A.F.V.R., No. 25 Sqn.
Flt. Lt. H. A. SHAW, R.A.F.V.R., No. 215 Sqn.
Flt. Lt. G. B. SMITHER, R.A.F.O., No. 273 Sqn.
Flt. Lt. W. STRINGER-JONES, R.A.F.V.R., No. 356 Sqn.
Flt. Lt. H. TAYLOR, M.B.E., R.A.F.V.R., No. 155 Sqn.
Flt. Lt. A. TOOTH, R.A.F.V.R., No. 82 Sqn.
Flt. Lt. R. S. WAMBECK, R.A.F.V.R., No. 82 Sqn.
Flt. Lt. R. A. WHITESIDE, R.A.F.V.R., No. 45 Sqn.
Act. Flt. Lt. N. RIX, R.A.F.V.R., No. 214 Sqn. (with effect from March 13th, 1945).
Act. Flt. Lt. J. R. STEIN, R.A.F.V.R., No. 234 Sqn.
F/O. M. N. DURRELL, R.A.F.V.R., No. 161 Sqn
F/O. T. P. FARGHER, R.A.F.V.R., No. 234 Sqn.
F/O. B. H. HARVEY, R.A.F., No. 196 Sqn.
F/O. J. HORROCKS, R.A.F.V.R., No. 20 Sqn.
F/O. G. A. JONES, R.A.F.V.R., No. 611 Sqn.
F/O. R. MORRIS, R.A.F.V.R., No. 161 Sqn.
F/O. B. J. SCOWEN, R.A.F.V.R., No. 82 Sqn.
F/O. R. C. WILLDEY, R.A.F.V.R., No. 155 Sqn.
F/O. G. R. T. WILLIS, R.A.F.V.R., No. 47 Sqn.
F/O. A. H. WITTRIDGE, R.A.F.V.R., No. 155 Sqn.
F/O. A. D. YEARDLEY, R.A.F.V.R., No. 126 Sqn.
P/O. J. A. MILLER, R.A.F.V.R., No. 161 Sqn.
P/O. P. MONAGHAN, R.A.F.V.R., No. 215 Sqn.
W/O. J. V. S. GIBSON, R.A.F., No. 82 Sqn.
W/O. S. O'CONNOR, R.A.F.V.R., No. 45 Sqn.
W/O. T. A. STREET, R.A.F.V.R., No. 161 Sqn.
Flt. Lt. R. M. BARCLAY, R.A.A.F., No. 45 Sqn.
Flt. Lt. E. J. HALLETT, R.A.A.F., No. 45 Sqn.
Flt. Lt. M. A. KEMP, R.A.A.F., No. 451 (R.A.A.F.) Sqn.
Flt. Lt. W. S. MCLELLAN, R.A.A.F., No. 45 Sqn.
Flt. Lt. J. D. MORROW, R.A.A.F., No. 681 Sqn.
Flt. Lt. H. M. P. NEIL, R.A.A.F., No. 45 Sqn.
Flt. Lt. R. H. SUTTON, R.A.A.F., No. 451 (R.A.A.F.) Sqn.
Flt. Lt. H. P. VANRENEN, R.A.A.F., No. 196 Sqn.
Flt. Lt. J. R. VERNON, R.A.A.F., No. 45 Sqn.
Flt. Lt. G. F. WILLIAMS, R.A.A.F., No. 45 Sqn.
Flt. Lt. C. I. YOUNGER, R.A.A.F., No. 681 Sqn.
Flt. Lt. N. F. ROBINSON, R.A.A.F., No. 99 Sqn.
F/O. J. O. CARTLEDGE, R.A.A.F., No. 45 Sqn.
F/O. H. HOYSTED, R.A.A.F., No. 196 Sqn.
F/O. H. M. NICHOLLS, R.A.A.F., No. 45 Sqn.
P/O. L. A. CAMERON, R.A.A.F., No. 215 Sqn.
Sqn. Ldr. D. B. FREEMAN, R.C.A.F., No. 406 (R.C.A.F.) Sqn.
Act. Sqn. Ldr. S. E. MURRAY, R.C.A.F., No. 406 (R.C.A.F.) Sqn.
Act. Sqn. Ldr. W. H. NICKEL, R.C.A.F., No. 644 Sqn.

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

Bar to Air Force Cross

Act. Wing Cdr. J. P. HUINS, O.B.E., A.F.C., A.A.F.

Air Force Cross

Wing Cdr. H. R. COLLINS, R.A.F.
Wing Cdr. G. H. GIBSON, D.F.C., R.A.F.
Wing Cdr. L. JOBBINGS, R.A.F.
Act. Wing Cdr. C. A. BALL, R.A.F.O.
Act. Wing Cdr. H. A. CHATER, R.A.F.O.
Act. Wing Cdr. F. G. FERRIER, R.A.F.O.
Act. Wing Cdr. L. E. GILES, D.F.C., R.A.F.O.
Act. Wing Cdr. W. G. JAMES, R.A.F.V.R.
Act. Wing Cdr. G. W. PETRE, D.F.C., R.A.F.O.
Act. Wing Cdr. E. E. RODLEY, D.S.O., D.F.C., R.A.F.V.R.
Act. Wing Cdr. J. H. THOMPSON, D.F.C., R.A.F.V.R.
Sqn. Ldr. W. A. HOWELL, R.A.F.O.
Sqn. Ldr. S. LUNT, R.A.F.V.R.
Sqn. Ldr. B. H. MOLONEY, A.A.F.R.O.
Sqn. Ldr. R. C. PATRICK, D.F.C., R.A.F.O.
Sqn. Ldr. D. SLOAN, R.A.F.O.
Act. Sqn. Ldr. J. E. BOYD, R.A.F.V.R.
Act. Sqn. Ldr. N. B. BUCKLEY, D.F.C., R.A.F.
Act. Sqn. Ldr. G. R. COOPER, R.A.F.V.R.
Act. Sqn. Ldr. R. I. CRUMP, R.A.F.V.R.
Act. Sqn. Ldr. E. J. DAVIDGE, R.A.F.
Act. Sqn. Ldr. R. W. DODD, R.A.F.O.
Act. Sqn. Ldr. W. DUNNETT, R.A.F.V.R.
Act. Sqn. Ldr. C. J. FOOKS, R.A.F.V.R.
Act. Sqn. Ldr. H. GANDY, D.F.C., R.A.F.
Act. Sqn. Ldr. A. W. GILIMORE, R.A.F.
Act. Sqn. Ldr. B. P. GLEDHILL, R.A.F.V.R.
Act. Sqn. Ldr. E. J. GREENWOOD, R.A.F.
Act. Sqn. Ldr. R. R. GREGORY, R.A.F.
Act. Sqn. Ldr. O. HAILSTONE, R.A.F.V.R.
Act. Sqn. Ldr. G. F. HARCOURT-POWELL, R.A.F.
Act. Sqn. Ldr. H. S. HARTLEY, R.A.F.V.R.
Act. Sqn. Ldr. J. D. HAWKINS, R.A.F.V.R.
Act. Sqn. Ldr. G. R. HAY, D.F.C., R.A.F.V.R.
Act. Sqn. Ldr. J. M. HEIME, R.A.F.V.R.
Act. Sqn. Ldr. H. M. T. HERON, R.A.F.O.
Act. Sqn. Ldr. W. H. JONES, D.F.C., R.A.F.V.R.
Act. Sqn. Ldr. T. C. KAYE, D.F.C., R.A.F.
Act. Sqn. Ldr. H. C. LANGFORD, R.A.F.V.R.
Act. Sqn. Ldr. B. P. K. O'DUFFY, R.A.F.O.
Act. Sqn. Ldr. E. V. SMITH, D.S.O., D.F.C., R.A.F.V.R.
Act. Sqn. Ldr. A. L. STEVENS, R.A.F.V.R.
Act. Sqn. Ldr. E. C. W. TROLLIP, R.A.F.V.R.
Act. Sqn. Ldr. R. WALTON, M.C., R.A.F.
Act. Sqn. Ldr. J. W. WARD, D.F.C., R.A.F.V.R.
Act. Sqn. Ldr. F. WILLIAMSON, R.A.F.V.R.
Flt. Lt. M. N. BARTLETT, R.A.F.
Flt. Lt. J. R. J. BELSON, R.A.F.V.R.
Flt. Lt. A. BOLLINGTON, R.A.F.V.R.
Flt. Lt. P. BOOTH, R.A.F.V.R.
Flt. Lt. E. J. T. BOUCHER, R.A.F.V.R.
Flt. Lt. W. W. BRISCOE, R.A.F.V.R.
Flt. Lt. C. T. CAMPBELL, R.A.F.V.R.
Flt. Lt. R. I. L. CHISHOLM, D.F.C., R.A.F.V.R.
Flt. Lt. D. W. CLAXTON, R.A.F.V.R.
Flt. Lt. R. J. COLE, R.A.F.V.R.
Flt. Lt. A. CRESSWELL, D.F.C., R.A.F.V.R.
Flt. Lt. D. M. DIXON, R.A.F.V.R.
Flt. Lt. K. W. DUNLOP, D.F.M., R.A.F.V.R.
Flt. Lt. J. H. ELSHAW, R.A.F.
Flt. Lt. W. M. EVANS, R.A.F.V.R.
Flt. Lt. F. C. FERGUSON, R.A.F.V.R.
Flt. Lt. R. B. FINNEY, R.A.F.V.R.
Flt. Lt. J. P. R. GALBRAITH, R.A.F.V.R.
Flt. Lt. G. C. GILBERT, R.A.F.
Flt. Lt. R. M. HACKNEY, R.A.F.V.R.
Flt. Lt. W. P. HADFIELD, R.A.F.V.R.
Flt. Lt. D. H. HALLETT, R.A.F.V.R.
Flt. Lt. R. E. R. HAMMERBECK, R.A.F.V.R.
Flt. Lt. H. A. HOOPER, R.A.F.V.R.
Flt. Lt. J. G. HORNE, R.A.F.V.R.
Flt. Lt. A. R. G. JACKSON, R.A.F.V.R.
Flt. Lt. L. S. LOVERIDGE, R.A.F.V.R.
Flt. Lt. R. R. N. LOWE, R.A.F.V.R.
Flt. Lt. R. A. MCKENDRICK, R.A.F.V.R.
Flt. Lt. P. C. MARIES, R.A.F.V.R.
Flt. Lt. J. METCALF, D.F.M., R.A.F.V.R.
Flt. Lt. B. A. NORT, D.F.C., R.A.F.V.R.
Flt. Lt. H. A. MACK. PASCOE, R.A.F.V.R.
Flt. Lt. W. S. O. RANDLE, R.A.F.V.R.
Flt. Lt. D. ROBERTS, D.F.C., R.A.F.V.R.
Flt. Lt. F. ROBINSON, R.A.F.V.R.
Flt. Lt. J. A. ROWAN-PARRY, R.A.F.V.R.
Flt. Lt. H. R. SHARMAN, R.A.F.V.R.
Flt. Lt. A. G. SHEPARD, R.A.F.V.R.
Flt. Lt. G. W. SIMS, R.A.F.V.R.
Flt. Lt. G. C. TURNER, R.A.F.V.R.
Flt. Lt. I. E. VERSTAGE, R.A.F.
Flt. Lt. J. S. VERTIGEN, R.A.F.V.R.
Flt. Lt. E. F. WALTER, R.A.F.V.R.
Act. Flt. Lt. I. S. DAVIES, R.A.F.V.R.
Act. Flt. Lt. R. N. HAMER, R.A.F.V.R.
Act. Flt. Lt. B. R. MARKS, D.F.C., R.A.F.V.R.
Act. Flt. Lt. A. WEATHERSTON, R.A.F.V.R.
F/O. W. M. ADDISON, D.F.C., R.A.F.V.R.
F/O. P. C. BARRAT, R.A.F.V.R.
F/O. F. L. CARNELL, R.A.F.V.R.
F/O. R. CROSTON, R.A.F.V.R.
F/O. B. S. EDMONDSON, R.A.F.V.R.
F/O. J. C. GILLON, R.A.F.V.R.
F/O. F. R. HANCOCK, R.A.F.V.R.
F/O. J. W. HEAMES, R.A.F.V.R.
F/O. R. J. ROONEY, R.A.F.V.R.
F/O. R. A. H. SNOW, D.F.M., R.A.F.V.R.
F/O. J. TOWEY, R.A.F.V.R.
F/O. W. J. WILKINSON, D.F.M., R.A.F.V.R.
F/O. J. C. WILLIAMS, R.A.F.V.R.
P/O. J. R. BATES, R.A.F.
W/O. G. T. CLARKE, R.A.F.V.R.
W/O. G. EDMOND, R.A.F.
W/O. H. E. MARSH, R.A.F.V.R.
W/O. E. G. WILDING, R.A.F.V.R.
Wing Cdr. D. R. MILLER.
Act. Sqn. Ldr. G. MACD. GILLESPIE.
Act. Sqn. Ldr. A. D. R. LOWE, D.F.C.
Flt. Lt. N. E. GREENWAY.
Act. Flt. Lt. T. E. C. AINSLIE, D.F.C.
Wing Cdr. J. H. M. SMITH.
Act. Sqn. Ldr. G. V. DONALD.
Flt. Lt. D. G. AURISCH.
Flt. Lt. R. B. BERNEY, D.F.M
Flt. Lt. M. E. NAIRN.
Flt. Lt. R. F. WORSLEY.
F/O. G. W. BURNESS, D.F.M.
Capt. J. R. MATHEWS.
Flt. Lt. H. BHARUCHA.

Air Force Medal

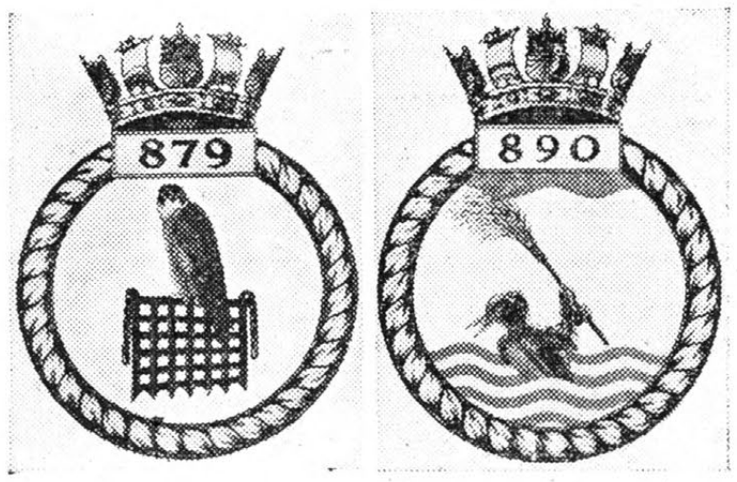
Flt. Sgt. R. A. WATSON, R.A.F.V.R.
Flt. Sgt. F. A. CHAPMAN, R.A.F.V.R.
Flt. Sgt. K. E. LEIGHTON-BENNETT, R.A.F.V.R.
Flt. Sgt. A. V. REDGRAVE, R.A.F.V.R.
Flt. Sgt. G. THOMAS, R.A.F.
Flt. Sgt. J. L. ARNETT, R.C.A.F.
Sgt. W. W. BEAMISH, R.A.F.
Sgt. T. E. C. MANSON, S.A.A.F.
Cpl. R. E. CHANNING, R.A.F.V.R.
Cpl. W. J. BUTLER, S.A.A.F.

George Medal

Flt. Lt. R. BULLEN, No. 458 Sqn.

O.B.E. (Mil.)

F/O. I. O. HULLEY, R.A.F.V.R.



(Left) Badge of No. 879 Squadron, Naval Air Arm—"Si vis defendre oppugna" (Attack is the best defence). On a white field, a Peregrine falcon proper perched upon a portcullis black. (Right) Badge of No. 890 Squadron, Naval Air Arm—"Caelum Verrimus" (We sweep the sky). On a white field, issuant from water barry wavy in base blue and white, a knight in armour to the sinister holding in his hands a broom all proper: a chief wavy blue.

B.E.M. (Mil.)

L.A/C. R. T. MILLER.
Flt. Sgt. J. L. SHERRARD, R.A.F.
Sgt. L. B. VOLLER, R.A.F.V.R.
Sgt. L. A. POTTER.
Sgt. J. BAKER, R.A.F. Police Detachment, Iceland.
Sgt. W. G. SHAW.
Cpl. G. H. EDGAR.
Cpl. J. E. BROWNE, R.A.F. Station, Chedbugh.
Cpl. F. G. H. WOOLVEN.
Cpl. J. SPENCER, R.A.F.V.R.
L.A/C. F. T. BIRCH, R.A.F.V.R.
L.A/C. D. WHITAKER, R.A.F.V.R., No. 33 A.S.R. M.C.U.
A/C.1 T. SULLIVAN, R.A.F. Station, Bentwaters.
A/C.1 G. A. WATKINSON, R.A.F. Station, Bentwaters.

Army Awards

THE KING has been graciously pleased to approve the following awards in recognition of gallant and distinguished services at Arnhem:—

Distinguished Service Order

Maj. (temp.) C. PERRIN-BROWN, M.C., The Parachute Regiment, Army Air Corps.
Maj. (temp.) P. E. WARR, M.B.E., The Parachute Regiment, Army Air Corps.

Second Bar to Military Cross

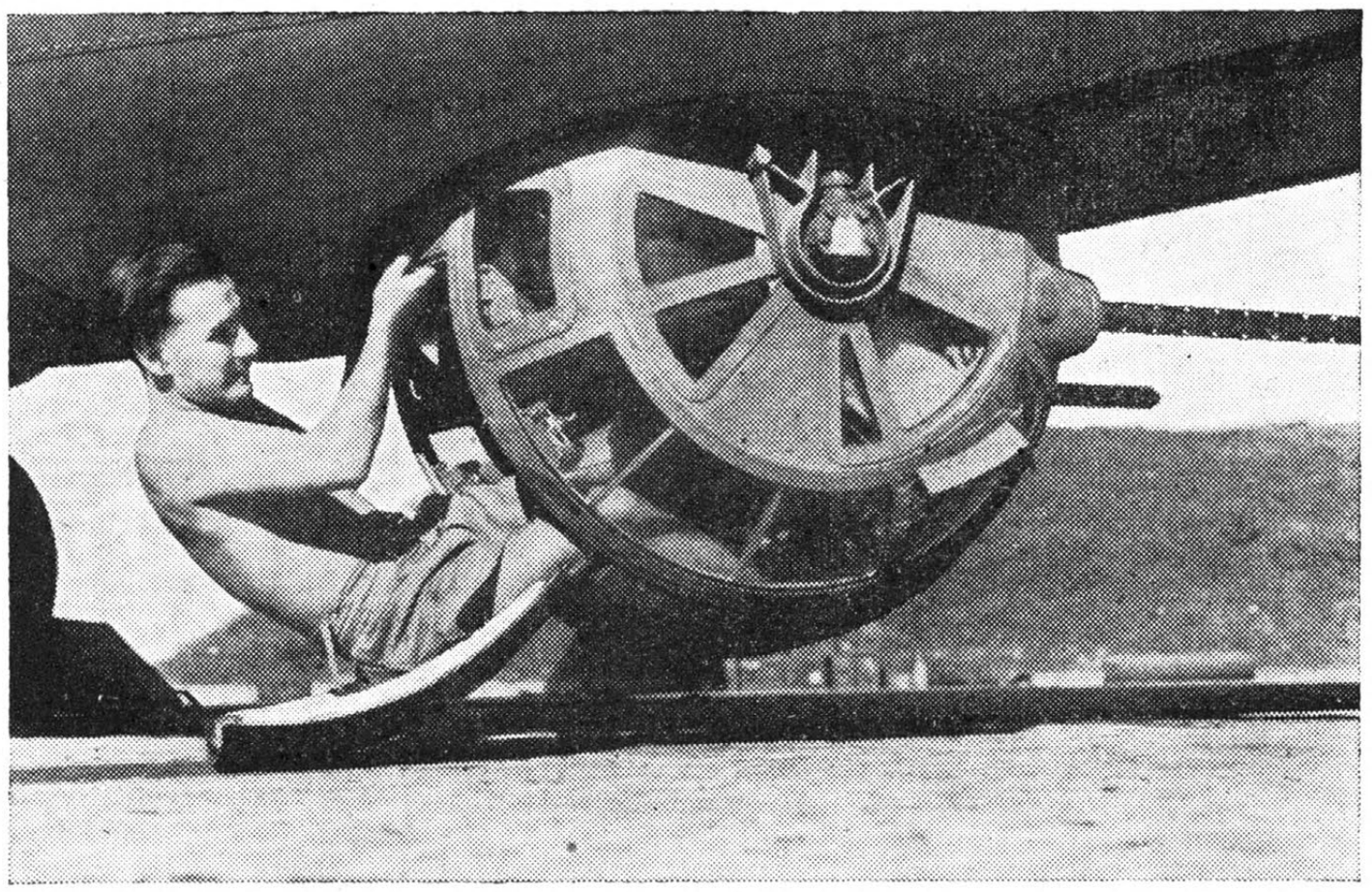
Maj. (act.) J. TIMOTHY, M.C., The Parachute Regiment, Army Air Corps.

Bar to Military Cross

Capt. (temp.) B. B. CLEGG, M.C., The Parachute Regiment, Army Air Corps.

Military Cross

Maj. (temp.) M. W. DENNISON, The Parachute Regiment, Army Air Corps.
Capt. (temp.) F. K. HOYER-MILLAR, The Parachute Regiment, Army Air Corps.



CROUCHING ROOM ONLY: Close-up of the uncomfortable but efficacious "ball turret" of an R.A.F. Liberator. R.A.F. squadrons of Liberators and Wellingtons made a fine contribution to the victory in Burma.

SERVICE AVIATION

Lt. J. A. S. CLEMINSON, The Parachute Regiment, Army Air Corps.

Distinguished Conduct Medal

W/O.I R. D. GAY, The Parachute Regiment, Army Air Corps.
Sgt. T. C. BENTLEY, The Parachute Regiment, Army Air Corps.
Pte. A. E. ETHERIDGE, The Parachute Regiment, Army Air Corps.

Military Medal

Sgt. H. W. CARRIER, The Parachute Regiment, Army Air Corps.
Sgt. F. S. MANSER, The Parachute Regiment, Army Air Corps.
Sgt. J. RICHARDS, The Parachute Regiment, Army Air Corps.
Pte. G. FLAMBERG, The Parachute Regiment, Army Air Corps.
Pte. R. A. LYGO, The Parachute Regiment, Army Air Corps.

THE KING has been graciously pleased to approve the following awards in recognition of gallant and distinguished services in Italy:—

Bar to Military Cross

Maj. (temp.) M. W. H. SHEPHARD, M.C., Army Air Corps.

Military Cross

Maj. (temp.) L. A. FITZROY-SMITH, Army Air Corps.

Distinguished Flying Cross

Maj. (temp.) J. S. STORMONTH-DARLING, Royal Regiment of Artillery (since died).
Capt. S. W. BARROW, Royal Regiment of Artillery.
Capt. (temp.) W. H. BUCHANAN, Royal Regiment of Artillery.
Capt. (temp.) R. FORBES, Royal Regiment of Artillery.
Capt. (temp.) A. S. C. GANDER, Royal Regiment of Artillery.
Capt. (temp.) I. N. KENDAL, Royal Regiment of Artillery.
Capt. (temp.) L. J. WHEELER, Royal Regiment of Artillery.
Capt. (temp.) D. WYLIE, Royal Regiment of Artillery.

Roll of Honour

Casualty Communiqué No. 541.

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

Royal Air Force

KILLED IN ACTION.—Flt. Sgt. A. Bennett; F/O. F. H. Cusworth; W/O. J. S. Davison; W/O. J. Grain; W/O. G. Hughes; F/O. A. S. Ledbrook; Sgt. A. B. C. Love; Sgt. W. S. E. Lowman; Flt. Sgt. R. E. Marshall; Sgt. J. M O'Sullivan; W/O. S. J. V. Philo; A/C.1 G. J. Robinson; Sgt. A. W. Skeldon; Sgt. K. C. Sparkes; Sgt. H. Swinnerton; W/O. H. A. Symmons.

MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. H. P. Thomas; Sgt. W. Marsden; Act. F/O. H. G. S. Kerr; Sgt. C. G. Hogg.

MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. J. A. Freeman.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. T. Ballantyne; Act. Flt. Lt. G. H. Calveley; Flt. Sgt. R. H. E. Collinson; Sgt. S. Holt.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. H. R. Anthony; Flt. Sgt. L. Barlow; Flt. Sgt. R. H. Barnes; Act. Wing Cdr. C. S. Bartlett, D.F.C.; Sgt. E. Beard; W/O. L. J. Billen; Sgt. H. D. Birkbeck; Sgt. D. C. Broome; Sgt. J. W. Broughton; Flt. Sgt. R. R. Bunker; Sgt. W. J. C. Cambridge; Sgt. J. McD. Campbell; Flt. Sgt. C. L. Carpenter; Sgt. R. M. Cartlidge; Sgt. L. F. Chappell; Flt. Lt. P. R Coldwell, D.S.O., D.F.M.; Flt. Sgt. R. S. Cornelius; Sgt. F. L. Corner; Sgt. P. Corrigan; P/O. W. F. Crosbie; Sgt. G. F. Crump; Flt. Sgt. L. B. Daitz; F/O. W. E. Day; Sgt. H. W. Douglas; P/O. T. J. Drew; Sgt. C. G. Dudley; F/O. L. C. Dudley; Sgt. J. L. Dunbar; Flt. Sgt. G. C. Dyke; Sgt. H. R. Elsbury; Sgt. L. D. Farmer; Sgt. S. Flavell; Sgt. F. W. Flude; Flt. Sgt. C. L. Foster; Flt. Sgt. R. Fryer; Flt. Sgt. T. Gaskell; Flt. Sgt. W. H. Giles; Flt. Sgt. J. L. Gledhill; Sgt. W. D. Glenn; Sgt. S. S. Greenwood; Sgt. H. Grice; F/O. J. L. Griffith; F/O. K. R. Hall; Sgt. W. Hall; F/O. R. A. C. Hammond; P/O. W. J. Hardwick; W/O. G. G. Harker; P/O. R. B. V. Harris; Sgt. R. J. Hawksworth; Flt. Sgt. J. Healy; Flt. Sgt. F. Heath; F/O. F. Heath; Flt. Sgt. J. M. Henderson; P/O. F. N. Henley; Sgt. J. Herkes; Flt. Lt. F. Hill, O.B.E., D.F.C.; Sgt. K. J. Holton; Sgt. R. C. Hulme; Act. W/O. R. T. Hunt; P/O. A. T. Jackson; P/O. T. I. Jones; Sgt. W. E. Jones; Sgt. J. Kiltie; Sgt. E. R. Kingham; Sgt. R. P. Kinnear; Sgt. L. V. Laight; Act. W/O. J. Lamonby; F/O. H. J. Larby; Flt. Lt. H. D. Lea; Sgt. J. Lindsay; Sgt. E. A. Louis; Sgt. A. J. McAllister; Sgt. J. Marshall; F/O. W. E. Marshall; F/O. H. T. Maskell; Flt. Sgt. B. C. Mattocks; Flt. Sgt. D. E. Moss; F/O. K. W. A. Muir; Flt. Sgt. D. W. Muddiman; Flt. Lt. I. M. Mundy; F/O. W. Murphy; Sgt. M. E Murton; Sgt. F. D. Nash; Sgt. F. T. Nolan; Sgt. W. F. O'Neill; Sgt. H. E. F. Owen; Sgt. K. W. Owen; Sgt. W. R. Patience; Sgt. M. Pickles; Sgt. H. E. Pollard; Sgt. A. Porter; Wing Cdr. E. F. Porter; P/O. A. Price; Sgt. R. L. Puckett; Sgt. J. Ramsay; P/O. R. R. Reed, D.S.O.; Sgt. N. C. V. Rooker; Sgt. R. A. Rose; P/O. J. W. Rouse; Sgt. W. F. Shead; F/O. M. R. Shute; Flt. Lt. E. N. Slade; Ft. Sgt. R. W. Snell; Sgt. J. Southern; Sgt. R. W. Stafford; Sgt. W. A. Steel; Sgt. J. Stewart; W/O. L. D. Stoddart; P/O. H. A. Sutherland; Sgt. A. Taylor; F/O. C. J. Taylor, D.F.M.; Sgt. R. Thompson; F/O. A. E. Truesdale; Sgt. F. F. Violett; Flt. Sgt. W. R. Waker; Sgt. F. G. Walter; Sgt. F. Ward; Flt. Sgt. J. B. Ward; Flt. Sgt. W. T. Warren; Sgt. W. Wass; Sgt. E. L. Watts; Sgt. F. H. Whittington; Sgt. M. Wigham; Flt. Sgt. E. Wilde; F/O. G. A. Wilkinson; F/O. F. N. Wilson; Sgt. R. Wilson; Flt. Lt. R. G. Young.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Flt. Sgt. T. Bamford; Sgt. A. Barker; Flt. Sgt. E. J. Coe; Sgt. E. J. Courtenay; Sgt. A. Craven; F/O. J. Christie; Sgt. R. G. Dean; F/O. D. K. Flaherty; Sgt. J. Furnival; Flt. Sgt. R. Haine; Flt. Sgt. F. W. Lambert; P/O. E. Leigh; F/O. W. McGillivray; Act. F/O. D. N. McKechnie; Sgt. J. E. Mackintosh; Sgt. F. Morgan; Sgt. K. T. Robbins; Sgt. S. J. Rodway; Sgt. V. F. Scrivens; Sgt. R. A. Williams.

WOUNDED OR INJUREI IN ACTION.—W/O. R. E. Coverdale; F/O. T. L. Hunt; Flt. Sgt. A. Mills; Sgt. A. H. Stredwick; W/O. R. L. Thomas.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Flt. Sgt. R. Rigby; P/O. W. Tonge.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. A. Armstrong; Sgt. W. A. Austen; F/O. E. L. Carmichael; Sgt. R. F. Gunn; F/O. J. L. Halcrow; W/O. A. Holmes; Flt. Sgt. W. J. B. Jones; Flt. Sgt. D. R. Newman; Sqn. Ldr. C. M. Palmer; Flt. Lt. B. W. Sharpe; Flt. Sgt. A. W. Snelling; Flt. Sgt. K. D. Wall.

MISSING.—Flt. Sgt. G. W. Ackerman; Flt. Sgt. J. B. Aherne; F/O. K. W. Ainsworth; Flt. Sgt. K. Allen; Flt. Lt. C. J. Blundell-Hill; Sgt. A. Boothman; Flt. Sgt. G. Brain; Flt. Sgt. W. T. Bray; F/O. R. Breakwell; Sgt. K. W. Clapperton; Sgt. N. MacD. Cox; Sgt. D. H. Davies; Flt. Lt. R. F. Escreet, D.F.M.; Sgt. D. S. Fielding; Flt. Sgt. J. D. Grime; Flt. Lt. C. G. Hall; F/O. P. Hawkins; Flt. Sgt. T. J. Henderson; Act. F/O. R. F. Hennessy; Flt. Lt. R. J. H. Holland; F/O. J. S. Holmes; Flt. Sgt. K. A. Horne; F/O. H. S. Johnson; Sgt. J. Johnson; Flt. Sgt. K. Kay; Sgt. P. Kitching; Sgt. F. M. Lancaster; Flt. Sgt. V. J. Lawrence; Sgt. J. Lyons; W/O. I. M. MacPhee; Act. Flt. Lt. R. Miller, D.F.M.; Sgt. L. D. Mills; F/O. R. F. Moneypenny; Sgt. A. Moore; P/O. J. M. Navin; Flt. Sgt. M. O'Loughlin; Act. F/O. I. H. S. Philcox; Flt. Sgt. A. Rainsford; Sgt. H. Richards; Sgt. N. F. Scaife; Sgt. R. J. Shepherd; Sgt. S. A. Sheppard; Flt. Sgt. A. J. Stacey; W/O. A. Standrin; Flt. Sgt. H. N. Stauber; W/O. N. Stott, D.F.M.; Flt. Sgt. A. V. Sullivan; F/O. F. Thompson; Sgt. A. West; Sgt. G. A. White; F/O. R. W. Wilson; Sgt. G. Wolloshin.

KILLED ON ACTIVE SERVICE.—A/C.2 J. C. Cantle; Flt. Lt. T. J. Cole; L.A/C. W. Dakers; L.A/C. S. Fordham; Sgt. K. S. Halliwell; Sgt. K. A. Kelsall; Act. Wing Cdr. C. M. Lander; Sgt. R. Podmore; P/O. D. J. H. Reader; F/O. A. Recina; Sgt. J. W. Stubbings; Sgt. W. J. Tyson; F/O. W. J. Wates; Flt. Sgt. J. Wright; Sgt. M. S. Wright.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED ON ACTIVE SERVICE.—Act. Sqn. Ldr. F. A. Grantham, D.F.C.

WOUNDED OR INJURED ON ACTIVE SERVICE.—L.A/C. P. J. Bury; L.A/C. E. Bowker; L.A/C. A. C. Dyer; Sgt. N. P. Gerrish; L.A/C. G. Griffiths; L.A/C. A. E. King; F/O. R. W. Merrison; L.A/C. R. Stephenson; L.A/C. L. Wilks; L.A/C. C. T. G. Williams; L.A/C. G. Williams.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—L.A/C. G. H. Collier; Cpl. A. C. Trebilcock.

DIED ON ACTIVE SERVICE.—A/C.2 J. H. Butler; L.A/C. A. Commons; Cpl. C. H. George; Act. Flt. Lt. R. R. Green; Sgt. A. W. Herkess; L.A/C. C. Horsfield; Sgt. A. J. Hughes; L.A/C. G. Readshaw; W/O. A. D. Rees; A/C.1 W. Reid; L.A/C. T. E. Rigby; F/O. R. Roberts; L.A/C. C. A. Rogers; F/O. R. Savage; Sgt. G. T. Tustain; L.A/C. A. P. Warren; Sgt. H. E. Walker.

Royal Australian Air Force

KILLED IN ACTION.—F/O. N. Carroll; F/O. R. M. Kennard; P/O. F. J. Newton.

MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. A. Olsen.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. H. E. Brock; W/O. W. T. Jones.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Act. F/O. M. T. Thomas.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW REPORTED KILLED IN ACTION.—W/O. C. A. Seeney.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Flt. Sgt. E. P. Austin; Flt. Sgt. M. R. Burgess; F/O. A. C. Cameron; Flt. Sgt. K. L. King; P/O. R. L. Nicholson; Flt. Sgt. E. H. Richardson.

MISSING, BELIEVED KILLED IN ACTION.—F/O. H. S. Chatto; F/O. L. A. Ellis; P/O. B. F. Greenwood; F/O. J. E. Paradise.

MISSING.—W/O. H. J. Arney; Flt. Sgt. L. J. Bull; W/O. R. R. Cameron; W/O. V. R. Campbell; W/O. G. S. Catford; Flt. Sgt. J. S. Coster; F/O. J. D. Cottman; Flt. Sgt. J. A. Day; W/O. D. P. Drummond; W/O. C. Jardine; P/O. G. O. H. Lind; P/O. A. G. Murray; W/O. D. P. O'Donoghue; Act. Flt. Lt. A. R. Palling; Flt. Sgt. V. E. Petschell.

KILLED ON ACTIVE SERVICE.—P/O. N. H. Orchard.

Royal Canadian Air Force

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Flt. Sgt. N. T. James; Flt. Sgt. W. R. Little; P/O. F. Vandroogenbroeck

Royal New Zealand Air Force

KILLED IN ACTION.—Flt. Lt. F. P. Adlam.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. A. S. Jones; Flt. Sgt. G. A. Sinclair; F/O. C. R. Strang.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—F/O. I. D. Graham.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Act. Flt. Lt. O. P. F. Taylor, D.F.C.

MISSING, BELIEVED KILLED IN ACTION.—Act. Flt. Lt. B. A. Gumbley, D.F.M.; F/O. E. J. Holloway; F/O. R. J. Scott.

MISSING.—Flt. Lt. J. Plummer, D.F.C.; F/O. F. H. Thompson; Act. Flt. Lt. R. L. Werner.

KILLED ON ACTIVE SERVICE.—F/O. S. F. Parlato, D.F.C.

South African Air Force

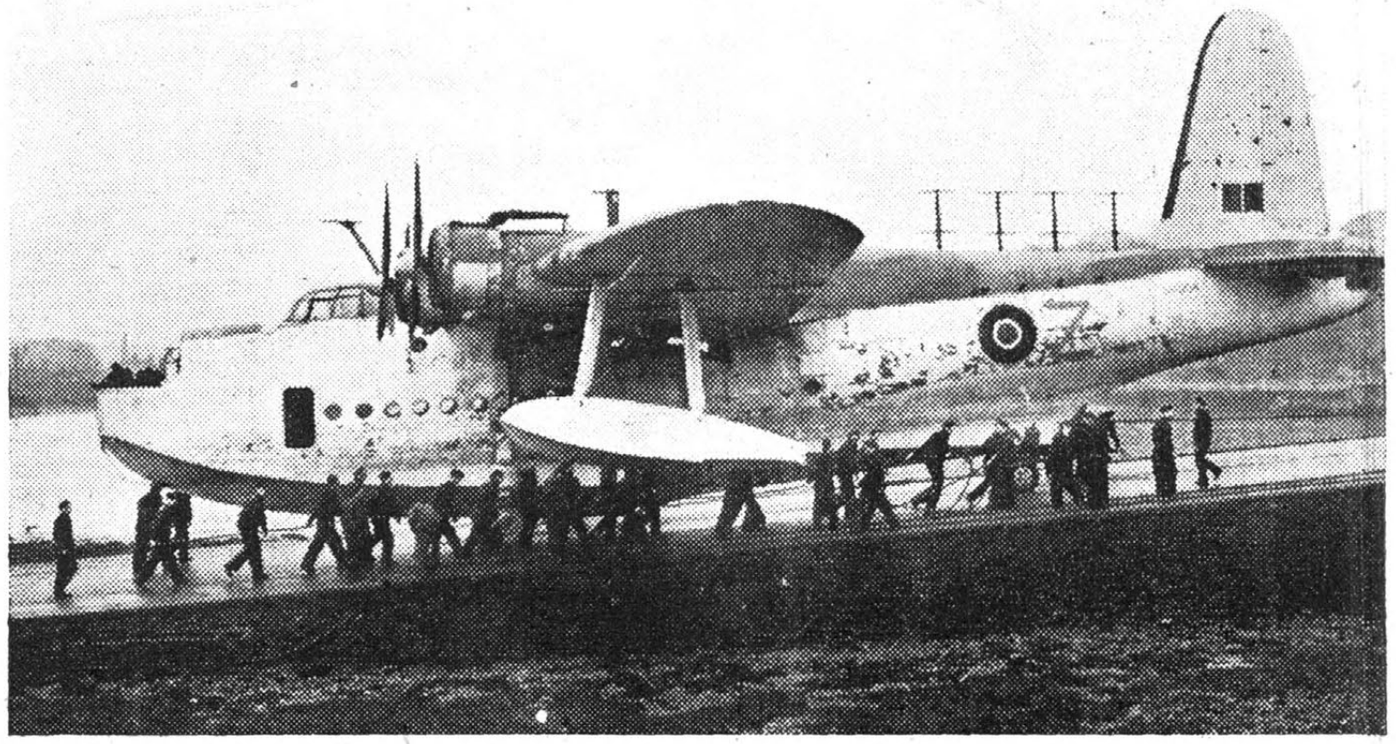
KILLED IN ACTION.—Lt. R. F. Kraynauw; Lt. W. B. Penn; Lt. E. W. Rosenstein.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Lt. N. Boys.

DIED ON ACTIVE SERVICE.—Capt. R. F. Leach.

Royal Indian Air Force

KILLED ON ACTIVE SERVICE.—A/C.2 V. A. Mhaskar.



COASTAL'S KILLER : A weather-beaten Sunderland III of an Australian squadron being towed up the slipway for overhaul.