

FLIGHT

and
AIRCRAFT ENGINEER

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The Outlook

The Air Estimates Speech

TO most people the most surprising feature of the speech with which Sir Archibald Sinclair introduced the Air Estimates last week was the statement that several young officers of the W.A.A.F. had been dropped by parachute at night in France and had played a useful part in helping the resistance of the French partisans. We have travelled a long way since Florence Nightingale first took British women out to a theatre of war to nurse wounded soldiers.

For the rest, the speech of the Secretary of State for Air was mostly a division of the credit due to Coastal, Bomber and Fighter Commands. Actually, he hardly made any definite allusion to Fighter Command, for his compliment to it was negative. It was on the destruction of the German fighter power that he laid stress, quoting his own remarks of last year and a recent statement by General Arnold, of the U.S. Army Air Forces, both to the effect that the attacks on German fighter production in February last year marked one of the decisive stages of the whole war. If the enemy had been able to increase his fighter output as he had planned to do, the subsequent developments of the war might have been very different from what they have been. Everyone has realised by now (or should have realised) that air superiority is a matter of fighters; they are the linchpin of air power.

Very rightly, Coastal Command came in for the highest possible praise from the Secretary of State. In conjunction with the Royal Navy, this Command had the responsibility of seeing that the U-boats did not wreck the Allied invasion of Normandy. The Biscay fleet of U-boats made its way on the surface to the western approaches to the Channel. There it was fiercely attacked by Coastal Command and by the Navy, and during the first four critical days from D-day the

Command made 38 sightings, which resulted in several destructive attacks. Prisoners admitted that entering the Channel was a nightmare. These successes, said Sir Archibald, were decisive.

It makes one shudder to think what might have happened if the invasion of Normandy had been a failure; and that reflection magnifies the gratitude which we must all feel towards the Navy and Coastal Command for breaking down the greatest threat to its success.

Bomber Command's Part

SIR ARCHIBALD turned to Bomber Command last. After recalling that for four years the Allied Air Force was the only force from the West carrying the war to Germany, he gave credit to this Command for having broken the strength of the *Luftwaffe*. Had not the *Luftwaffe*, he said, been outfought in the air, hammered on its airfields, and smashed in its factories there could have been no invasion of Normandy last year. Every port in Southern England before D-day was packed with shipping for the invasion—a bomb-aimer's paradise—yet not a bomb fell. Of course, the Americans share with the R.A.F. the credit for this smashing of the power of the *Luftwaffe*; but in presenting the Air Estimates it was not the business of the Secretary of State to say much about our Allies. His business lay in getting money from the House of Commons for the R.A.F.

Quite rightly he went back to an earlier stage, when the persistent raids by Bomber Command forced the Germans to surrender their thoughts of a decisive offensive against Britain, and to concentrate on defence against those raids. That meant reducing their own production of bombers and trying in every way to multiply their production of fighters. But that effort

had failed; the fighters were mainly scotched in their factories and on their airfields (in addition to losing large numbers through the R.A.F. fighter sweeps), and when the critical day came the enemy had neither fighters to contest our air supremacy nor bombers to strike at our invasion fleet.

Sir Archibald admitted, in answer to an interruption, that there had been in no theatre of war at any time during this war any case of an army being so paralysed by air attack that it had been *quite* incapable of movement. But the Allied Air Forces had reduced German oil production to such an extent that the enemy's resources were approaching exhaustion. Without oil, an army cannot move freely.

Road Closed

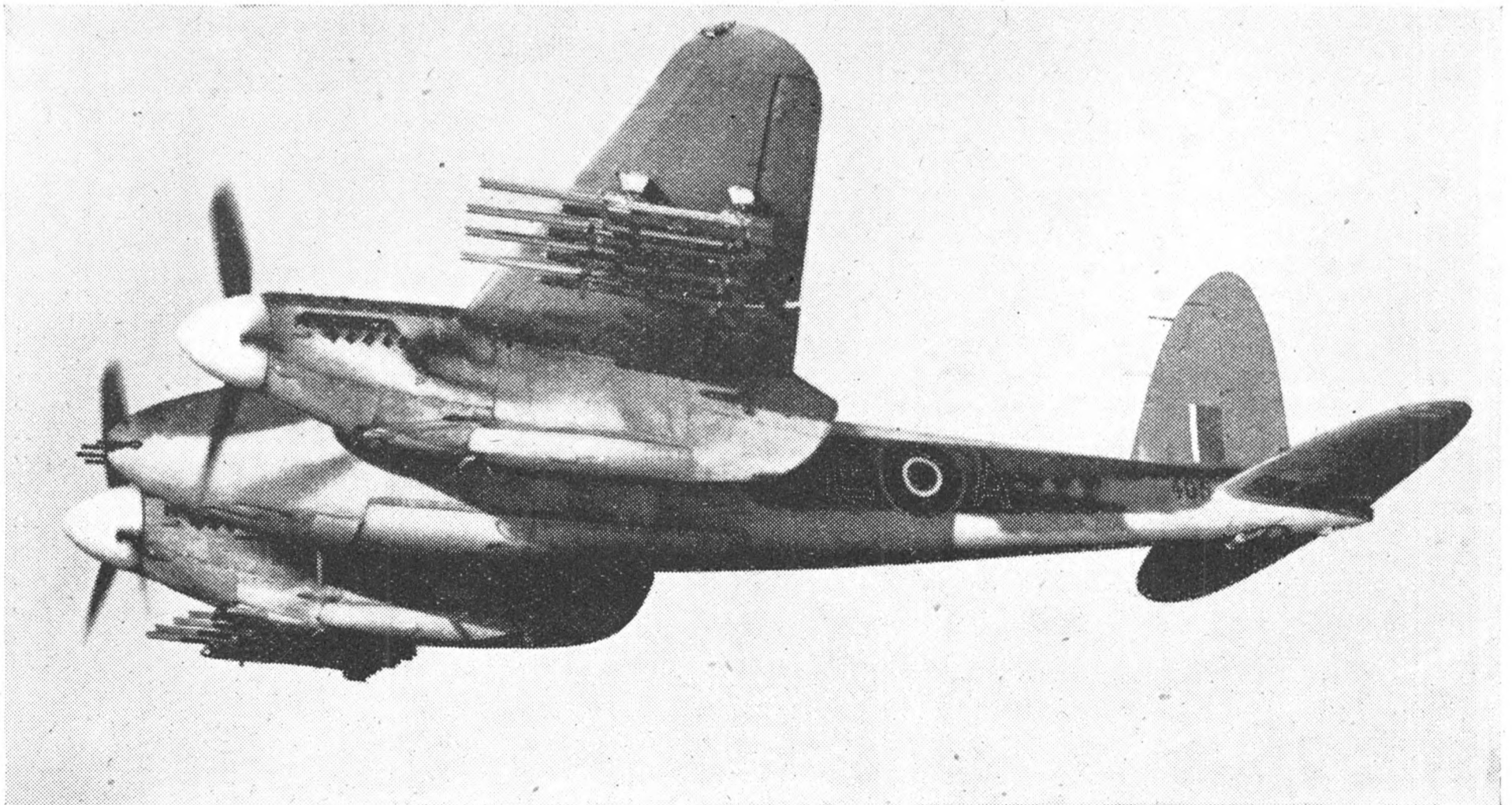
BELATED as it was, the birching which the Government received at the hands of many Members of Parliament over the shameful treatment meted out to the Air Training Corps is to be welcomed. In spite of the pious hopes expressed on behalf of the Government, the debate on March 6th may well be the swan song of the A.T.C. After the way the Corps has been mishandled, it is by no means certain that the young men will be there to volunteer when they are wanted next time, or even in the post-war scheme. They might well be forgiven for holding back, and Commander Brabner's promise to ensure that post-war A.T.C. output shall bear a close relationship to the intake requirements of the R.A.F. may be difficult of fulfilment—in a sense different from that which he meant to convey.

With a keenness beyond all praise, these young lads joined the A.T.C. as being what the Secretary of State for Air once described as "the royal road to the Royal Air Force." That road is now, to all intents and purposes, closed. The closing may be inevitable; probably it is. But at least the Air Ministry might have

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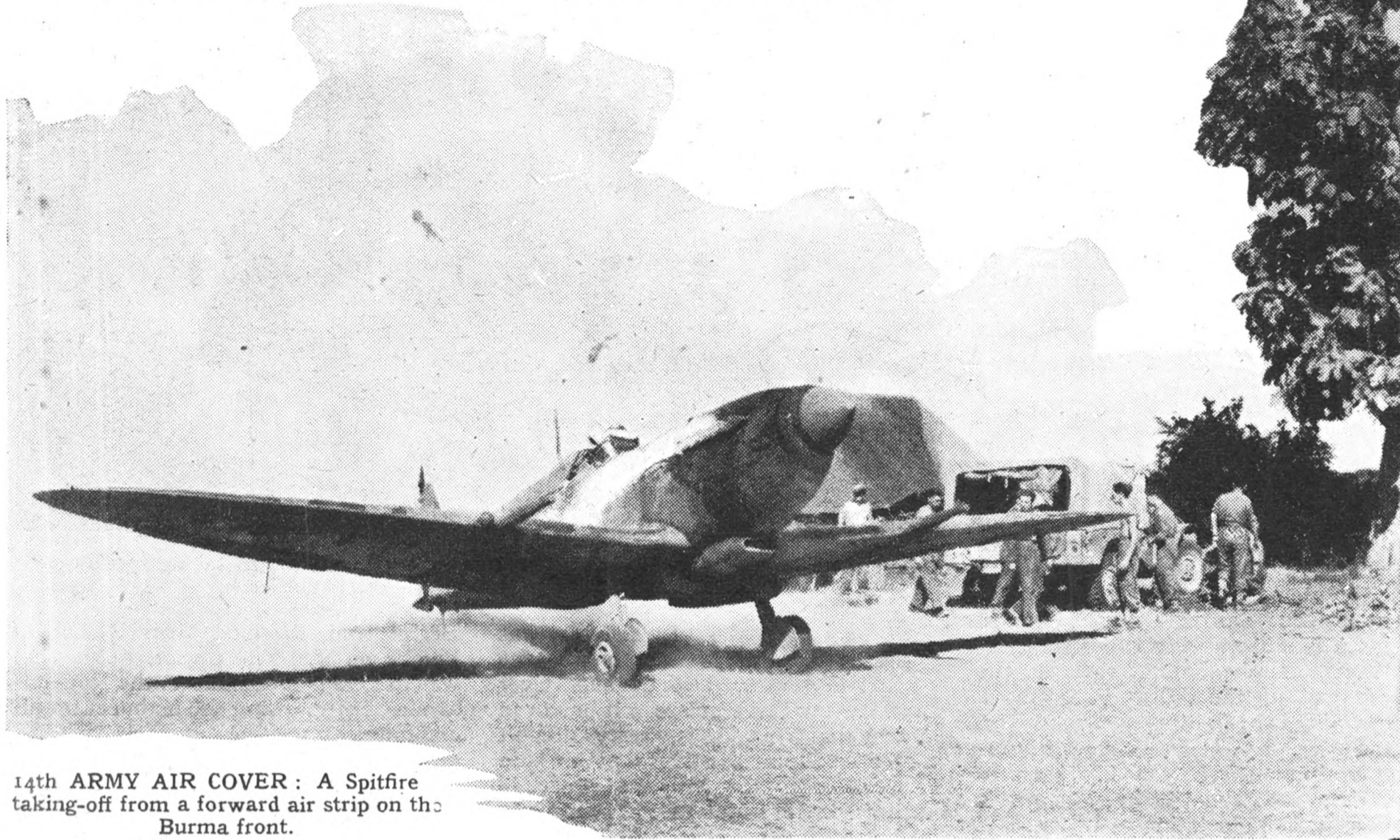
tapered off recruiting or raised the entry standard instead of making a sudden announcement on the radio diverting these highly trained lads to the Army or even to the mines. It would be no more than poetic justice if, next time the emergency arises, the Air Ministry had to call in vain. Fortunately for the nation, that is never likely to happen. British youth, thank goodness, is too patriotic and too air-minded, but to trade on that fact, which is what the Government has done, is neither dignified nor plain common justice.

Mr. W. R. Perkins, in one of the best air speeches he has ever made in the House, drew a sombre picture of the future. We do not think he exaggerated when he said that, unless the Air Ministry acts at once, in three months there will be no A.T.C., and "this priceless national asset will have gone for ever, never to be revived." We have received many letters from members and supporters of the Air Training Corps, and it seems quite clear that the shabby treatment dealt out to the Corps has not only caused bitter resentment and disappointment, but, what is far worse, has almost killed the magnificent spirit with which it was imbued.



HITTING POWER: The Mark VI Mosquito which Coastal Command are now using for shipping strikes. It carries eight rockets in addition to the usual four 20 mm. Hispano cannon and four .303 Browning machine guns. The exploding cannon shells are used during an attack as tracers, to decide the exact moment to release the rockets. For special occasions a number of 500 lb. bombs can also be carried.

WAR in the AIR



14th ARMY AIR COVER : A Spitfire taking-off from a forward air strip on the Burma front.

Allies Across the Rhine : Cologne Occupied : Brenner Route Blocked by Air Attack : British in Mandalay

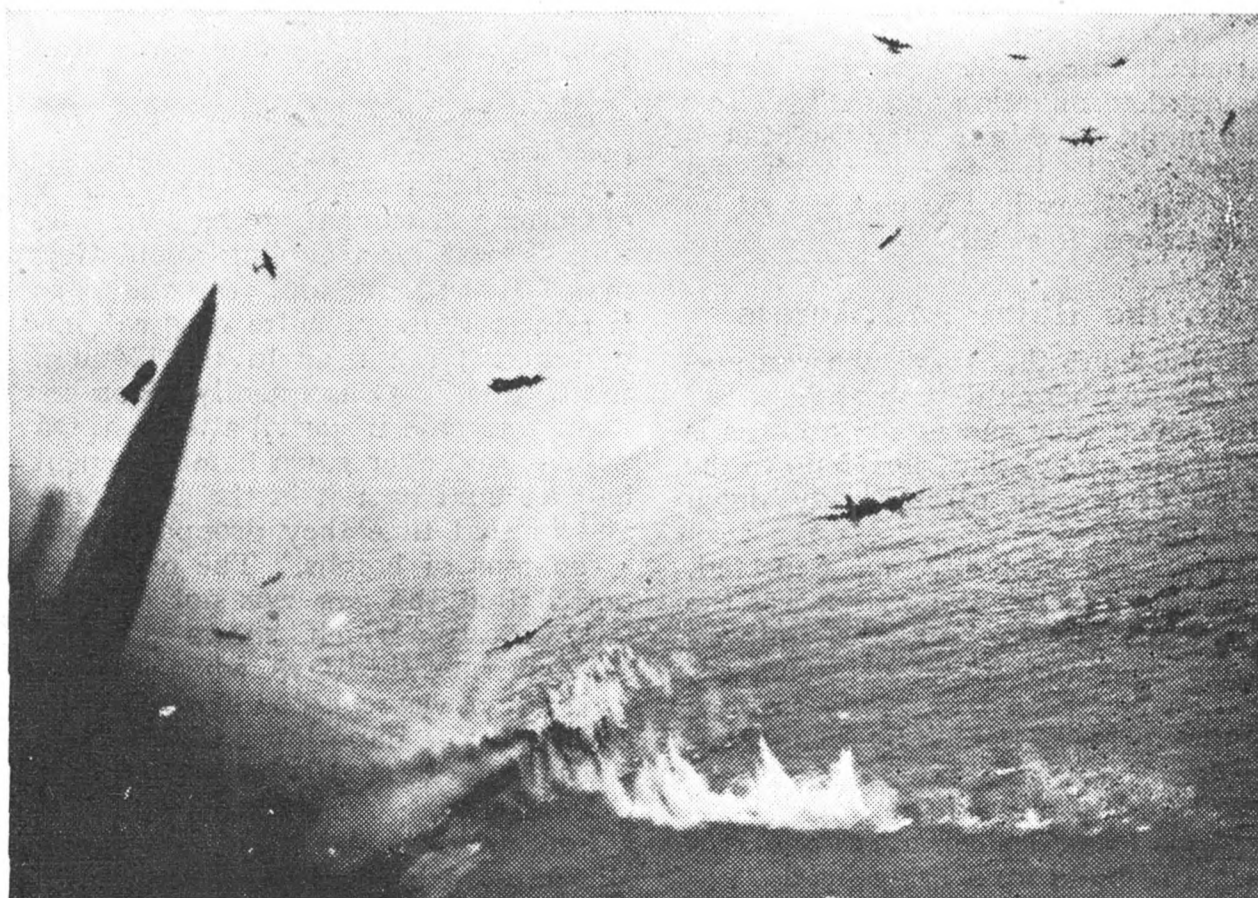
ONE of Germany's best-known national songs was *Die Wacht am Rhein*. In the last war Tommy Atkins, *more suo*, parodied it by singing "We wound up the watch on the Rhine," much as this time he (somewhat prematurely) declared that he would "hang up the washing on the Siegfried line." But the Rhine certainly has a solemn, almost a religious, significance to the ordinary German, not very inferior to his reverence for East Prussia.

To know, as all Germans must soon know, that the Americans are in Cologne and elsewhere actually across the Rhine will, therefore, be one of the bitterest pills that even non-Nazi Germans have ever had to swallow. Unfortunately, the capture of this great city does not mean that the Allies are in possession of bridges by which they can pass in force into the heart of Germany. The main part of

the city is on the west bank, and is connected with the eastern suburbs by bridges, of which the chief was the Hohenzollern bridge. All were prepared for demolition a long time ago, and prisoners saw that a bomb from a

fighter-bomber of the Allies set some of the charges off.

Not long ago it seemed to be the interest of the Allies to damage bridges over the Rhine so as to hamper Rundstedt's freedom of movement. Now



BUSY BEAUS: One of the finest photographs ever taken of a shipping strike by Coastal Command Beaufighters. The target was an M-class minesweeper N.W. of Borkum. Thirteen Beaufighters appear in the picture and the towed balloon can be seen just behind the rudder on the left.

WAR IN THE AIR

that he has withdrawn the bulk of his forces to the eastern side of the river, it is to the advantage of the Germans to destroy the bridges, while the Allies want to capture them intact. To cross the Rhine in force may be a tough job, but though it is unpleasantly wide for an invading army to tackle, its length makes it hard for the diminished German forces to defend, and gives the Allies a great choice of spots for making their attack.

The British and American heavy bombers have continued their raids, with oil and railways as their chief objectives. One notices that of late there has been a tendency to reduce the size of the fighter escorts sent with the day raiders. One evening last week a force of more than 900 Fortresses and Liberators attacked Dortmund and other places, and had an escort of not much more than 250 Mustangs and Thunderbolts. Only one bomber failed to return. Evidently the danger from German fighters is still steadily diminishing.

Wesel, on the Rhine, towards the north end of the Allied line, was a scene of severe fighting. As the Germans gave way, their troops, armour, and equipment were withdrawn across the river into the town. The result was a traffic block in the town. It was a great target for aircraft. Two heavy attacks were made on it, and, in addition, aircraft went in singly and bombed at intervals of about eight minutes, and kept the process up for seven hours. At the end of that time one feels sure that the nerves of the surviving Germans must have been like fiddle strings.

Then, suddenly, the German resistance collapsed. They blew up the bridges, leaving their rearguards to get back as best they could, and most of them seem to have managed to do it. The defenders of the place were a parachute force, which fought with the utmost determination and skill. These men might have been very useful elsewhere; but the very tough 1st Canadian Army had to be opposed by good troops, if at all.

To the Rhine and Across

TO the south the Americans were giving another exhibition of the speed with which they can move, and, as is well known now, they closed up to the Rhine practically all the way down to Coblenz.

What was probably not expected, or provided for by either side, was the American crossing of the railway bridge over the Rhine at Remagen. Charges had been laid, ready to blow up the bridge, but, "by chance or accident" (to give the German version), nobody pressed the button, and the Americans dashed across and proceeded to build up a bridgehead.



CATECHISM CORNER: Lancaster air crews back from a raid telling specialised interrogators how everything did or did not work.

Of course, the *Luftwaffe* was promptly instructed to bomb the bridge, and it tried to do so. Ever since the civil war in Spain it has been known that a bridge is a very difficult target for bombs, and to make sure of destroying one it is necessary to keep on trying, and using a most extravagant number of bombs. The *Luftwaffe* is now in no case to keep up an attack of that sort. Moreover, it did not take long for American fighters to send sentries to guard the precious bridge; and of the first 47 German bombers which tried to attack it 23 were promptly shot down.

The unexpected capture of this crossing of the Rhine may well mean that both Eisenhower and Rundstedt will have to remould their plans for the next stages of the great battle. Things have been moving so fast of late that nobody can foretell what the position will be by the time these lines are published.

Essen has now taken on a new importance. We may disregard its former status as the chief centre of German armament production. The time is past for troubling about German future production. But the place is now a railway centre of great importance, lying near to the German front line. Consequently Bomber Command paid it special attention. On Sunday last over 1,000 bombers spent half an hour over it in the afternoon, and in that time they dropped about 4,500 tons of bombs. The crews reported that the *flak* was not particularly heavy, which shows a great change from the days when Essen's production was regarded by the enemy as of first-rate importance, and the defences were among the strongest in all Germany.

For a long succession of nights Mosquitoes have regularly visited

Berlin and dropped their 4,000 lb. bombs on it. The object, doubtless, was to give tactical help to the Russian armies, by upsetting the main centre of communications behind their opponents. The U.S. 8th Air Force has again been to the yards where U-boats are built; for the new types of U-boats have been lately increasing the amount of damage done to our convoys. The Americans also went for oil refineries—targets which must have the most direct effect on the great battles.

Down in Italy the Allied bombers can boast that they kept the railway line from the Brenner Pass blocked all through February. Considering the frequent reports of bad weather from northern Italy, this was a very creditable feat. We must suppose that Kesselring had stored up large quantities of supplies in good time, or else he would surely have run short by now. But how about his line of retreat?

The Sinking Sun

JAPAN is not in much better shape than Germany, even though the Allies have not yet directed their full strength against her. Fifteen square miles in Tokyo are said to have been devastated by fire. The stubborn defenders of Iwojima are near the end of their tether, and that island will provide a better base than the Americans have yet had for heavy air raids on Nippon. The large Philippine island of Mindanao has been invaded, and the Americans at once made for the airfield of Zamboanga. In Burma the British and Indian forces forced their way into Mandalay, and the Japanese Army in that part of Burma seems to have a very poor chance of escape. Air raids have denied it the use of the railway from Siam, and the only way of escape is to the east, through almost trackless jungles.

The Air Estimates

Sir Archibald Sinclair's Speech

ON Tuesday, March 6th, Sir Archibald Sinclair, Secretary of State for Air, introduced the Air Estimates to the Committee of Supply of the House of Commons. He commenced by saying that the story of the air war in the past year was the story of the Royal Air Force and the United States Army Air Force working in the closest partnership and harmony for the destruction of the common enemy. Their tasks were complementary, their fortunes were intertwined. Together they had achieved mastery of the air over Germany and the battle area. The extent of their mastery was illustrated by the reduction in the casualties incurred by squadrons of Bomber Command. In 1942 the bomber squadrons lost 4.1 per cent. of the aircraft despatched. In 1943 they lost 3.7 per cent. In 1944 the figure fell to 1.7 per cent., and for the first two months of 1945 it had been as low as 1.1 per cent., although an increasing number of operations had been carried out by day. He explained that now we were reducing the air crew training organisation to the level that would be required after the defeat of Germany. He paid a tribute to the training work done during the war by the Dominions, especially Canada. But the air superiority which we had won had been at a cost. Between April 1st and September 30th, 1944, Bomber Command alone had suffered more than 10,000 casualties. The casualty rate had now fallen far below what had been anticipated two years ago. So now it had been decided to transfer several thousands of men from the Royal Navy and the Royal Air Force to the Army.

Preparations for peace were being made by inviting officers of the R.A.F. Volunteer Reserve to apply for permanent commissions, and early last year airmen were given the chance of becoming regulars.

The pattern of the air offensive in Europe, said Sir Archibald, had been reflected in Burma. The blows from the integrated British and U.S. Air Forces had destroyed the enemy's dumps, airfields, bridges, and all forms of land and water transport. Air supremacy had enabled us both to starve the enemy's troops and to sustain our own. As many as three divisions had been at one time maintained solely by air transport.

The Air Minister then paid a tribute to the work of the Mediterranean Allied Air Force, and then alluded to the attempts of the *Luftwaffe* in February of last year to renew on a small scale the blitz on London, as well as to recent raids, saying that small numbers of fast aircraft might get through from time to time, but not without paying their toll to Fighter Command. On Saturday, March 3rd, 70 long-range fast night fighters carrying a limited number of bombs had tried to attack us, but had lost six, or more probably eight, of their number. Sir Archibald briefly alluded to the attacks by flying bombs and V2 weapons, and said that the only way to silence this form of long-range artillery was the physical occupation of the sites from which they were fired. He emphasised the close partnership of all three Services in opposing the enemy.

D-day Operations

This carried the speaker on to the Air Force's share in D-day operations, and he spoke of how Coastal Command, working in the closest co-operation with the Royal Navy, had obtained an increasing mastery of the German submarines. Bomber Command had also contributed by attacks on the assembly yards and pens of the U-boats. In the three weeks before D-day Admiral Dönitz was trying to move his U-boats from Norway to the Channel coast. Sir Sholto Douglas, A.O.C.-in-C., Coastal Command, anticipated every move they made. The U-boat crews had been given a course of training against air attack, and the boats had been equipped with a 37 mm. A.A. gun. But they were mauled by Coastal Command. When the invasion came the Biscay U-boat fleet moved to the western approaches on the surface. During the first four critical days from D-day the Command made 38 sightings which resulted in several destructive attacks. These successes of Coastal Command, won in unison with the Navy, were decisive. Likewise hardly a motor gunboat or motor torpedo-boat put to sea without being spotted and attacked from the air. Coastal Command was also carrying on a deadly campaign against the enemy's shipping which had been carrying supplies to bases in Norway or evacuating troops from Norway.

Turning to the work of Bomber Command, the Air Minister said that its work and that of the U.S. Strategic Air Force, in preparation for our invasion, had been continuous over a period

of years. We had known that the Germans had made a tremendous effort to build up the biggest fighter force that the world had ever seen. They were sacrificing their bomber force and concentrating on defence. Our bomber offensive was proving to be the most effective defence of our homes and factories against a blitz on the grand scale. Had the Germans been left undisturbed, they would have increased their fighter production to 2,500 or 3,000 a month by the end of last year. The British and U.S. bomber forces therefore in the winter of 1943 and the spring of last year turned their main effort against the German fighter factories.

The Air Minister recalled that, when introducing his Estimates on February 29th last year, he had said that historians of the future might look back on the period when those attacks were being delivered from Italy and from this country as one of the decisive stages of the war, and he quoted General Arnold as having recently said practically the same thing. That great series of attacks had laid the foundation of the air mastery which the Allies had enjoyed on D-day and since.

Seine Bridges

In the late spring the destruction of German communications behind the intended invasion front took first place among our bombing objectives. Twenty-four road and railway bridges over the Seine were selected, and by D-day all had been either demolished or severely damaged. The enemy had naturally assumed that he could reinforce his defensive front by road and rail more quickly than we could reinforce by sea. As things turned out, the weather favoured this calculation, and for three critical days it was impossible to land troops or supplies over the beaches. But so thoroughly had the Air Forces done their work that the Allied armies were able to reinforce much more quickly than the Germans.

The R.A.F. also successfully delivered two of the largest airborne formations ever taken into battle. In the first of these operations British and American airborne forces formed the spearhead of the Normandy landing. The second operation succeeded later in forcing the Maas and the Waal. Moreover, since D-day over 55,000 casualties had been evacuated by air.

In reply to a question, Sir Archibald said that he did not think there had been in any theatre of war at any time during this war any case in which an army had been so paralysed by an air force that it had been quite incapable of movement.

The Air Minister then spoke of the sinking of the *Tirpitz*. Two squadrons of Bomber Command, bombing from some 15,000ft., scored three direct hits and two near misses. The aiming was done with a British bombsight of extraordinary complexity, ingenuity, and accuracy.

Sir Archibald then mentioned how the R.A.F. had dropped arms for the patriots in the occupied countries, how some Polish officers had been brought to this country in a Dakota, and how officers of the Women's Auxiliary Air Force had been dropped by night by parachute in France and had helped the Maquis.

However, said the Air Minister, the strategic bomber offensive remained the principal role of the British and U.S. Bomber Commands. From time to time targets were bombed in direct support of the Red Armies. The shortage of tanks and other equipment, and, most of all, of oil, was hampering and enfeebling the power of Germany on every front.

Sir Archibald said that it was a big decision of policy when the Prime Minister and the War Cabinet determined in 1941 to launch this tremendous offensive. We knew, he said, that then only a small proportion of our own bombs were hitting the right target, and that the same was true of the German Air Force in the blitz. He described some of the difficulties which had to be overcome. For four years, he said, the Allied Air Force was the only force from the West carrying the war to Germany. "Had not the *Luftwaffe* been out-fought in the air, hammered on its airfields, and smashed in its factories, there could have been no invasion of Normandy last year. Every port in southern England before D-day was packed with shipping for the invasion—a bomb-aimer's paradise. . . . Yet not a bomb fell."

The combined offensive against German oil production had begun last April. By September this production had been cut to about a quarter of the April figure. Now many combat units of the German Army were not allowed to use oil except during actual operations. German oil production had been reduced to such an extent that available reserves were approaching exhaustion.

HERE AND THERE

A.T.A. Roll of Honour

SIR STAFFORD CRIPPS disclosed last week that 117 men and 13 women pilots of the Air Transport Auxiliary had lost their lives in the course of their flying duties.

On January 31st last the A.T.A. had 385 men and 86 women pilots actively engaged in ferrying aircraft.

Pacific Air/Sea Rescue

FOUR R.N.Z.A.F. Catalinas picked up 142 survivors from a destroyer within easy range of the Japanese guns on Leyte island, one of the "Cats" successfully taking off with no fewer than 63 men aboard.

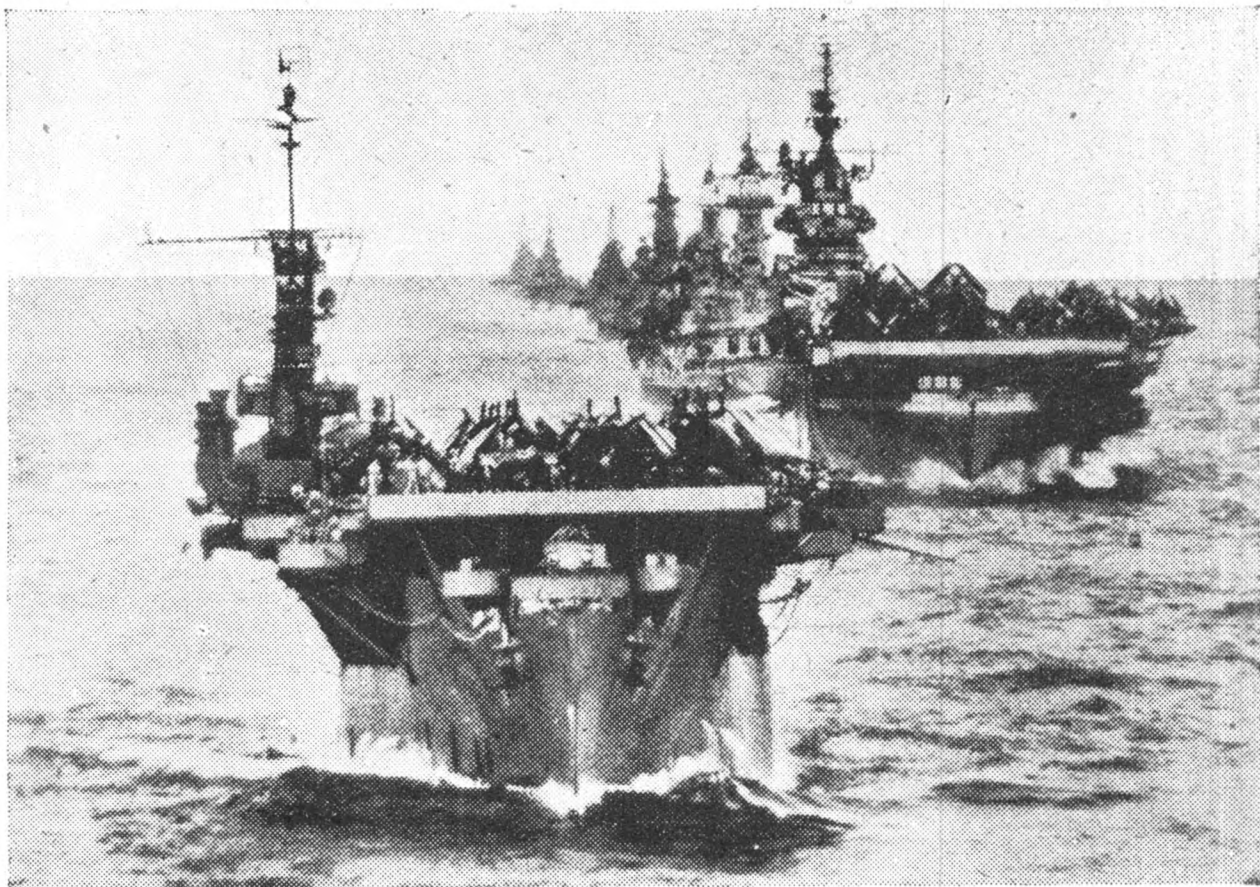
Seven Thunderbolts covered the flying boats during the rescue.

Clusters Fluster Fritz

A TRIBUTE to the effectiveness of the new "cluster" bombs being dropped by fighter-bombers of 2nd T.A.F. was recently paid by a German prisoner on the Canadian Army's section of the Western Front.

"They give you the creeps," a captured Panzer Grenadier is reported to have said. "They are worse than ordinary bombs, for they come from nowhere and the blast knocks you over before you know what hit you."

Cluster bombs are bunches of 26 fragmentation bombs with parachute



FIGHTING VANGUARD: Leading a line-ahead of this U.S. Third Fleet unit in the Pacific is an Independence class carrier followed by one of the Essex class. Aircraft, mostly Hellcats, crowd their flight decks.

attached and timed to explode a short distance above the ground.

Air Estimates Debate

ALTHOUGH the debate in the Commons which followed the Air Minister's speech on the Air Estimates last week devoted more time to the A.T.C. than to any other subject, many other points were stressed by a variety of Members.

Mr. Montague (Islington West) expressed the personal opinion that "this worship of the goddess of speed" would be unlikely to make human beings any more happy, but he agreed that as we lived in a competitive world menaced by war, we must think in terms of 20 years hence, and he paid a tribute to the "back-room boys" who had developed

jet-propulsion. They were, he knew very well, actuated by patriotism and by considerations that had very little to do with matters of private property.

Pacific Partners Turned Down

MR. MONTAGUE went on to say, however, that military and civil aircraft advanced together, and that as future peace depended on "a razor edge of equilibrium," we might as well leave the development of the rocket bomb to private enterprise as that of the fast aircraft of the future.

All "Chicago" amounted to was making the air world safe for commercialism, and any commercial cartel could do exactly the same thing—arrange zones of influence and divide world trade. Lord Swinton had told the Aerodrome Owners' Association that we had achieved a commonwealth partnership in the air, but we had done nothing of the sort; we had turned down our two Pacific partners, and in Empire as in transatlantic services, civil aviation was to run as virtually private monopolies.

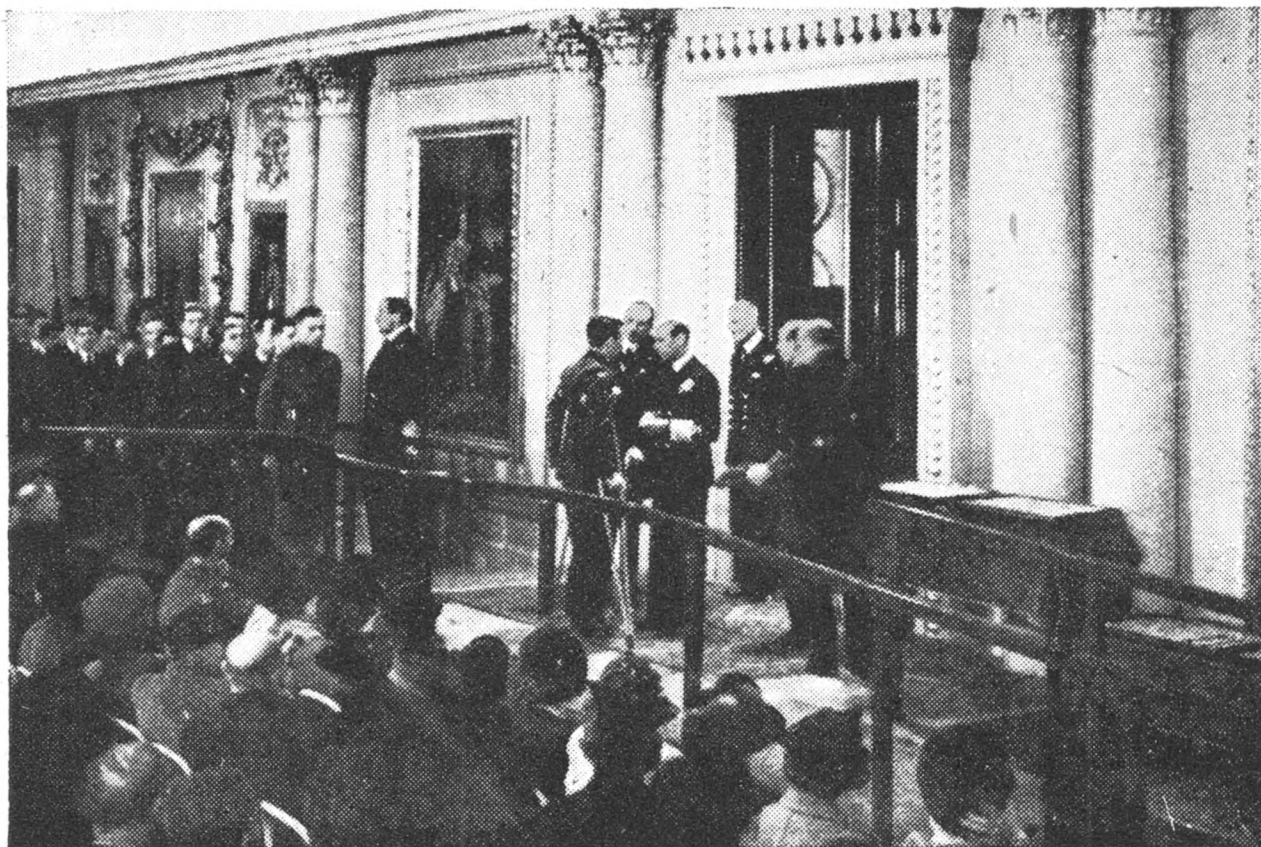
Importance of Research

THE importance of going ahead with technical development was a point made by Wing Cdr. Roland Robinson (Blackpool), who thought we could not spend too much money on research. The Germans had been very smart about it, as witness their V-weapons, and he wanted an assurance that we should give the greatest possible backing to the "back-room boys" both now and after the war.

He also suggested that regular photo-reconnaissance of Germany by the R.A.F. during its occupation would avoid locking up unnecessary land forces.

Rugby Retirement

MR. A. P. YOUNG, manager of B.T.H. Rugby works since January 1st, 1929, has recently retired and has been succeeded by Mr. H. T. Satchell as from March 1st. Mr. Young, who received a presentation from the em-



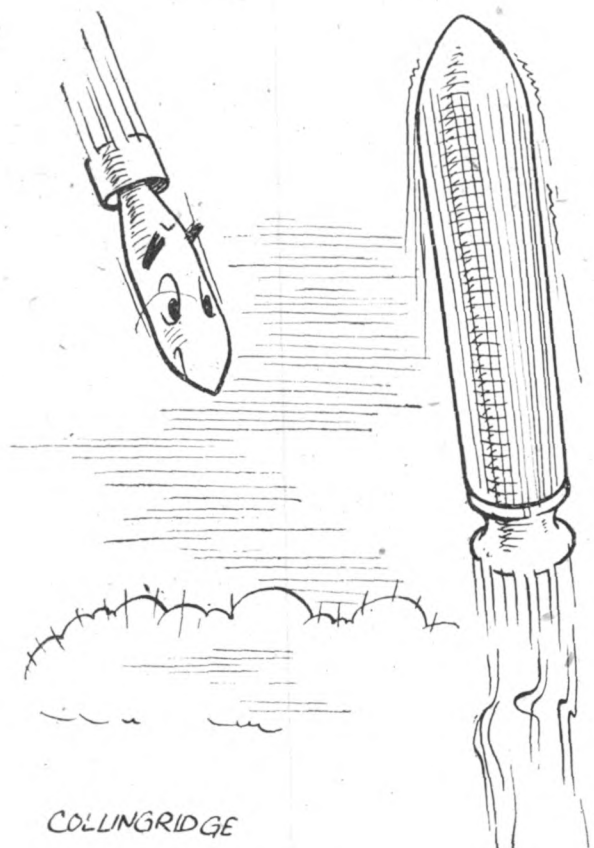
INVESTITURE: First Press picture ever taken of a Royal investiture within Buckingham Palace shows the King presenting the C.G.M. to Flt. Sgt. E. Durrans, R.A.F. Bomber Command.

HERE AND THERE

ployees on his retirement, joined B.T.H. in 1901, and, except for a two-year interval in America, has served the company continuously for forty-four years.

Queer Cargoes

B.O.A.C. aircraft have carried some queer cargoes from time to time, and the corporation's *News Letter* for February lists a few of the more unexpected items, which include live frogs and fleas for research, 1,000 kg. of morphine for Moscow, a packet of industrial diamonds worth £20,000, a £4,000 violin, three gold bricks worth £10,000, and a small packet of medical supplies assessed at £11,000.



COLLINGRIDGE

King Farouk Visits F.A.A.

KING FAROUK of Egypt recently paid his first visit to a British warship when he spent some six hours aboard H.M.S. *Hunter*, one of the Royal Navy's most modern escort carriers on active service.

The carrier was lying off Alexandria at the time, and the Fleet Air Arm "laid on" a demonstration of operational flying technique for the visitor.

Passed to You

THE Japs will have their German cronies to thank if they learn, before too long, what nasty things flying bombs can be.

For, according to a report from U.S., it is believed that a much faster and even more lethal version of the missile—a super Yankee-Doodle bug, as it were—will be used from carriers in the softening-up process of the Japanese mainland.

The U.S. Ordnance Department is said to be busy on their production now.

Flight recently published a picture of the American version.

Jap Petrol Substitutes

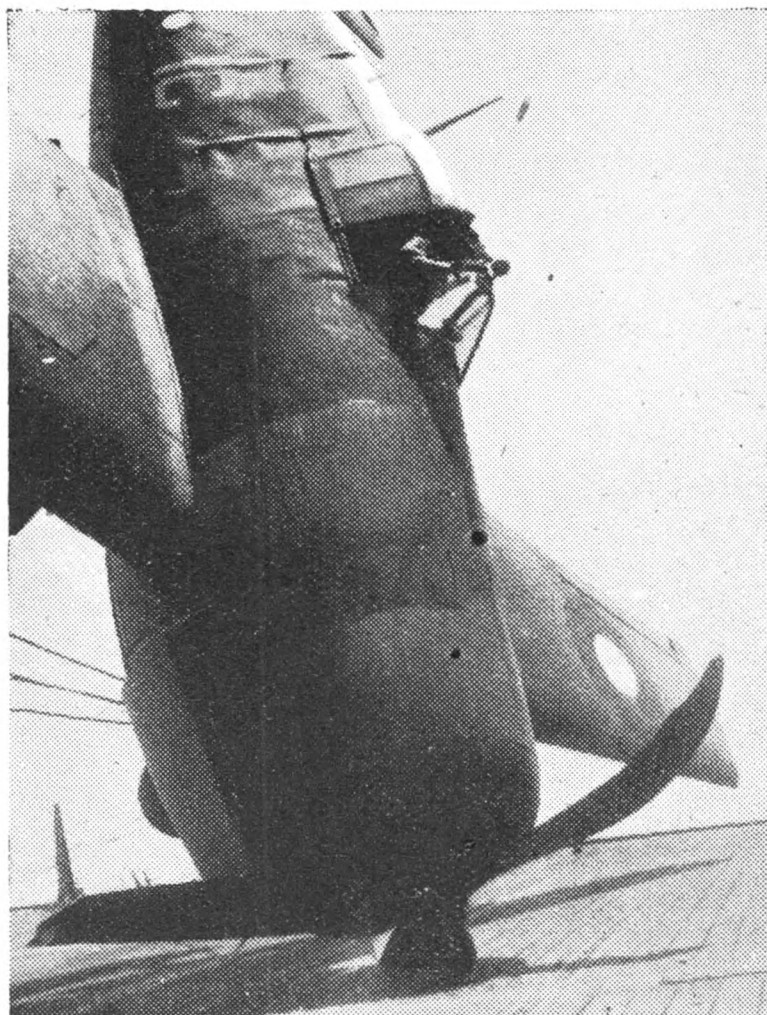
A CLAIM that Japan can produce substitute fuels for aircraft if she is deprived of the natural resources in the Philippines and East Indies was made recently by Lt. Gen. Reikichi Tada, director-general of the Japanese Scientific Mobilisation Association, in an article in their news agency's commercial service. He said that petrol from coal, buthanol and alcohol from potatoes, and fuel and lubricating oil from pine roots could all be produced in sufficient quantities to make Japan self-sufficient.

Even assuming this is possible, he made one little slip; he should have said *when* she is deprived, etc., not *if*.

New Ranger Engine

A NEW Ranger aircraft engine which will be "ready for peacetime jobs as soon as the war ends," and is suitable for feeder-line aircraft, has been announced as under development.

It is a twelve-cylinder air-cooled inverted V-type unit which gives 700 h.p. for take-off with 100-octane fuel, and weighs only 870 lb. complete with standard accessories; it is thus claimed to be 25 per cent. lighter than other engines of comparable horse-power. Compactness is also a feature, as it is 74.92in. long, 33.28in. wide, and 31.11in. in overall height.



PIN-POINTED: The camera caught this Hellcat poised momentarily on its nose after hitting the barrier on its carrier. A second later it fell back.

Asia-Pacific Air Link

A REGULAR round-trip air service between India and Australia has been introduced by the U.S.A.A.F. Air Transport Command "to provide closer liaison between the Allied Commands in S.E. Asia and those in the S.W. and Central Pacific," it has been announced by the U.S. War Department. Special missions have, of course, been previously flown over this route, but regular flights between Calcutta and Exmouth Gulf, Australia, are a new feature.

The long over-water hop from Ceylon to a point north of New Guinea is made by C-54 Skymasters in 15 hr.

For Your Diary

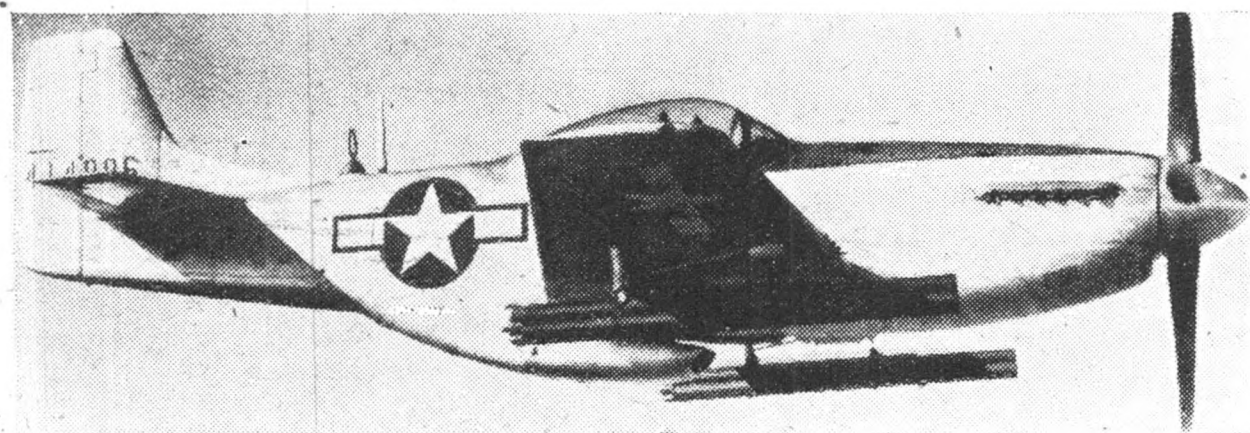
THE Royal Aeronautical Society (with which is incorporated the Institution of Aeronautical Engineers) is to hold its annual general meeting at 4, Hamilton Place, London, W.1, on Thursday, March 29th, starting at 5.30 p.m.

An "open session" with addresses by Sir Stafford Cripps and Mr. G. Manning, director-general of A.I.D., is to be included in the agenda of the annual general meeting of the A.I.D. Technical Staff Association to be held at the Central Hall, Westminster, on Saturday, March 17th.

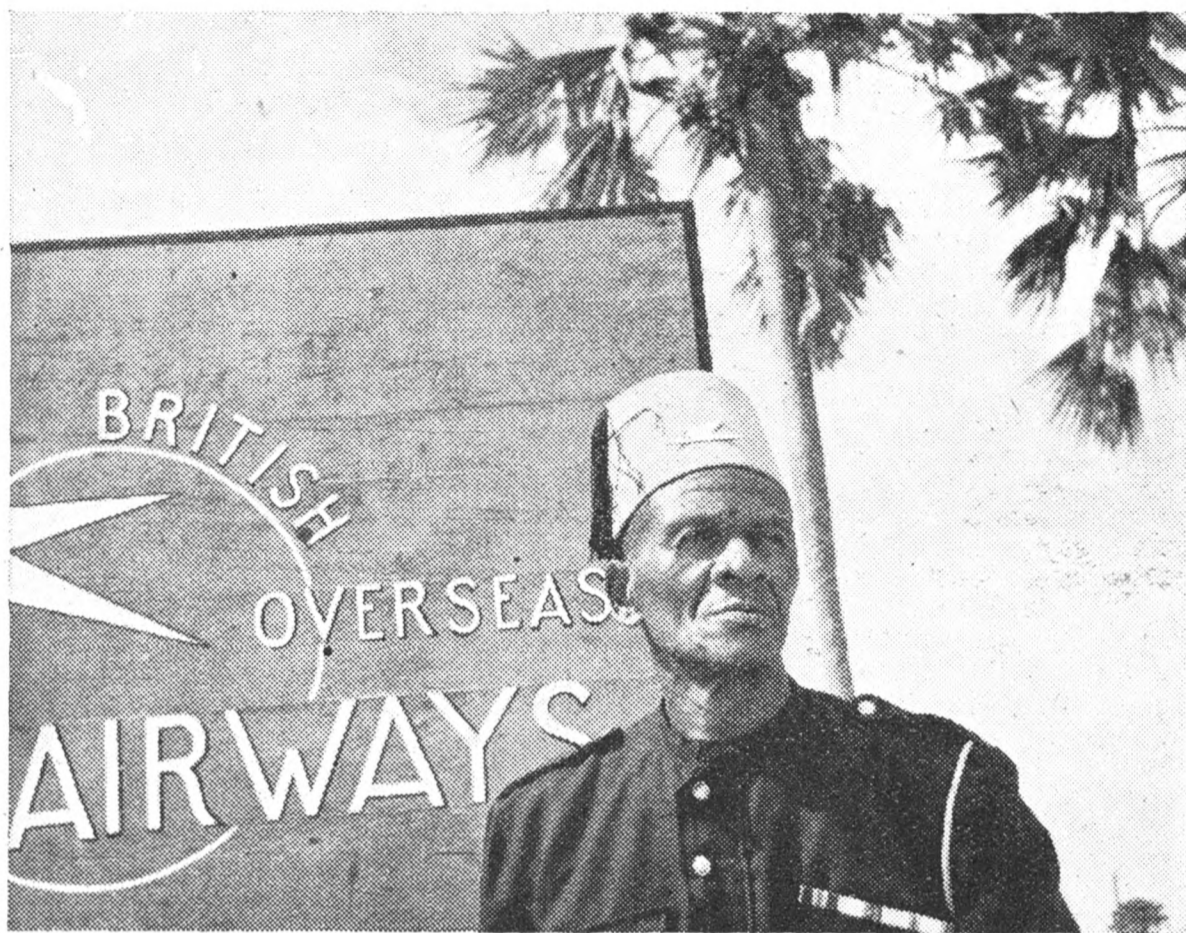
The meeting is called for 1.30 p.m., but the open session begins at 3.15 p.m.

The 1945 conference (the fourth in the series) of the X-ray Analysis Group of the Institute of Physics has been fixed for April 12th and 13th next, and will be held at the Royal Institution, London, under the chairmanship of Sir Lawrence Bragg.

Among the series of papers and discussions on the programme will be a lecture by Prof. J. D. Bernal on "The Future of X-ray Analysis."



KANGAROO MUSTANG: Rocket-firing Mustangs are to be produced in Australia by the Commonwealth Aircraft Corp., by arrangement with North American Aviation Inc., for the war against Japan. Note the curious camouflage effect of the tailplane shadow in this picture.



B.O.A.C. WARTIME SERVICES

Difficulties and Achievements: Pioneering New Routes

By V. L. GRUBERG

been practically snapped, and powerful enemy air forces lurked right outside the home base of transport aircraft. Civil aircraft could leave and enter their home termini only under the cover of darkness. Most flying had to be done to or through combat zones. Such was the set-up.

FOR over five years, since that memorable day of September 2nd, 1939, when the first party of R.A.F. personnel was flown in an Ensign to France, the B.O.A.C. has performed all kinds of front-line duties. It ceased to be a commercial undertaking. The machines were stripped and adapted to their wartime tasks, the time-tables scrapped, personnel allotted war jobs, and instead of the gay crowd of passengers, military and other war important personnel and supplies were rushed along the sky routes.

Some are to-day bemoaning the loss of opportunities and initial advantage due to the complete disregard of commercial considerations in the opening stages of the war. But it seems only right that along with all other resources of the Nation air transport should have been mobilised for the war effort without hesitation and limitations, and without back-thought.

It is one of the inherent characteristics of war that it disrupts and seriously undermines the efficiency of all transport enterprise. Air transport, with its long-range operations, is even more susceptible to this disruptive interference. Consider the situation: France had collapsed; Italy entered the war. Vital Empire communications had

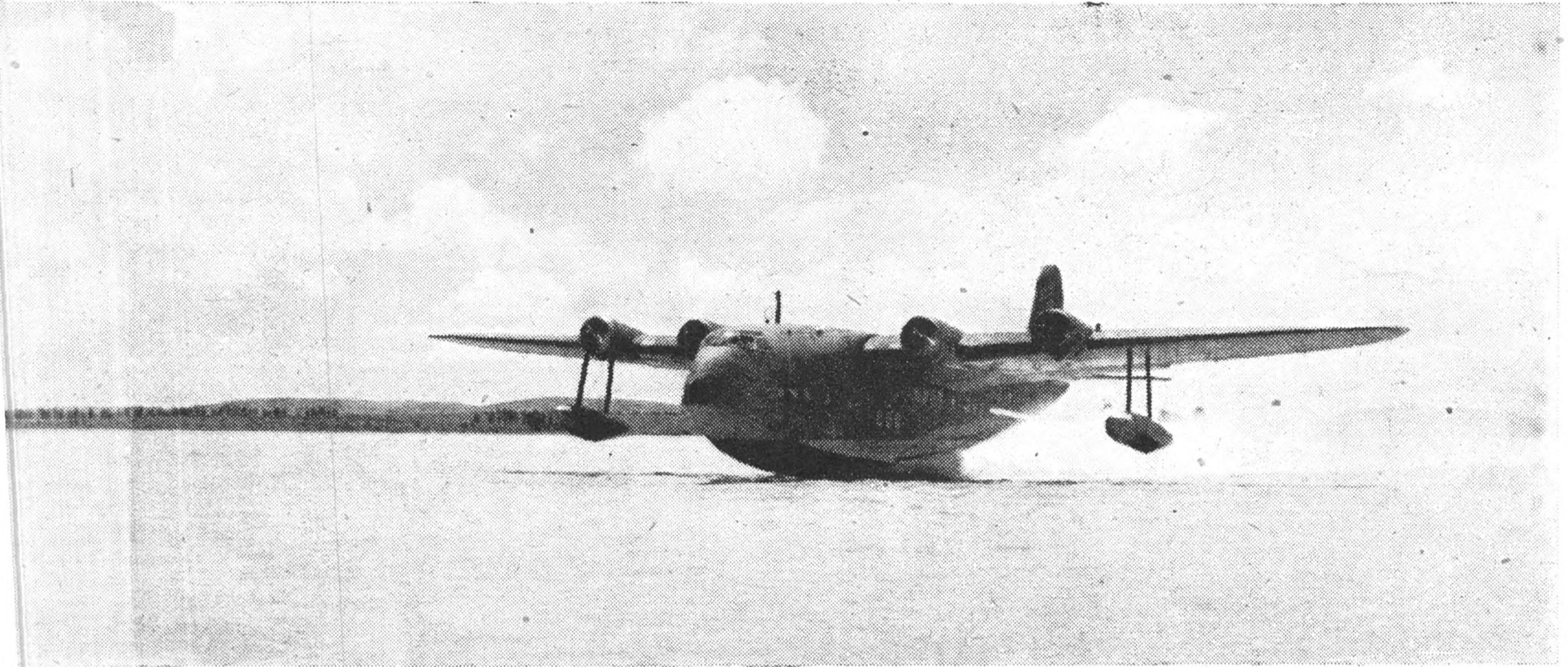
the Middle East, the traditional air route had to be deviated to West Africa, to link up with the transcontinental African system and to follow the Lagos-Khartoum route established in 1936 by Imperial Airways.

The Royal Mail *Clyde*, with Capt. A. C. Loraine as skipper, was the first flying boat to make the voyage from England to the West coast of Africa. It flew from England to Lisbon, some 1,000 miles, and thence to Bathurst, in Gambia, covering a further 1,900 miles, the equivalent of an Atlantic crossing. The task was not easy. South of Lisbon there were no facilities for flying boats. In French Equatorial Africa the political situation was then delicate. Maintenance facilities did not exist. But the *Clyde*, after covering some 12,000 miles, returned to England, and the route was established. Four Short Empire flying boats were then rapidly fitted with extra fuel and oil tankage for the long Lisbon-Bathurst hop, and pressed into service.

This was the beginning of the new great route to the African continent which now bifurcates at Lagos into a 2,500 miles long land-arm operated with Dakotas across Africa to Khartoum and Cairo, and a 3,500-mile flying-boat service up the Congo. By the middle of 1944 the returns



JOURNEY'S END: *Cleopatra* circles before alighting at Durban.



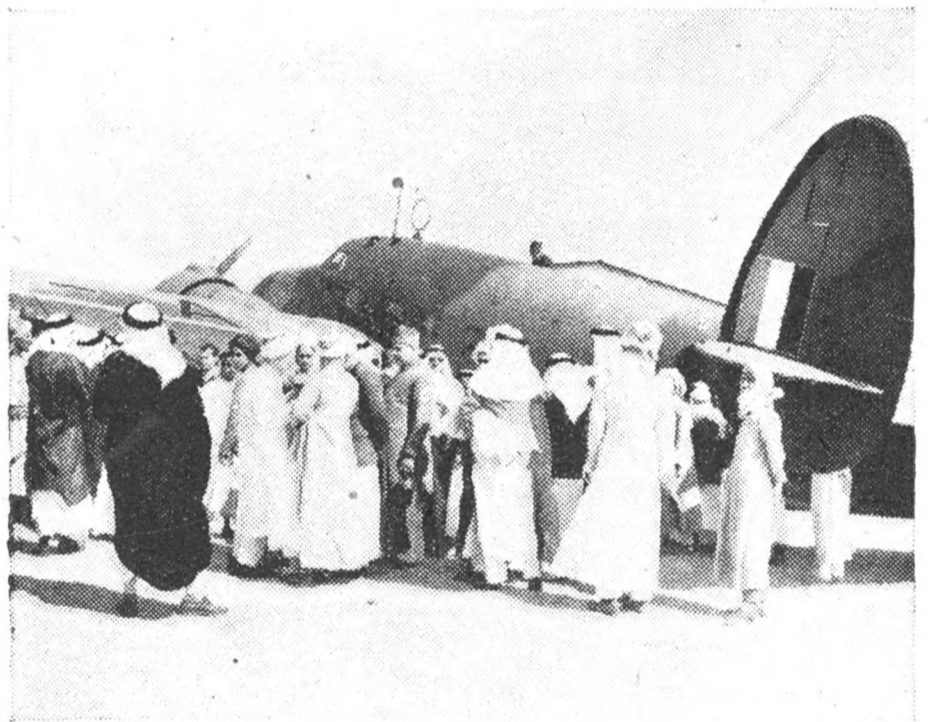
FOR FUTURE SKIPPERS : An Empire flying boat at the B.O.A.C. Training School near Johannesburg on the Vaal River

of twelve months of operations to West Africa showed 2,659,932 capacity ton-miles.

Lagos is now within three days' reach of London, and if the more direct route across the Sahara were to be established, the journey would shrink to 16 hours.

At Khartoum this service links up with the "Horseshoe route"—a service based on Durban (and operated with the "C" class flying boats, S23's and S30's) and leading via Egypt, Palestine, and Iraq to India. The importance of these services might be illustrated by the fact that during 12 months ending April, 1944, alone, 7,925,708 capacity ton-miles were operated on the "Horseshoe route," or about 60 per cent. more than the total capacity ton-mileage on all transatlantic services.

Five B.O.A.C. services link this country with the African continent: U.K. - Lisbon - Rabat - Port Etienne - Bathurst - Freetown - Takoradi - Accra - Lagos; U.K. - Lisbon - Bathurst by Boeing flying boats continuing to Baltimore; U.K. - Jerba - Cairo and thence via Habbaniyeh - Bahrein to Karachi and Calcutta, operated with Sunderlands; and U.K. - Tripoli -



MODERN CARAVAN : A Lodestar at jedda, near Mecca, on the South Arabian route

Cairo, and U.K. - Rabat - Tripoli - Cairo, both operated with Dakotas.

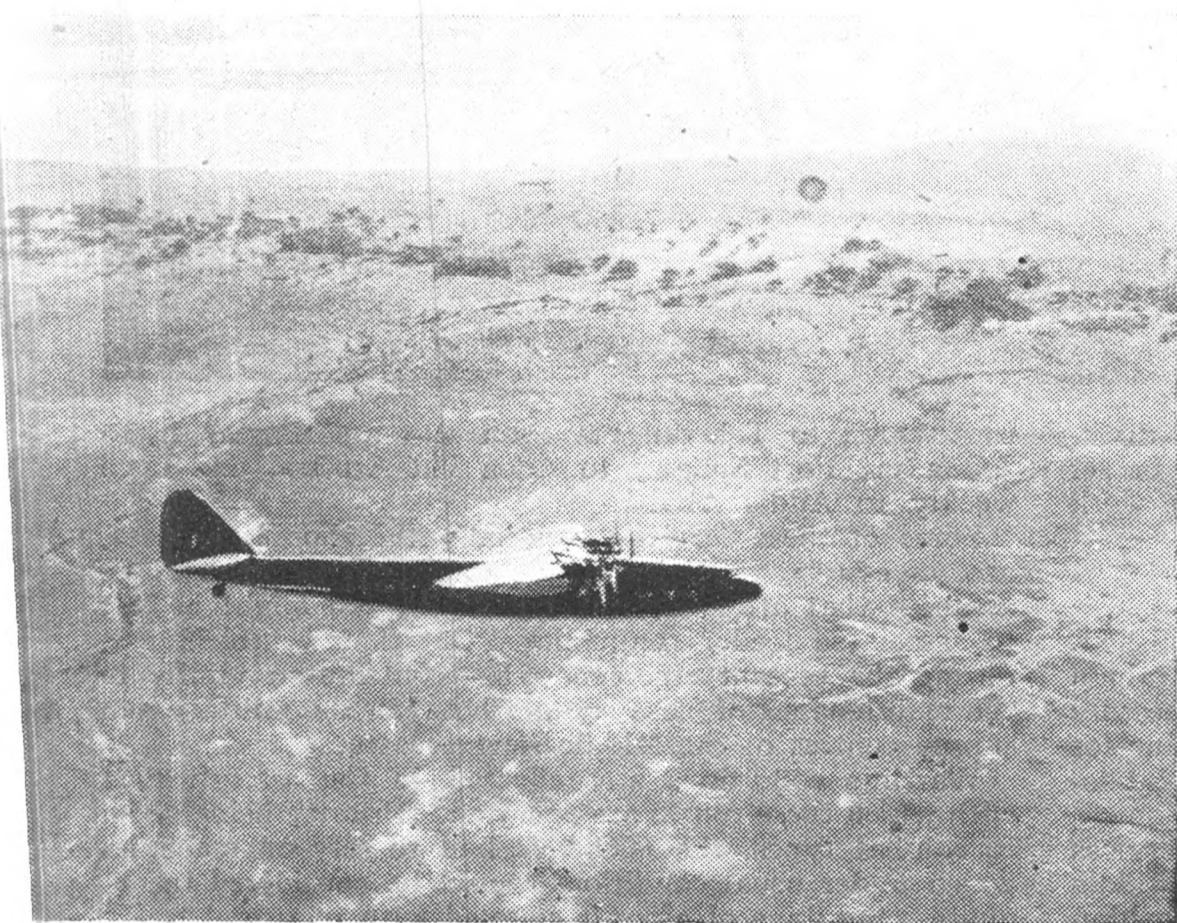
The approaching of German armies towards the Suez Canal and the ensuing North African and Mediterranean military operations made a heavy call on the Corporation's resources. Ground staff, aircraft and crews were charged with innumerable tasks connected with the campaign, carrying valuable freight, despatches, important persons, munitions, wounded, etc.

In Crete the B.O.A.C. rushed up two flying boats which in 13 unarmed and mostly unescorted trips, evacuated 469 passengers, skipping between swarms of Junkers and Dorniers. B.O.A.C. aircraft called at Malta and Tunis, unloading vital supplies and loading sick and wounded to the

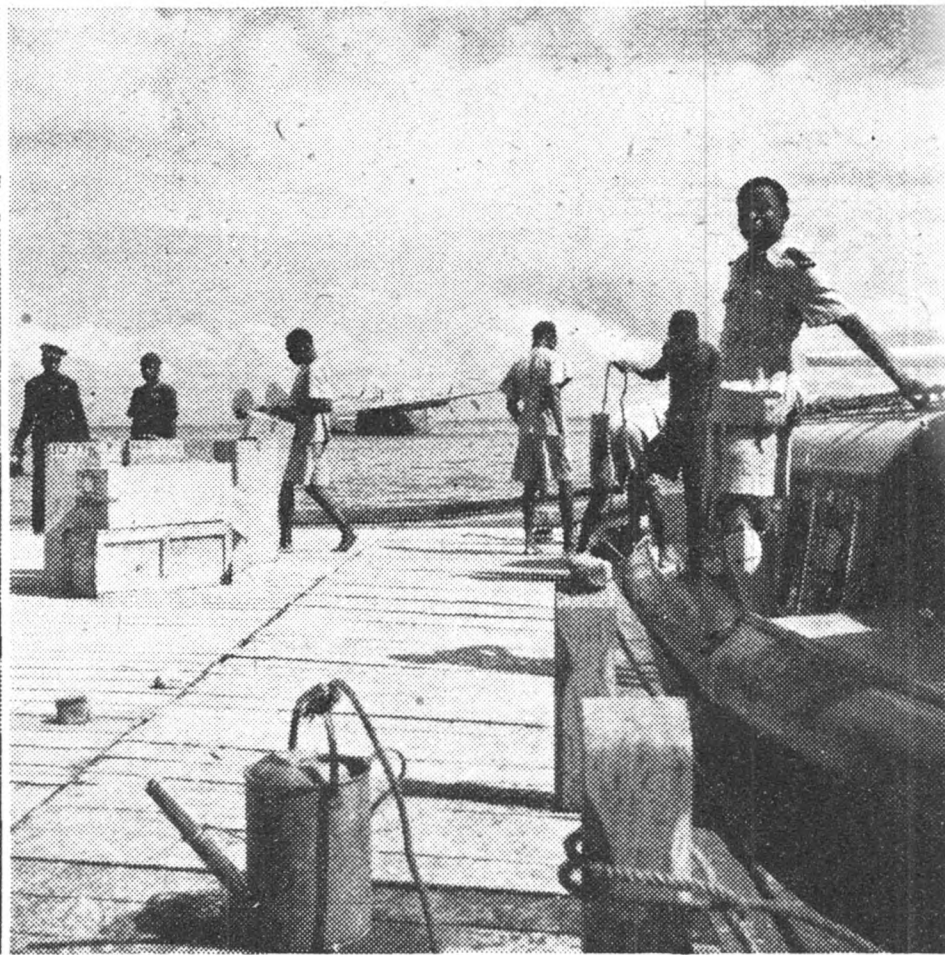
accompaniment of *Luftwaffe* bombs.

Later, the treacherous, Axis - assisted "about-turn" of Iraq

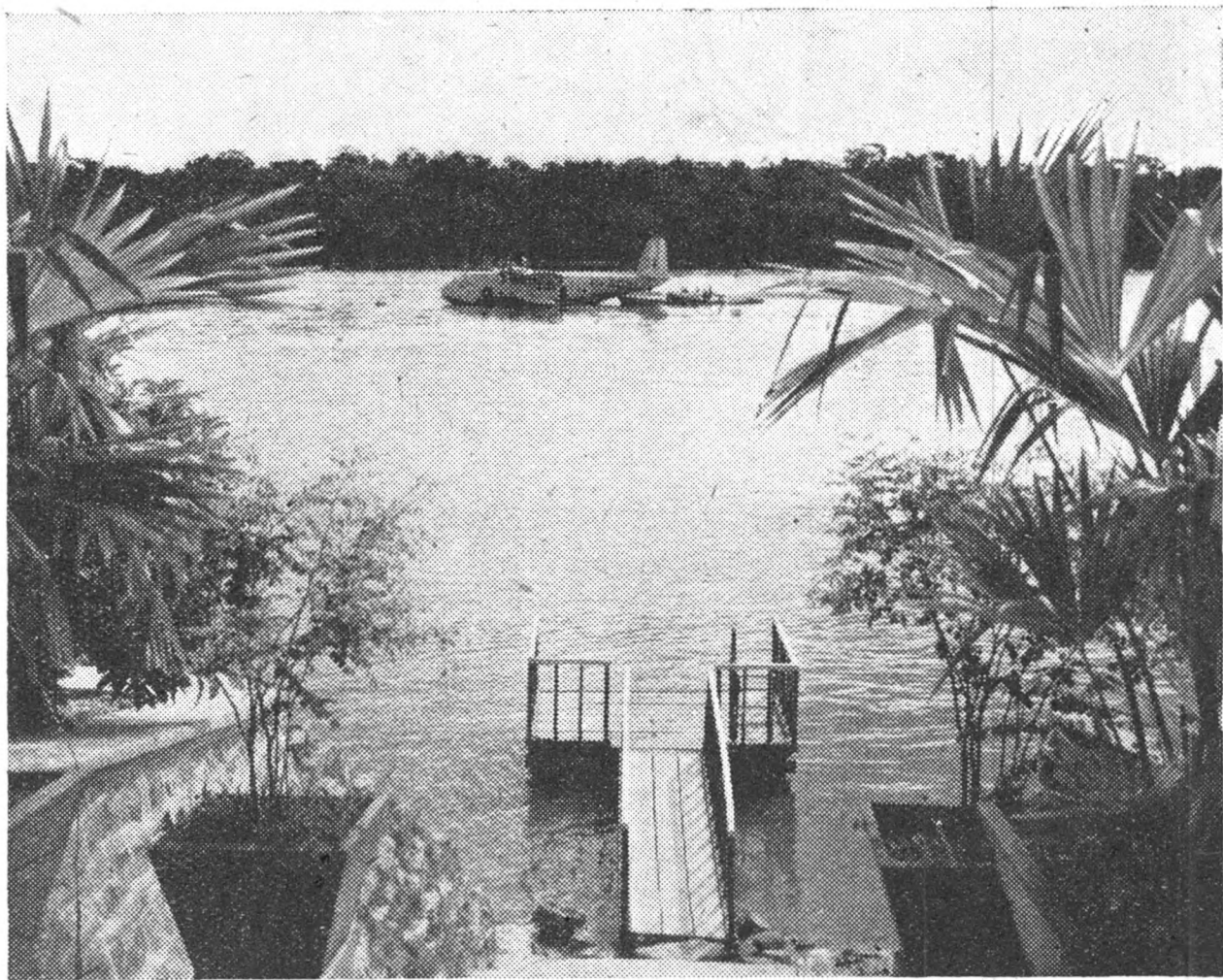
An Ensign airliner of B.O.A.C. circling to land at Khartoum in the background is the Nile.



B. O. A. C. WARTIME SERVICES



(Above.) AFRICAN EXPECTATION : The arrival of the flying boat is a social event in a Congo village. (Top right) A Boeing flying boat brings freight from America to Lagos, Nigeria. (Right) CONGO IDYLL : *Canopus* refuelling at Stanleyville during a trans-African flight



bore grave dangers to the security of the Cairo-Karachi route via the Persian Gulf. Under strict secrecy, land and sea aircraft of the R.A.F. and the B.O.A.C. surveyed an alternative route for an emergency. Instead of going north from Egypt via Palestine and Iraq, the route would strike south from Cairo to Port Sudan and Asmara, and thence east across to Aden, via the southern fringe of the Arabian Peninsula to Karachi.

One's imagination does not have to be very flamboyant to realise what was involved in breaking this virgin route. Even from schoolboys' maps one can gather a picture of this region, deprived of water, cultivation, etc. Because of heavy surf during the monsoon period it was decided to use land aircraft, and bases had to be established at Salalah and Masirah from scratch. Runways, buildings, hangars, dormitories, distilling plant for water and wireless equipment had to be set up. Even food had to be supplied by air when the work was in progress

Middle East Hub

At the beginning of 1941 the work was accomplished. Starting at first as a monthly service, the South-Arabian route was later flown weekly in addition to being heavily used by the R.A.F. and U.S. A.T.C. as a supply line for China, and was fully equipped with wireless for point-to-point and ground-to-air communication and navigation.

At Cairo the West African and trans-African services meet the service to India and Australia, and the Middle East routes which radiate from here in a spoke-like fashion

to Ankara; to Teheran via Damascus and Baghdad; to Jeddah via Port Sudan; to Aden via Asmara, and once weekly to Addis Ababa.

Some of these services, especially the short-haul ones, are, of course, typical wartime creations, and it can be assumed that after the war their operation might be left to associated feeder companies. But their establishment during the present emergency has contributed vitally to the maintenance of close contact between the military and supply centres of the Middle East theatre.

Wartime conditions are reflected in the aircraft fleet with which these routes are operated. Priority being given to combat types, the B.O.A.C. had to rely on machines which under usual conditions would be considered inadequate. Shortage of aircraft coupled with increased traffic

B. O. A. C. WARTIME SERVICES

demands and hazardous war conditions were alleviated by the employment of American machines. At present, except for the Sunderland flying boats and the Ensigns, all East-bound services are operated with American types.

Never before the war has the African continent and the Middle East been spun by such a close air network as that developed by the B.O.A.C. during the past few years. If this in itself is an achievement, it is enhanced by the conditions under which it has been accomplished.

Admittedly, as on many occasions in human history, war exigencies—and their concomitant disregard of commercial considerations—forced the pace of transport development. But it is under these conditions of war, with shortages of equipment and personnel, emergency needs and priority for direct military operations, that the excellence of flying and engineering skill and resources come to the fore. Here are the dividends of the vast fund of experience gathered in the early days of Empire flying.

Bombing Pinpoints in Jungle

WHEN aircrews in Europe are briefed before a mission they study photographs of the target they are to bomb. Landmarks are pointed out to them; the intersections of wide roads, reservoirs, great warehouses and marshalling yards show up like arrowheads pointing to the place where their bombs must fall.

In Burma, pilots, navigators and bombardiers do not often know such luxuries as these. Too often the target is a place without a name, a mere pinpoint on a large-scale map. And when they are shown a photograph of the spot they are lucky if they see much more than the top of trees—a few hundred of the many millions of identical-looking trees above which the airmen of Eastern Air Command daily fly.

Yet as the Army advances steadily southward it moves over tracks littered with smashed equipment, across wrecked stores areas and through strong-points which have become graveyards for the Japanese—all this the work of Allied airmen.

How is such accuracy attained? What decides why one small patch of jungle, looking very much like the surrounding forest, is the point which must be attacked?

As in all other aspects of air warfare in South-East Asia, this problem is one which must be met by special measures. But behind all of them is the need which is fundamental in every theatre: precise navigation. Without this all the tricks would fail.

V.C.P. bombing is one of the methods of obtaining pinpoint accuracy, but it can only be used when the target is within sight of our own lines. A visual control post—V.C.P.—is manned sometimes by a flying man, sometimes by an Army officer, equipped with a small radio transmitter and a pair of binoculars.

An enemy position giving trouble to our land forces is to be attacked from the air, and a formation sets out to the approximate position. As the aircraft approach his concealed transmitter the V.C.P. officer calls up the lead aircraft on his radio and guides the force to its objective, using all the little

local landmarks which no map, however large, could show. A peculiar rock formation, a gap among the trees, the scarred earth where a shell has fallen: such irregularities as these are the aids to V.C.P. bombing. And when the first bombs have been dropped the ground observer corrects the aim until the target is wiped out.

This method is so effective that frequently congratulatory messages reach the airmen from the Army thanking them for neutralising an obstinate Japanese pocket.

As in air warfare in the West, Allied flying men over Burma occasionally have Pathfinders to direct their strikes. But they are much more literally Pathfinders in the Far East.

Sometimes a pilot on reconnaissance over enemy territory notices an unusual movement beneath him. The Japanese are masters of the art of camouflage, but some change in the monotonous green landscape catches the pilot's eye. He circles, noting every distinctive feature on the ground, makes a careful check of his position, and then flies home to report his suspicions to Intelligence.

An attack is ordered against that small point, so like its surroundings that only the man that has seen it once can recognise it again. And so he leads the squadron to the spot—a true pathfinder—to put his suspicions to the test of fire and high explosive.

Bombs dropped in thickly wooded country may hit and destroy some cleverly concealed Japanese objective, but the success of the mission will also be concealed if high explosive alone is used. In this specialised warfare the backroom boys are engaged as much as they are in Europe. Experiments have been made on secret testing grounds until the best mixture of explosive and incendiary has been evolved, not only to destroy but also to reveal what damage has been done to targets screened by the effective camouflage of jungle growth.

This and the missions of the cargo aircraft is why Eastern Air Command now mounts 3,000 sorties in a single day—yet drops bomb loads far smaller than in the West.

TRANSFERS FROM AIR FORCE TO ARMY

THE following message from the Secretary of State for Air (Sir Archibald Sinclair) to all Commands, Groups and units of the Royal Air Force has been issued:—

His Majesty's Government recently decided that the armies in the line were to be reinforced by the addition of fighting men who would be drawn in part from the Royal Navy and the Royal Air Force.

We are engaged upon the concluding stages of a great combined operation. Our resources are taxed to the utmost and the time has come when the three fighting Services must be regarded as, in effect, one Force, the members of which must be prepared to serve in whichever arm the need is greatest. Loyalty to a particular Service and individual preference must take second place.

The Army needs officers, and an opportunity will shortly be given to officers and airmen to volunteer for commissioned service in the Army. The Army also needs men to fight in the ranks, and airmen will be asked to volunteer for transfer to the Army for service in that capacity. But if there are not enough volunteers it will be necessary to make up the number by compulsory transfer. Such transfers will be made, as far as possible, from Group V trades and from the R.A.F. Regiment, which is being reduced in size.

The number to be transferred will represent a very small proportion only of the total strength of the R.A.F., and transfers will be spread over several months. The conditions of transfer will be announced by Air Ministry Orders.

I realise that the transfers, with the shift of loyalties they

entail, will cause disappointment to those who hoped to serve their country in the R.A.F. But the needs of war must come first, and this will, I know, be understood and accepted by the Service.

(Signed) ARCHIBALD SINCLAIR.

"FLIGHT" HANDBOOK

AIR CHIEF MARSHAL SIR ARTHUR W. TEDDER, G.C.B., has contributed an excellent foreword to the fourth edition of the *Flight Handbook* published recently. The new edition has been much enlarged and is lavishly illustrated. It surveys progress in design and construction and briefly comments upon recent developments, including contra-rotating airscrews, rocket and stratosphere flight, gas turbines, jet propulsion, assisted take-off, night navigation by astrograph, radiolocation, de-icing, and the use of thermo-plastics. A special chapter is devoted to instruments. As well as dealing with the more advanced aerodynamic and structural phases of modern aviation, first principles are explained in simple language.

Included in the new edition are sectional perspective drawings of the Airspeed Oxford, Avro Lancaster heavy bomber, De Havilland Albatross, Handley Page Halifax heavy bomber, Hawker Typhoon, Short Stirling and Vickers Supermarine Spitfire; also interior sectional drawings and particulars of the Rolls-Royce Merlin, Bristol Hercules, Napier Dagger, Pratt and Whitney Twin Wasp engines. German power units, too, are described.

The price is 7s. 6d., and the handbook is obtainable through booksellers or from *Flight Publishing Co., Ltd., Dorset House, Stamford Street, London, S.E.1* (post free 7s. 10d.).

Operational Japs

Latest Official Data on Some Current Enemy Aircraft in the Far East

THE belief, commonly held in this country and America before the war, that Japanese aircraft were as "cheap and nasty" as the flash-lamp bulbs they exported is now known to have been entirely fallacious. From the day they plunged into the war with their surprise attack on Pearl Harbour, it became increasingly evident that the crafty Nips had been leading the rest of the world up the garden for years. So far from being any Gilbert and Sullivan outfit, the Mikado's air force had been taking every advantage of the information carelessly passed on to them by us Anglo-Americans on how to design, build and use military aircraft, and constituted an air power to be reckoned with.

It is true that, beginning with the Val dive-bombers used on that fateful December 7th, many of the types first encountered were slightly hampered by fixed undercarriages and thus did not completely shatter the carefully nursed notion of aerial inferiority at one fell blow. But there was, it might as well be admitted, more up that flowing oriental sleeve than a yellow arm, and it is probably true to say that the Japanese Air Force works to a higher standard than is generally supposed even to-day. Indeed the American journal, *Popular Science Monthly*, which recently published an analysis of Japanese military aircraft, agreed that several Jap types are superior to similar U.S. types in performance, adding that it was equally true that in other categories the U.S. types were definitely on top.

High-performance Types

Four types which come into the high-performance class and which have lately been encountered in combat may be taken as evidence of the efforts being made in research and production, though now that the U.S. Superforts are paying steadily increasing attention to industrial targets on the Jap homeland, it may not be too optimistic to look for a definite check to their productive activities. Available information indicates, however, that certain weaknesses common to most Jap aircraft are being tackled, although it is true that, in general, insufficient attention has yet been paid to such things as armament—the muzzle velocity of their guns is inferior, and so are their sighting and compensating devices—the leakproofing of fuel tanks, and the provision of adequately hardened steel for protective armour.

Inferior control at high speeds has been another weak-

ness with their fighter types, but this, at any rate, is being rapidly improved.

To enumerate the four new (or comparatively new) types just mentioned, Frank I is fitted with a water-injection device to provide emergency speed, and is believed to carry armour for the protection of the pilot, bullet-resistant glass and leak-proof fuel tanks. Its 18-cylinder, two-row, air-cooled radial engine gives it a top speed of over 400 m.p.h., and it has a range of some 1,700 miles.

A 400 m.p.h. Navy Interceptor

Jack II is a Navy interceptor with a top speed of about 400 m.p.h. and a range of just over 1,000 miles. Its engine is believed to be of 1,875 h.p., but it is not thought to have any armour or self-sealing tanks.

Irving II (illustrated and briefly described in *Flight*, February 15th) is a reconnaissance fighter-bomber and night-fighter with a top speed of about 330 m.p.h., and is fitted with armour plating behind the pilot and leak-proof tanks. Its two Nakajima Sakae 21 air-cooled radial engines are each rated at about 1,100 h.p. at sea-level; it has a maximum cruising range of about 1,900 miles, and climbs at about 1,700ft./min. at sea-level; three or four cannon are fitted.

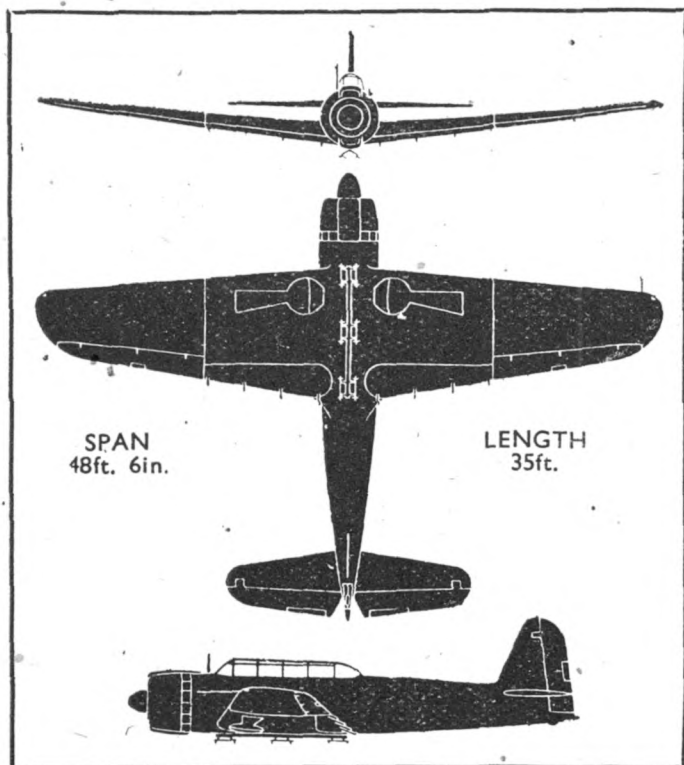
The fourth newcomer is Judy II, a dive-bomber with a top speed of about 330 m.p.h. and a range of 2,100 miles.

It has recently been denied that the Japs' notorious proclivity for copying the products of other nations is extended to their aircraft, but it does not need a particularly careful study of many of their types to see that they have, to say the least of it, borrowed freely from both German and American designs; indeed, the fuselage lines and long cockpit covers, and even an occasional fin and rudder outline, of some of their single-engined, two-seater types are distinctly American in general appearance.

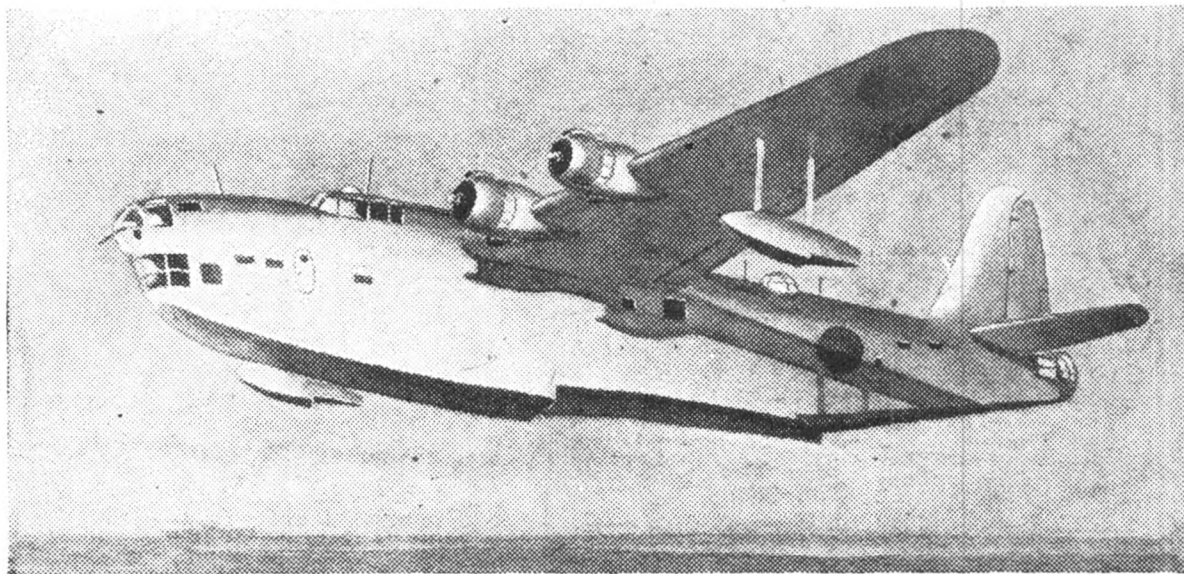
Excellent Workmanship

But this does not mean they are inferior; in some instances their adaptations actually show a definite improvement on the originals. It is generally agreed, too, that, so far as workmanship is concerned, their aircraft leave very little to be desired.

When, some time ago, the Americans captured an almost undamaged "Zero" (as it was then called) in the Aleutians, they shipped it home and went over it with the proverbial fine-tooth comb. The official reports as a result of this examination gave the Japs full marks as craftsmen. The aircraft was "made like a watch," and was finished with a very thin coat of good-quality lacquer; the instruments



JILL 12, a torpedo-bomber with top speed of over 300 m.p.h.



EMILY 22 is one of the best of all Japanese aircraft and boasts a particularly good performance with a top speed of 296 m.p.h.

were an unblushing crib of American instruments but beautifully made. The report intimated, however, that the whole job was so light as to verge on the fragile (it had no armour), and it was not surprising that it flew to pieces when it got in the way of a burst from a P-40's 0.5in. guns.

Better Protection

More recently the Jap has begun to realise he could no longer afford to go rushing into the arms of his honourable ancestors with quite such heroic abandon, laudable as this may seem to the theologians of Nippon, and his combat aircraft are now designed to prolong his mortal life in the purely mundane interests of the "Son of Heaven." Not all Jap fighters, however, are yet equipped with armour and self-sealing tanks. The latest descendant of the Zero, built by Mitsubishi and Nakajima, for example, is the Zeke 52, which has neither of these protective fittings. It weighs less than 6,000 lb. in fighting trim compared with the 10,000 lb. plus of its opposite number, the Hellcat. Other Jap fighters, however, such as Tony 1 and Tojo 2, have been given this protection for man and machine, but still scale only 6,900 lb. and 6,100 lb., respectively. Other interesting data on these three up-to-date Jap fighters is as follows:—

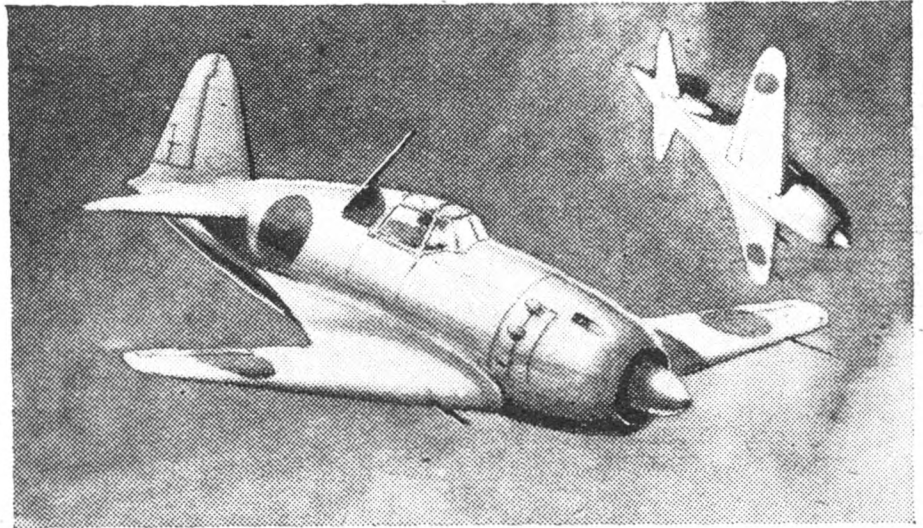
Zeke 52: top speed about 350 m.p.h., climb about 2,800ft./min. at sea-level, maximum range about 1,500 miles, powered by a 14-cylinder, air-cooled radial Nakajima Sakae 21 engine with two-speed blower giving 1,100 h.p. at sea-level; armed with two 7.7 mm. machine guns and two 20 mm. cannon.

Tony 1: built by Kawasaki, top speed about 360 m.p.h., climb about 2,400ft./min. at sea-level, maximum range about 1,900 miles, powered by a 60-degree V-type 12-cylinder liquid-cooled Kawasaki 2 engine with two-speed blower giving about 1,100 h.p. at sea-level; armed with two 7.7 mm. and either two or four 12.7 mm. guns.

Tojo 2: built by Nakajima, top speed about 375 m.p.h., climb about 3,900ft./min. at sea-level, range with normal fuel load about 800 miles (extendible by drop tanks), powered by a 14-cylinder air-cooled radial Nakajima 2 engine with two-speed blower giving about 1,400 h.p. at sea-level; armed with two 7.7 mm. and two 12.7 mm. guns.

First In-line Type

Incidentally, Tony 1 is the first Jap aircraft to be fitted with an in-line liquid-cooled engine and to be built sturdily enough to try to stay with U.S. aircraft in power-dives; most other Jap fighters will not stand the high stresses imposed by such dives. Tojo 2 is now in service mainly in the China-Burma theatre. Its armour for the pilot is good, but the attempt to make its tanks leak-proof is ineffective. Up to the present the Japanese have enclosed their fuel tanks in layers of rubber, or sometimes kapok, to deal with leaks, but the benefit has been practically nil. Much of their armour plating, which varies in thickness from 6.5 mm. to 17.5 mm. has been found to be of such



JACK II, a 400 m.p.h. Navy interceptor with a range of just over 1,000 miles.

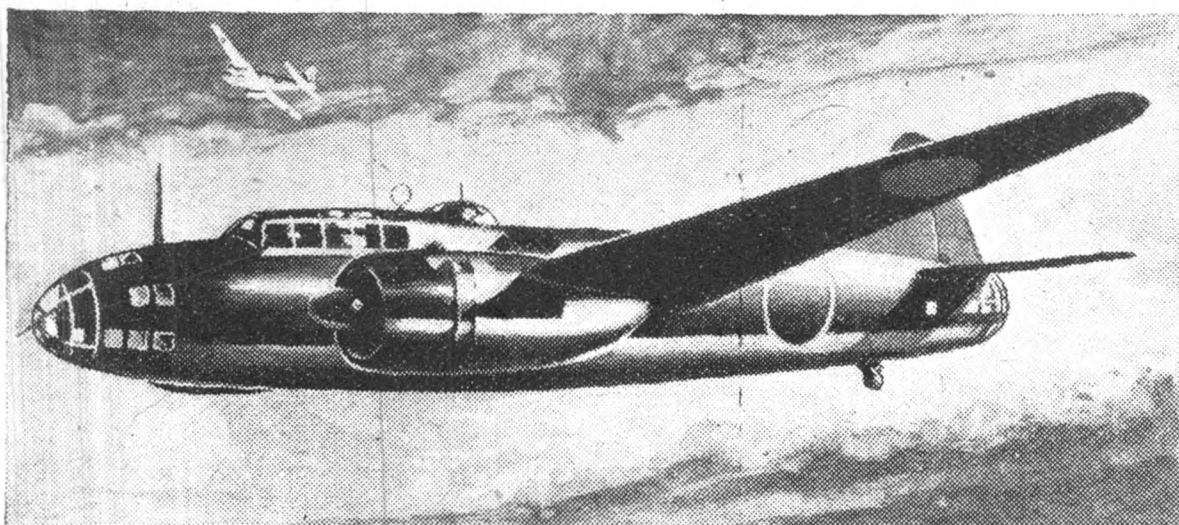
poor quality that 0.3in. bullets will shatter it; U.S. armour, on the other hand, will deflect 0.5in. bullets.

Twin-engined Fighters

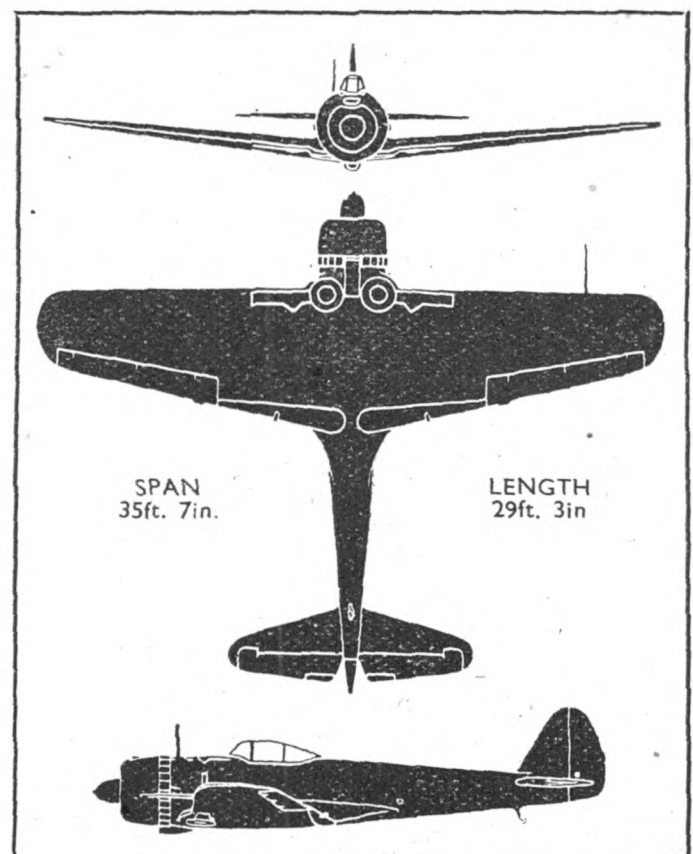
Another recent addition to the list of Jap Army fighters is the two-seater twin-engined Nick 1 which is probably manufactured by Kawasaki. Like the Irving II, its engines are of about 1,100 h.p. at sea-level, but in this case they are the 14-cylinder Mitsubishi 1 air-cooled radials with 2-speed superchargers and three-bladed c.s. airscrews. Nick 1, however, has a rather better performance than the multi-purpose Irving II and is a somewhat smaller machine, having a span of 50ft. and length of 34ft. compared with the 55ft. 8in. and 40ft. respectively of the reconnaissance fighter-bomber. Actually its top speed, at about 350 m.p.h., is only some 20 m.p.h. faster, but it climbs at 2,400ft./min. at sea-level compared with 1,700ft./min. Range, on the other hand, is less—about 1,300 miles maximum instead of the Irving's 1,900 miles. Armament of Nick 1 comprises two 12.7 mm. machine-guns and a 37 mm. cannon firing forwards, and one 7.7 mm. machine-gun on top.

In the Indian theatre, the Nakajima fighter Oscar 2 is now replacing Oscar 1 which was a development of the obsolescent Nate, now practically non-operational. Oscar 2 has a 1,100 h.p. engine, heavier armament and a very-much-improved rate of climb at 3,300ft./min.

One more Jap fighter currently in service is worth mentioning, and that is Rufe 11 (recently illustrated in *Flight*) which presents the unusual in being a single-seater mounted



BETTY 22 is capable of about 330 m.p.h. and is believed able to carry two torpedoes in lieu of bombs when required.



OSCAR 2, with a 1,100 h.p. radial engine, climbs at 3,300ft./min.

OPERATIONAL JAPS

on a single float; it is, in fact, virtually a seaplane version of the older Zeke 21 fitted with the 900 h.p. (for take-off) Nakajima Sakae 12 engine employing a single-speed supercharger. Rufe 11's performance has naturally suffered by the addition of floats, its top speed being down to about 280 m.p.h., but its sea-level climbing rate is 2,200ft./min., which is not too bad. Manœuvrability is not likely to be very bright, however, and one imagines that Rufe 11 pilots try to keep out of the way of Corsairs, Hellcats and Wildcats. Incidentally, the substitution of a central float and wing-tip stabilisers for Zeke 21's undercarriage has increased the weight by about 100 lb.

Classed as reconnaissance bombers, two single-float biplanes are also in limited use by the Jap Navy, namely, Dave 11, produced by Nakajima, and Pete 11, manufactured by Sasebo Naval Arsenal. The former is powered by a nine-cylinder Nakajima Kotobuki III air-cooled radial of about 650 h.p. fitted with a two-bladed controllable-pitch airscrew. Its top speed is about 180 m.p.h., rate of climb at sea-level about 900ft./min. and range with normal fuel load about 800 miles. Armament is limited to one forward-firing 7.7 m.m. machine-gun and another in the rear cockpit, while its normal bomb load is no more than some 200 lb. Its upper wing spans 35ft. 7in. and the lower wing 34ft. 6in., length being 28ft. 4in.

Pete 11 is slightly larger, its dimensions being, span 37ft. and length 32ft. 3in., and it is fitted with an 850 h.p. 14-cylinder air-cooled radial Mitsubishi Zuisai 13 with three-bladed c.s. airscrew. Top speed is 240 m.p.h. (approximately) and maximum range about 650 miles. Armament in this case comprises two 7.7 mm. guns forward and another in the rear cockpit. This aircraft is reported to be used from seaplane bases and catapulted from warships.

Torpedo Bombers

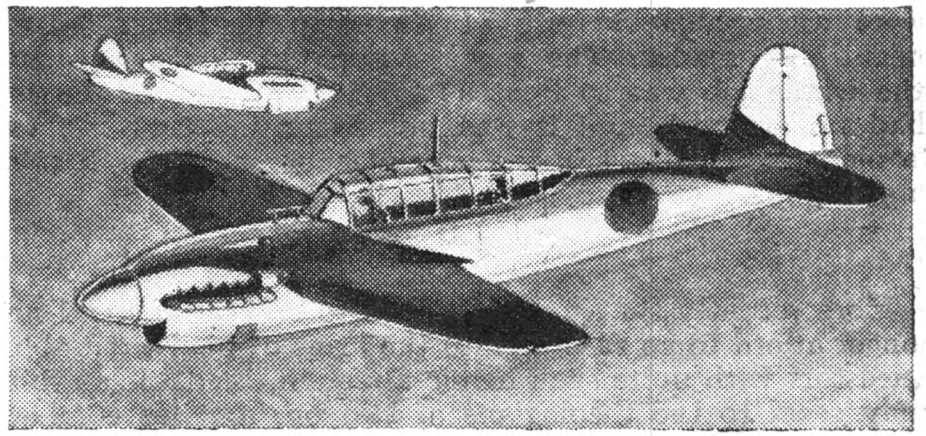
Among Japanese torpedo bombers at present in operational service, Nell 22 has the distinction of being the type credited with the sinking of *H.M.S. Prince of Wales* and *Repulse*. Of the mid-wing type with a span of 82ft. and length 54ft., it is powered by two 14-cylinder Mitsubishi Kinsei 45 air-cooled radial engines with three-bladed c.s. airscrews, each developing about 1,000 h.p. for take-off. Top speed is about 240 m.p.h., rate of climb about 1,100 ft./min. at sea-level and maximum range about 2,200 miles. Four 7.7 mm. machine-guns and one 20 mm. cannon form the protective armament. Produced by Mitsubishi and Nakajima, this type is also used for long-range reconnaissance.

From the point of view of performance, however, about the best of the Jap torpedo aircraft is the Jill 12, but, as is usually the case, it has a smaller factor of safety than the U.S. Avenger which is virtually its opposite number. It has a top speed of 310 m.p.h. compared with the Avenger's 250 m.p.h. plus, a range of 2,000 miles compared with the Avenger's 1,000 miles plus, and, dispensing with armour and self-sealing tanks, weighs only 10,000 lb.

COMMONS DEBATE ON THE A.T.C.

ELSEWHERE in this issue is a summary of Sir Archibald's speech in the House last week on the Air Estimates. During the debate which followed, the chief subject under review was the Air Training Corps.

It was Mr. Touche, the Member for Reigate, who moved an amendment which "regretted the present lack of leadership by the Air Council" and called upon the Government for "an immediate declaration of policy." This was seconded by Sir Wavell Wakefield, who was followed by nine other Members. Of these eleven speakers, only two could not be described as severely critical of the Government's handling of the Corps. In his reply Commander Brabner (Joint Under-Secretary for Air) did little more than reiterate a few reassuring (?) generalities, except for a statement that they were taking steps to see that the output of the A.T.C. would be in close relationship with what would be required by the R.A.F. after the war.



JUDY 11 is a new dive-bomber with in-line engine. Top speed is about 330 m.p.h. and range 2,100 miles.

gross as against the 14,500 lb. of the American Grumman.

In the patrol bomber class, the Kawanishi-built Emily 22 is one of the best of all Jap aircraft. Its armour and protected fuel system is better than on any other Japanese type, and with a top speed of 296 m.p.h. and maximum range of over 4,000 miles is superior to the Coronado which is the corresponding U.S. type. The Emily, which has a span of 124ft. 7in. and weighs 68,000 lb., is powered by four 14-cylinder Mitsubishi Kasei 22 air-cooled radial engines fitted with two-speed blowers and four-bladed c.s. airscrews, each unit giving some 1,400 h.p. for take-off. It climbs at about 1,200ft./min. and carries a crew of nine.

Medium-bomber Features

Japanese medium bombers are, in general, noted for their lightness, speed and long range, while their multi-purpose characteristics have given them a decided advantage. Their defensive equipment, however, is decidedly sketchy by British and American standards, the Jap having shown no very great enthusiasm for the power-operated gun turret. Probably the best of the current types is the Betty 22, a development of Betty 11, which is said to be able to carry two torpedoes, if required, instead of bombs. This medium bomber spans 82ft., is 65ft. 10in. long and weighs about 17,000 lb. empty. Powered by a pair of Mitsubishi Kasei 21 air-cooled radial engines each developing about 1,800 h.p. at sea-level, Betty 22 has a top speed of about 330 m.p.h., a climb of about 1,200 ft./min. at sea-level and a maximum range of some 2,800 miles. Armament is limited to three 7.7 machine-guns and two 20 mm. cannon.

Finally, in the heavy four-engined bomber class, Japan has apparently been unable to develop a really satisfactory example in spite of a number of attempts in this field, and Liz, the current type in this class, is now used only as a transport. It compares with the Superfortress in dimensions, having a span of 140ft. No actual figures are available about its performance, but it is inferior in every way to the B-29 and B-32 super-heavies of the U.S.A.A.F. In silhouette it somewhat resembles the outline of a C-54, but it is very doubtful if, even as a transport, it can "hold a candle" to this famous American load-carrier.

Finally, Mr. Touche formally withdrew his amendment, although, as he said, "the grains of comfort are very small." But his speech in moving it stressed the point that not only had the various blows which had fallen on the A.T.C.—the mines ballot and drafting into the Army, etc.—had a harmful effect on the morale of the cadets, but officers and instructors were frankly discouraged, and many squadrons were mere shadows of their former selves. The position was serious.

Sir Wavell Wakefield also stressed the harmful effect on the Corps of now having nothing at which to aim. "There is a lack of guidance and leadership and no purpose ahead; the future is aimless," he said. He suggested the formation of a National Advisory Council. What was wanted now was not mere assurances, but decision and action.

Lt. Cdr. Joynson-Hicks was mostly concerned with the fact that the A.T.C. was run entirely by the R.A.F. and that the Navy was not represented in its administration.

Compressibility

An Analysis of Basic Factors : Some Practical Experiences with the Republic P-47 in Dives : Sources of Buffeting

By COSTAS ERNEST PAPPAS

NATURE appears determined to prevent man from travelling fast in the air. In the upper levels where the air is "thin," and where consequently the resistance to forward motion is low, jet propulsion affords an opportunity for very high speeds. But unfortunately it is also a law of nature that the airflow around the components of an aircraft changes when the speed of sound is reached or even approached, and until we have learned how to design for the altered flow, troubles are encountered, as almost every aircraft designer has discovered. To make matters worse, the speed of sound falls off with altitude, so that the attractions of high-speed travel at great heights are difficult of attainment.

The present article is based on a paper read by the author before the Albany Society of Engineers and is reproduced here by courtesy of our New York contemporary Aviation. The author is chief of the aerodynamics department of the Republic Aviation Corporation.

PROBLEMS associated with high-speed flight are manifested because air is compressible—and these problems are, in truth, very complex.

Compressibility is the term which aeronautical engineers use for a large class of aerodynamic effects associated with high speed. This designation has been adopted because changes which occur in fluid flow at high speeds are chiefly produced by the elasticity or compressibility of the air. If air were an incompressible medium, these effects would not be present. Associated with compressibility is the density of air, which changes rapidly, in turn causing the airflow to change over the surface of the body.

At speeds approaching that of sound—approximately 760 m.p.h. at sea level—the aerodynamicist is confronted with the problem of the airflow changing in character due to rapid changes in density resulting from compressibility properties of the atmosphere.

The practical significance of compressibility effects in aeronautics lies in the fact that the lift and drag of supporting surfaces, the effective operation of control surfaces, and the operation of the airscrew with respect to efficiency and capacity, are all affected

since the actual fluid is compressible. The lift, drag, and moment of a body are functions of the ratio of speed of the body to the speed of sound at the altitude in question. This ratio is called the Mach number after the Austrian physicist, Ernest Mach, who specialised in the study of high-speed phenomena.

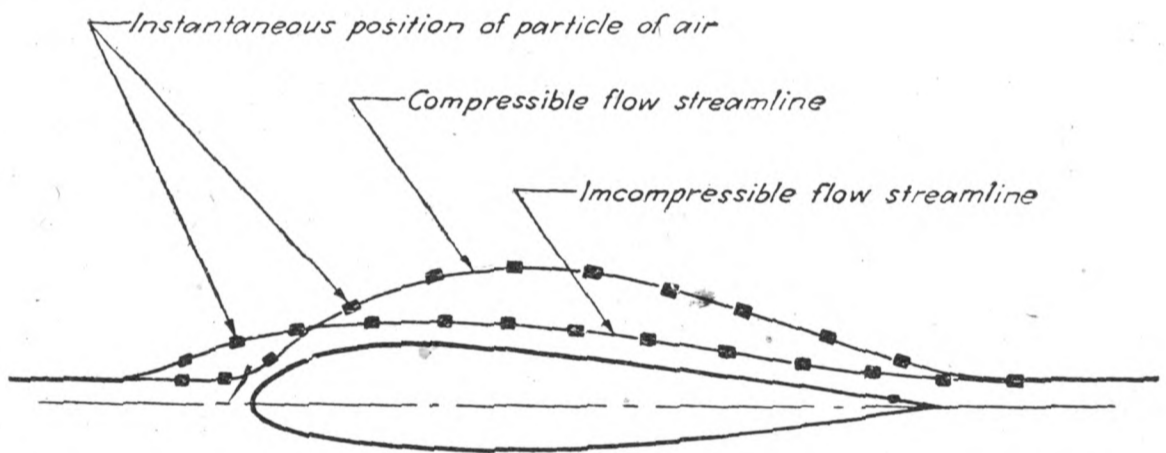


Fig. 2. Comparative position of streamlines for compressible and incompressible flow.

A rather abstract appreciation of the foregoing is afforded by a consideration of the elementary forces acting on a fluid particle. For our purposes it suffices to name principal forces.

First is the well-known D'Alembert force of acceleration. This force is proportional to the square of the velocity with which the particle executes its motion, and the mass of the particle. Evidently the force is very small unless the velocity is high, but the force increases very rapidly as the velocity is increased.

Second is the force of pressure acting differently on opposite sides of the particle. This force serves to balance the D'Alembert reaction. It is therefore called into being by the motion, and it disappears when the motion ceases. Let us agree that viscosity forces are small and may be neglected within the first order approximation.

Our picture now is of a particle of fluid executing an irregular motion in such a way as to avoid an airfoil which moves through the region initially occupied by the particle (Figs. 1 and 2). Since the particle is accelerated from rest and follows an irregular path thereafter, a complicated system of inertia forces appears on the moving particle. These forces are balanced by pressure differences which appear between different points of the fluid.

Since inertia forces are small with small acceleration, we expect small pressure differences at low speeds. However, as the speed increases, the pressure forces required increase according to the square of the velocity. At sufficiently high speed these

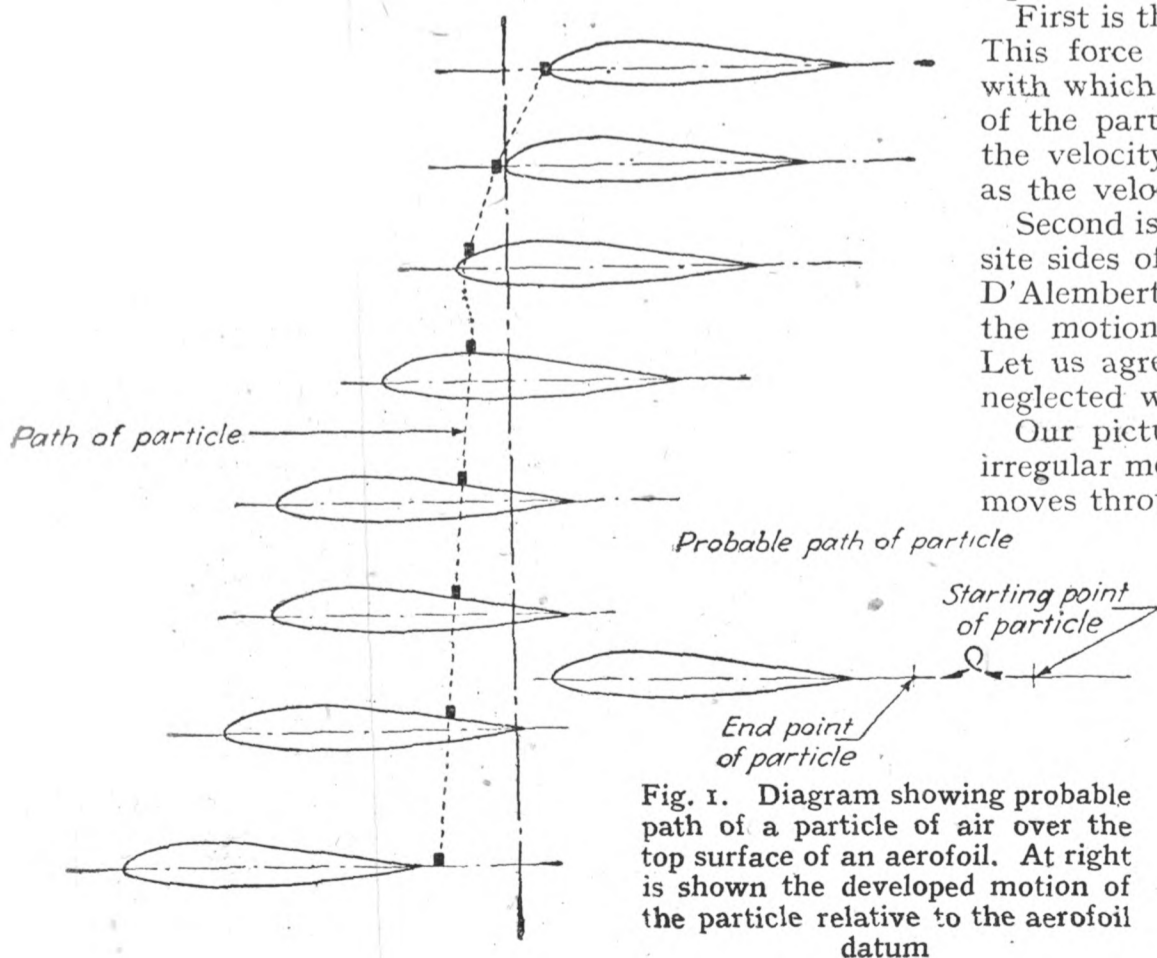


Fig. 1. Diagram showing probable path of a particle of air over the top surface of an airfoil. At right is shown the developed motion of the particle relative to the airfoil datum

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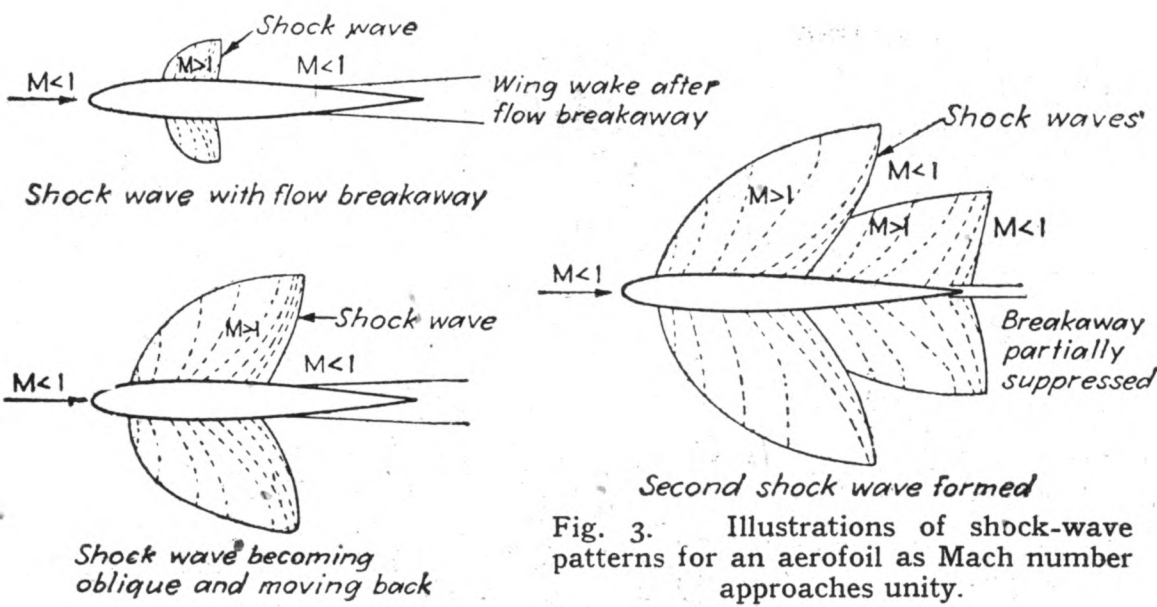


Fig. 3. Illustrations of shock-wave patterns for an aerofoil as Mach number approaches unity.

pressure differences will theoretically exceed atmospheric pressure, and vacuums may appear in the flow. In the case of a comparatively incompressible fluid, such as water, this phenomenon is usually called cavitation.

However, with a fluid such as air, which can expand to fill any space, we find a different situation. Instead of cavitation we find the air becoming more and more attenuated in the regions of low pressure. Unfortunately for the mathematician the attenuation of the air lessens the density, so that the inertia forces are decreased, in turn decreasing the required pressures, thereby unbalancing the force system, causing the flow to undergo further readjustment, etc. This ends in a headache.

Energy Loss from Sound Waves

In addition to the expansion of air in regions of low pressure, a second phenomenon occurs at the speed of sound. It can be shown, theoretically, that a steady reciprocating motion of a piston in a pipe can be maintained without energy loss so long as the motion is below a certain frequency. Above this frequency, increasing amounts of energy are sent down the pipe in the form of sound waves. Similarly, at low speeds, the steady motion of a body requires no energy input, while at and above the speed of sound energy is continuously radiated outward in the form of a wave. This wave is very similar to the bow wave of a boat.

However, such waves would be unimportant at present-day speeds were it not for the fact that a complicated interaction occurs between the first phenomenon of fluid expansion and the second phenomenon of wave motion. This interaction causes the shock waves which occur approximately midway of the length of the aerofoil chord (Fig. 3). An example of very similar occurrence is given by the well-known hydraulic jump in the spillways of dams. Theoretically, little can be said about shock waves, but from a practical aspect they cause much greater headaches than either of the first two phenomena.

The task of estimating compressibility effects from a

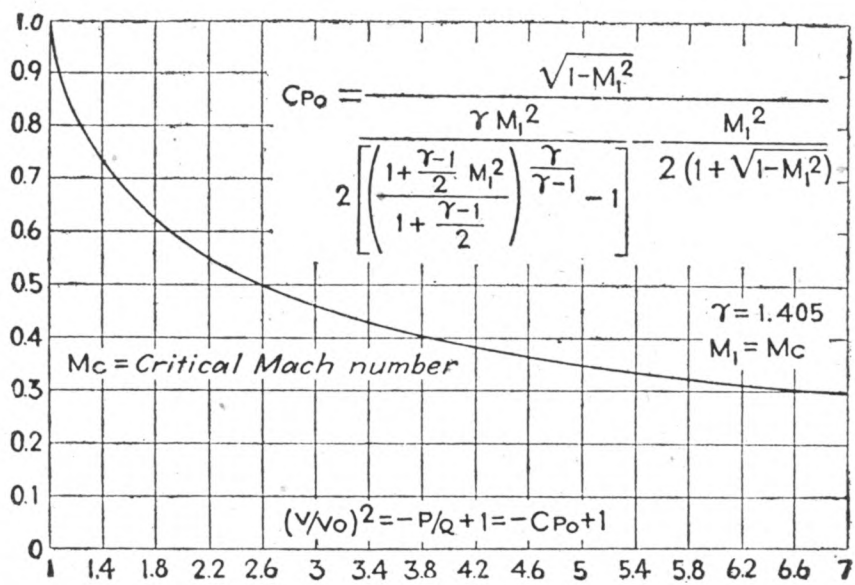


Fig. 4. Aerofoil critical velocity v . maximum pressure coefficient.

mathematical viewpoint presents many interrelated difficulties such as:—

- (1) Absence of exact mathematical solutions of practical interest.
- (2) Questionable convergence of approximate methods.
- (3) Uncertainty as to the criterion for occurrence of shock waves.
- (4) Considerable inaccuracy of experimental verification.

When mathematical studies are made, a steady adiabatic flow-field of an ideal gas about a two-dimensional body is assumed. When shocks are present, the assumption of irrotationality no longer exists.

Through the demands of structural and aerodynamic design, the interest of aircraft manufacturers has become more and more sharply focused on the attempts to find a satisfactory and practical solution to the problems outlined previously.

We shall start with the diagram of pressure distribution over a wing as obtained from low-speed wind tunnels. The pressures are proportional to the velocity squared.

On this basis then, the higher the pressure, the higher will be the local velocity, and as a result, the sooner we will run into trouble. (Fig 4.) This suggests immediately

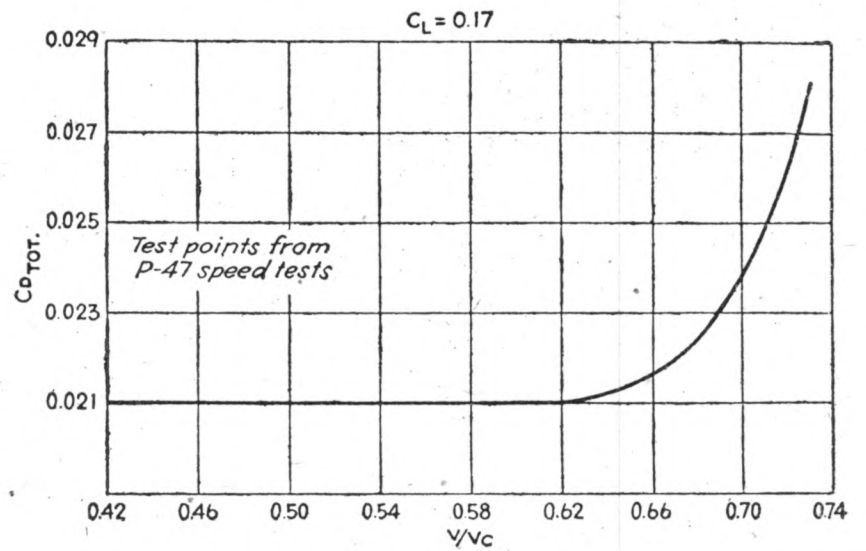


Fig. 5. Apparent variation of total drag coefficient with Mach number.

that we should be very careful of curvature. The smaller the curvature, the better will be the flow conditions over the body. Small radii of curvature should be avoided when designing radial engine cowls, aerofoil section, canopy, and fuselage lines. It is important that the fuselage lines be as nearly straight as possible in the vicinity of the wing juncture, since we have superposition of fuselage and wing airflows.

Efforts to determine, theoretically, the influence of the Mach number on the pressure distribution and total lift of a wing have already been made. The answer, although not applicable up to the speed of sound, is relatively simple. The expression determined by Glauert-Prandtl is as follows: Increase all ordinates of the aerofoil by $1/\sqrt{1-M^2}$. The air forces are then equivalent to those of an incompressible flow acting on the modified profile.

In particular, since angles of attack and camber also increase with the factor $1/\sqrt{1-M^2}$, the lift will increase proportionately to $1/\sqrt{1-M^2}$. The drag will increase in degree indicated by the increased angle of attack and especially the increased thickness of the profile. Such conditions apply only in the case of relatively low Mach numbers, for example, up to $M=0.6$. Thick profiles, however, should be avoided. According to the factor $1/\sqrt{1-M^2}$, we have for $M=0.6$ (i.e., $V=455$ m.p.h. at sea level) a profile with 15 per cent. thickness which corresponds to 18.8 per cent. thickness in an incompressible flow. Such a thickness

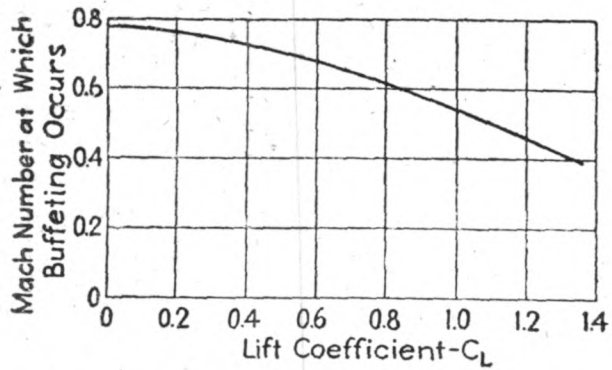


Fig. 6. Variation of lift coefficient with critical Mach number at which buffeting occurs.

exceeding 0.65 at moderate values of lift of the aerofoil. The streamline shape now breaks down completely, and the drag coefficient increases rapidly with increase of the Mach number; for example, between $M=0.60$ and $M=0.75$, the drag of a 12 per cent. symmetrical profile increases tenfold and the lift breaks down.

It is of interest to point out that when the fluid attains the local speed of sound, the airflow does not necessarily break down. In all probability a weak shock wave comes into the picture at this point, which is not too detrimental to the flow. However, as soon as supersonic regions appear, discontinuities may occur in which the velocity drops and the pressure rises over a very small distance.

When the intensity of the shock wave increases (by intensity we mean the ratio of the pressure ahead of the wave to the pressure behind the wave), rotationality of the field sets in and a turbulent flow region exists behind the wave. These waves extend a finite distance into the free flow and then fade away. The intensity of turbulence increases with the intensity of the shock wave. These compression shocks involve the dissipation of mechanical energy resulting in an increase in entropy. Eventually separation sets in, especially at the higher angles of attack, and at this point the drag increases precipitously (Fig. 5) and the lift decreases rapidly.

With the introduction of separation, the wing circulation is decreased with the resultant loss in CL_{max} . The turbulent field existing behind the shock wave will cause the tail surfaces to buffet and fast aircraft will be limited in high speed because of buffeting (Fig. 6). The location of the horizontal tail surfaces is of paramount importance, and it is very difficult to position the horizontal tail so that it will be out of the wing wake, particularly so since the wing wake thickness increases appreciably when rotationality of the field sets in because of the shock wave.

ratio, however, is known to have appreciably greater profile drag. In order to possess good characteristics, the thickness ratio of a high-speed profile should not exceed 12 per cent.

The actual critical effect of compressibility begins at values of M

In the case of projectiles, it is well known that drag coefficient increases abruptly with approach to the speed of sound. It is now recognised that this is a phenomenon of general application, but that it is more pronounced in the case of aerofoils and fuselages than in projectiles, since in the former, the initial drag is proportionately less because of favourable shape for the lower speed range.

The maximum speed of aircraft will probably occur at sea level since the maximum speed of sound occurs there. We can therefore expect a top speed of between 650 to 685 m.p.h. at sea level. This corresponds to $M=0.85$ and $M=0.90$, respectively, and it means that with further increase in engine power, all types of conventional aircraft will tend to approach the same top speed—650 to 685 m.p.h.

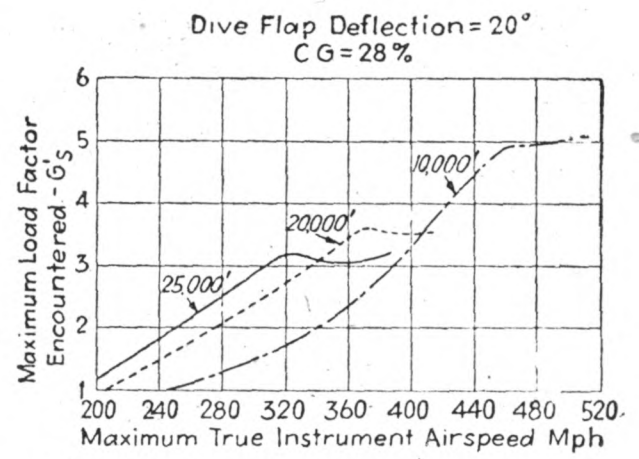


Fig. 8. Maximum load factor encountered in pull-out v. maximum true instrument airspeed.

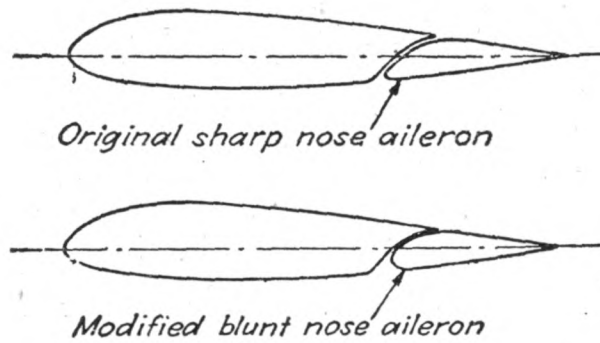


Fig. 7 - Comparison of sharp-nosed and blunt-nosed ailerons.

It is interesting that the same phenomenon is observed with ships, it being noteworthy how little the speed of express steamers has increased (*Mauretania*, built 1909, 70,000 h.p.—24 knots; *Queen Mary*, 1938, 200,000 h.p.—31 knots). For ships, also, there are limiting speeds above which the required power increases beyond all proportion. This critical point, at which the resistance rises abruptly, can be raised by increasing the length of the vessel. With aircraft, too, it would therefore be important to discover some means of postponing the occurrence of this critical point in the drag curve.

In designing high-speed aerofoils:—

- (1) More maximum thickness to 30-40 per cent. of the chord aft of the leading-edge.
- (2) Note that when the shock wave occurs, it tends to form opposite the maximum section.
- (3) Consider that lenticular sections are best from the point of view of drag at very high speeds, but poor as maximum lift sections.

In the supersonic region, the aerofoil experienced undulatory and frictional resistance. It can be shown that for almost rectilinear supersonic velocities, the body of least undulatory resistance, for a given volume, is bounded by two arcs of parabolas symmetrical with the X axis. Furthermore, for a body of minimum resistance, for a given volume, the frictional resistance, when considered, must equal the resistance due to the generation of waves.

Before discussing the action of the control surfaces, fuselage, wing, air-screw, and engine cowl in high-speed dives, a few remarks will be made regarding the attainment of these dives

The gross weight of the present-day fast aircraft is such as to give wing-loadings of approximately 40-50 lb./sq. ft. This loading is quite high, and in a dive the weight of the aircraft acts as thrust. Coupled with large wing-loading and good aerodynamic cleanliness, modern high-speed aircraft attain very high dive-speeds. It is inevitable that all aircraft will run into difficulty at speeds approaching that of sound.

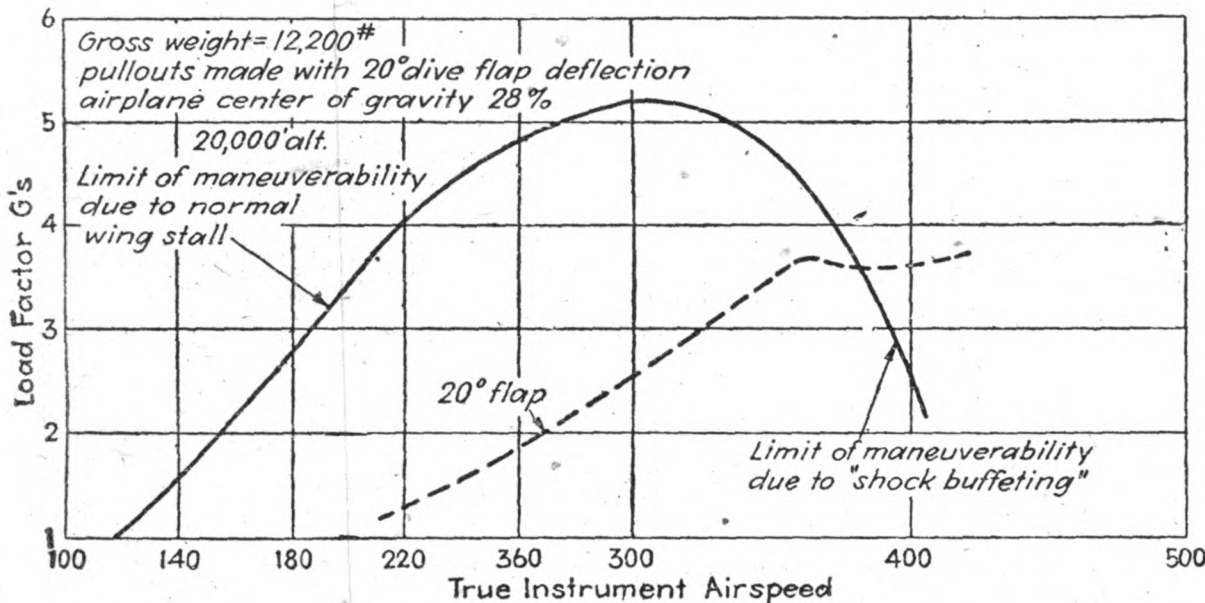


Fig. 9. Velocity acceleration diagram obtainable with dive flap, showing limitation on load factor as a result of compressibility stall.

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Recovery made with 20 degree
dive flap deflection
Gross weight = 12,200#
C.G. position at 28% M.A.C

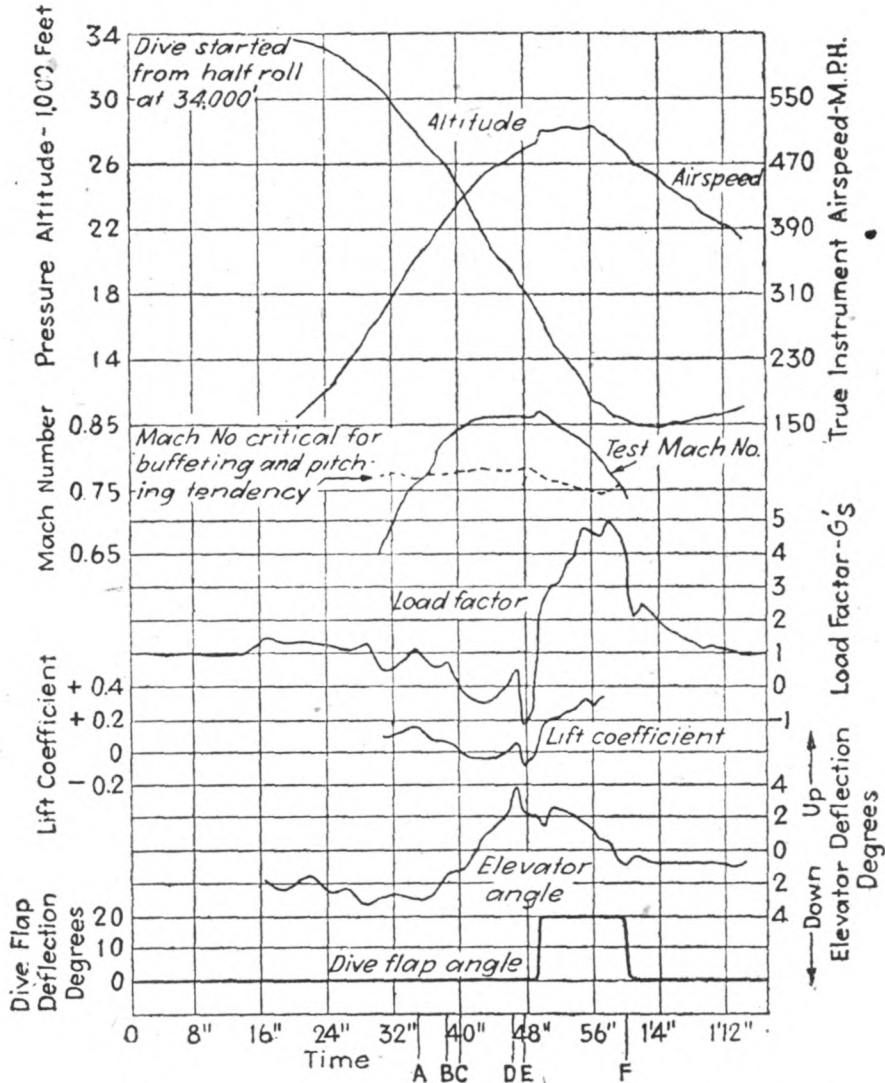


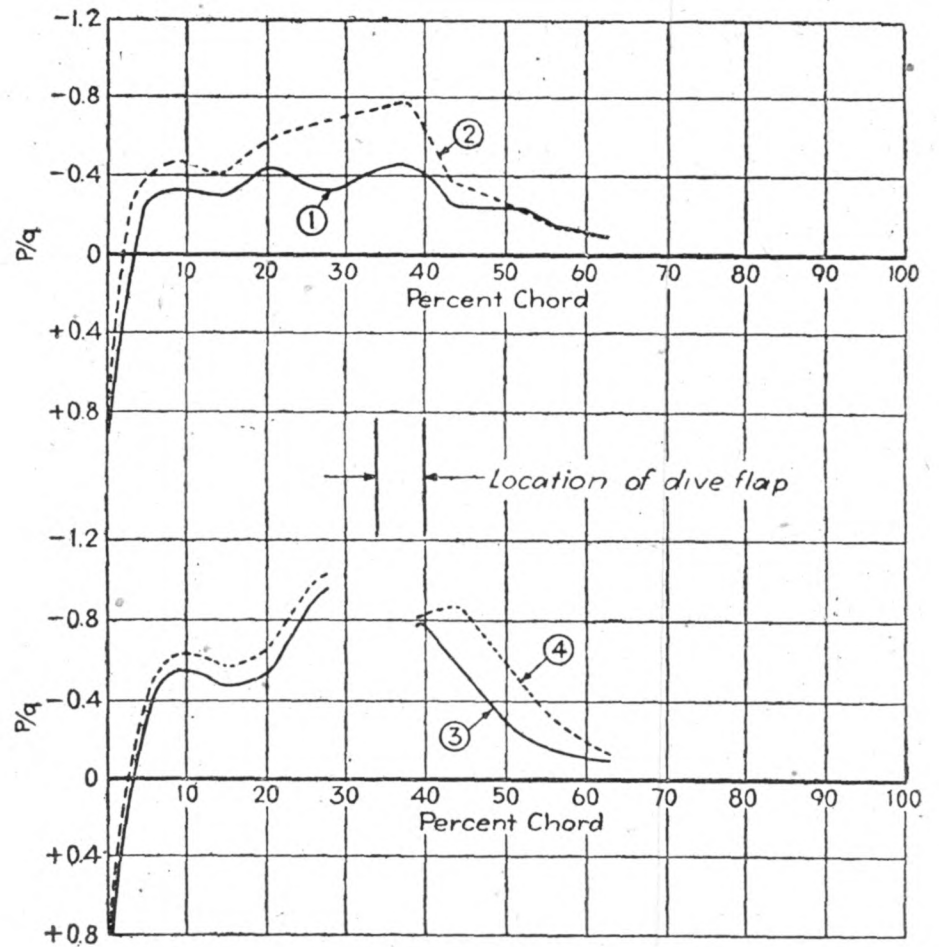
Fig. 10. (Above) Time history of 0.87 Mach number dive. A, buffeting and pitching first encountered. B, dive flap failed to operate. C, elevator pull-out attempted. D, elevator stick force relaxed slightly when dive-flap switch was discovered "off." E, flap deflected, recovery started. F, flap retracted. Fig. 11. (Top right) Variation of pressure distribution over lower surface during 0.87 Mach number dive. Fig. 12. (Right) Variation of pressure distribution over top of wing during dive in which buffeting and pitching tendency was momentarily encountered.

Since the Republic P-47 attains a Mach number of 0.85 to 0.90 in dives, it is not surprising that difficulties have been encountered. It is unfortunate that Nature has decreed that the type of flow-pattern changes as we approach the speed of sound. With the establishment of the shock wave, the flow over the wing changes in such a manner as to induce a flow separation.

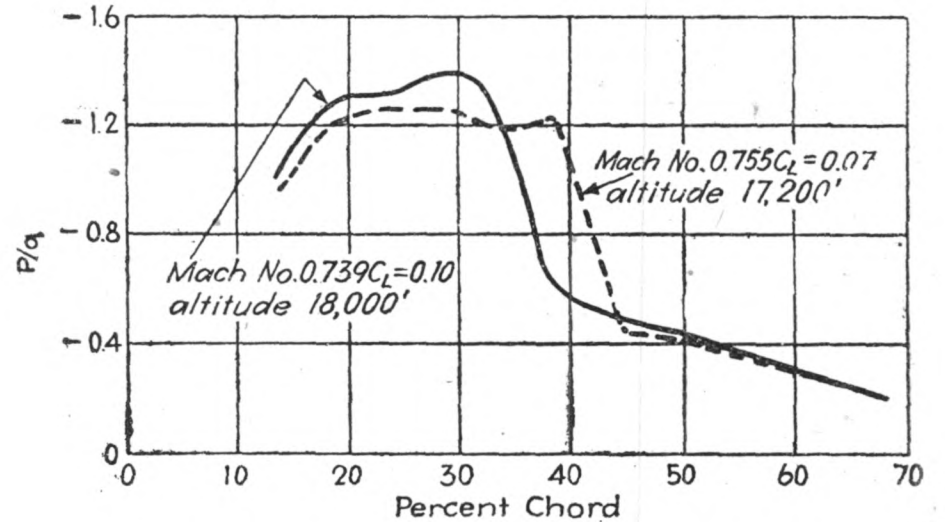
This results in material increase in the wing wake—of such a magnitude as to envelop the horizontal tail surface. By definition, the wing wake is a region of very turbulent airflow, and because of this turbulence the tail is subjected to buffeting.

We shall enumerate briefly the experiences encountered with the P-47 in high-speed dives and the steps taken in flight tests to overcome the difficulties:—

(1) Elevators. During high-speed dives, compressibility has manifested itself through buffeting, increased stick forces, and a decrease in elevator efficiency. Special care should be exercised by the designer with regard to the slot and aerodynamic balance. The leading-edge of the balance should not protrude beyond the normal contour of the tailplane-elevator combination, for if it does, high local speeds will result, causing buffeting, experienced by the pilot as a slight shake of the control stick. From the high-speed aspect, it may be necessary that larger horizontal tail surfaces be used, or an adjustable stabiliser



① Mach number 0.711 $C_L=0.11$ ③ Mach number 0.827 $C_L=0.07$
② Mach number 0.799 $C_L=0.07$ ④ Mach number 0.848 $C_L=0.03$



required. Internal sealed balances are highly recommended.

(2) Rudder. The observations applicable to the elevators also apply to the rudder.

(3) Ailerons. The Frise type aileron used on the P-47 has caused some difficulty at high speeds where the aileron's nose is deflected downward approximately 4 deg. (Fig. 7). At this point, the nose protrudes into the free stream and produces a flow breakdown causing the ailerons to buffet. The distribution of forces on the ailerons changes in character so suddenly and to such large degree that the pilot is unable to hold the control stick at a given point. The stick continues to move violently back and forth from one side of the aircraft to the other. This characteristic is referred to as "aileron snatch."

Aileron Design

The original aileron (Frise type) installation had hinges flush with the lower surface. At speeds of 400 m.p.h. and over, a violent oscillatory motion of the ailerons usually occurred. A series of flight tests were conducted to eliminate this condition, the procedure consisting of changing the position of the aileron hinge line.

Best results were obtained by moving the hinge line in. down and $\frac{5}{16}$ in. aft, with respect to the original position. The new arrangement did not completely solve the problem, but limited the snatch condition to Mach numbers above 0.8. Further work led to the construction of a blunt nose aileron with a variable mechanical advantage in the control system to reduce stick forces. The

COMPRESSIBILITY

blunt nose aileron with the differential control eliminates aileron snatch at high speeds up to 500 m.p.h. and gives greater rolling velocities at all speeds.

As a result of increased tail loads because of compressibility, the structural strength of the fuselage must necessarily be increased. Tail loads are increased because of redistribution of forces on the wing, resulting in a dive tendency of the aircraft in general. Parts of the fuselage such as canopy, ducts, fillets, and doors must be reinforced because of increase in air loads resulting from high speeds.

Special emphasis has been given to the P-47 fuselage design with regard to the contours at the wing juncture in that the fuselage lines are substantially straight at the wing root. Special emphasis has also been given to the length of the fuselage aft of the trailing-edge of the wing to minimise fuselage drag.

The wing forces and moments also change as a result of compressibility effects. With increase in speed or Mach number the resultant of the lift forces tends to shift toward the trailing-edge of the wing. Accordingly, care should be given to the design of the wing trailing-edge as a result of this shift in loading. The leading-edge of the wing should be very rigid as a result of the increase in pressure. It is extremely important to make the root section as thin as possible, and effort should be made compatible with the installation of machine guns, gas tanks, and landing gear not to exceed a maximum thickness of 12-14 per cent.

In this respect, airscrew slipstream effects will tend to increase the local speed over the wing immediately behind the airscrew.

In dives at Mach numbers above 0.82, the greatest increase in diving moment, resulting from compressibility, tends to nose the aircraft down, and control becomes difficult until an altitude of approximately 12,000ft. is reached. Neither elevator nor full tab motion is very effective, although the full tab deflection will raise the altitude at which pullout is possible by a few thousand feet. The pullout, when it occurs at approximately 12,000ft., is relatively sudden and sharp, and excessive load factors may be developed. The solution to this condition was the installation of a dive flap. With this flap a controlled pullout can be achieved at any altitude and Mach number (Figs. 8, 9, 10, 11, and 12).

The airscrew problem is very important since the airscrew's primary purpose is to convert engine horse-power into thrust. A blade section presents the same problem

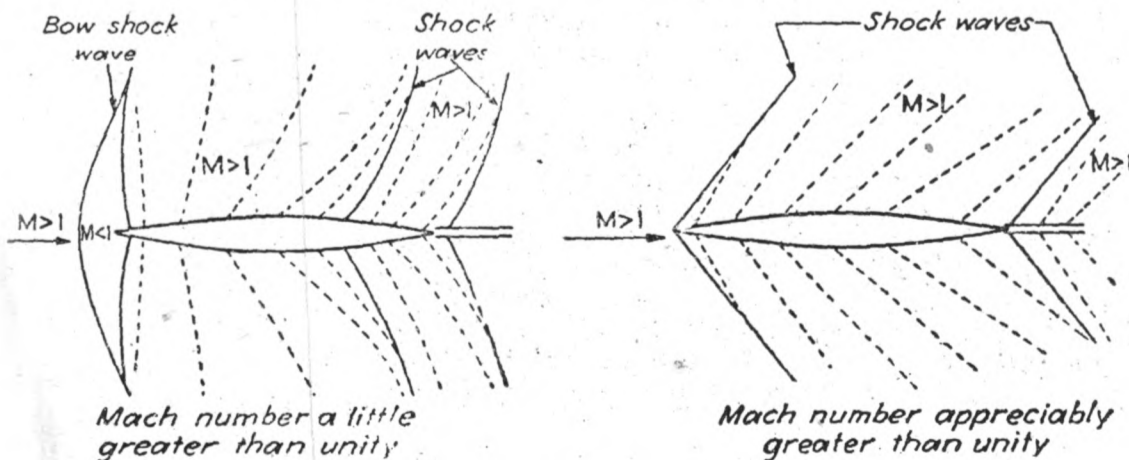


Fig. 15. Shock-wave patterns for sharp-nosed aerofoil as Mach number increases beyond unity.

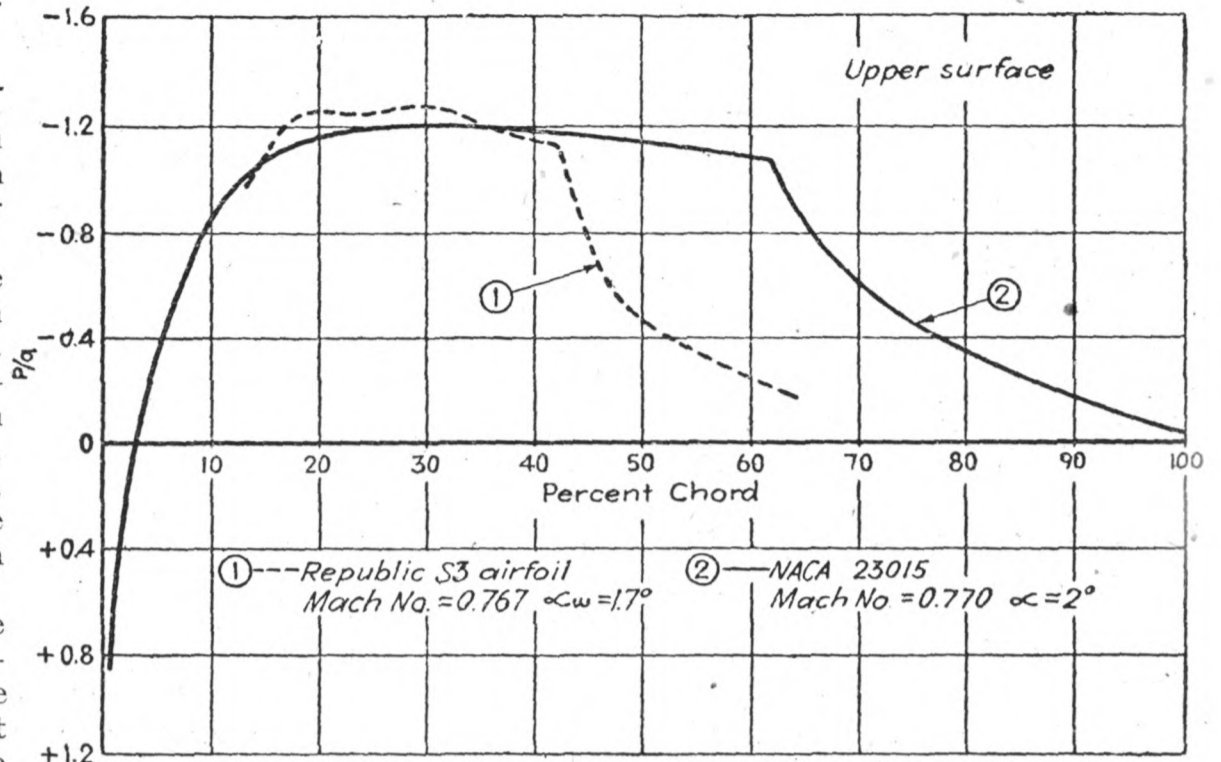


Fig. 13. Comparison of pressure distributions from wind tunnel and flight test at Mach number critical for buffeting and pitching tendency.

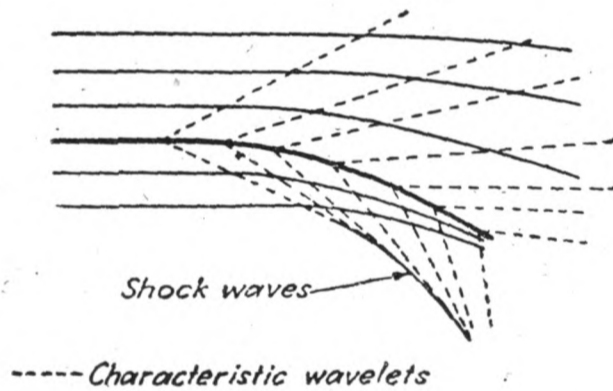


Fig. 14. Sketch showing formation of shock wave in region of compression below curved plate aerofoil at zero incidence in supersonic flow.

as does an aerofoil section, but it involves more difficulties in that we have rotational as well as forward speed. As a result of these two speeds, the problem of compressibility is much more severe.

The general trend of present-day airscrew design is toward wider blade chord to alleviate the effects of compressibility on the blade section. Various airscrews have been tried on the P-47 to increase the rate of climb performance. The original airscrew had a somewhat narrow chord distribution, with result that climb performance was sacrificed. Tests with wider blade chord airscrews have increased the rate of climb considerably.

With the introduction of more horse-power and improved turbo-superchargers which increase the critical altitude of the aircraft at which maximum horse-power can be maintained, six-bladed dual-rotation airscrews have been tested to determine their effect on stability, high speed, and rate of climb. The results to date have been discouraging. More development and research work will have to be devoted to the dual-rotation problem.

The engine cowl is very much like an aerofoil section in that it has a leading-edge radius. The redistribution of forces on the cowl are similar to that of the wing. Care should be taken to avoid sharp curvatures at the leading-edge of the cowl, in much the same way as with an aerofoil section.

Wind tunnel experiments show that the shock wave is not limited to a particular point on the aerofoil, but moves within a given neighbourhood of points. This phenomenon is called by some the "dancing" shock wave and immediately suggests an uncertainty factor in our theoretical set-up. The dancing phenomenon may be quite similar to the Uncertainty Principle in quantum mechanics, where a single wave function of a given type for a free particle corresponds to the physical condition in which the momentum and the energy are exactly known, but the position of the particle is unknown.

The aeronautical engineer should probably content himself with certain "band" values rather than exact values of the aerodynamic forces and moments in the subsonic region of flow. Flight tests have indicated that compressibility effects are not as severe as pre-

(Concluded on page 291.)

CIVIL AVIATION NEWS

EXPANSION

WORK has already begun on extending the runways at Lisbon Airport for the larger airliners that are to be used by B.O.A.C. and Pan-American Airways.

FROM BELFAST

SIR BASIL BROOKE, Prime Minister of Northern Ireland, stated that as a result of his talks with Lord Swinton, it has been arranged to study the possibilities of establishing an international airport in Northern Ireland.

TAXI!

OPERATION of air taxi service in Portugal is the subject of a licence granted to the firm of Daun and Black, Ltd., by the Portuguese Civil Aviation Secretariat.

The taxis will be used for passenger and freight carriage inside Portugal and to places abroad.

T.U.C. ALARMED

THE General Council of the Scottish T.U.C. in a resolution for the annual congress at Aberdeen on April 25th expresses alarm at the indefinite statements of the Government on the permanent retention of Prestwick Airdrome as a first-class international airdrome and at the Government's lukewarmness on the Forth bridge.

Both projects, the Council consider, are of exceptional importance to Scotland's industrial life.

NEWSPAPERS BY PARACHUTE

SIR MILES THOMAS, vice-chairman of the Nuffield Organization, at the Banbury Rotary Club said he did not think there would be enough aerial traffic to justify an expensive municipal airport in every town. He visualised commerce using the air to a great extent, however, and said he thought glider trains would distribute morning papers by parachute, with a light alloy printing machine aboard the tug plane to allow latest news flashed by radio to be stop pressed.

Even with the transmission of the normal news service over the radio the written word and particularly the illustrated word would always augment the spoken message, Sir Miles added.

IN THE HOUSE

ALLUDING to the proposed London Airport at Heath Row, Mr. Fred Montague (Labour), former Under-Secretary for Air, said during the Air Estimates debate in the House that normally the best agricultural land in Middlesex did not command more than £25 per acre. While recognising the necessity for compensation for farm buildings, etc., against this, he was told that the Government were prepared to pay up to £600 an acre.

Turning to post-war civil aviation, Mr. Montague said that a deal had been made with the railway and shipping companies of this country and that minutes of a private meeting between Lord Swinton and the independent operators show that the Government was throwing at them a declared policy which had not been declared previously either to the House or to the country.

"This idea that the railway and shipping companies have vast experience in transport is all my eye and Betty Martin," Mr. Montague said. "This means monopoly and prefabrication, backstairs-influence and a game of poker with national interests on world peace as counters," he added.

Commander Brabner, replying, said that there had been no devolutions of White Paper information about civil air policy to people outside the House of Commons. In legal fact there was as yet no White Paper on the subject, he said, and added that there would be a White Paper in due course and then the House would have, presumably, an opportunity to discuss it. Further than that, he did not think he could be expected to go.

THE RAILWAYS' SHARE

NEGOTIATIONS on points of principle of post-war civil transport between the Government and the railways have been concluded, and the railways hope to have a substantial share in European and internal air services, stated the Southern Railway chairman addressing the company's annual meeting.

The discussions with Lord Swinton and Sir William Hildred, the Director-General of Civil Aviation, have been frank and businesslike, he added, with each party in no doubt of the intentions and good faults of the other.

SOUTH AFRICAN CONFERENCE

VISCOUNT SWINTON, the Minister for Civil Aviation, will be the Chairman of the U.K. delegation to the South African Civil Aviation Conference which is due to open at Cape Town on March 20th.

Other U.K. delegates are: The Hon. Sir Evelyn Baring, High Commissioner for the Union of South Africa, representing Basutoland, the Bechuanaland Protectorate and Swaziland; Mr. W. C. G. Cribbett, Assistant Under-Secretary, Civil Aviation; Mr. W. J. Bigg, Colonial Office.

Advisers: Viscount Knollys, Chairman, British Overseas Airways Corporation; Mr. N. Pritchard, Dominions Office; Mr. B. C. H. Cross, Colonial Office; Mr. L. J. Dunnett, Mr. R. D. Poland, and Mr. F. A. Butters, Office of the Minister for Civil Aviation; Mr. D. S. S. MacDowell, British Overseas Airways Corporation.

TO THE CONTINENT

PROPOSALS for post-war civil air services between the United Kingdom and Europe have been submitted to Lord Swinton, Minister for Civil Aviation, by Shipping Airlines, Ltd., which represents 37 shipping companies, including some large tramp owners.

The company is formed of a group of the British mercantile marine distinct from the shipping companies who are concerned with air services to South America, and also from the few shipping companies who have associated themselves with the railways.

Major Mayo worked out the technical aspects of the project, which is designed to provide efficient services between Britain and all European capitals.

The chairman of the company, Mr. R. D. Ropner—a director of the shipping firm of Sir R. Ropner and Co., Ltd.—had a recent opportunity to discuss the company's proposals with Lord Swinton.

RAILWAYS' AIR PLAN

SIR HAROLD HARTLEY, vice-president of the L.M.S. and chairman of the Railways Air Committee, told a London Press conference that the railways planned to operate the services without subsidy, assuming that neither subsidies nor special advantages would be given to other services, including foreign air lines entering Britain on a reciprocal basis.

As reported in *Flight*, October 26th, 1944, the railways propose to form a separate air company to operate regular services in Britain, including Northern Ireland, the Channel Isles and Isle of Man, and to Eire and the Continent.

They propose to offer partnership to other air operators who provided regular services in this country before the war and those shipping lines who operated regular pre-war services.

Sir Harold said that an initial expenditure of £5,000,000 would be available to operate the plan, all of which would be provided by the rail group.

"Railways are not asking for air transport monopoly," he stated, "we have offered to take the rough with the smooth—the profitable routes with the unprofitable routes."

"Two years' investigation has shown there was insufficient traffic on the pre-war routes in Britain to justify competition, but as flying develops and the public gets more air-minded there will be the call for flying from centres in this country to the Continent, and that is what the railways hope to operate, in partnership with others.

"The railways intend to use two types of British-built aircraft, one a 25-seater twin-engined monoplane for Continental operations and the longer distance international services, and the other a twin-engined 12-seater aircraft for short-range operations. Specifications for Type 1 (corresponding figures for Type 2 in brackets) provide for an all-up weight of 30,000 lb. (15,000), net payload 6,200 lb. (3,500) exclusive crew of four, operational range 500-600 miles (300-500), ceiling 20,000ft. (18,000), rate of climb 1,600ft./min. from sea level (1,000ft./min.) and 300ft./min. (250ft./min.) on one engine at full all-up weight. Type 1 is to have an economical cruising speed of about 200 m.p.h. (160) at not more than 50 per cent. take-off power.

"But at the moment there are no British aircraft to fit the service and in the interim of what might be about two years, Dakotas will be used," Sir Harold stated.

Mr. John Elliott, deputy general manager of the S.R., said that within ten to fifteen years they visualise that the majority

of the first-class traffic to the Continent will be by air, and hope to run a Paris service every half-hour.

A SCOTTISH VIEW

ONE international airport will be totally inadequate for post-war civil aviation in the United Kingdom, Sir William Y. Darling, chairman of the Scottish Council on Industry, said in a recent interview.

Prestwick is no more a Scottish question than Heath Row is an English one, or Goose Bay a Canadian one.

Prestwick is a European and an American problem. A fog-free airport on the Western coastline of Europe is important to every nation on the Atlantic fringe.

SURPLUS TRANSPORT AIRCRAFT

THE sixth allocation of surplus transport aircraft, non-standard to Army specifications, announced by the U.S. Surplus Property Board, consisted of twelve machines, including six to domestic applicants and six to foreign applicants.

Altogether a total of 131 surplus transports has been so far allocated. Domestic applications have received eighty of them and foreign applicants fifty-one.

Of the new allocations to foreign operators, Taca Airways, S.A. received three, the Royal Norwegian Air Transport three Lockheed Lodestars, and in addition, one Lockheed 12 (Executive type) has been allocated to unspecified foreign applicants.

SWITCHING OVER

FORTY air wireless operators, including wireless navigators, will be released from the R.A.A.F. to train as aeradio operators for employment in civil aviation.

This results from an agreement between the R.A.A.F. and the Department of Civil Aviation, which, besides implementing post-war civil aviation expansion plans, affords selected men excellent post-war prospects in an occupation for which R.A.A.F. service has fitted them.

Only men who have returned from overseas service, or have completed an operational tour in the Pacific theatre, will be selected, and final release depends on R.A.A.F. requirements.

When the required number of men is selected they will begin a six-months' specialist course, followed by approximately four months' practical training at a department aeradio station. Successful appointees must undertake to serve the Department of Civil Aviation for at least two years. More men are to be released later for this work.

IN PARLIAMENT

ASKED by Mr. Bowles (Lab., Nuneaton) to publish verbatim all speeches at the Plenary session of the Chicago Conference on Civil Aviation, Sir Archibald Sinclair, Secretary for Air, read the resolution passed at the conference authorising publication of the final act and reports of committees.

Mr. Bowles protested that was not what he was asking for, he wanted verbatim reports of the speeches so that members taking part in the debate might know political or other reasons for turning down certain proposals.

Earl Winterton (Con., Horsham and Worthing) asked if the Minister would consider, in view of the fact that there were two Ministers, "and in view of the rather unfortunate history of past relations," whether the debate should not be in the hands of another Minister.

Sir Archibald repudiated the idea that there is anything unfortunate in the relations between his department and the Civil Aviation Ministry, and in further answer to Mr. Bowles said that he would ask the Minister for Civil Aviation whether there were any further documents of speeches which would be made available.

Mr. Edwards (Lab., Middlesbrough E.) asked the Secretary for Air if in view of the new facilities granted to U.S. Civil Aviation by the removal of regulations relating to numbering of aircraft operated by U.S. companies similar measures are contemplated in this country.

Sir Archibald Sinclair, in a written reply, stated that so

long as the U.K. remains a centre of air operations and all available resources have to be concentrated on the prosecution of the war no change is contemplated in the existing policy under which the numbering of internal Civil Air Services in this country is determined solely by the requirements of the national interest.

Asked by Sir Wavell Wakefield (Con., Swindon) if post-war requirements for Civil Aviation would include the carrying of lifeboats by British aircraft flying on ocean routes, Sir Archibald Sinclair replied that a general requirement of this character was not contemplated, but the carriage of lifeboats, dinghies or rafts might be stipulated for flights by U.K. aircraft on regular services if this were considered necessary in the interests of safety.

PACIFIC TAKE-OFF

MR. WILLIAM TEMPLETON, manager of the Vancouver Airport, commenting on a report that San Francisco might continue as a take-off point for trans-Pacific flights after the war instead of Vancouver, said:—

"It would be ridiculous for British air lines to cross the Atlantic in peacetime, land at Montreal, and then head south and west over the U.S. to San Francisco, and thence over the Pacific.

"Although the shorter trans-Pacific route is logical in wartime, to continue it from San Francisco after the war would involve competition from established U.S. air lines and defeat the idea of an Empire route round the world.

"Moreover, an Empire route using Empire ports of call as much as possible would save travellers the complicated nuisance of passport visas and other immigration technicalities.

AN AMERICAN REPORT

THE U.S. Department of Justice is opposed to single-company operation of U.S. international air transport, according to a report by the Attorney-General, Mr. Francis W. Biddle.

They also oppose the ownership or control of air lines by companies controlling other forms of transport.

In a recommendation on policy to the U.S. Government the Department make the following points:—

- (1) Competition to be controlled.
- (2) International agreement on subsidies.
- (3) An international organisation to analyse information on technical operational problems.
- (4) Maintenance of conditions, legal and economic, designed to encourage the continued private operation of America's international air carriers.

As an alternative to single-company operation the Department suggested that different companies should be given geographical zones of operation under the American flag or that there should be indirect competition on alternative routes.

The report added that Government operation of international air lines might be advisable when absence of profit opportunities made private operation impossible. "International aviation policy should be formulated by the Government."

It was crucial that the real danger of American air policy being formulated by a European cartel should be recognised and steps taken to assure that it was both formulated and administered by the Government.

The right of carriers to land in a foreign country for refuelling, repairs or other services should be established as an international principle.

The U.S. should pursue a policy aimed at a more liberal legal framework for international aviation, says the report, adding that it would be in the interest of the United States to have the right of transit and the right to land for non-traffic purposes established as a universal principle for international aviation.

"The advantages accruing from the world-wide interchange of landing rights would be greatly in excess of any loss to any individual country that might result from the granting of such general rights with respect to territory under its sovereignty," the report states.

COMPRESSIBILITY (Concluded from page 289)

dicted by theory (Fig. 13). This may be partially explained by the fact that we have not evaluated the influence of viscosity with the attendant boundary layer. The boundary layer probably serves as a cushion and thereby tends to alleviate conditions, since the temperature within the boundary layer is several degrees warmer than the air outside this layer.

In conclusion, these and many other problems challenge our imagination without as yet yielding more than a tantalising guess as to their real nature. Furthermore, it should not be forgotten that speeds above that of sound are near and cannot be dismissed much longer (Figs. 14 and 15). For the man who wants problems of immediate practical interest to tax his powers to the utmost, compressibility is a happy hunting ground.

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.

FIGHTER SPEEDS

An Example of Bad Propaganda

THE newspapers recently published the top speed of the Hawker Tempest as 435 m.p.h. Surely this figure is very low considering the aircraft and its engine and comparing the performance of older fighters such as the Spitfire and Mustang, which have a top speed of 450 m.p.h.

Naturally, the top speed of the Tempest cannot be published, for security reasons, but does it not seem like bad propaganda on our part to herald the Hawker Tempest as the "fastest" fighter on operational service when there are at least two older aircraft operating with higher top speeds?

F. T. C. SANSON.

LIGHT AIRCRAFT UPKEEP

An Example from the West Indies

WITH reference to the question on the cost of operating a light aircraft, by "Potential Owner," in *Flight* of February 8th, 1945, I can give some information and figures, which are, however, applicable neither to the conditions in this country nor to the type of aircraft that was indicated, but which, in case no more accurate information is available, at least gives some idea as to the cost involved.

The data are taken from the records of a small flying club in the West Indies, operating with four Piper Cubs with 65 h.p. Continental engines, which aircraft cost approximately £400 each at the factory. The aircraft were used for instructional purposes as well as for flights by licensed members of the club. The instruction was given by professional pilots of an airline company, whereas maintenance, overhauls and inspections were carried out by the technical service of the same company. The club employed a native mechanic for servicing and general assistance. The aircraft carried insurance against legal liability, but aircraft and occupants were not insured against crash damage.

The figures given below cover a period of four years from the end of 1938 to the end of 1942. Later figures are not available, although the club is still active up to the present moment. In the figures no hangar rent, landing fees, salaries for instruction or any general club expenses are included.

Number of flying hours	2,300
Maintenance repair inspection	£1,085
Fuel and oil	£515
Native mechanic	£720
Insurance	£170
Reservations for depreciation	£660
Crash damage	£800
Total	£3,950
Total per flying hour	£1 14s.

On account of the lower salaries, wages, and material prices here as compared to those abroad, the maintenance cost in this country could be estimated at least 30 per cent. lower.

For other types of aircraft the cost could be taken in the same proportion to the initial value of the new aircraft.

VAN.

CARGO AIRCRAFT

Tug and Glider Loadings

I WAS delighted to see that letter (*Flight*, March 1st) from V. A. Stanley-Adams (Lt., R.A.), and to hear that he agrees with me about the impracticability of gliders as post-war freight carriers (except for that "one very remarkable statement").

I said that some of our single-seater fighters could tow a Horsa, and there is nothing very remarkable in that statement. During this war our fighters have had wing loadings some 25 per cent. lower than our heavy bombers. That is one point in their favour, because for optimum results you want loadings not too dissimilar on glider and tug.

The other major issue is that of overall power loading. Now I saw the first test flight made by the first Horsa. The tug was a Whitley with Merlin XX engines, and the date September 10th, 1941. On that same date and on that same airfield the half-scale Hamilcar made its first hop.

September, 1941, and we were preparing to invade the Con-

continent! However, the point is that long before that date a variety of Horsa tugs had been considered and complete performance data worked out. It was not a question so much of seeing which was the *best* tug, because the *best* tug might not be available for that purpose, as of finding which machines could best be spared for such a secondary job as glider towing. Included among the aircraft considered was, I remember, the Hurricane and the Wellington, both with early-type Merlin engines rated at 1,145 h.p.

I will guess the weight of the Hurricane tug at 6,500 lb., the Wellington 30,000 lb., and we will take Stanley-Adams' own figure of 16,500 lb. for the Horsa. That gives an overall power loading of 20 lb./b.h.p. for both combinations with the Wellington fractionally higher.

Astonishing, isn't it? Naturally, I was not thinking of the old Hurricane when I made that remarkable statement, but of our later fighters—say, the Sabre Tempests when the overall power loading is almost halved. In fact, the Tempest has more power than the Whitley for much less than half the weight.

Of course, Stanley-Adams, who has flown these gliders, is quite right in saying that the Horsa pilot could make things very difficult for the fighter-tug pilot if he did not like him.

He could do just that with a Lancaster, too, if he were that way inclined. He should be dropped if he doesn't behave!

To be quite fair, I should point out some disadvantages of the fighter as a tug. It would not give the required range. There would be overheating difficulties and perhaps some control troubles. Also the take-off would be worse than the power and wing loadings would indicate because of the restricted airscrew diameter of a fighter.

May I say how much I have enjoyed the correspondence and the higher mathematics on the V2? It is the best of good, clean fun!

As president, treasurer and chief stressman of the Inter-Stellar-Space Circumlocution, Development and Exploitation Society (1987) Inc., I agree that there may be better planets than this! "HORACE" (THE TAME STRESSMAN).

CROPPED AIRSCREW BLADES

And Factors Affecting Those That Bend

WITH reference to the letter from "Aged" (*Flight*, February 10th) we would like to make the following points.

(A) From the performance point of view it matters little whether the tip of the blades are sheared off or bent sharply—in either case the affected portion ceases to have any further use. Official figures show that the performance of an aircraft is not much affected by cropping of the airscrew within reasonable limits. If all blades are similarly affected, the centrifugal loads remains balanced, and apart from an increase in engine revs. the difference would not be noticeable.

(B) If the blades are differently affected the centripetal loads become unbalanced and shaft vibration would be experienced.

(C) The angle to which the affected blade is bent depends obviously on the magnitude, direction and position of the forces to which it is subjected during contact with the obstruction, and also on the section modulus of the part of the blade which is bent. The factors affecting the angle of bend would seem to be:

(a) The shape, size and material of the blade, the airscrew shaft and the obstruction (sand, water, etc.).

(b) The fixity or otherwise of the obstruction.

(c) The velocity of the blade relative to the obstruction and the part of the blade which strikes the obstruction depending on: (1) The r.p.m. pitch and diameter of the airscrew; (2) the speed and direction of flight of the aircraft relative to the obstruction; (3) the length of blade affected and duration of contact; (4) the efficiency of the blade; (5) the angular position of the blade in question in relation to the obstruction at the time of impact; and (6) the power behind the blade at the time of impact.

"Aged's" experience would seem to show that these factors usually combine to give a "helluva" force, and so the angle of bend is usually approximately 90 degrees forward. He does not reveal how he got his slide rule to, say, 60 degrees. We defy anyone to develop a formula for the angle of bend, taking into account all of the above variations.

We would like to know what would happen in the case of a

CORRESPONDENCE

contra-rotating airscrew. If the leading airscrew comes into contact first, there is a chance that it would clear the way for the rear one, which might escape with very little damage. However, if one of the blades on the rear airscrew struck the obstruction first, interference would probably occur one-twelfth of a revolution later, as the linear velocity of impact between the two blades would be in the region of 1,000 m.p.h. The stress and strain caused would be considerable, and the resultant tangle would probably be of use only to a scrap merchant.

We would like to hear of some reader's opinion on this subject through the courtesy of your columns.

J. R. F. WAREHAM and W. E. LANG.

Six Men and a Sergeant

MR. BRITAIN, in his letter in *Flight* of Feb. 8th, is inclined to favour metal-bladed airscrews, whereas I, for less obvious reasons, am of the opposite school.

I have had some experience with wooden blades while in the Middle East some time ago, and must confess these were very easily damaged, superficially, by airborne stones and sand—often when running up, tail on to a strong wind. While a repair to the blade could often be effected on the spot, as often as not the balance of the airscrew was upset.

I remember one case particularly, where a front cowling button was left loose, and when run in coarse pitch, the trailing edge of each blade, near the root, was hit by the button. We had to send the airscrew back for re-balancing, but then our inspection section was very touchy about vibration.

I can imagine metal blades resisting similar violence, but I have seen a wooden Rotol fitted to a Halifax without any lifting tackle beyond six men and a determined sergeant!

ROSS INGRAM.

IMPLICATIONS OF V2**The Kernel of the Argument**

I MUST apologise for a careless error in my previous letter (*Flight*, March 1st). I stated that at 500 km. the gravitational attraction of the moon decreased the escape velocity of a rocket from 10.19 km./sec. to 9.74 km./sec. This should read "from 10.69 to 10.62 km./sec."

Commenting further on "Escapist's" letter (*Flight*, January 25th), it can be seen from the expression dealt with by Messrs. Becker and Sykes, namely,

$$V = v \log_e R - gt,$$

that gt must be kept to as low a value as possible. This figure has the dimensions of velocity, and numerically equals the velocity with which a body hits the earth when released from the height (H) at which escape velocity is attained. This naturally is greater for all heights than the decrease in escape velocity which I mentioned in my last letter. I am assuming the velocity *in vacuo*, of course.

BOOK REVIEWS

Air Aces. By Gordon Anthony, with biographical notes by John Macadam. Home and Van Thal, Ltd. 12s. 6d. net.

A BOOK which is sure to be popular is this collection of 32 photographs of R.A.F. officers, all of whom have been decorated with at least the D.S.O. and D.F.C. (or D.F.M.). The short biographical notes help to transform a mere name in the papers into a living personality. Mr. Anthony is a well-known portrait photographer, and his studies of these officers are of the highest class.

We may add with some satisfaction that all but seven of these portraits were reproduced in *Flight* of September 21st last.

Merchantmen at War. Prepared for the Ministry of War Transport by the Ministry of Information. 1s. 9d. net.

"WE need not wonder that airmen and sailors feel warmly towards each other." So says this official publication, which gives a fairly full account of the various ways in which the aircraft of Coastal Command and of the escort carriers have helped the heroic men of the Merchant Navy through the long years of war, how the fighters drove off the Focke-Wulf Condors, how the long-range machines attacked the U-boats, or at least kept them submerged where they could not attack, and how on many occasions the aircraft have flown off to find stragglers and lame ducks at the request of the Convoy Com-

The figure H can be determined from the average acceleration, which, for a given rocket, depends on burning time.

Thus it is of paramount importance to keep gt to a minimum, i.e., acceleration a maximum. That this entails increased structural weight is obvious, but it must be borne in mind that the principal stress is tankage stress, and the tanks are emptying as the acceleration increases. Also, V_2 is operating at comparable stresses already. In the absence of a better fuel, I think we can safely adopt Mr. Sykes's figure for efflux velocity of 3.565 km./sec.

Now, the kernel of the argument is the burning time, for this affects the acceleration, hence the height at which V_{max} is reached.

Mr. Becker assumes a burning time of 50 sec., when $gt=490$ km./sec. This implies that V_{max} is reached at a height of almost exactly 12 km. In order of magnitude, this is about the best we can expect. The average acceleration is under 9 gs, and the final acceleration should be about 18 gs. These are the probable stresses in the V_2 .

Now, it seems to me basically unsound to embody a smaller rocket in the bigger one, from the engineering point of view. So I put this suggestion, suggested by the high g -value:

Why not use the turbo-engine for a short distance only, then have it jettisoned at a g -value of, say, 4 to 5? Thenceforth the increasing g -value should provide the necessary forced feed to obtain the highest efflux velocity. At the same time, R will be instantaneously increased, possibly to its previous value. Admittedly, jettisoning the turbine gear while still retaining the jet orifice is difficult, but it not an insuperable problem.

In conclusion, it seems to me highly probable that, with sufficient support, the Interplanetary Societies will be able to send a robot to the moon within the next ten or 20 years.

Travellers to our satellite, though, will have to wait for the development of some source of power other than chemical combustion. In the meantime, they will have to brush up their mathematics, as "Escapist" suggests. STUDENT.

Minute Payload in Space Travel

WITH regard to the correspondence carried on recently by Messrs. Gatland, Spearman, and Burgess as to the possibilities latent in V_2 as a means of extra-terrestrial travel, I should like the opportunity of commenting on the essential inadequacy of the results anticipated.

I do not, of course, wish to dispute the calculations of Messrs. Gatland and Burgess, but the chief weakness of their argument appears to me to be the minute payload available, having regard to the immense amount of fuel to be employed (the ratio being about 1/120).

This being the case, it would seem that the attention of astronautical experimenters should be directed principally to the development of more powerful fuels (possibly of an atomic nature). With adequate driving force, the problem of space navigation is, in essentials, solved.

But, failing this, the only kind of space travel that will be practicable will be extremely costly and of a purely experimental nature.

WALTER DOBSON.

modore, or have spotted lifeboats and rafts with men in them and summoned assistance.

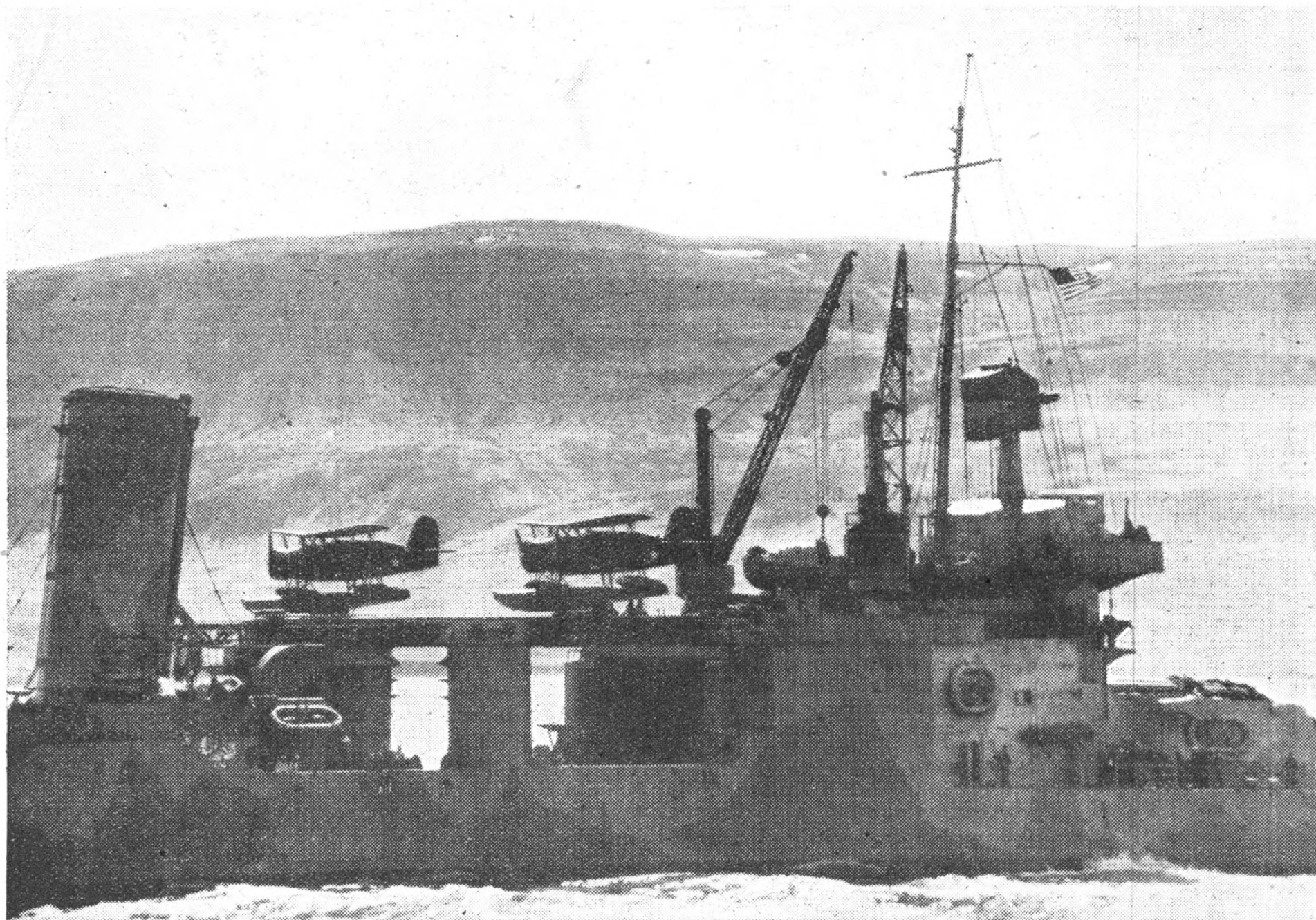
Those stories are only one feature of this book, which tells the thrilling story of the undaunted seamen of Britain in all parts of the world, ending up with the invasion of Normandy. It is well written and has a number of excellent photographs.

Atlantic Bridge. Prepared for the Air Ministry by the Ministry of Information. 9d. net.

THE R.A.F. TRANSPORT COMMAND is one of the remarkable things of this war. It is a by-product, but it is of enormous value, and the brains, the planning, and the ways in which the organisation have developed have all been on the highest level.

This little pamphlet tells the story of this Command, which grew out of the flight of seven Hudsons from Newfoundland to Britain in November, 1940. The early stages of the development are, as a matter of fact, rather confusing to follow; and it cannot be said that this publication makes them absolutely clear. The organisation did not start as a branch of the R.A.F., but as it developed it had inevitably to grow into one. The name of Air Chief Marshal Sir Frederick Bowhill will always be connected with its final development.

Many good stories of adventurous flights are told in this book, which we advise our readers to buy and study for themselves.



SEA SCOUTS : Two Curtiss SOC's in position on the twin catapults of U.S.S. *Tuscaloosa*. The *Tuscaloosa*, a 10,000-ton cruiser, carrying from four to six aircraft, was engaged for a while on Russian convoy work.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News and
Announcements



Awards

Fleet Air Arm

THE KING has been graciously pleased to approve the following award for distinguished service in air operations in the Mediterranean:—

Distinguished Service Cross

Lt. (A) G. R. GREENWAY, R.N.V.R.

Royal Air Force

THE KING has been graciously pleased to approve the following awards in recognition of gallantry displayed in flying operations against the enemy:—

Bar to Distinguished Service Order

Group Capt. K. M. HAMPSHIRE, D.S.O., D.F.C., R.A.A.F. No. 456 (R.A.A.F.) Sqn.—Since being awarded the D.F.C. this officer has led the squadron on very many sorties, during which thirty-two enemy aircraft have been destroyed. Much of the success achieved can be attributed to this officer's outstanding leadership and great skill. His iron determination and unflinching devotion to duty have set an example of the highest order. Group Capt. Hampshire has inflicted much loss on the enemy, including the destruction of seven aircraft.

Distinguished Service Order

Act. Group Capt. V. A. POPE, R.A.F.O., No. 644 Sqn.—This officer has taken part in a very large number of sorties, many of them with this squadron which he has commanded with outstanding success. He has displayed high qualities of leadership, great skill and courage, and has set an example which has impressed all

Act. Wing Cdr. W. E. COLES, D.F.C., A.F.C., R.A.F.O., No. 233 Sqn.—This officer has displayed great skill and courage in operations against the enemy. In September, 1944, he took part in several supply dropping missions to our forces in



Air Comdre. J. N. Boothman, winner of the 1931 Schneider Trophy, was recently decorated with the C.B. and D.F.C. He is seen here with his son, F/O. P. J. Boothman who received the D.F.C. at the same investiture.

the neighbourhood of Arnhem. On one occasion, whilst over the dropping zone, his aircraft sustained severe damage and became difficult to control. In spite of this, Wing Cdr. Coles made a second run over the target to release the re-

mainder of his containers. He afterwards flew the badly damaged aircraft to base. He displayed superb skill and great personal courage.

Flt. Lt. J. A. ANDERSON, R.C.A.F., No. 419 (R.C.A.F.) Sqn.—This officer has displayed a high degree of gallantry and devotion in operations against the enemy. He has completed very many sorties and has set the finest example in pressing home his attacks, often in the face of fierce opposition. On one occasion in September, 1944, he was pilot and captain of an aircraft detailed to attack Bottrop. When over the target intense anti-aircraft fire was encountered. Flt. Lt. Anderson's aircraft was hit repeatedly by fragments of shrapnel. Both the port engines were put out of action. The hydraulic system was rendered unserviceable. The controls were so damaged that it became necessary for two members of the crew to assist their captain by pulling manually on the rudder controls. In spite of this, Flt. Lt. Anderson executed a good bombing run. He afterwards flew the severely damaged aircraft to base where he effected a masterly landing. In most difficult and dangerous circumstances this officer displayed outstanding coolness and great courage.

Bar to Distinguished Flying Cross

Flt. Lt. G. A. MARTIN, D.F.C., R.A.F.V.R., No. 73 Sqn.—Since the award of the D.F.C. Flt. Lt. Martin has continued to display exemplary leadership skill and daring in low-level attacks on enemy targets. During this period he has destroyed 31 locomotives, bringing his total to 55. In addition he has destroyed much mechanical transport and 12 aircraft on the ground. In air combat he has destroyed two enemy aircraft. Flt. Lt. Martin has continued to display the utmost skill and courage, both in the air and on the ground.

Act. Sqn. Ldr. S. F. BEADMAN, D.F.C., R.A.F.V.R., No. 571 Sqn.—Since being awarded the

SERVICE AVIATION

D.F.C. this officer has completed many sorties and continues to display great keenness and gallantry in his attacks on the enemy. On a recent occasion he flew with great distinction in an attack on an enemy target. His skill, leadership and resource contributed materially to the success obtained.

Wing Cdr. A. GADD, D.F.C., R.A.F.O., No. 144 Sqn.—Wing Cdr. Gadd is a fearless and determined leader, who has delivered a number of successful attacks on enemy shipping. During one of his missions in September, 1944, he led an attack on an enemy trawler and merchant ship, both of which were left burning. In October, 1944, Wing Cdr. Gadd again led a force of aircraft against three merchant ships and eight escort vessels with successful results. Another successful sortie in November, 1944, led to the destruction of one enemy vessel while another was set on fire. Since the award of the D.F.C., Wing Cdr. Gadd has continued to display a high order of courage and devotion to duty which has set a fine example to his squadron.

Act. Sqn. Ldr. M. A. ENSOR, D.S.O., D.F.C., R.N.Z.A.F., No. 224 Sqn.—Sqn. Ldr. Ensor has taken part in many operational sorties during his second tour of duty. During this period he has attacked enemy U-boats on three occasions. One of the submarines was probably seriously damaged, and, from one of these engagements, Sqn. Ldr. Ensor's aircraft was severely damaged by the heavy and accurate anti-aircraft fire encountered. This officer has displayed outstanding enthusiasm, tact and courage as flight commander and officer in charge of squadron training. He has contributed much to the development of new and successful methods of attacking enemy submarines.

Act. Sqn. Ldr. H. P. LARDNER-BURKE, D.F.C., R.A.F.V.R., No. 1 Sqn.—This officer continues to display a high degree of courage and resolution in his attacks on the enemy. Recently, he has led the squadron on many missions in the Ruhr area and throughout has displayed great skill and tenacity. Sqn. Ldr. Lardner-Burke has destroyed seven enemy aircraft in air fighting. He has also most effectively attacked enemy targets on the ground.

Flt. Lt. D. H. GREAVES, D.F.C., R.A.F.V.R., No. 25 Sqn.—This officer has completed very many sorties in his second tour of operational duty. He has at all times displayed the greatest keenness and has set a fine example of determination and devotion to duty. He has destroyed nine enemy aircraft.

F/O. R. R. F. BRUCE, D.F.C., R.A.F.V.R., No. 418 (R.C.A.F.) Sqn.—Since being awarded the D.F.C. this officer has completed numerous sorties far into enemy territory. He is a navigator of exceptional skill, whose faultless work has contributed in good measure to the successes obtained. F/O. Bruce has proved himself to be a most devoted and valiant member of aircraft crew.

F/O. F. MITTON ROBBINS, D.F.C., R.A.F.V.R., No. 25 Sqn.—As observer, F/O. Robbins has participated in a very large number of sorties. Throughout he has displayed a high degree of skill and co-operation and has assisted in the destruction of nine enemy aircraft. His keenness and determination have set a very fine example.

Act. Sqn. Ldr. R. B. COWPER, D.F.C., R.A.A.F., No. 456 Sqn.—This officer and Flt. Lt. Watson have completed a second tour of operational duty and have consistently displayed a high degree of skill and co-operation. Their keenness to engage the enemy has always been evident, and they have been responsible for the destruction of five hostile aircraft.

Flt. Lt. G. A. HALL, D.F.C., R.A.F.V.R., No. 219 Sqn.; and Flt. Lt. L. STEPHENSON, D.F.C., R.A.F.V.R., No. 219 Sqn.—Since the award of the D.F.C., Flt. Lt. Hall as navigator and Flt. Lt. Stephenson as pilot have completed numerous operational sorties. The majority of these have been flown over the beachhead area in Normandy during July and August, 1944, and more recently over the Dutch and German battle areas. They have throughout proved to be an outstanding team, who have displayed a fine fighting spirit, courage and determination. They have destroyed a further three enemy aircraft, bringing their total victories to nine enemy aircraft destroyed, including three in one night.

Act. Flt. Lt. N. L. MERRETT, D.F.C., R.A.A.F., No. 164 Sqn.—Since being awarded the D.F.C. this officer has participated in many sorties, involving harassing attacks on enemy troops and positions. He has consistently displayed the finest qualities of skill and courage, setting an example worthy of the greatest praise. In December, 1944, Flt. Lt. Merrett took part in an attack on an enemy field gun position near Tiel. As he went into the attack his aircraft was hit. Nevertheless, he dived to a low level and pressed home a vigorous attack. He afterwards flew the damaged aircraft to our own lines and effected a crash-landing in a small field, which was apparently the only one not waterlogged or ploughed up. This officer displayed unbeatable determination.

Act. Wing Cdr. M. BOOTH, D.F.C., R.A.F.O., No. 271 Sqn.—This officer has displayed skill and courage, qualities which have contributed in good measure to the success of the many operations in which the squadron has been concerned. In September, 1944, Wing Cdr. Booth participated in the operation whereby the first force of gliders was landed in the vicinity of Arnhem. Three days later he took part in a supply-dropping mission to our ground forces. In the face of



SECOND ROUND: A F.A.A. Hellcat flies round its escort carrier for a fresh approach, with undercarriage, flaps, and arrestor hook down. This Hellcat bears recognition stripes similar to those on the Thunderbolt.

heavy enemy opposition, Wing Cdr. Booth displayed great determination and devotion to duty.

Sqn. Ldr. P. D. SQUIRES, D.F.C., R.A.F.O., No. 271 Sqn.—This officer has completed three tours of operational duty. He has at all times displayed the greatest keenness, and his undoubted skill and fearless example have won great praise. He has participated in all the operations to which the squadron has been committed, and his resolute and gallant efforts have contributed materially to the successes obtained. Sqn. Ldr. Squires flew with great distinction on several sorties in the neighbourhood of Arnhem in September, 1944.

F/O. A. E. KELL, D.F.C., R.A.A.F., No. 617 Sqn.—Since being awarded the D.F.C. this officer has participated in many sorties, the last three of which were attacks on the German battleship *Tirpitz*. He has invariably displayed a high degree of skill and courage, and his determination to make every sortie a success has won great praise.

Distinguished Flying Cross

Act. Group Capt. C. H. HARTLEY, A.F.C., R.A.F.V.R.

Act. Wing Cdr. J. H. IREMONGER, R.A.F., No. 486 Sqn.

Act. Sqn. Ldr. L. GARSTON, R.A.F.V.R., No. 88 Sqn.

Capt. J. A. HAHN, S.A.A.F., No. 37 (S.A.A.F.) Sqn.

F/O. J. A. SIMPSON, R.A.F.V.R., No. 225 Sqn.

F/O. W. S. MARTIN, R.C.A.F., No. 409 (R.C.A.F.) Sqn.

W/O. E. F. COLE, R.C.A.F., No. 409 (R.C.A.F.) Sqn.

Act. Sqn. Ldr. E. H. M. PATTERSON, R.A.F.V.R., No. 229 Sqn.

Flt. Lt. G. H. BASTOW, R.A.F.V.R., No. 16 Sqn.

Flt. Lt. H. W. BATHURST, R.A.F.V.R., No. 245 Sqn.

Flt. Lt. W. J. DAWSON, R.A.F.V.R., No. 620 Sqn.

Flt. Lt. D. A. J. DRAPER, R.A.F.V.R., No. 4 Sqn.

Flt. Lt. A. T. LAMB, R.A.F.V.R., No. 245 Sqn.

Flt. Lt. R. A. MARSH, R.A.F.V.R., No. 487 (R.N.Z.A.F.) Sqn.

Flt. Lt. G. E. T. NICHOLS, D.F.M., R.A.F.V.R., No. 226 Sqn.

Flt. Lt. J. NIVEN, R.A.F.V.R., No. 88 Sqn.

Act. Flt. Lt. J. P. COOPER, R.A.F.V.R., No. 644 Sqn.

Act. Flt. Lt. R. G. MCQUAKER, R.A.F.V.R., No. 644 Sqn.

F/O. E. GILL, R.A.F., No. 88 Sqn.

F/O. E. G. F. LYDER, R.A.F.V.R., No. 180 Sqn.

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

F/O. G. PHILIPSON, R.A.F.V.R., No. 266 Sqn.

F/O. A. PIRNIE, R.A.F.V.R., No. 88 Sqn.

F/O. W. A. ROE, R.A.F.V.R., No. 21 Sqn.

F/O. H. N. SIMSON, R.A.F.V.R., No. 88 Sqn.

F/O. G. A. WINTER, R.A.F.V.R., No. 16 Sqn.

P/O. F. MORGAN, R.A.F.V.R., No. 180 Sqn.

Flt. Lt. G. ANDREWS, R.A.A.F., No. 69 Sqn.

Flt. Lt. P. V. MCDADE, R.A.A.F., No. 453 (R.A.A.F.) Sqn.

F/O. C. R. LEITH, R.A.A.F., No. 453 (R.A.A.F.) Sqn.

P/O. O. MOUNTFORD, R.A.A.F., No. 464 (R.A.A.F.) Sqn.

P/O. E. G. WICKY, R.A.A.F., No. 464 (R.A.A.F.) Sqn.

Act. Flt. Lt. C. O'B. R. CLACKEN, R.C.A.F., No. 440 Sqn.

Act. Flt. Lt. D. F. HUSBAND, R.C.A.F., No. 401 (R.C.A.F.) Sqn.

Act. Flt. Lt. A. L. SINCLAIR, R.C.A.F., No. 401 (R.C.A.F.) Sqn.

F/O. T. S. W. HARVEY, R.C.A.F., No. 226 Sqn.

F/O. J. R. MACDONALD, R.C.A.F., No. 98 Sqn.

F/O. E. A. WELLS, R.C.A.F., No. 226 Sqn.

Act. Sqn. Ldr. A. G. WILLIAMS, R.A.F., No. 9 Sqn.

Flt. Lt. E. F. A. JONES, R.A.F.V.R., No. 9 Sqn.

Act. Flt. Lt. R. C. LAKE, R.A.F.V.R., No. 9 Sqn.

F/O. R. C. HARVEY, R.A.F.V.R., No. 9 Sqn.

F/O. F. SOWERBY, R.A.F.V.R., No. 9 Sqn.

Act. F/O. D. MACINTOSH, R.A.F.V.R., No. 9 Sqn.

Act. F/O. J. E. STOWELL, R.A.F., No. 9 Sqn.

Act. F/O. W. D. TWEDDLE, No. 9 Sqn.

P/O. E. SHIELDS, R.A.F.V.R., No. 9 Sqn.

Act. Wing Cdr. W. A. BROWN, A.A.F., No. 38 Sqn.

Act. Wing Cdr. A. H. SIMMONDS, R.A.F.O., No. 254 Sqn.

Sqn. Ldr. R. B. FLEMING, A.F.C., R.A.F.O., No. 547 Sqn.

Act. Sqn. Ldr. J. C. T. DOWNEY, R.A.F.O., No. 224 Sqn.

Act. Sqn. Ldr. F. L. GODBER, R.A.F.V.R., No. 628 Sqn.

Flt. Lt. D. O. ANDREW, R.A.F.V.R., No. 220 Sqn.

Flt. Lt. P. R. BASSETT, R.A.F.V.R., No. 404 (R.C.A.F.) Sqn.

Flt. Lt. R. H. GILBERT, R.A.F.V.R., No. 628 Sqn.

Flt. Lt. W. JOHNSON, R.A.F.V.R., No. 172 Sqn.

Flt. Lt. J. D. MARQUIS, R.A.F.V.R., No. 177 Sqn.

Flt. Lt. B. H. QUEIGH, R.A.F.V.R., No. 235 Sqn.

Flt. Lt. W. McD. SOUTER, R.A.F.V.R., No. 5 Sqn.

Flt. Lt. J. R. E. STODDART, R.A.F.V.R., No. 404 (R.C.A.F.) Sqn.

Flt. Lt. F. J. TOON, R.A.F.V.R., No. 404 (R.C.A.F.) Sqn.

Act. Flt. Lt. F. B. PARKER, R.A.F.V.R., No. 211 Sqn.

F/O. S. G. DALE, R.A.F.V.R., No. 540 Sqn.

F/O. M. ROSS, R.A.F.V.R., No. 681 Sqn.

F/O. J. T. STEVENS, R.A.F.V.R., No. 211 Sqn.

Act. Sqn. Ldr. F. J. McHALE, R.A.A.F., No. 459 (R.A.A.F.) Sqn.

Flt. Lt. S. S. SHULEMSON, D.S.O., R.C.A.F., No. 404 (R.C.A.F.) Sqn.

Flt. Lt. H. L. WAINMAN, R.C.A.F., No. 404 (R.C.A.F.) Sqn.

Flt. Lt. C. R. STEPHENSON, R.N.Z.A.F., No. 117 Sqn.

Lt. Col. R. H. AITCHISON, S.A.A.F., No. 30 (S.A.A.F.) Sqn.

Maj. E. SAID, S.A.A.F., No. 30 (S.A.A.F.) Sqn.

Capt. H. V. BARFIELD, S.A.A.F., No. 15 (S.A.A.F.) Sqn.

Capt. R. C. HIRST, S.A.A.F., No. 250 Sqn.

Capt. H. G. LEE, S.A.A.F., No. 24 (S.A.A.F.) Sqn.

Capt. R. T. ROGERS, S.A.A.F., No. 260 Sqn.

Capt. G. ROSENTHAL, S.A.A.F., No. 178 Sqn.

Capt. C. M. STEINBERG, S.A.A.F., No. 30 (S.A.A.F.) Sqn.

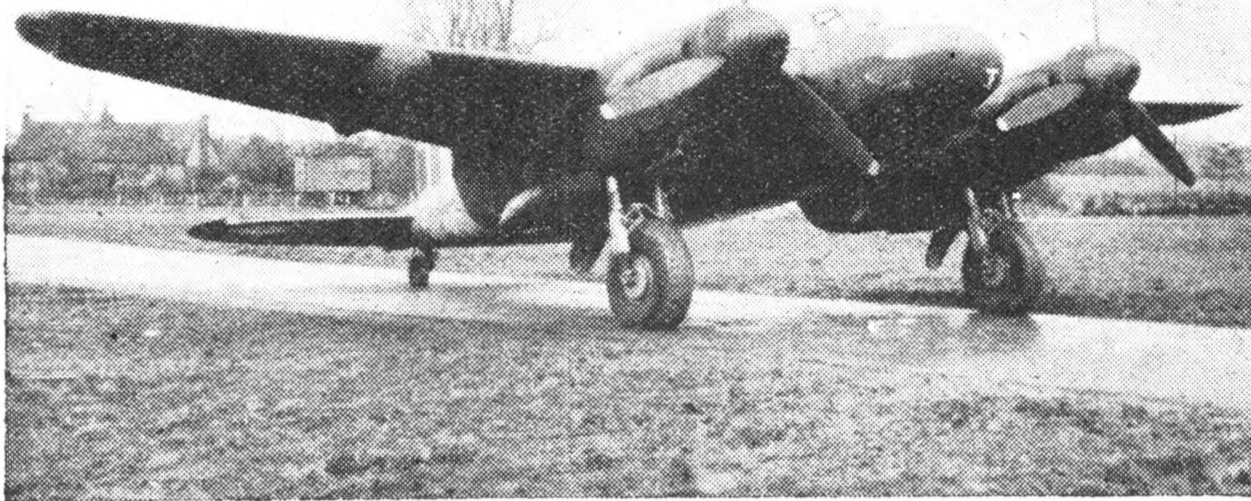
Capt. F. G. THOMPSON, S.A.A.F., No. 30 (S.A.A.F.) Sqn.

Act. Capt. B. C. HARDING, S.A.A.F., No. 24 Sqn.

Lt. A. F. CLOETE, S.A.A.F., No. 31 (S.A.A.F.) Sqn.

Lt. N. E. HAYMAN, S.A.A.F., No. 178 Sqn.

Lt. R. B. MCKECHNIE, S.A.A.F., No. 2 (S.A.A.F.) Sqn.



PROWLER: The Mosquito XIII night-fighter has given up its four '303 machine guns in favour of special equipment. Other Mosquito night-fighters are flying with "bull-noses."

F/O J. LOVETT, R.N.Z.A.F., No. 88 Sqn.
 F/O J. C. STUART, R.N.Z.A.F., No. 69 Sqn.
 Flt. Lt. W. WATSON, R.A.F., No. 456 Sqn. (For citation see Act. Sqn. Ldr. Cowper, D.F.C.).
 Act. Wing Cdr. J. R. GRICE, R.A.F.O., No. 297 Sqn.
 Act. Wing Cdr. B. HOWARD, R.A.A.F., No. 456 (R.A.A.F.) Sqn.
 Flt. Lt. K. C. M. GIDDINGS, R.A.F.V.R., No. 118 Sqn.
 Flt. Lt. W. W. PROVAN, R.A.F.V.R., No. 29 Sqn.
 Flt. Lt. D. M. REID, R.A.F.V.R., No. 25 Sqn.
 Flt. Lt. R. L. G. SUTCLIFFE, R.A.F.V.R., No. 644 Sqn.
 Flt. Lt. R. D. WARD, R.A.F.V.R., No. 644 Sqn.
 Act. Flt. Lt. W. J. GAWNE, R.A.F.V.R., No. 644 Sqn.
 Act. Flt. Lt. E. S. HUGHES, R.A.F.V.R., No. 19 Sqn.
 F/O J. H. KAY, R.N.Z.A.F., No. 620 Sqn.
 F/O I. W. SANDERSON, R.A.A.F., No. 456 (R.A.A.F.) Sqn.
 W/O W. G. NICOL, R.A.F.V.R., No. 29 Sqn.
 W/O R. A. SMITH, R.A.F.V.R., No. 298 Sqn.
 Flt. Lt. J. K. O'N. EDWARDS, R.A.F.V.R., No. 271 Sqn.
 Flt. Lt. B. P. LEGGE, R.A.F.O., No. 575 Sqn.
 Flt. Lt. M. R. S. MACKAY, R.A.F.V.R., No. 48 Sqn.
 Flt. Lt. W. B. PEARSON, R.A.F.V.R., No. 512 Sqn.
 Flt. Lt. A. E. SAUNDERS, R.A.F.V.R., No. 512 Sqn.
 F/O A. McP. CAMPBELL, R.A.F.V.R., No. 512 Sqn.
 F/O S. S. FINLAY, R.C.A.F., No. 48 Sqn.
 F/O G. P. HAGERMAN, R.C.A.F., No. 437 (R.C.A.F.) Sqn.
 F/O L. R. PATTEE, R.C.A.F., No. 48 Sqn.
 W/O K. G. CRANFIELD, R.A.F.V.R., No. 233 Sqn.
 Act. Wing Cdr. T. A. HEATH, A.F.C., R.A.F.O., No. 169 Sqn.
 Act. Sqn. Ldr. J. A. C. PARSONS, R.A.F.V.R., No. 524 Sqn.
 Flt. Lt. G. T. PYKE, R.A.F.V.R., No. 550 Sqn.
 Act. Flt. Lt. H. AMBROSE, R.A.F.V.R., No. 175 Sqn.
 F/O G. W. SMITH, R.A.F.V.R., No. 514 Sqn.
 Act. F/O J. H. C. BRAHAM, R.A.A.F., No. 57 Sqn.
 Act. F/O D. P. LEADLEY, R.N.Z.A.F., No. 75 (N.Z.) Sqn.
 Act. F/O T. C. MARKS, R.A.F.V.R., No. 514 Sqn.
 Act. F/O J. B. TOPHAM, R.A.F.V.R., No. 514 Sqn.
 Act. Flt. Lt. A. J. PHILLIPS, R.C.A.F., No. 220 Sqn.
 F/O A. V. RUGIENIUS, R.C.A.F., No. 113 Sqn.
 P/O D. M. FINLAYSON, R.C.A.F., No. 524 Sqn.
 Flt. Lt. H. R. MCKEGG, R.N.Z.A.F., No. 489 (N.Z.) Sqn.
 F/O E. F. G. BURROWES, R.N.Z.A.F., No. 489 (N.Z.) Sqn.
 P/O R. R. A. McLAUGHLAN, R.N.Z.A.F., No. 5 Sqn.
 W/O R. SHAND, R.N.Z.A.F., No. 483 Sqn.
 Flt. Lt. S. B. DE VERE, R.N.Z.A.F., No. 66 Sqn.
 Flt. Lt. J. PLUMMER, R.N.Z.A.F., No. 75 (N.Z.) Sqn.
 Act. F/O J. GUDBERRY, R.A.A.F., No. 10 Sqn.
 P/O N. G. SIEVWRIGHT, R.A.F.V.R., No. 182 Sqn.
 F/O P. N. ALDRED, R.A.A.F., No. 460 (R.A.A.F.) Sqn.
 Wing Cdr. J. S. HAMILTON, A.F.C., R.A.F.V.R., No. 613 Sqn.
 Sqn. Ldr. G. TURNER, R.A.F., No. 107 Sqn.
 Flt. Lt. R. D. ARMSTRONG, R.A.F.V.R., No. 16 Sqn.

Flt. Lt. P. L. BATEMAN-JONES, R.A.F.V.R., No. 164 Sqn.
 Flt. Lt. R. C. C. CURWEN, R.A.F., No. 197 Sqn.
 Flt. Lt. E. E. O. IRISH, R.A.F.V.R., No. 80 Sqn.
 Flt. Lt. E. M. SPARROW, R.A.F.V.R., No. 3 Sqn.
 Act. Flt. Lt. R. W. HORNALL, R.A.F.V.R., No. 245 Sqn.
 F/O G. B. COLBOURN, R.A.F.V.R., No. 98 Sqn.
 F/O C. E. DAVIDSON, R.A.F.V.R., No. 464 (R.A.A.F.) Sqn.
 F/O A. B. LUND, R.A.F., No. 107 Sqn.
 F/O J. W. MORTON, R.A.F.V.R., No. 98 Sqn.
 F/O F. PARKIN, R.A.F.V.R., No. 180 Sqn.
 W/O J. W. WILLIAMS, R.A.F.V.R., No. 98 Sqn.
 P/O P. W. PHILLIPS, R.A.F.V.R., No. 172 Sqn.
 Flt. Lt. H. J. PANITZKI, R.A.A.F., No. 168 Sqn.
 F/O M. L. DOUBE, R.A.A.F., No. 464 (R.A.A.F.) Sqn.
 F/O W. D. HEMMINGS, R.A.A.F., No. 613 Sqn.
 F/O J. M. MOON, R.A.A.F., No. 464 (R.A.A.F.) Sqn.
 Flt. Lt. L. E. FOWNES, R.C.A.F., No. 409 (R.C.A.F.) Sqn.
 Flt. Lt. B. T. GILMOUR, R.C.A.F., No. 421 Sqn.
 Flt. Lt. L. V. KIRSCH, R.C.A.F., No. 198 Sqn.
 Flt. Lt. J. M. ROBB, R.C.A.F., No. 414 (R.C.A.F.) Sqn.
 Act. Flt. Lt. A. LAMBROS, R.C.A.F., No. 438 Sqn.
 F/O R. I. BRITTEN, R.C.A.F., No. 409 (R.C.A.F.) Sqn.
 F/O N. E. DAWBER, R.C.A.F., No. 438 Sqn.
 F/O L. J. DEROSIER, R.C.A.F., No. 107 Sqn.
 F/O R. H. ROHMER, R.C.A.F., No. 430 (R.C.A.F.) Sqn.
 F/O D. E. NESS, R.C.A.F., No. 56 Sqn.
 Act. Sqn. Ldr. A. K. ORROCK, R.A.F.V.R., No. 248 Sqn.
 Act. Sqn. Ldr. K. P. JONES, R.A.F.V.R., No. 357 Sqn.
 Flt. Lt. B. R. RODGERS, R.A.F.V.R., No. 7 Sqn.
 F/O D. R. BRITTON, R.N.Z.A.F., No. 90 Sqn.
 Flt. Lt. D. FITZGERALD, R.A.F.V.R., No. 2 Sqn.
 Flt. Lt. C. H. LOCKYER, R.A.F.V.R., No. 608 Sqn.
 Flt. Lt. J. A. L. FORD, R.C.A.F., No. 608 Sqn.
 Act. Flt. Lt. G. LEWIS, R.A.F.V.R., No. 156 Sqn.
 Act. Flt. J. A. ROWLAND, R.A.A.F., No. 635 Sqn.
 F/O M. J. B. COLE, R.A.F.V.R., No. 137 Sqn.
 F/O J. J. MCKEE, R.A.A.F., No. 149 Sqn.
 F/O P. J. P. TROTMAN, R.A.F.V.R., No. 692 Sqn.
 F/O W. H. T. UNDERWOOD, R.A.F.V.R., No. 166 Sqn.
 Act. F/O A. N. CLARK, R.A.A.F., No. 622 Sqn.
 Lt. A. F. GREEN, S.A.A.F., No. 184 Sqn.
 W/O R. LOCKYER, R.A.F.V.R., No. 182 Sqn.
 Act. Wing Cdr. N. ALEXANDER, R.A.F.O., No. 7 Sqn.
 Act. Wing Cdr. R. T. FROGLEY, R.A.F., No. 50 Sqn.
 Act. Wing Cdr. M. STOCKDALE, R.A.F.O., No. 12 Sqn.
 Act. Sqn. Ldr. P. C. BARGH, R.A.F., No. 582 Sqn.
 Act. Sqn. Ldr. J. H. CROTCH, R.A.F.V.R., No. 192 Sqn.
 Act. Sqn. Ldr. T. R. A. DOW, R.A.F.O., No. 139 Sqn.
 Act. Sqn. Ldr. E. A. O. MANGE, R.A.F.V.R., No. 635 Sqn.
 Act. Sqn. Ldr. P. S. MORRIS, R.A.F.V.R., No. 7 Sqn.
 Act. Sqn. Ldr. H. R. POOLEY, R.A.F., No. 9 Sqn.
 Act. Sqn. Ldr. P. REYNOLDS, R.A.F.V.R., No. 186 Sqn.
 Act. Sqn. Ldr. D. N. SHEPHERD, R.A.F.V.R., No. 90 Sqn.
 Act. Sqn. Ldr. N. F. SMITH, R.A.F.O., No. 23 Sqn.
 Act. Sqn. Ldr. J. G. TIMMS, R.A.F.V.R., No. 514 Sqn.



The badge of No. 120 Sqn., R.A.F.—"Endurance."

Act. Sqn. Ldr. L. J. WARD, R.A.F.O., No. 102 Sqn.
 Act. Sqn. Ldr. D. P. WHITE, R.A.F.V.R., No. 166 Sqn.
 Act. Sqn. Ldr. P. A. WILLIAMS, R.A.F.V.R., No. 582 Sqn.
 Flt. Lt. E. AKERS, R.A.F.V.R., No. 10 Sqn.
 Flt. Lt. BARRITT, R.A.F.V.R., No. 166 Sqn.
 Flt. Lt. L. F. BELTON, R.A.F.V.R., No. 149 Sqn.
 Flt. Lt. G. BROWN, R.A.F., No. 571 Sqn.
 Flt. Lt. E. S. BUCKLAND, R.A.F.V.R., No. 186 Sqn.
 Flt. Lt. J. CUNNINGHAM, R.A.F.V.R., No. 115 Sqn.
 Flt. Lt. E. L. D. DRAKE, R.A.F.V.R., No. 105 Sqn.
 Flt. Lt. J. E. EARNSHAW, R.A.F.V.R., No. 692 Sqn.
 Flt. Lt. C. G. ENDERSBY, R.A.F.V.R., No. 169 Sqn.
 Flt. Lt. F. J. HALPIN, R.A.F.V.R., No. 105 Sqn.
 Flt. Lt. M. L. HAMILTON, R.A.F.V.R., No. 617 Sqn.
 Flt. Lt. J. K. HAVILAND, R.A.F.V.R., No. 141 Sqn.
 Flt. Lt. H. L. HING, R.A.F.V.R., No. 576 Sqn.
 Flt. Lt. W. B. HOLMAN, R.A.F.V.R., No. 186 Sqn.
 Flt. Lt. W. D. F. HUGGETT, R.A.F.V.R., No. 692 Sqn.
 Flt. Lt. H. LEWIS, R.A.F.V.R., No. 7 Sqn.
 Flt. Lt. E. J. LISLE, R.A.F., No. 35 Sqn.
 Flt. Lt. N. E. LITCHFIELD, R.A.F.V.R., No. 105 Sqn.
 Flt. Lt. T. J. LONG, R.A.F.V.R., No. 608 Sqn.
 Flt. Lt. P. P. MATHER, R.A.F.V.R., No. 7 Sqn.
 Flt. Lt. A. J. MCCALL, R.A.F.V.R., No. 7 Sqn.
 Flt. Lt. G. R. McQUEEN, R.A.F.V.R., No. 582 Sqn.

Distinguished Flying Medal

Flt. Sgt. R. J. ALLCOTT, R.A.A.F., No. 460 (R.A.A.F.) Sqn.
 Flt. Sgt. J. A. THOMPSON, R.A.F.V.R., No. 196 Sqn.
 Sgt. R. V. SWAN, R.A.F.V.R., No. 158 Sqn.
 Flt. Sgt. A. McHUGH, R.A.F.V.R., No. 437 (R.C.A.F.) Sqn.
 Flt. Sgt. J. E. MASINI, R.A.F.V.R., No. 512 Sqn.
 Flt. Sgt. A. H. HORRY, R.A.F.V.R., No. 9 Sqn.
 Flt. Sgt. W. C. KAY, R.A.F.V.R., No. 620 Sqn.
 Flt. Sgt. J. SMITH, R.A.F.V.R., No. 180 Sqn.
 Flt. Sgt. S. YEARDSLEY, R.A.F.V.R., No. 178 Sqn.

R.A.F. Military Awards

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

Military Cross

F/O S. W. R. HARRIS (R.A.F.V.R.), R.A.F. Regt.—On Sept 27th, 1944, F/O Harris accompanied by two airmen, drove a jeep into the forward areas. As the party entered the village of Stradone they were fired at by snipers and compelled to leave the jeep and take cover in a nearby building. Shortly afterwards four army stretcher bearers were also compelled to take cover close by. The enemy fire continued. F/O Harris led the two parties from the rear of the building in an attempt to get clear of the danger area. As they reached the main road heavy mortar fire was encountered; F/O Harris was seriously wounded in the chest. All other members of his party, with the exception of a corporal, were wounded and some were unable to walk. F/O Harris, assisted by the uninjured corporal, walked back to the village and retrieved the jeep. Having been assisted into the seat, F/O Harris drove the vehicle back to the nearest field dressing station some four miles away. On arrival, F/O Harris collapsed from loss of blood and the intense pain he had suffered. The outstanding courage, fortitude and devotion to duty displayed by this officer are worthy of high praise.

F/O A. I. MITCHELL (R.A.F.V.R.), R.A.F. Regt.—On September 29th, 1944, whilst on detachment with the Oxfordshire and Buckinghamshire Light Infantry in South Mayu Range, this officer accompanied an assault party in an attack on an enemy position. When the commander was killed, F/O Mitchell immediately assumed command and succeeded in capturing and consolidating the objective under accurate hostile shell fire. Despite the unusual situation in which he was placed he remained completely calm and showed initiative and resolution of a high order. On October 2nd, 1944, he was attached to a platoon of the service regiment which was detailed as a fighting patrol in the area of Sunia Marpara Pimples. The patrol was repeatedly attacked by superior forces and eventually surrounded. Later when the situation had deteriorated seriously F/O Mitchell gallantly volunteered to make his way back to the company's base, with a view to bringing down artillery support to assist in the withdrawal of the patrol. Although there was little cover on the journey, and the ground was swept by enemy automatic fire, he succeeded in getting through. His conduct was most praiseworthy and materially assisted in the successful withdrawal of the patrol. F/O Mitchell showed marked courage and determination in carrying out an extremely difficult and hazardous task.

F/O N. J. PAGE (R.A.F.V.R.), R.A.F. Regt.—One afternoon in September, 1944, in an attempt to save 20 men of a L.A.A. unit, who were surrounded, the rifle flight under the command of F/O Page twice engaged greatly superior forces of the enemy, who were in well concealed positions in a wood N.E. of Vaeke, south of the Leopold Canal. During the second engagement, the flight was beset on three sides by heavy enemy machine gun fire and fairly heavy mortar fire, but, by outstanding skill and leadership, F/O Page with-

VIATION

drew his flight without loss, including casualties on the enemy. For about 14 days F/O. Page's flight occupied the left flank of a forward defence locality at Moerkerke. During this period he was tireless in his devotion to duty. He frequently led patrols to enable mortar fire to be brought to bear on the enemy and, by night, he directed counter measures against enemy patrols. F/O. Page at all times justified the trust and disciplined response of his men by his dash and energy. He directed skilfully the tasks allotted to the flight and, although the enemy was at all times superior in numbers and fire power, the operations were carried out without loss, whilst casualties were inflicted on the enemy.

F/O. J. R. B. WILD (R.A.F.V.R.), R.A.F. Regt.—In October, 1944, this officer was in charge of a forward observation post, consisting of one troop of reconnaissance cars, on the south bank of the Wilhelmina Canal, when a warning was received that a patrol of the enemy was working across the canal towards him. F/O. Wild immediately set out to meet the oncoming patrol, covered by two of his men. He encountered four of the enemy, and although under heavy fire, threw a hand grenade at them. F/O. Wild then worked his way round to the enemy's flank and threw a further grenade which wounded a German officer and two men. He then advanced on the German position, killing the officer with his revolver, but the other men escaped, leaving their weapons behind. F/O. Wild, accompanied by others, continued the search, but the remainder of the enemy patrol had escaped across the canal. This officer, during the whole of the operation in this sector, displayed courage and skill of the highest order. He personally accounted for at least six of the enemy by sniping and at all times set a magnificent example to his men.

Military Medal

W/O. H. LIGGETT, R.A.F.
Flt. Sgt. H. T. JEFFREY, R.A.F.V.R.
Sgt. H. SMISTER, R.A.F.

Flt. Sgt. A. E. GREENING (R.A.F.), R.A.F. Regt.—For about 14 days this non-commissioned officer was a detachment commander in a three-inch mortar flight located in Moerkerke and close to the enemy lines. The detachment was under continual fire from enemy mortars and snipers and was subjected to periodical shelling. On one occasion the church tower at Moerkerke, from which Flt. Sgt. Greening was observing, was hit and set on fire, but he completed the shoot and escaped from his observation post. The accuracy of the fire he directed undoubtedly caused the enemy to lose the initiative in an area where our own positions were very thinly held. The offensive spirit and good shooting of Flt. Sgt. Greening's detachment successfully discouraged the enemy from preparing for a series of local attacks.

Army Awards

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

O.B.E. (Mil.)

Capt. (Act.) D. B. RENDELL, Army Air Corps.
Lt. J. K. ENGLAND, Army Air Corps.

Military Cross

Lt. J. E. BLACKWOOD, Army Air Corps.

Roll of Honour

Casualty Communiqué No. 480.

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

Royal Air Force

KILLED IN ACTION.—Sgt. M. A. V. Bareham; Sgt. L. Cross; Sgt. G. E. T. Gooch; Sgt. W. Hunter.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. H. W. Ambrose; Sgt. A. J. O. Archer; Sgt. G. Armstrong; F/O. T. R. Atkinson; P/O. J. H. Baird; Sgt. A. S. Baker; Flt. Sgt. K. E. F. Barton; F/O. D. V. F. Bennett; Flt. Sgt. C. E. Bishop; Sgt. J. W. Brewster; Flt. Sgt. R. Brotherton; Sgt. R. Burrell; Sgt. H. Campbell; P/O. D. Canning; Flt. Sgt. R. K. Chapman; Sgt. J. L. Colbourne; F/O. W. B. Conn; W/O. V. C. Cordery, M.M.; Flt. Sgt. D. Cromar, D.F.M.; Sgt. L. N. Crownwell; Sgt. K. R. Corbett; Flt. Sgt. R. N. V. Daniel; Sgt. A. S. Davis; Sgt. J. W. Diwell; Sgt. H. Duckworth; Sgt. A. F. Eastman; F/O. D. A. V. I. D. Finlay; Flt. Sgt. W. H. E. Fitzearle; Sgt. K. Foyle; Sgt. P. E. Gander; Sgt. R. Gillies; Sgt. J. Graham; Sgt. J. D. Groves; F/O. G. R. Harris; P/O. P. E. Head; Sgt. J. Hill; P/O. J. T. Hitchen; Sgt. W. P. Houston; Flt. Sgt. R. J. Hunter; Sgt. P. G. Kemoen; Sgt. J. E. Kennison; Sgt. C. King; Sgt. S. W. Lamberth; F/O. C. Large; Sgt. C. J. McLoughlin; Sgt. B. Machan; Sgt. V. Mandy; Sgt. P. J. Manley; Sgt. H. W. Marshall; Sgt. R. Martin; Flt. Sgt. C. E. Mason;

Flt. Lt. W. W. Maxfield; Sgt. A. Mickus; F/O. A. Moore; Flt. Sgt. F. H. Morgan; Flt. Sgt. W. E. Paul; F/O. W. H. Rogers; Flt. Sgt. W. J. Rosser; Flt. Sgt. J. M. Smith; Sgt. E. Starkie; Sgt. A. H. Steel; Flt. Sgt. A. R. G. Stewart; Flt. Sgt. R. A. C. Wilson; Sgt. D. Wood; Act. Wing Cdr. E. N. Woods, D.F.C.; P/O. A. E. Wright; Sgt. E. J. Wright.

WOUNDED OR INJURED IN ACTION.—F/O. S. Berry; F/O. J. Campbell; Act. Sqn. Ldr. F. W. Lister, D.F.C.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. D. E. Firman.

MISSING.—W/O. A. Adams; Sgt. N. Amos; Sgt. T. A. Arlow; Flt. Sgt. E. D. Atkinson; F/O. W. R. Beechey; Sgt. G. S. Brown; Sgt. H. C. Burnside; Flt. Sgt. J. Chamberlain; Sgt. A. Clark; Sgt. I. Cohen; Flt. Lt. A. J. Craven; P/O. E. Crossley; Flt. Lt. J. A. Currie; Sgt. T. R. Edgell; Flt. Sgt. C. D. Evans; F/O. D. W. Eves; Sgt. J. W. Freeborn; P/O. W. Galbraith; W/O. C. W. Gentry; Sgt. M. A. Gault; Sgt. E. H. Grundy; Sgt. G. F. Harding; Sgt. S. P. Hunt; Flt. Sgt. A. Jamie; Sgt. J. Langton; Sgt. J. Lawson; Sgt. W. Lightowler; Flt. Lt. E. W. Lilley; Flt. Lt. R. C. Luck, D.F.C.; Flt. Sgt. J. D. McAree; Sgt. J. Marshall; Sgt. J. C. Millar; F/O. D. C. Moore; P/O. E. M. Morris; Flt. Sgt. C. A. Myers; F/O. J. A. Norton; Flt. Sgt. A. Oxley; Sgt. E. J. Payne; F/O. J. Redmond; Flt. Sgt. H. Ruston; Sgt. E. G. Simmonds; F/O. J. K. Smith; Sgt. S. O. Spence; Act. Group Capt. W. E. Surplice, D.S.O., D.F.C.; P/O. J. H. Tales; Sgt. J. V. Thompson; Sgt. R. W. S. Tilsed; Flt. Sgt. W. Wilson; Flt. Sgt. L. W. Woodard.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Flt. Lt. A. R. H. Palmer.

KILLED ON ACTIVE SERVICE.—Sgt. E. H. Bailey; Sgt. J. W. Ford; Sgt. T. N. C. Johnston; P/O. H. R. Lyle; Sgt. E. S. Powell; Sgt. J. W. Walker; Sgt. V. A. Waters; Sgt. B. I. Williams.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. S. J. Degnan; Sgt. J. McDermand; Sgt. D. P. Rance.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Flt. Sgt. A. English; F/O. C. V. Mayhead; Cpl. A. N. D. Young.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. M. Lindsay.

DIED ON ACTIVE SERVICE.—L.A./C. J. Cameron; Cpl. L. C. L. Cawthorn; L.A./C. L. C. Ford; A/C.1 A. Grant; L.A./C. A. T. Harvey; L.A./C. E. Hewby; A/C.2 P. J. Kelly; L.A./C. J. D. McRobert; A/C.2 J. Mitchell; A/C. J. G. Oke; L.A./C. L. P. Orrom; Act. Sqn. Ldr. W. Pollock; L.A./C. T. Porter; Cpl. D. Postlethwaite; L.A./C. P. Richards; L.A./C. G. O. Smith; L.A./C. R. Smith; Sgt. G. S. Souter.

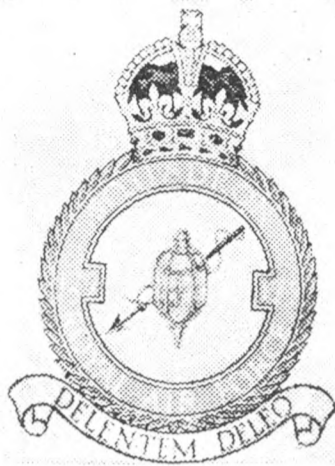
PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—W/O. J. V. Collett; Flt. Lt. W. C. Dallin; Flt. Sgt. E. J. Gillman; Flt. Sgt. G. Hather; Flt. Sgt. J. Kenny; Act. Flt. Lt. W. Nichol; Flt. Sgt. G. R. Wheaton; Flt. Sgt. P. G. G. Wilmschurst.

Royal Australian Air Force

KILLED IN ACTION.—Act. F/O. R. J. Hoggard; P/O. O. F. Meredith.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. J. R. Henninghan.

MISSING.—P/O. J. Binstead; F/O. L. M. Hough; Flt. Sgt. M. L. Morey; P/O. H. J. Pearmain; P/O. J. A. Picken.



The badge of No. 179 Sqn., R.A.F.—"Delentem Deleo" (I Destroy the Destroyer.)

KILLED ON ACTIVE SERVICE.—Sgt. A. White.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—F/O. W. D. Hogg.

Royal Canadian Air Force

KILLED IN ACTION.—P/O. B. C. Chinnery; F/O. I. Law; Sgt. H. Lowe; Flt. Lt. A. A. Pierce; Flt. Lt. S. D. Webb.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—F/O. F. Forrest; P/O. L. A. Frost; F/O. J. McN. Kendall; F/O. G. E. Lemerick; P/O. F. H. Palmer; W/O. I. Rodin; F/O. W. E. Suddick; P/O. R. Tarbet; F/O. W. R. Waddess; F/O. F. J. Zubie.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. J. L. D. Armstrong; W/O. R. E. Black; F/O. A. J. Brown; P/O. K. L. Brager; W/O. J. S. Briegel; Flt. Sgt. E. D. Brokenshire; P/O. T. D.

Cochrane; Flt. Sgt. L. F. Cook; Flt. Sgt. J. E. Dayton; W/O. W. E. C. Dillow; Flt. Sgt. J. P. H. Dube; P/O. E. C. Ecclestone; F/O. A. L. Forbes; F/O. S. J. Gibson; F/O. W. A. Hadden; P/O. J. W. K. Hall; Flt. Sgt. H. E. Mansell; F/O. W. A. Holmes-a-Court; Flt. Sgt. A. G. Innes; Sgt. G. H. Jessiman; Sgt. H. A. Keast; Flt. Sgt. J. E. N. R. Labelle; Sqn. Ldr. J. F. Lambert; P/O. R. G. Leese; P/O. G. J. Little; P/O. S. H. Long; Flt. Lt. F. C. Lord; F/O. J. C. Lowther; W/O. M. A. McCurdy; Flt. Sgt. D. H. McKitterick; Flt. Sgt. L. A. McQuestion; W/O. H. C. A. Maynard; F/O. K. M. Mosher; W/O. T. W. Myers; P/O. E. F. Parker; Flt. Sgt. G. J. Partidge; F/O. C. W. Peasland; W/O. E. J. Ramey; F/O. J. N. R. Redpath; W/O. R. W. Revell; P/O. F. J. Roberts, D.F.C.; Flt. Sgt. E. Rogers; P/O. M. C. Shaw; W/O. L. M. Stormer; F/O. J. R. Symons; F/O. S. E. C. Thorn; W/O. H. A. Turner; W/O. E. L. Tycoles; Sgt. R. J. H. Walsh; Flt. Sgt. E. F. Warr.

WOUNDED OR INJURED IN ACTION.—Sgt. D. Cochran; Sgt. G. R. Fawcett; W/O. D. P. Garber.

MISSING, BELIEVED KILLED IN ACTION.—F/O. A. J. W. Cayer; P/O. A. T. Keeping.

MISSING.—F/O. B. B. Anderson; F/O. W. F. Anderson; F/O. J. F. J. Bachant; F/O. W. S. P. Bonar; F/O. K. B. Brooks; Flt. Sgt. C. H. F. Campton; F/O. J. E. Clements; Flt. Sgt. K. C. Collins; F/O. D. D. Connor; P/O. M. Dorrell; Sgt. R. E. Fahselt; Flt. Sgt. C. C. Goble; Sgt. J. D. Griffin; Flt. Sgt. L. G. Griffith; Flt. Sgt. W. H. Hanes; Flt. Sgt. J. R. Harper; F/O. R. W. Harrison; F/O. J. Holtze; F/O. L. J. Hopper; F/O. W. Huskison; Flt. Sgt. N. F. Jodrell; P/O. R. C. Joiner; F/O. H. Knobovitch; Flt. Sgt. V. J. Lazier; F/O. H. F. Lenoury; Sgt. J. A. Lord; F/O. E. A. Love; Flt. Sgt. J. Lupinsky; Flt. Sgt. J. M. A. McCann; P/O. R. J. McCormack; F/O. A. McDonald; Flt. Sgt. J. A. McLea; F/O. G. A. Mortimer; Sgt. M. R. Morton; F/O. G. J. Mullin; Sgt. V. E. Nelson; F/O. A. B. Orchard; F/O. R. E. B. Pike; Flt. Sgt. C. A. M. Potage; F/O. H. Rabkin; F/O. W. H. Regimbal; P/O. A. E. Rheubottom; Flt. Sgt. A. J. Roach; Flt. Sgt. C. C. Robertson; F/O. R. H. M. Rose; W/O. L. J. Ruhl; P/O. A. G. Samuel; P/O. C. A. R. Seeley; Flt. Lt. G. W. Sellars; P/O. V. L. Valde; F/O. G. J. Zbura.

KILLED ON ACTIVE SERVICE.—P/O. C. W. A. Britton; F/O. W. W. Cook; Sgt. W. Drozdak; Sgt. H. L. Fernstrom; W/O. H. W. Ferris; Flt.



SPOTTER: The Sea Otter I, besides replacing the Walrus in the Navy, is also employed on air/sea rescue and reconnaissance duties with the R.A.F. in Burma.

SERVICE AVIATION

Sgt. W. M. Freeman; Sgt. J. F. Gazzard; Sgt. J. A. A. Giroux; Sgt. D. Goodwin; Flt. Sgt. M. S. Harbor; Sgt. J. S. Hodd; F/O. R. N. MacDonald; Flt. Sgt. G. W. H. Patterson; P/O. A. Rosen; F/O. A. Sharp; Flt. Sgt. G. W. Stone; F/O. R. P. Willison; F/O. T. McL. Young.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—F/O. L. E. Charnaud; Flt. Sgt. D. J. Dolphin; W/O. A. Wilson; W/O. B. J. Yard.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—P/O. R. McGhie; Sgt. L. A. Pinchless.

WOUNDED OR INJURED ON ACTIVE SERVICE.—F/O. J. S. Bean; F/O. A. C. Mullen.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Act. Flt. Lt. L. W. Munro.

South African Air Force

KILLED IN ACTION.—Lt. H. D. Wheeler.
PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Capt. D. J. Maree; 2/Lt. K. W. Prescott; 2/Lt. L. A. Van Zyl.

Casualty Communiqué No. 481

Of the names in this list 153 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—F/O. D. S. Arnett; F/O. P. A. C. Caryer; Sgt. K. D. Conway; F/O. A. F. Cullington; Sgt. J. McN. Dick; Sgt. R. D. Driscoll; P/O. D. L. Francis; W/O. J. Garcia-Webb; Sgt. D. W. Garside; W/O. D. H. Jones; Sgt. D. Keen; Flt. Lt. G. A. Marshall; Flt. Sgt. P. G. Masters; Sgt. J. Nugent; F/O. F. Roberts; Sgt. L. A. Rolfe; Sgt. J. Routledge; F/O. W. A. Sparks; W/O. R. J. Wendes.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—F/O. F. I. Allison; Sgt. S. G. Bentley; L.A./C. C. Davies; F/O. G. J. G. de Marigny; F/O. P. G. W. Goode; W/O. W. Grier; F/O. R. L. Hawkins; F/O. D. B. Hume; Flt. Sgt. A. S. Jacobs; Flt. Sgt. K. M. O. King; Flt. Sgt. S. C. Linn; Flt. Lt. S. J. Lovell; Sgt. E. Pearce; Flt. Sgt. K. J. Seeley; Flt. Sgt. P. G. Short; F/O. P. W. Webb; W/O. W. H. Westby.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. A. W. Archer; Sgt. R. Bateman; F/O. J. Battersby, B.E.M.; Sgt. D. G. Bingley; Flt. Sgt. A. W. Bouchier; Sgt. R. V. T. Bowerman; Sgt. R. E. Burke; F/O. E. J. L. Carpenter; Flt. Sgt. D. Clark; Flt. Lt. E. S. Clarke; Sgt. H. G. Clements; Sgt. R. G. W. Clime; Sgt. E. C. Cornwall; Sgt. R. S. Cornwall; Sgt. E. J. Crowe; Sgt. G. J. Davies; Sgt. J. Edmunds; Sgt. J. E. Fake; Sgt. A. H. R. Fielding; F/O. R. S. Gall; Flt. Sgt. C. Gibbons; Sgt. C. Gilroy; P/O. J. E. Glendinning; Sgt. F. G. Goodall; Sgt. J. Hamer; Act. Flt. Lt. C. V. Harvey, D.F.C.; Sgt. A. P. Hateley; F/O. F. W. D. Haynes; Flt. Sgt. P. H. O. Herbert; Sgt. H. W. Hewitt; Sgt. L. Horrocks; Sgt. K. F. Hutson; Sgt. J. E. W. Iverson; Act. Flt. Lt. S. James; Flt. Sgt. W. D. James; F/O. J. D. Johnston; Sgt. W. Kingham; Sgt. W. McArdie; Sgt. D. McCreadie; Sgt. T. Martin; Sgt. L. C. Nosworthy; Flt. Sgt. J. S. Poole; Sgt. A. J. E. Raven; Sgt. A. P. Readdy; Flt. Sgt. G. Ridley; Sgt. R. Roxby; Sgt. J. C. Scott; F/O. T. B. Shearer; Sgt. J. S. Smith; Sgt. M. F. R. Sorton; Sgt. J. C. Stones; Sgt. R. Stripe; L.A./C. C. W. Summers; Sgt. C. R. Tingle; P/O. G. R. Tomlinson; Flt. Lt. S. A. Tucker; Sgt. R. V. Turner; Flt. Sgt. A. B. Tuttle; P/O. C. A. Wakley; Sgt. C. H. Walder; Sgt. P. Walker; Flt. Sgt. W. V. Wilkes; Sgt. G. E. Wilks; Flt. Sgt. S. E. Woolf.

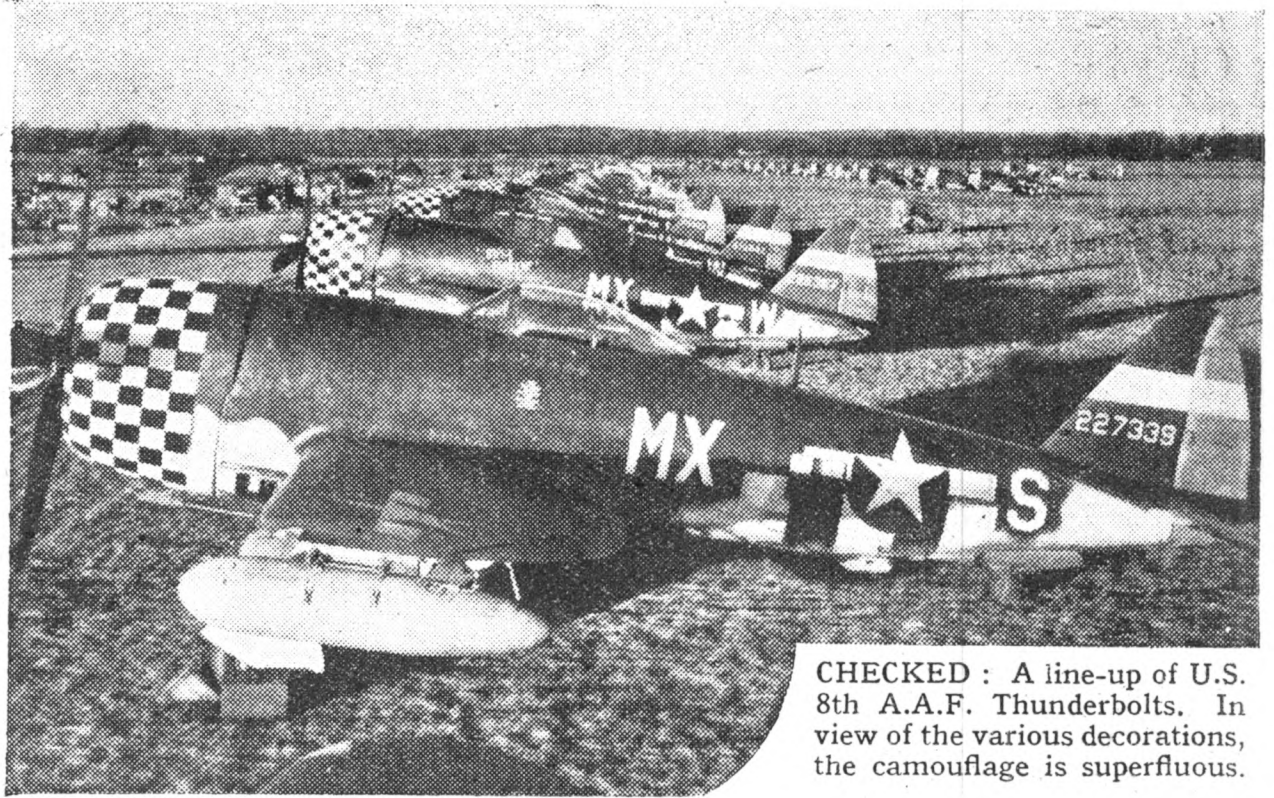
WOUNDED OR INJURED IN ACTION.—Sgt. J. K. Finney

PREVIOUSLY REPORTED MISSING, NOW REPORTED DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—F/O. T. W. Baptie.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. C. R. Anthony; Sgt. J. H. McKee; F/O. E. Parker; Sgt. F. T. H. Rookwood; Flt. Lt. A. J. Strachan; P/O. J. L. Thompson; Sgt. J. Young.

MISSING.—Flt. Sgt. R. C. Bartlett; Sgt. W. F. Beary; Sgt. J. Beeson; Flt. Sgt. S. C. Bennett; Sgt. T. P. Browne; Flt. Sgt. P. J. J. Byrne; Sgt. F. Caffrey; Sgt. W. A. Clowes; Sgt. E. K. Corcoran; Flt. Sgt. E. F. Craddock; Sgt. G. A. Dalton; F/O. A. G. Davies; Sgt. D. F. G. Day; Sgt. F. K. Derby; Act. F/O. T. J. Edwards; F/O. G. E. Eid; Flt. Sgt. A. McG. Findlay; Sgt. K. J. Fletcher; Sgt. J. Fulton; Sgt. W. J. Gall; P/O. D. Hardie; P/O. W. R. Harding; F/O. P. E. G. Harford; Sgt. R. F. Holland; F/O. J. M. S. Jackson; Sgt. R. F. O. James; Sgt. E. G. Kelly; Sgt. N. V. Madgwick; Sgt. S. A. Meadows; Sgt. J. B. Mitchell; Flt. Sgt. J. W. Norman; Sgt. E. G. Paradise; Flt. Sgt. J. H. Parry; Flt. Sgt. H. C. Pollard; Sgt. E. W. Quick; Sgt. J. A. Rix; Sgt. H. Roxby; Sgt. F. P. J. Smith; Sgt. R. S. Stapley; Flt. Lt. J. A. Swanson; Sgt. C. Terriere; F/O. P. M. C. Veitch; Sgt. G. E. Vernon; Act. Sqn. Ldr. T. Y. Wallace, D.F.M.; Sgt. K. H. Williams.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Sgt. E. Gordon; F/O. J. Morse; Sgt. K. A. Peulden.



CHECKED: A line-up of U.S. 8th A.A.F. Thunderbolts. In view of the various decorations, the camouflage is superfluous.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. G. A. Allen; L.A./C. D. Armstrong; Flt. Sgt. D. J. Bennett; Sgt. J. Curran; L.A./C. A. B. Gold; A/C.1 T. Gray; A/C.2 D. I. Hughes; L.A./C. A. G. E. Jones; L.A./C. I. M. Jones; Sgt. H. McDonald; Sgt. J. A. Moore; Flt. Sgt. W. C. Picton; Sgt. W. Pilkington; Sgt. H. Vance; Flt. Sgt. R. J. Westcott.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—F/O. G. Cartwright; F/O. R. H. Irvine; F/O. E. A. Rose; Sgt. S. Turner.

WOUNDED OR INJURED ON ACTIVE SERVICE.—F/O. J. Booth; Sgt. L. J. Curtis; F/O. J. Double, D.F.C.; Flt. Sgt. R. Evans; L.A./C. S. Gillett; P/O. H. J. Harris; Sgt. V. Jones; Flt. Lt. W. S. Kersey; P/O. W. Rae; L.A./C. G. E. R. Sage; W/O. M. E. J. Savill.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—L.A./C. R. J. Goulding; Cpl. J. Lovatt; Flt. Sgt. F. G. M. Parker; Flt. Sgt. M. G. Williams.

DIED ON ACTIVE SERVICE.—A/C.1 J. W. Brooks; Sgt. G. C. R. Butcher; Flt. Lt. L. G. Farthing; Cpl. W. E. Gibson; L.A./C. A. Hall; L.A./C. J. E. Riley; L.A./C. W. Wadsworth; L.A./C. G. M. Williams.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Flt. Sgt. W. Jones; Flt. Sgt. G. E. Plowman; Act. Flt. Lt. G. Rice, D.F.C.; Sgt. J. R. Smith.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—A/CW.1 H. M. Alway.

Royal Australian Air Force

KILLED IN ACTION.—F/O. J. A. Baker; Flt. Lt. A. G. Carlton; Flt. Sgt. D. L. Mitchell; P/O. A. L. Plowman; Flt. Lt. R. C. Powell; Flt. Lt. O. S. Shave; Flt. Lt. S. D. Titterton.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Act. Flt. Lt. C. O. Aubert, D.F.M.; Flt. Sgt. C. A. M. Barber; Flt. Sgt. J. Butterworth; P/O. N. P. Chapman; F/O. T. E. Charles; Flt. Sgt. K. R. R. Glover; P/O. A. W. Heap; W/O. W. L. C. Hickling, D.F.C.; Flt. Sgt. G. H. Irvin; F/O. N. C. Law; Act. Flt. Lt. G. B. Loder, D.F.C.; F/O. O. P. Luther; Flt. Sgt. C. E. McEvoy; Flt. Sgt. R. D. McWha; Flt. Sgt. L. K. Nicholl; Flt. Sgt. B. A. C. Paterson; Act. Flt. Lt. N. T. R. Poulton, D.F.M.; Act. Flt. Lt. L. J. Powell, D.F.C.; P/O. E. W. Ritchie, D.F.C.; F/O. F. W. Rush; Flt. Sgt. L. M. Ryan; Act. Flt. Lt. J. F. Samuel, D.F.C.; F/O. R. S. Smith; F/O. R. R. Stain, D.F.M.; W/O. W. A. Watson; Flt. Lt. R. P. Wishart; Flt. Sgt. R. I. Wynne.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. D. W. Davidson; Flt. Sgt. W. K. Loughnan; Flt. Sgt. K. A. G. Reed; Act. Flt. Lt. P. H. Strong, D.F.C.

MISSING.—Flt. Sgt. V. G. Bambrick; W/O. K. M. Bright; W/O. J. N. Casey; P/O. N. C. R. Dodgson; Flt. Sgt. E. J. Everest; P/O. E. A. McCasker; Flt. Sgt. J. S. McLay; F/O. C. W. P. Mortel; W/O. F. J. L. Paton; Flt. Sgt. E. M. Ryder; Flt. Sgt. W. O. Shaw; Act. F/O. D. G. Smith; W/O. R. D. Stopher; Flt. Sgt. H. J. Tolhurst.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. A. W. Cooke; P/O. W. A. Edmonds; Flt. Sgt. J. J. Grieve; Flt. Sgt. K. E. Jeffery; Flt. Sgt. C. B. MacKay; P/O. A. W. S. Maggs; Flt. Sgt. G. C. Swinbourne.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Flt. Sgt. A. L. Barr; F/O. V. G. Boyd-Gerny; Flt. Sgt. R. M. Cameron.

Royal Canadian Air Force

KILLED IN ACTION.—P/O. W. G. Armour; W/O. E. J. L. Bolingbroke; F/O. W. L. Cook; P/O. V. B. Gilson; F/O. C. R. Grassie; Flt. Sgt. A. C. Ineson; Flt. Sgt. K. McCormick; F/O. L. J.

Reaume; Flt. Sgt. G. Rye; F/O. D. A. Staples; Flt. Sgt. H. Sulz.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—W/O. W. R. Halloran.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. G. V. Bartle; F/O. A. S. Bellingham; P/O. D. J. Cameron; F/O. W. P. Cameron; F/O. D. A. Campbell; Sgt. J. H. Dipinto; F/O. G. E. Donaldson; W/O. W. L. Doran; Sgt. D. C. Elliott; W/O. C. B. Gowrie; F/O. R. Greaves; Sgt. W. H. Hamil; Flt. Sgt. D. G. Hamilton; Sgt. G. P. Hooper; F/O. B. S. Jones; F/O. J. A. Linde; P/O. W. J. Louth; W/O. J. P. S. McLeod; Flt. Sgt. W. D. Miller; P/O. V. R. Purmal; Flt. Sgt. L. C. Skerry; P/O. J. W. Thrasher; F/O. B. E. A. Vye.

MISSING.—F/O. A. J. Bate; Flt. Sgt. H. W. Botterill; F/O. K. L. Chapman; Sgt. W. J. Commins; F/O. O. J. Cox; F/O. A. E. B. Denovan; W/O. C. K. Douglass; W/O. M. W. W. Duley; F/O. J. Fraser; Sgt. J. L. Gallant; Flt. Sgt. W. J. C. Gibson; Flt. Sgt. A. N. Gould; Flt. Sgt. I. McC. Hamilton; P/O. A. Jacobs; Flt. Sgt. R. J. Kay; F/O. P. Leeds; Flt. Sgt. D. A. MacLaren; Flt. Sgt. H. K. Mainprize; F/O. W. N. Moore; F/O. W. F. Moran; W/O. R. D. Picciano; F/O. J. H. Quirt; Flt. Sgt. E. A. Smith; F/O. J. McA. Taylor; F/O. G. T. Weiss; Flt. Sgt. W. Yunsko; P/O. B. Zimring.

KILLED ON ACTIVE SERVICE.—Sgt. L. E. Eddie; Sgt. J. Wakefield.

WOUNDED OR INJURED ON ACTIVE SERVICE.—F/O. J. H. MacLean; Sgt. F. W. Thomas.

DIED ON ACTIVE SERVICE.—L.A./C. J. Bergin.

Royal New Zealand Air Force

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

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. J. A. Couper; F/O. I. T. Findlay; Flt. Sgt. J. E. S. Margetts; P/O. E. S. Wilkinson.

MISSING.—W/O. G. T. Bulman.
PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—P/O. H. R. Willis.

South African Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Lt. D. N. Campbell; Flt. Sgt. A. C. Lamb.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Act. Flt. Sgt. A. D. Marsberg; 2/Lt. R. G. Parry; Flt. Sgt. F. Van Zyl; Lt. R. H. Yaldwyn.

MISSING, BELIEVED KILLED IN ACTION.—Lt. C. G. Bochoff; Lt. K. C. Kemsley.

MISSING.—Lt. P. J. Dutoit; Lt. R. W. P. Manning; 2/Lt. R. E. Rorvik.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Maj. E. T. Strever, D.F.C.

Official Corrections

Casualty Communiqué No. 476.

Under "MISSING" delete F/O. G. W. Davies and Flt. Sgt. G. Postlethwaite. For Sgt. L. Marfill read Sgt. L. Marfil.

Delete "MISSING, BELIEVED KILLED ON ACTIVE SERVICE," and transfer L.A./C. R. J. Eden to "KILLED ON ACTIVE SERVICE."

R.A.A.F.—Under "PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION" delete Sgt. N. R. Thurect.

R.C.A.F.—Under "KILLED IN ACTION" for Flt. Sgt. F. P. Cartan read P/O. F. P. Cartan.

Under "MISSING" the following should rank as P/O.s.—Flt. Sgt. P. R. Jones; Flt. Sgt. K. Leigh; Flt. Sgt. A. H. Macleod; Flt. Sgt. W. G. Mann; Flt. Sgt. W. F. Palmer; Sgt. G. A. F. Whinfield; Flt. Sgt. E. C. Wilson.