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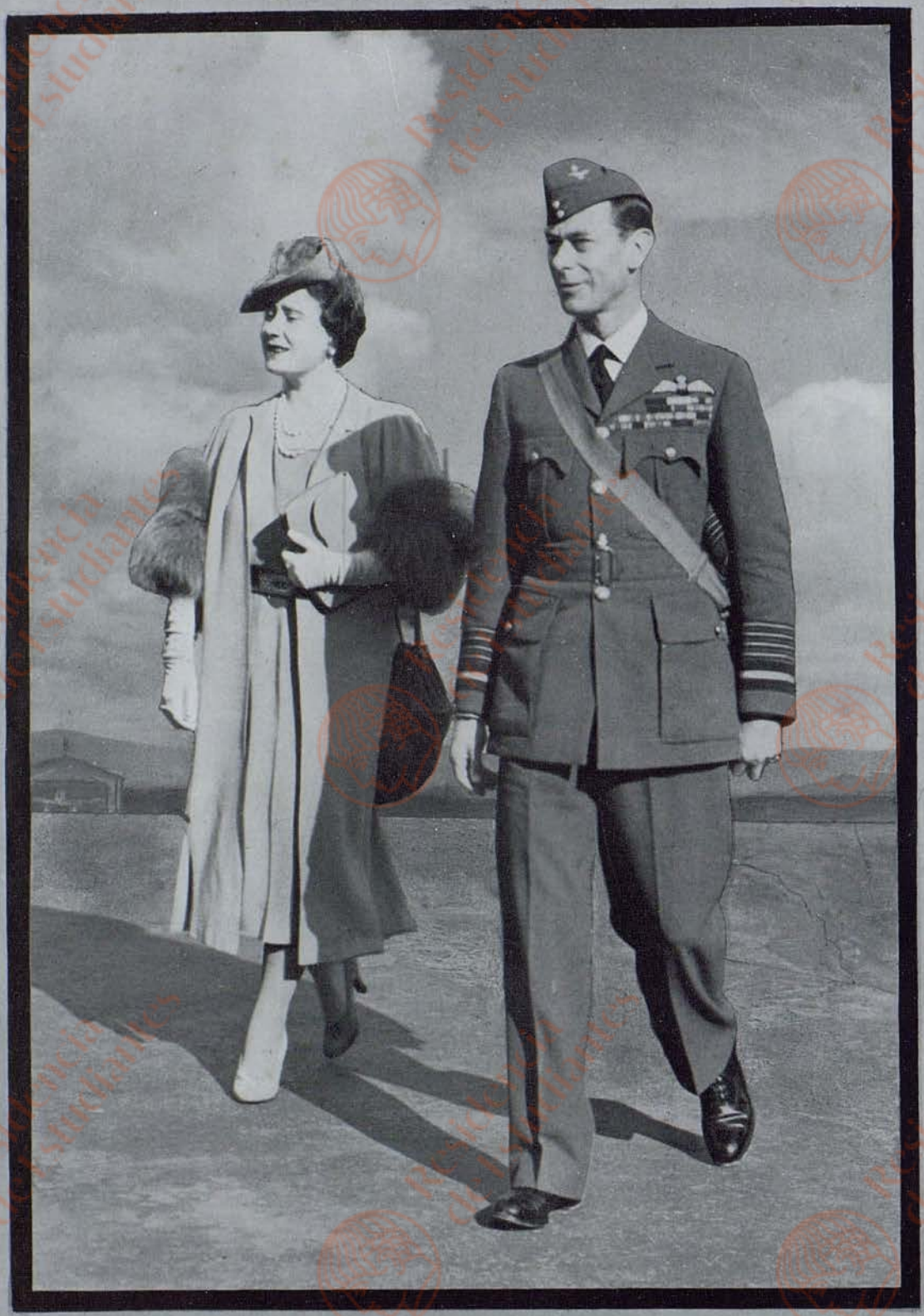

THE ROYAL AIR FORCE AT WAR

Edited by
WILLIAM BUCHAN
and including material provided
by the Air Ministry

THE PILOT PRESS

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TO THE
GALLANT AIRMEN
WHO ARE FIGHTING
THE BATTLE OF
FREEDOM

Right

Major the Rt. Hon.
Sir ARCHIBALD SINCLAIR, M.P.
(*Air Minister*)

Educated Eton & Sandhurst. Secretary of State for Scotland, 1931. Leader of Liberal Opposition in House of Commons. Air Minister, 1940.

Below

Air Marshal Sir C. F. PORTAL, D.S.O., M.C. (*Chief of Air Staff*)

Born 1893. Educated Winchester & Oxford. Flying Officer in France 1914-18. Director of Organisation, Air Ministry, Air Member for Personnel. Appointed C.A.S. October 1940.

Left

"Night Fighter."

THE R.A.F. AT WAR

THE JUNIOR SERVICE

The twenty-one years separating the two great wars of this century have witnessed profound changes in the instruments and technique of warfare itself. And the most spectacular changes have been apparent in the growth of air power, the conquest of the new dimension. To be a pilot between 1914 and 1918 was to be something of a pioneer. It was both dangerous and deadly work, but work which few considered a vital, decisive part of the war effort. Only when the struggle was well advanced did the general public and, indeed, military theorists, begin to have dim visions of what the war of the future might bring.

On July 7th, 1917, came an event which marks a turning point in history. Twenty-two enemy aeroplanes dropped bombs on London and Margate in broad daylight. One hundred and three people were killed and 316 wounded. In spite of extremely vigorous British counter action, only one of the raiders was brought down.

The writing on the wall—or rather, in the skies—was plain for all to see, but for a number of years it went unheeded. When ordinary people thought about the next war at all they saw visions so frightful that they shut their eyes, or said : " This is too terrible ; it can't happen here."

But it has happened, and no one will overlook the fact that the aerial aspect of the struggle may well be the most decisive. The activities of the opposing air fleets have rightly captured universal attention.

In the last few years, and since the Munich Agreement in particular, the Royal Air Force has been developed and enlarged out of all recognition to allow Britain to fight this new kind of war on equal terms with the enemy. The speed and efficiency with which both Air Force personnel and the aircraft industry have adapted themselves to this very recent mushroom-like growth, will be looked upon as one of the major triumphs of Britain's war effort. In 1934 the Air Force, judged by present-day standards, was neither large nor formidable. Including the Fleet Air Arm

Pilots studying a map.

and the Squadrons overseas, it numbered about 87 squadrons and its personnel strength was roughly 30,000 officers and men.

In July of that year ominous signs from Germany made it apparent that considerable expansion was necessary, and it was accordingly decided to raise Air Force strength by 41 squadrons. The scheme, however, was not scheduled for completion before April, 1939, and it had not been in operation for more than a few months before it was announced that the Government had prepared a new scheme which aimed at increasing the strength of the Metropolitan Air Force by 71 squadrons by the spring of 1937. But by 1936 even this drastic revision was considered insufficient ; the international situation continued to deteriorate alarmingly. It was decided to speed up still further delivery of first-line aircraft, and these aircraft were to be the finest that aeronautical science could produce. It

was recognised that this expansion would necessitate virtual reorganisation of the aircraft industry. The first steps were accordingly taken to put the industry on a war-time basis. Arrangements were made for the conversion of various types of plant for use in producing aircraft components : factories were built and still more factories. All this interest in military aviation gave a new impetus to research work, and designers and technicians bent with renewed zeal over their blue prints.

Yet the 1936 scheme was only the beginning. About the middle of 1938 it was decided to aim at 2,370 first-line aircraft by March, 1940. Then came the Munich Agreement which, in spite of Mr. Chamberlain's dictum that he believed it was to be peace in our time, had the effect of making all nations concerned speed up their rearmament plans still further in preparation for the cataclysm which they knew could not be long delayed. The 1936 scheme was enlarged enormously ; even greater numbers of

Operating the " Predictor," which gauges the height and speed of aircraft.

first-line 'planes were to be produced in less time, and deficiences in reserves made good. In effect, the British aircraft industry and the Royal Air Force were now on a war-time basis.

The general public became more and more air minded. The Government asked for large numbers of recruits to man Britain's immense new air Armada, and got them. Young men, attracted by the chance of seeing life from a new angle, of interesting jobs and high pay, joined up in thousands. On April 1st, 1939, R.A.F. personnel numbered 100,000 keen, highly trained officers and men.

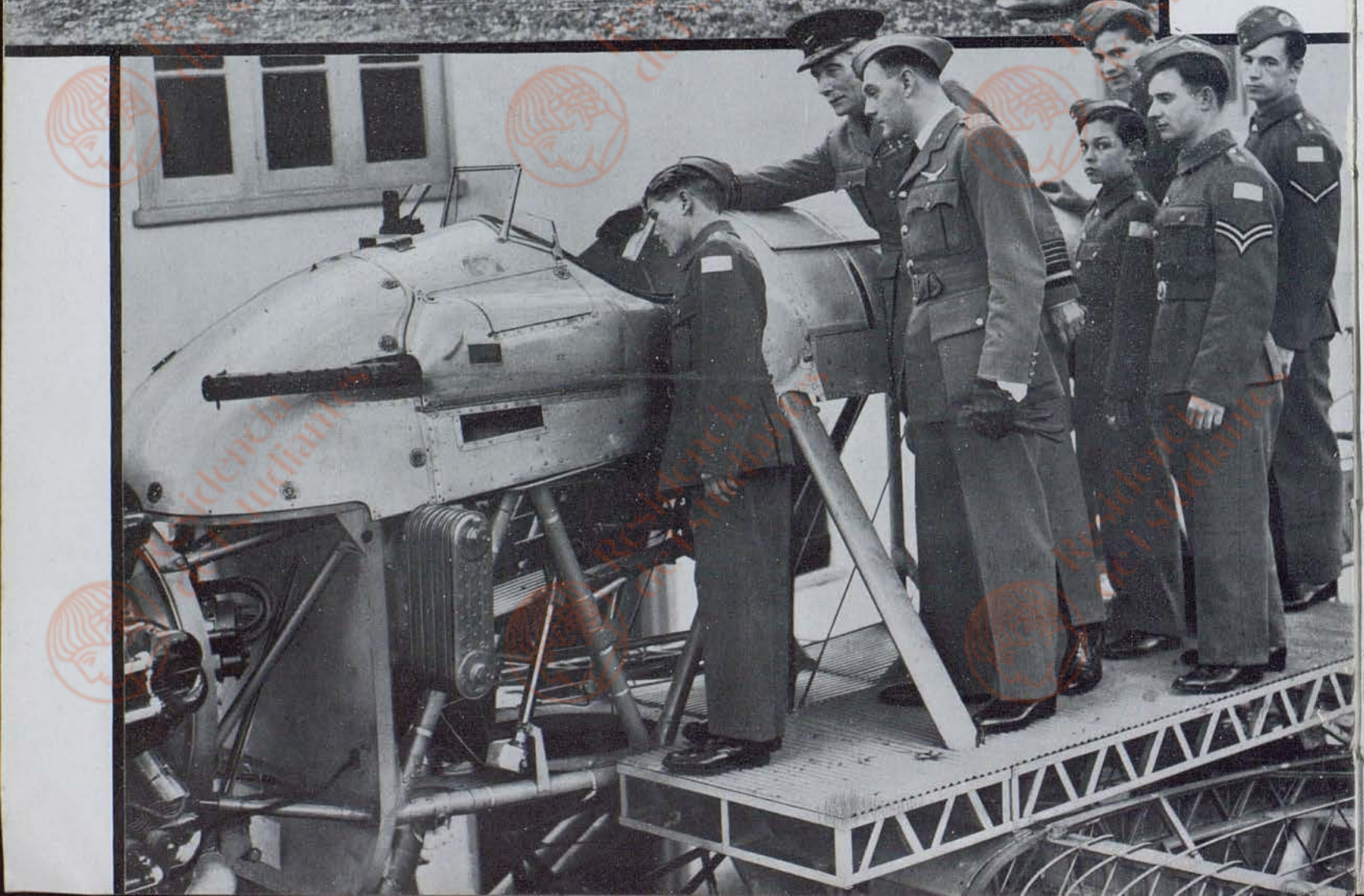
Then came the war, and under actual war conditions all Britain's previous efforts to make the R.A.F. if not the biggest, then certainly the most efficient air force in the world, have been redoubled. Much has been heard in some quarters of the supposed inferiority of our Air Force as compared with that of the enemy. It is undoubtedly true that in actual numbers Germany is still superior. It is not in the public interest to quote estimates of British production, and moreover, it must not be forgotten that when the United States lifted the arms embargo, she put us in a position to buy the very finest American aircraft—some of them still on the secret list—and buy them in quantity. Needless to say, we have not been slow to avail ourselves of this opportunity.

It is not enough, however, merely to equal the enemy's numerical air strength. To ensure its protection the whole Empire needs to co-operate in producing and maintaining the largest possible air force. In Canada, for example, there is a young, but very flourishing aircraft industry. And as evidence of what England herself can do unaided, it should not be forgotten that she produced something like 3,500 'planes a month towards the end of the last war.

MACHINES AND ARMAMENT

The Fighters

The following descriptions of aircraft at present in use by the R.A.F. is not exhaustive, and does not include some of the latest types, no details of which, for obvious reasons, can be given. Our aim is simply to give a general idea of the different types of machines which our airmen operate.



The Hawker " Hurricane " and the Supermarine " Spitfire " are our most famous interceptor 'planes. Both are single-seaters of performance equal to that of similar aircraft of any nationality. They are powered by Rolls-Royce " Merlin 11 " engines which develop well over 1,000 h.p. Some indication of their performance is given by the fact that they can climb 20,000 ft. in 9 minutes. As for speed, perhaps it is sufficient to recall that as long ago (technically speaking) as 1938 a " Hurricane," piloted by Squadron-Leader Gillan, flew from Edinburgh to Northolt, a distance of 327 miles, at over 407 miles an hour. This fighter is armed with eight Browning-type machine-guns mounted in the wings. The length of the fuselage is 31 ft. 5 in. ; the span of the planes is 40 ft.

The Supermarine " Spitfire " is smaller than the " Hurricane " and rather faster. Its armament, too, consists of eight machine-guns situated in the wings. In spite of their great speed, both machines are extremely easy to manœuvre. It is a popular fallacy that speed is the one great essential quality of fighter aircraft. Of course, it is necessary to intercept the enemy bomber before he has time to attack, or catch it before it has time to make its escape. But it is difficult to keep in close contact with

Assembling the " Gyro-Pilot," the machine which can take over control from the pilot for short periods on a flat course.

Marshal of the Royal Air Force, Sir John Salmond, inspecting cadets at an R.A.F. College.

the relatively slow moving bomber if the fighter does not respond very readily to the controls at high speed. Oddly enough, when it comes to actual combat, the slower 'plane may have the advantage. The Germans have showed a tendency to sacrifice everything to speed: the Messerschmitt fighter, for example, has done 464 miles an hour under test. The designer must keep constantly in mind that it takes three miles to turn round at a speed of three hundred miles an hour. Moreover, there is a limit to the speed that the human body can stand on the turn. A sort of mental black-out results when a turn is taken at excessive speed, and even fainting may occur. Such a mental black-out normally lasts only a matter of seconds, but lost seconds can cost a pilot his life.

This leads to the interesting question of armament. Messerschmitt fighters are equipped with automatic 37 mm. cannon which fire through the propeller shaft in addition to the usual complement of fixed machine-guns. These cannon, being relatively long-range weapons, to some extent counteract the machines' inferior " manœuvrability " ; there are reports that the British high speed fighter aircraft have been similarly fitted. It

The " Miles Magister," with hood for training pilots in blind flying.

Temporary relaxation beside the 'planes.

would, therefore, seem that a combination of both cannon and machine-guns is now the usual armament of this type of 'plane.

It is thus evident that aircraft armament cannot be studied as an isolated subject, but only in relation to the speed and general design of the machines to which weapons must be fitted. The guns range from those of rifle-calibre to the 37 mm. type cannon. These cannon, it should be pointed out, can fire high-explosive projectiles which burst at the slightest contact and have far greater destructive power than machine-gun bullets. But when considering the cannon versus machine-gun controversy, it is necessary to remember that a burst of heavy machine-gun fire at short range is more likely to be effective than fire from a hastily sighted 37 mm. gun. Effective fighting ranges of common types of aircraft guns are approximately as follows :

Ordinary machine-gun of rifle-calibre ..	range up to 300 yards.
20 mm. shell gun	range 300 to 700 yards.
37 mm. cannon	range 500 to 1,000 yards.

As protective armour plating is developed, new problems in aircraft armament will become apparent. In addition to being difficult targets at the best of times, 'planes are becoming less vulnerable even when bullets find their mark. The development of the cannon is an effort to offset this increasing protective strength. This weapon plays a corresponding role in aerial warfare to that of the anti-tank gun in ground warfare.

Yet another British fighter is the Boulton Paul "Defiant." It is powered by a single Rolls-Royce "Merlin" liquid-cooled engine and in general design is similar to the "Hurricane" and "Spitfire." But this machine is a two-seater equipped with overwhelmingly powerful armament. The provision of a gunner-observer in addition to the pilot vastly increases the field of fire. The gunner is situated in a mechanically operated multi-gun turret made necessary by the fact that the speed of the aircraft makes it impossible to operate the guns when exposed to the full force of the wind. Whereas both the "Hurricane" and "Spitfire" can only bring their guns into use when approaching the target, the "Defiant" can rake the enemy when he is in the rear. It is only possible to say that this machine is very fast indeed; it can certainly meet any enemy machine on more than equal terms.

The Bombers

An interesting machine is the Bristol "Blenheim" fast medium bomber which really combines the qualities of a fighter also. The 'planes already dealt with cannot venture any great distance from their base because of their limited range. They are therefore unsuitable to accompany bombers on raids far into enemy territory. The "Blenheim," on the other hand, is ideal as a long-range bomber or reconnaissance machine possessing many fighter qualities. It is powered by two Bristol "Mercury VIII" air-cooled, radial engines developing 840 h.p. each. Range is about two thousand miles and the speed about three hundred miles an hour. The observer-gunner is placed in a rotating turret amidships. The bomb aimer lies prone in the extreme nose of the machine and can thus obtain an excellent view of his target.

Britain's latest bomber is the Bristol "Beaufort" which, although it has been in production for well over a year at Bristol and Melbourne,

A Squadron of Hawker " Hurricanes."

Australia, has remained until very recently on the Air Ministry Secret List. Important details—such as speed, range, armament and bomb load —still remain secrets, but it can be said that it is the fastest medium bomber in service with any Air Force. It has a wing span of 57 ft. 10 in., carries a crew of four, and is powered by two Bristol " Taurus " engines. The " Beaufort " has been well called the " Jack-of-all-trades " of the R.A.F., for it is designed to operate as a bomber, torpedo-bomber, or a long-range reconnaissance aircraft. As a bomber it has already been used with devastating effect in the campaigns in Holland and Belgium, particularly against airports held by the enemy.

The Fairey " Battle " bomber is a machine which is likely to do much stalwart service in the present conflict. A single-engined machine, it is capable of a cruising speed of around 251 miles an hour and carries a

very considerable bomb load. Its clean design and moderate size make it specially suitable for dive-bombing tactics. A crew of three is housed in a long cockpit, the cover of which is hinged at the rear to allow the gunner free and sheltered use of the back gun. The pilot is also provided with a gun situated in the wing. Bombs are situated in cells recessed in the wings and an additional load can be carried on racks also on the wings.

One of Britain's largest bombers is the Vicker's " Wellington," which is remarkable for its exceptionally long range. Fully loaded it can fly 3,240 miles. Its fuselage is constructed on the geodetic principle—devoid of its covering it looks rather like a neat piece of basket work—which gives the aircraft exceptional strength combined with a degree of lightness hitherto considered impossible in a heavy bomber. Two Bristol " Pegasus " motors provide the power which can carry this aircraft plus bombs from London to any point in Europe and back within a few hours. A machine of similar performance is the Armstrong-Whitworth " Whitley," a twin-engined, mid-wing cantilever machine which carries a crew of five. Its range is only a little less than two thousand miles. It can carry an enormous load of bombs and is powerfully armed with five machine-guns. In spite of its very considerable weight, the " Whitley " has a useful cruising speed of something in the neighbourhood of 240 miles an hour.

Yet another most useful machine is the Handley Page " Hampden " twin-engined bomber which has been designed to provide a link between the " Blenheim " and the two big machines we have just mentioned. Power is provided by two Bristol " Pegasus XVIII " engines which give a maximum speed of 265 m.p.h. and a range of 1,790 miles. Its armament is powerful and a large load of bombs is carried internally.

During the last war the most usual way of carrying out a bombing raid was simply to heave the bombs out of the 'plane by hand when the pilot judged he was over the target. To-day to be a bomb aimer is to have a specialist's job and one requiring a great deal of technical knowledge. Even now, a direct hit is a rare thing, but as time goes on there is no doubt that aerial bombardment will rival artillery in accuracy. The bomb-aimer does not rely on his senses, but on instruments and calculation, made all the more necessary owing to the fact that efficient anti-

The Bristol " Blenheim " Bomber.


4864

aircraft defences frequently force the attacking 'plane up to heights well above 20,000 ft. The aimer, using his wind indicator and compass, guides the pilot towards the target. He adjusts his bomb-sight for the height and speed of the aircraft. This complicated mechanism also allows him to take the speed of the wind into consideration. He is in constant telephonic communication with the pilot, and when the target is in sight, the bomb-aimer is virtually captain of the 'plane. Immediately the target is correctly sighted, he presses a small button, rather like an electric light switch, and the deadly load is released on its journey of destruction and death.

Dive bombing is another method of attack. The pilot aims his machine at the target, roaring earthward with his engine full out. At the bottom of the dive, perhaps only a thousand feet or so from the ground, the bombs are released and the 'plane flattens out, to climb once again and renew the attack. This form of attack is usually undertaken by several aircraft diving immediately after each other, a method which puts the ground defences at a considerable disadvantage as several 'planes hurtling towards the earth at speeds of 400 m.p.h. and more, are almost impossible targets.

Sometimes bombs are dropped by parachute, the idea being that they will descend vertically—not at an angle, as is usual—and so give the greatest possible explosive effect. These tactics are usually employed by low-flying aircraft to break up troop concentrations and destroy enemy supply depots.

Another highly effective method of attack—and one used with much success by the R.A.F. on their raids on the German occupied aerodrome at Stavanger in Norway—is known as " ground strafing." The raiding aircraft roar at high speed and low altitude over the aerodrome or troop concentrations, open fire with all machine-guns and drop bombs. Under such treatment the morale of the troops is speedily weakened, and an aerodrome can be made useless for many days.

One of the most remarkable of our machines is the Sunderland Monoplane. This is a military adaptation of the Empire Flying Boat ; it is very large, weighing over 20 ton, and carries seven guns. Its speed is 210 m.p.h. and its range 2,500 miles. It takes off in 33 seconds. Some

Westland " Lysander " aircraft, used in army co-operation work.


K6127

short while ago, whilst engaged in an air battle with six German 'planes, it shot down two of the enemy 'planes, and after wounding another, returned home unharmed. Two of these monoplanes recently rescued 32 men, the crew of a steamer that was torpedoed in the Atlantic. It is used principally on long range sea reconnaissance flights.

In these pages no effort has been made to describe R.A.F. machines in any detail and, indeed, many interesting and important machines have not been mentioned. But we hope enough has been said to give the reader a clear idea of the general nature of modern military aircraft and their armament. Altogether about sixty different types of aircraft are in use by the R.A.F., but the ones we have mentioned are the most predominant, and are most likely to feature in the day to day news of the progress of the war. But it must never be forgotten that the aircraft industry is young and vigorous, and that war makes it doubly so. All news made public about aircraft and armament during wartime is several months out of date. The R.A.F. will undoubtedly have surprises in store for the German *Luftwaffe*.

THE TRAINING OF THE R.A.F.

You can build machines by the thousand, you can pile up bombs and armament, hew out aerodromes of rock—the most important factor will be still missing : the men to fly the machines, to drop the bombs, to work the machine-guns, cannons and cameras.

It is in the quality and training of personnel the immense advantage of Britain in the air has been proved over and over again.

Training—a thorough, swift and foolproof way of making good pilots, observers, gunners, etc.—is the most vital part of building up a superior air force.

As machines became faster and faster, their equipment more and more complicated, the training of the personnel also became an increasingly elaborate task. Before the outbreak of the war, entry into the permanent commissioned ranks of the General Duties (Flying) Branch of the R.A.F. was by the R.A.F. Cadet College at Cranwell, Lincolnshire, though University candidates were allowed to enter direct. Normally the entrance

Armstrong - Whitworth "Whitley" Bombers.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was by examination and by the award of King's Cadetships and Honorary King's Cadetships. These were offered to the sons of officers of H.M. Forces who have died in the King's service and to the sons of R.A.F. officers who had reached the rank of Squadron Leader or higher. The Cranwell training took two years and included an intensive course of general education and Service training.

This training was designed to fit the Flight Cadet to take his place as an operational pilot in a Service squadron ; to have a knowledge of the duties appropriate to a junior officer ; and to lay the foundation which would enable an officer to prepare himself for the Royal Air Force Staff College. Each year was divided into three terms, lasting thirteen-and-a-half weeks. A day's work was organised in periods of three-quarters of an hour and a week's work amounted to thirty-two hours. The subjects studied in the first year were : English, world history with special reference to the British Empire, aerodynamics, mathematics, mechanics, the theory of heat engines, mechanical drawing, the construction of engines, including practical work on engines and the use of tools ; elementary air navigation, airmanship, armament, sending and receiving by the Morse code. The second year was devoted more to purely professional work. The subjects studied were : advanced navigation, armament, maintenance of air-frames and engines, flight routine, meteorology, signals, law and administrations, accounts, sanitation and hygiene, the organisation and employment of the Navy, Army and Air Force. The College was divided into three squadrons of Flight Cadets, each being commanded by an officer who had to assist him a Flight Cadet Under-Officer and four Flight Cadet N.C.O.'s.

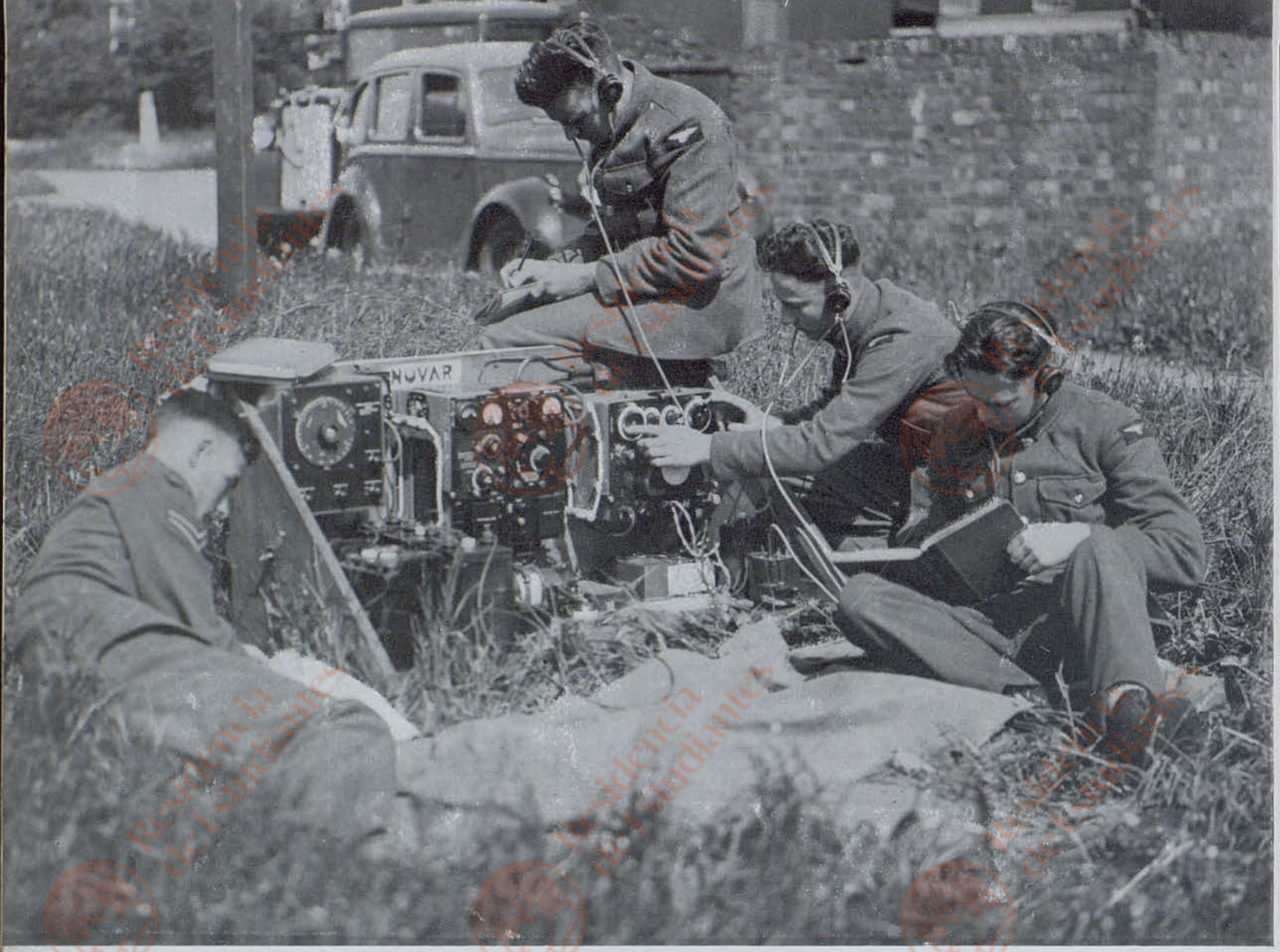
All Cadets began their flying training on the elementary training type of aircraft within the first few days of their arrival at the College. During the first term they were taught to fly these machines ; for the remainder of the first year they flew single and twin-engined Service types. They passed to the Advanced Training Squadron in their second year ; here they were taught the theory and practice of bombing and air-flying and the other aspects of Service flying. Night Flying Training was progressive throughout the two years. Certain Cadets of the Senior Term were chosen to be Under-Officers or non-commissioned officers. They

Vickers " Wellington " Bombers.


C◦LY

Opposite are two of Britain's latest aircraft.
(Above) : Bolton Paul " Defiant " Fighter.
(Below) : Bristol " Beaufort " Bomber.

(Below) : Handley Page " Hampden " Bomber.



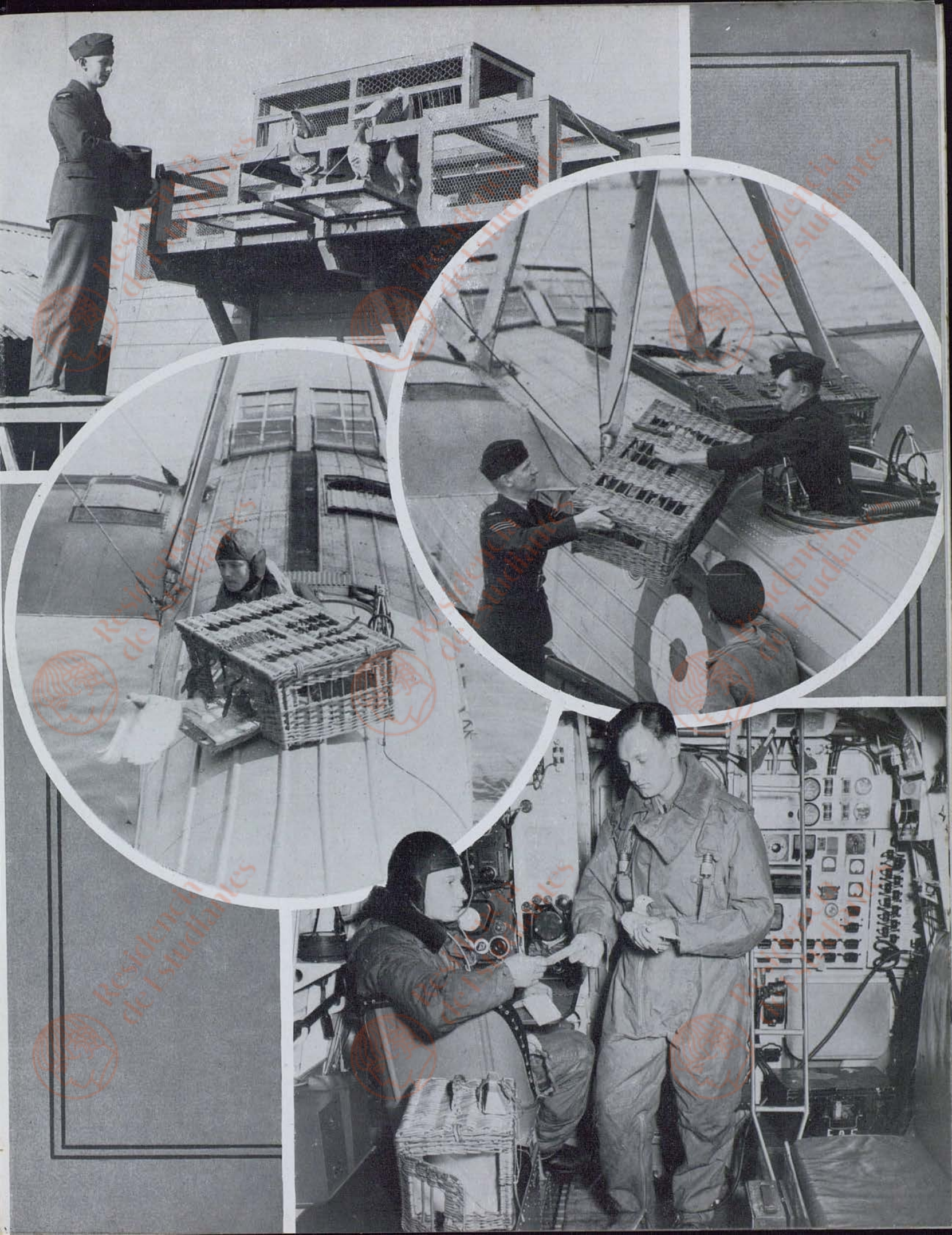
Training in the use of field wireless.

were responsible for the general conduct of the College routine. Cadets also had a choice of various sports, including rowing and riding.

The war changed the training system in a great many aspects. A huge mass of non-professional airmen had to be incorporated and the whole scheme speeded up, at the same time the safety and thoroughness had to be carefully observed.

The newest feature in training is the Initial Training Wings to which Pilots and Air-Observers must go for their preliminary courses. The pupils of these are drawn at present almost entirely from the Royal Air Force Volunteer Reserve, and are men who volunteered before the out-

Carrier-pigeons, often used for R.A.F. communications.



break of the War. Later they will be replaced by those who have joined the R.A.F.V.R. " for the duration."

The syllabus at an Initial Training Wing consists of instruction in discipline, administration, ground drill ; lectures on the theory of flight, air navigation, gunnery, bombing, Morse and airmanship. Lectures are illustrated with talking films on such subjects as theory of flight, meteorology, wireless, fog, airmanship, gunnery, deck landings, recognition of aircraft, etc.

Before entering the Initial Training Wings, men will have been provisionally recommended for one or another special duty—as pilots, air-observers, wireless operators, air gunners, etc. These recommendations, however, are subject to revision, according to the pupil's showing. Chances of a commission are open to all pupils being trained as pilots and air-observers.

Training at an Initial Training Wing is all carried out on the ground ; but pupils are given special courses on the famous Link Trainer. Through this instructors can discover their reactions to different conditions of flying and their aptitude for controlling the machine.

From the Initial Training Wing, pilots go to an Elementary Training School where they are taught to fly in elementary aircraft. They can then pass to a Service Flying School where they learn to fly " operational " aircraft and where they continue with studies begun at the Initial Training Wing.

At the Flying Training School the pilot has to go through two courses—an elementary and an advanced one. After passing the first, he is awarded his " wings." No one is given a commission until he has passed the advanced course.

During the Intermediate Course pupils are divided into two classes—those who are trained on single-engined, and those who are trained on twin-engined aircraft. They receive theoretical and practical instruction in the above-mentioned subjects of airmanship, discipline, ground drill and administration, as well as in maintenance of aircraft and engines, navigation, armaments, signalling, photography, instrument flying, night flying, cross-country flying and landing tests.

During the advanced course they receive further instruction in these

Various forms of camouflage used in France. (Top left) : A look-out keeps watch on an aerodrome.

subjects and are, in addition, instructed in air-to-ground and air-to-air gunnery and bombing.

Air observers, too, go to an elementary training school, but stay there for a much shorter time, before being sent to various special courses for air navigation, bombing, air photography and general reconnaissance.

Physical training at all schools is compulsory, but facilities are given for almost every kind of game. In spite of the speeding up, the " graduates " of the R.A.F. are the best all-round airmen any air force turns out in the world.

CAMERAS OVER GERMANY

There is little mystery about what goes on in the enemy camp. The R.A.F. reconnaissance flights bring back photographs as well as verbal reports, and the photographs show an astonishing amount of detail.

Aerodromes, substitute landing grounds, ports and naval bases, railways, canals and navigable rivers, military and commercial main roads, all have a story to tell. All movements by road, rail or water are soon known to the Allies. In the matter of information we have a decided advantage.

On these reconnaissance flights our aircraft generally aim to avoid contact with the enemy, for the very good reason that speedy knowledge of what is happening at some German harbour, or in the vicinity of fortifications, is more useful to us than the possible destruction of a German fighter.

The value of photographs is obvious. The camera sees more and retains more than the eye. " Close-ups " are often so clear that they show useful details. Photographs of a naval base may tell not only the number but also the identity of ships in harbour, whether they have steam up or appear to be fuelling, and whether there is activity in the building yards.

Much useful work is done by comparison with earlier photographs of the same scene. Every change is noted, and the trained intelligence officer, who may spend hours poring over a single print, sees much that the ordinary observer would pass over.

Each aircraft carries two cameras. Both are compact and virtually

A cameraman and the air-gunner who protects him.

foolproof ; they are designed to work in the most adverse conditions and require very little attention. One is completely automatic, and contains an interchangeable magazine, big enough to give 125 exposures. The magazine can be changed in the air in a few seconds.

At dawn, a van crosses the aerodrome to the waiting machine. Cameras and drums of ammunition are transferred to the aircraft, and the vertical camera is screwed into place ; the oblique camera is held in the hands and is placed ready in the fuselage. The vertical camera is set before the flight begins, according to the probable visibility and flying altitude. Service is so efficient that the setting rarely proves unsuitable, and should there be an error it is so small that it is easily corrected while the films are being processed.

Meanwhile, the first pilot has started the engines, and the crew have come aboard. The aircraft takes off for Germany. The purpose of this particular flight is, let us say, to obtain information of certain enemy aerodromes. On approaching the first objective the pilot takes the aircraft down through the cloud bank, sees on the left the circle of hangars, and swings the machine round towards it.

A straight and level course, which is necessary for good aerial photography—though it makes gunfire from ground defences more dangerous,—is set over the middle of the aerodrome, the cameras are started, and after photographing 20 or 30 German aircraft lined up 2,000 ft. below, the aircraft goes on to its next objective. No notice has been taken of the solitary raider.

Suddenly the pilot turns the aircraft off its prearranged course and signals to the observer to start the vertical camera : he has seen a substitute landing ground. At their furthest point the observer prepares to photograph another aerodrome. There is some activity ahead, but the aircraft flies on at a fixed speed, height and course, while the crew look down on three Messerschmitts, as, apparently oblivious of the raider, they prepare to land.

It is not until the R.A.F. machine reaches the third aerodrome that it encounters opposition. Most of the necessary photographs have been taken, however, before the enemy fighters dive down on the raider from behind. Our air gunners hold their fire until the enemy are close, and in

These pictures show the return from reconnaissance flights. The results are rushed to the dark room and the Air Intelligence Department where they are developed, studied and tabulated. These extensive reconnaissance flights enabled the R.A.F. to find its target with unfailing aim when the bombing started in earnest.

the meantime the British aircraft keeps on its course until the camera has finished its task. Only then does our aircraft slip upwards into the clouds.

At the final aerodrome on the list it is necessary to drop to 1,000 ft. in order to make sure of getting good results, and the observer now uses the oblique camera. Pom-poms and machine-guns fire at the intruder, but it is off again before any damage can be done.

At home, the magazines are removed for developing and printing; the observer makes his report, and in two or three hours the prints are being inspected by experts. Stereoscopes and magnifiers tell them much that was unseen even by the trained observer in the aircraft; types of aircraft will be recognised and activity noted.

Sometimes it is much less straightforward, and photographs may have to be taken from as low as 500 ft. or as high as 24,000.

A DAY WITH THE FIGHTERS

The day for a pilot of the Fighter Command begins at 6.15 when his alarm clock goes off. After his morning toilet he goes off to mess about 7.15, where he has a hearty breakfast and glances at the morning papers. At eight o'clock, wearing his greatcoat and forage cap, he reports at the hangar to his flight commander, along with the other pilots of his flight. They put on their flying overalls and jackets with fleece linings which are kept in lockers in the hangars. Their heavy knee boots have been already pulled over their thick socks.

The flight sergeant has their aircraft waiting on the tarmac. The pilot climbs into his fighter and taxis to his allotted position. He tests his instruments and switches and opens out to maximum boost. Then he joins the others in the pilots' hut where officers and sergeant pilots meet on completely common ground, sharing the same fire, playing the same games, discussing the same topics.

Here they wait their orders—they may wait five minutes or all day. To while the time away, there are magazines, books, technical flying papers, draughts, darts, and a wireless which is practically never silent. Talk is on the war, the local cinemas and again and again it returns to the one

In these pictures we see the way the cameraman's work is developed and copied with amazing speed. In the bottom picture the photographs are fitted in with those already taken, and thus a composite picture of a large section of enemy territory is created.

absorbing topic of the air. But the whole atmosphere is changed if there is any broadcast mention of an air engagement.

Suddenly the loudspeaker interrupts them. " Blue Section stand by." Coats are buttoned—parachutes and helmets are kept in the aircraft—and the pilots " double " to the hangar and almost at once they are in the air. The rest of the pilots turn their heads to pass what good-natured criticism they can on the formation, and within a few minutes the pilots' room is back again to normal.

The pilots are to identify aircraft in such-and-such an area. Within ten minutes they are there and have proved the " raid " to be friendly aircraft. So back they go and in another twenty minutes have received permission to land, have refuelled and are back in the pilots' room.

Lunch is arranged in relays, or sent over in hay boxes, according to the number of pilots available, for the aircraft must always be ready.

They are just beginning to think about tea, when the moment arrives for which they have all been waiting—suddenly, as it always happens in the Air Force. Two unidentified aircraft have been reported.

The day's story ought to end with a thrilling account of a successful combat : but this *a* day and not *the* day.

At six o'clock the pilots are released. Another flight arrives with camp beds. Over in the mess, they get a bath and dinner at seven o'clock. By 10.30 the pilots are back in bed.

But not every day is so peaceful—at least not at every aerodrome.

Here is a typical " brush " between British fighters and German raiders :

" Two German Heinkels were first observed flying almost at sea level below a British fighter patrol. The fighters dived and gave the enemy several bursts of fire, chasing them eastwards. There was no reply to the British fire. Soon afterwards, seven Heinkels were seen and attacked as they were flying south down the coast in close formation. A British fighter patrol drove the Heinkels down to sea level and one pilot carried out a running attack 15 feet above the water. A second pilot hit one of the enemy aircraft, and then attacked a second which returned the fire. This raider also appeared to be hit.

Two of our fastest fighters.
(Above) : Supermarine "Spitfire."
(Below) : Bolton Paul " Defiant."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" A third British pilot tackled two Heinkels, registering hits on one of them as they skimmed at 100 feet over the sea. The fourth fighter pilot had a narrow escape. He had seen his bullets hit a Heinkel when he himself was hit by cross-fire from another aircraft. One bullet pierced his, earphones and wounded him in the ear. A second hit him in the left thigh, a third pierced the petrol tank. Although dizzy from loss of blood, he managed to return safely.

" The Heinkels, speeding south, encountered a patrol of three British fighters five minutes later. Two of the British fighters hit two of the Heinkels. The Heinkels, five holed by bullets, disappeared into the mist on their long and difficult journey home. . . . "

A DAY WITH THE BOMBERS

During the first months of the war British bombing machines were restricted in their activity—apart from one or two exceptions—to " bomphlet raids," scattering leaflets all over Germany.

But the grim test of the heaviest type of aircraft soon came. One or two typical days in the life of our bombers read like the sort of adventure which former soldiers of Britain could not crowd into a week of fighting. And yet it's " all in the day's work " for these dare-devil fellows.

" We started at 4 p.m.," the leader of a bombing raid on Wilhelmshaven said. "When we left, the afternoon was fine, but as we flew we ran into foul weather with heavy continuous rain. We reached Wilhelmshaven after two hours of flying. As we turned on our last course, five minutes away, the weather cleared for a few minutes. Breaking the flight formation we flew singly into the Schillig roads.

" We could see a German warship taking on stores from two tenders at her stern. We could even see some washing hanging on a line. Undaunted by the washing we proceeded to bomb the battleship. Flying at 100 feet above mast height all three aircraft in the flight converged on her. I flew straight ahead. The pilot of the second aircraft came across from one side, and the third crossed from the other side. When we flew on top of

Starting off—an air observer and an air gunner of the R.A.F.


FIRST
AID

the battleship we could see the crews running fast to their stations. We dropped our bombs. The second pilot, flying behind, saw two hits. We came round, and the ship's pom-pom's guns began to fire as we headed for home. My navigator saw shells bursting almost on the tail of the aircraft."

The second and the third pilot also dropped his bombs, although anti-aircraft guns were blazing furiously. Then they made for home—and arrived at 7.30 p.m. at their stations unscathed.

But it is not always such an easy job to finish a bombing raid. The story of another pilot proves this fully enough :

" When we were near Heligoland and before the main fight had begun, we were attacked by a solitary fighter. He chose my aircraft out of the formation and in a few seconds my rear gunner had the satisfaction of seeing his enemy crash into the sea. I, too, saw him go straight down. Later, when the battle had developed on a large scale, and when the formation was steadily penetrating over German waters, a Messerschmitt 110 singled us out for special attention and sat on our tail for about 20 minutes. We certainly hit him, but I am not at all sure whether he was actually brought down. We last saw him flying towards the sea. . . . We were busily engaged with another Messerschmitt 110 when a Messerschmitt 109 suddenly flew straight into our cross-fire and blew up in the air. . . . If at any time during the battle we managed to get a 15 seconds rest we were more than grateful. . . . "

On the same day another aircraft had to leave the formation and descend into the sea some distance off the English coast through a petrol leak. It had got severely shot at in the action, all its guns had been damaged by shells and machine-gun bullets and the bottom of the front turret had been blown out by shells and set on fire. The gunner, however, put it out with his gloved hand. His quick action saved the lives of his companions. As the bottom of the gun turret was blown away, he found that his leg was dangling in the air over the water, but he kept his seat. After gliding down to the water, they just had time to get out their rubber dinghy for the aircraft sank in two minutes. Luckily the airmen were picked up after some time by a trawler.

The " day " of a bomber might be often a—night. The famous raids

on the island of Sylt which took place on March 19th and 20th, lasted from 8 p.m. to well after 3 a.m. So continuous were the attacks that some of the 'planes had returned to their bases as others were just reaching their objectives.

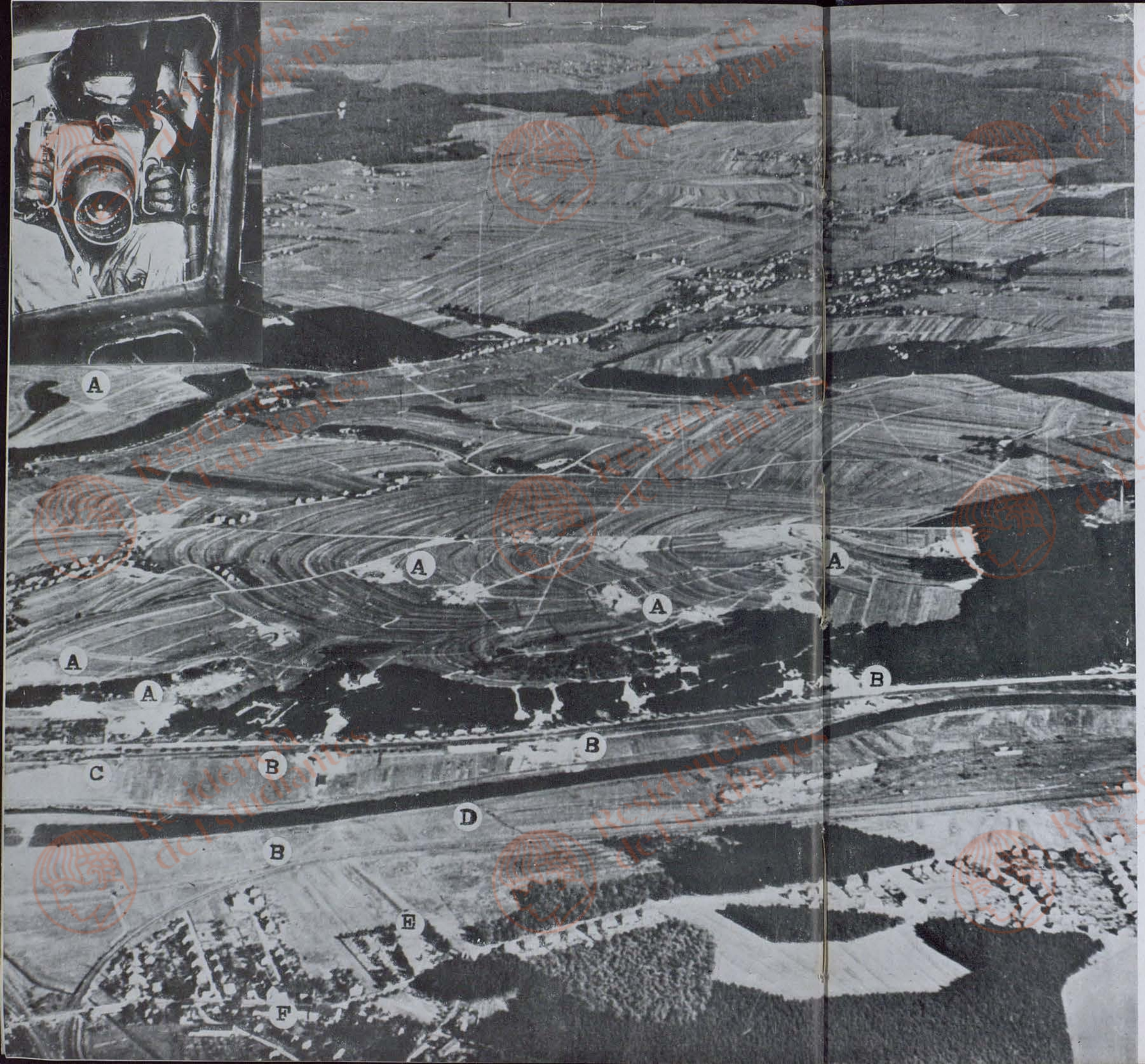
Now that Norway, Denmark, Holland, Belgium and France are under German control, our bombers have an added responsibility and a gruelling task. Theirs is the duty to ground the German 'planes as completely as possible in the aerodromes which they have filched from these countries. The successive raids on French, Norwegian, Danish and German airfields have proved highly successful. Waves after waves of British bombers flew over these wasps' nests till runways were pitted with deep craters, hangars blazing, ammunition dumps exploding, flinging molten metal through the air. Searchlights were put out by machine gun bursts fired down the beam. And although fighters tried to head them off, the bombers usually returned to their base safely.

THE USE OF AIR BOMBARDMENT

Since the German advance into French territory, the Bomber Command aircraft have played a vital role in the disorganisation of supply trains, attacks on troop concentrations and aerodromes behind the enemy lines. Alone or protected by fighter 'planes they have singled out important objectives in Germany itself where railheads and petrol dumps have been demolished by salvo after salvo of high explosive and incendary bombs, the targets easily identified in the light of the moon or of parachute flares.

The Dutch and Belgian Governments had asked the Allies for help against the invader. Within the hour British bombers were raiding the aerodrome near Rotterdam, Blenheims of the Fighter Command were diving from 5,000 feet to 50 feet, the height of the housetops, riddling the German troop-carrier aircraft on the beach near the Hague with 18,000 rounds of ammunition. Of the nine Junkers aircraft the bombers accounted for two.

" After the bombers had finished," said the flight lieutenant who led the fighters, " we went down one after the other, our front guns blazing at the other enemy aircraft.



Near Saarlantern. A typical section of the Siegfried Line as seen by the R.A.F. on reconnaissance.

Key to annotation :

A. Concrete machine-gun and anti-tank emplacements.
B. Railway.
C. Train.
D. River Saar.
E. Cemetery.
F. Town of Wadgassen.

Langen Haagen Aerodrome : ten miles north of Hanover. Taken by R.A.F. cameras.

Key to annotation :

A. Quarters.
B. Special railway line.
C. Station and platform.
D. Hangars.
E. Motor transport.
F. Oil patches made by aircraft.
G. Servicing tarmac.
H. Runway.
I. Aircraft moving off across aerodrome.

R.A.F. Bombers over Bergen. Showing an enemy supply-ship and warehouses blazing after an R.A.F. raid.

" The result of our attacks was that out of the other seven remaining aircraft we destroyed four more and the other three were riddled with our bullets."

So devastating were the attacks on Rotterdam's civil aerodrome, where at least fifty troop carriers were observed, that after successive waves of British bombers had dropped their salvos the resulting fog of smoke and flame made close observation impossible. In one dive bombing attack, when the machines like shells hurtled earthwards towards a group of four Heinkels, the enemy machines were lifted bodily off the ground and disintegrated in clouds of flame.

For three-quarters of an hour the attack was driven relentlessly home. Machine guns and multiple pom-poms, similar in action to the guns with which our fighting ships are fitted and which fire incessant streams of explosives, threw a curtain of flying steel over the aerodrome. But within fifty minutes of the start of the raid, three hangars were burned out while the fourth was described by a pilot as being " white hot." During this attack, the lights of Rotterdam, which had been visible for many miles out to sea, blacked out suddenly as though the electric power system had suddenly failed.

At ten p.m. they came on again with dramatic suddenness and guided the second force of British raiders to the smouldering objective. Yet a third wave dropping great quantities of H.E. bombs from low altitude, arrived shortly after midnight.

Four salvos straddled the hangars, six enemy aircraft were hit and burst into flames, a huge explosion from some unknown source shattered the air and as, towards morning sunrise the last of the bombers flew to its base, after the most intensive air bombardment of any objective in a single night, fires were raging in all parts of the pitted and battered landing ground, and through the drifting smoke which partly obscured the ruined buildings and runways, twenty four-engined aircraft could be seen blazing furiously on the west side of the aerodrome.

All our aircraft returned.

Faster and faster the tempo, larger and larger the numbers of 'planes involved, greater and greater the damage inflicted on the enemy.

The success of Allied bombing attacks on military objectives in Germany

Low altitude photograph of four H.E. seaplanes moored off Bergen. Taken by an R.A.F. aircraft during operations against the enemy in Norway. The large white shape of a bomb dropping is seen on the edge of the photograph.

is best illustrated by the efforts of the German High Command to minimise their importance and to attempt to blind the German public to the essential vulnerability of their country.

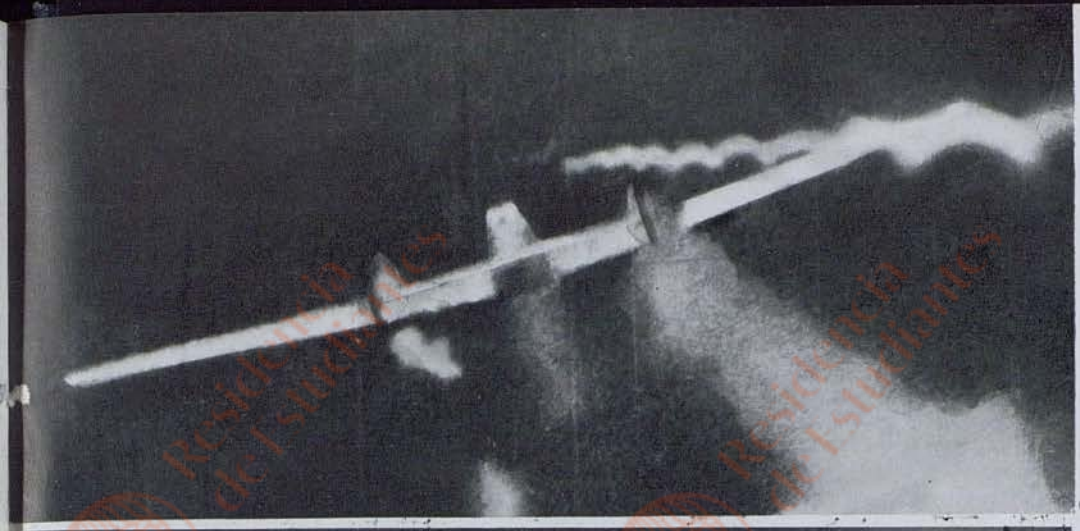
Long range heavy bombers of the Whitley, Wellington and Hampden types have taken part in operations designed to disrupt enemy communications, hamper production, and destroy petrol dumps, the blood of mechanised warfare.

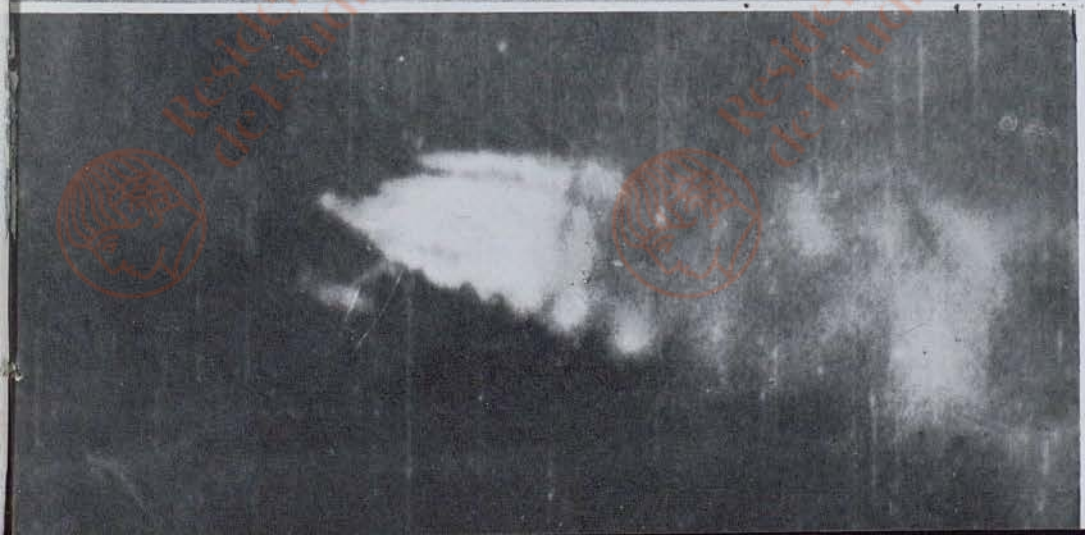
One Whitley bomber made three separate runs over its target at varying heights in the face of the most intense anti-aircraft fire. One hit was registered on a main road, the other on a railway line where the track crumpled and reared madly into the air. Other machines bombed roads leading to bridges, setting the adjoining woods alight and also attacked a military encampment whose position was revealed by the light of parachute flares. Another Whitley scored a direct hit in the centre of a mechanised column two miles long. Lorries carrying troops were swept into the ditches, tanks and armoured cars disappeared in gouts of flame.

Emerging from a cloud, one of our machines, had a chance of testing the efficacy of the balloon barrage. The pilot found himself heading for the deadly cables, and only by banking steeply was he able to avoid disaster.

A few days later, with no more damage resulting from the operation than a broken tail plane, oil refineries and storage tanks were destroyed by our machines. The refinery burned with a blue flame in the light of the moon, while the tanks, on which much of Germany's success or failure depends, burst wide open into terrible yellow fire. To deliver their attack, the aircraft had to fly through a terrific barrage of shrapnel and flaming onions which the ground defences flung up at them. A column of smoke 7,000 feet high was left behind as a memorial.

And in France itself, our bombers were thrown into the front line of attack. Light bombers, when a heavy offensive was developing at the crossings of the Meuse, were sent out to attack the pontoon bridges which the enemy had thrown across the river. Then at midday over 150 combined British and French machines followed up, breaking up large tank concentrations, shattering bridges and blocking roads in front of the German advance.





AERIAL COMBAT

These photographs are the first official records of aerial combats. They were taken by the camera-gun fitted to Hurricanes and Spitfires. These cameras, which are loaded with 16 mm. film, are fitted in the wings alongside the guns and automatically register a record as the pilot puts his guns into action. When firing ceases, the picture ceases. Every time a picture is taken, therefore, the British fighter is actually firing at an enemy aircraft. If the records sometimes lack clarity due to cloud condensation on the lens, vibration and fumes from the exhaust of aircraft being attacked, they nevertheless provide certain evidence of the concentrated gunfire brought to bear by an eight-gun British fighter, the fire power of which is greater than that of the entire machine-gun strength of a 1914 brigade of infantry. These pictures have been enlarged from the cinematic records of several recent combats.

PICTURE No. 1 shows the remarkable effect of the first bursts of a Messerschmitt 110. Both engines are on fire. The port engine is bursting into flames. The curling white streak marks the path of a tracer bullet.

PICTURE No. 2.—The devastating effect of machine-gun fire from our fighter aircraft is dramatised by these two pictures of the same Dornier 17.

PICTURE No. 3.—This is a Heinkel III at the end of a combat just before it crashed in flames. The engines, fuselage and petrol tanks are all ablaze. The film from which this picture was taken shows the enemy aircraft disintegrating in mid-air.

PICTURE No. 4.—The starboard engine and wing are on fire. The devastating effect of machine-gun fire from our fighter aircraft is dramatised by these pictures of a Dornier 17.

Although the new German military technique proved too much for France, British bombers harass and destroy the enemy, cut off his supplies and take the war into the very heart of Germany.

PRODUCTION OF AIRCRAFT

Starting almost from scratch, Britain has built up in a few years an aircraft industry of which she can be justly proud, and which is on the road to ending any initial advantage totalitarian Germany might have possessed.

The original decision of 1935 to expand the R.A.F. found the country with a professional aircraft industry which, although still virile, had shrunk to small proportions during the post war period of financial stringency. The decision to expand also coincided with two major changes in aeronautical technique : first, the introduction of all-metal construction and second, the disappearance of the old bi-plane type in favour of the modern monoplane type which demanded a greatly increased complexity of construction.

First of all the productive capacity of the professional industry had to be expanded. Then it was decided to seek the help of outside engineering firms, in particular certain of the larger motor-car plants. The Government built new factories—which became known as " shadow " factories—alongside or in association with the motor-car firms works, in which these could undertake their portion of the expansion programme. They were given considerable freedom in planning their factories and their production processes so that, in association with the professional firms concerned, the country should be able to benefit by their great experience of quantity-production in other fields.

Next, subcontracting on an extensive scale was undertaken with large numbers of firms involved ; these manufactured components, which were then passed to the main factories for assembly. Some thousands of firms, ranging from the railway companies down to quite small concerns were soon ably contributing to the general production flow. Arrangements have also been made in some cases whereby a number of firms have formed a group so that the largest firm receives parts and components from the others and assembles them into complete aircraft.

The existing factories are now in process of reaching their full war tempo. A special committee on supply, appointed some time ago by the Air Council, meets daily to review the production situation in all its aspects. Every supply problem is carefully and constantly under review.

Nor must we forget the great schemes for aircraft production in the Dominions which are making rapid progress.

From raw material to the finished aircraft, a most scrupulous attention is given to quality and to checking of work at each stage.

These are the main stages in an average factory :

1. The Receipt Store.—Here the material is checked against delivery note.

2. The Issue Store.—Here it is checked for any defect in such a way that any item of any particular delivery can be traced and the suspect article returned for fresh checking in.

3. The Quarantine Store.

4. From the Issue Store the material passes to the shops, of which there are three : (*a*) Machine Shop ; (*b*) Detail-Fitting Shop, whence it is passed to inspection rooms for further check ; (*c*) Sheet Metal and Press Shops where it is checked on location by travelling inspectors.

5. The material reaches the finished part store, perfectly checked. The distribution of parts is controlled by schedule.

6. The next stage is the Assembly Shops of which there are two : the sub and main assembly. Here the components are assembled : first the fuselage and the centre section, second the installation of fuselage ; the wings are fitted last, so as to economise floor space until the last possible moment.

7. The complete aircraft is taken to the flight sheds whence it is given performance trials.

A visit to any of these aircraft factories—which are wonderfully camouflaged and amply protected from attack in any form—is like a visit to some Wellsian hive of industry.

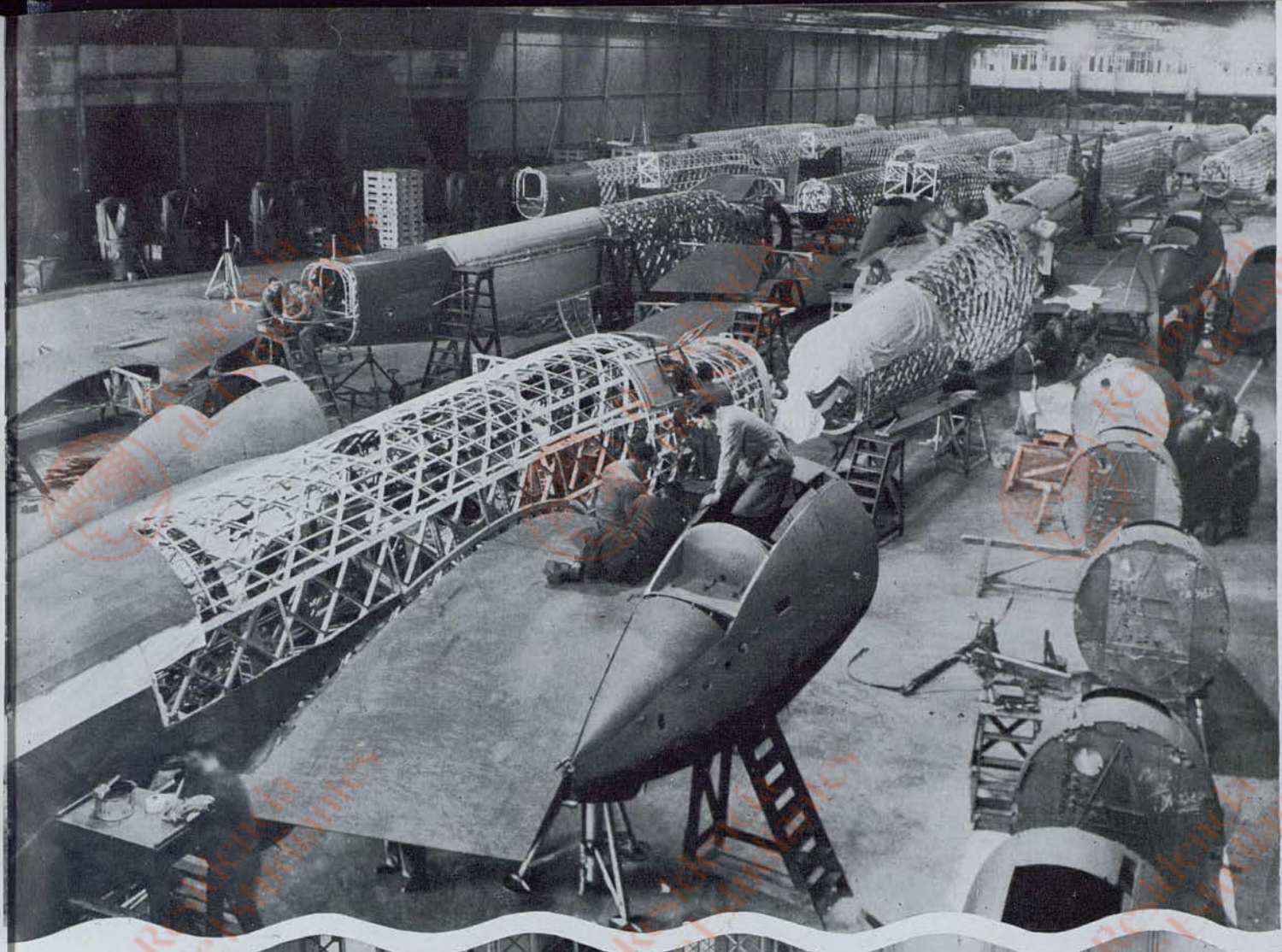
In one place you can watch the anodic process for treating light alloys as a protection against rust—where a deposit of exactly 10 thousandths of an inch can be guaranteed. Then, looking up, you can see the electrically operated over-head railway, located high in the roof by which large sec-

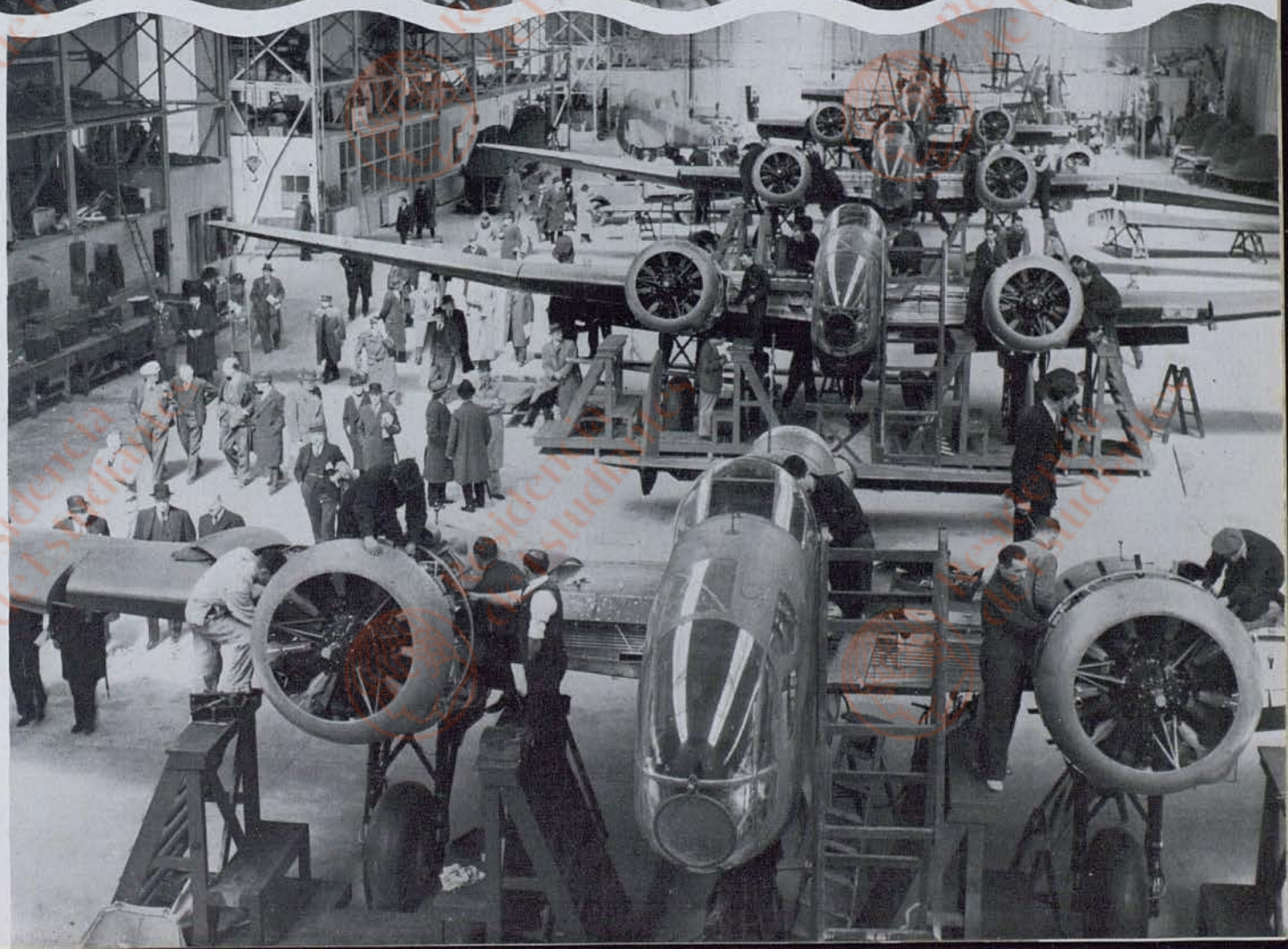
tions and even whole airframes can be transferred from one part of the building to another without interfering with the operatives.

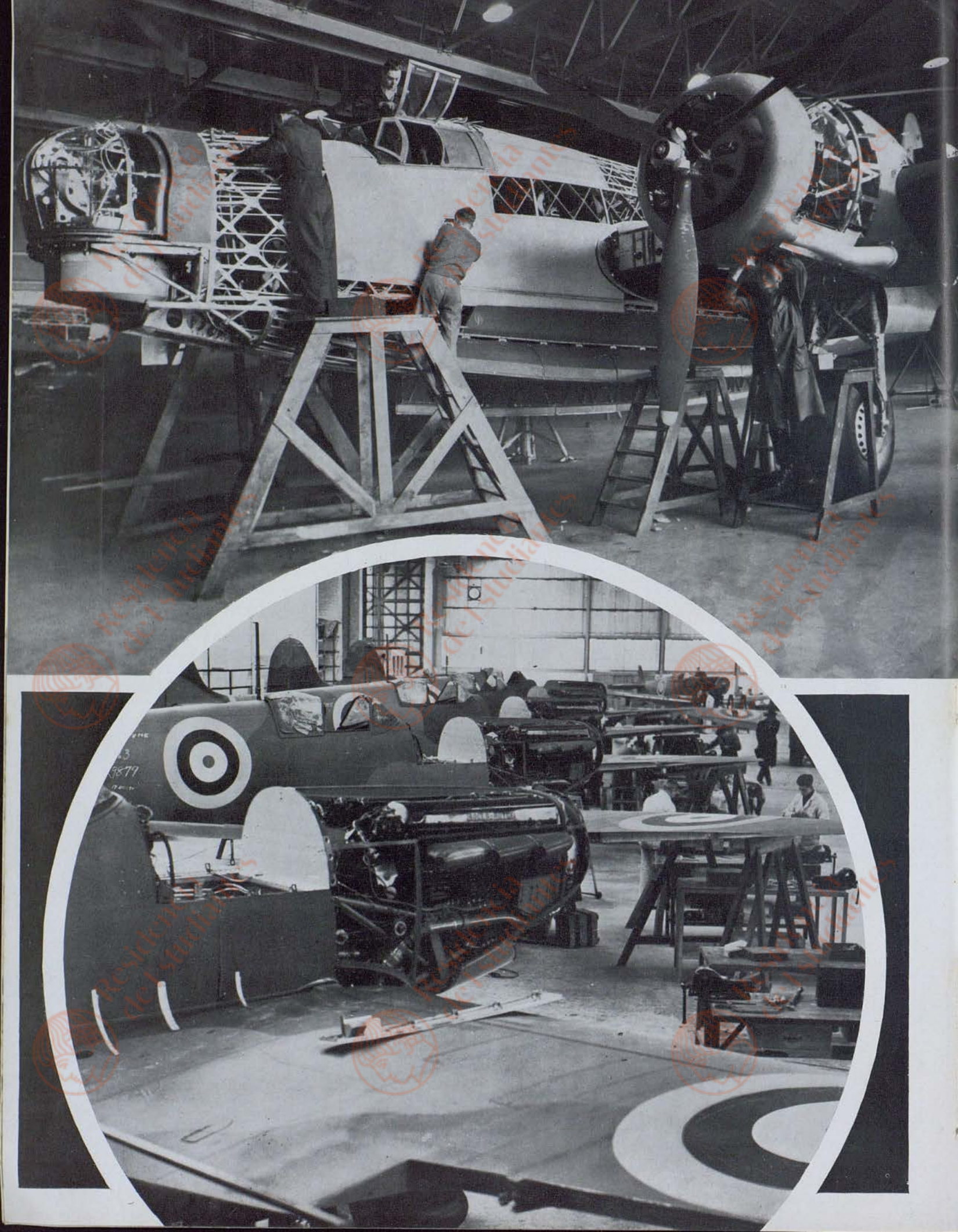
Then the visitor walks into the huge, echoing sheds where the aircraft is kept ready for the test-flights. Tall, weather-beaten figures move around : the test pilots whose jobs, except for the fighters and the bombers, are the most dangerous. Outside on the tarmac the lovely metal birds are drawn up and the air is always full with the drone of the engines, the swish of the wings.

In a hundred secluded and secret spots Britain is creating aircraft for her splendid pilots, giving them winged speed and endurance which is destined to break German air power for ever.

British aircraft production: assembling Vickers " Wellington " and Handley Page " Hampden " Bombers.







THE ROLE OF AIR POWER

With the invasion of Holland, Belgium and France the war has at last assumed the course which experts predicted. Noble cities have been bombed, harmless civilians have been murdered in thousands, the great armies have met. Yet it will be instructive to recall the progress of military events since the outbreak of war.

Between September 3rd, 1939, and May, 1940, there was local activity of no great importance on the Western Front—apart from, of course, the early advance into, and retreat from, German territory by French troops to relieve the pressure on beleagured Poland. The blockade has worked efficiently, and in April of this year was tightened to such an extent that Germany was in desperation driven to invade two neutral Scandinavian countries, Denmark and Norway. U-boat warfare against Allied (and neutral) shipping has failed. Then, with shattering suddenness, came simultaneous attacks on the Low Countries and Luxemburg.

What has been the role of air power in these operations? More particularly, what has been the role of the R.A.F.?

First and most important comes reconnaissance. Large areas of enemy territory have been surveyed, his fortifications, industrial centres and aerodromes have been photographed. Our pilots and navigators are now well acquainted with Germany. This reconnaissance is highly necessary; no bombing raid can be successful unless an aircraft's crew have a clear idea of their objective, unless, of course, the aim is simply to destroy the morale of the civilian population. These flights have also had the useful effect of proving to the people of Germany that our Air Force is a very real factor to be reckoned with, and to their Nazi rulers that any attack on our cities will assuredly bring swift retribution.

Our aircraft have done valuable work in the spotting and destruction, or capture, of enemy shipping, especially U-boats. They have dealt efficiently with enemy raiders and helped to make our convoy system an almost 100 per cent. success.

On the Western Front the whole aspect of the war in the air changed after the invasion of the Low Countries. Hitler has used his *Luftwaffe* with great violence and the R.A.F. has replied in terms which he understands. It is well known that the Nazis believe that air power will be

A bomber and a fighter aircraft being assembled.

decisive ; that great fleets and armies can be annihilated by the new weapon. They envisage their victims' countries paralysed by aerial bombardment ; then their mechanised shock troops break through the undermined defences and the campaign is over. Such is the Nazi theory. It is the technique of the *Blitzkrieg*.

Hitler gambled for success in Norway, relying on his thesis that the strongest navy in the world would be almost useless when confronted by great massed air power. As yet this thesis has been proved neither right nor wrong. Hitler has chosen to allow his fleet to bear first the brunt of the struggle, and his navy has been considerably weakened. But the fight between the *Luftwaffe* and the British Navy still goes on. And upon the outcome of this struggle the result of the war may well depend. Strong naval powers everywhere, such as the U.S.A., Japan, are watching the conflict with a more than academic interest, for if Germany wins, it may be confidently stated that the days of large navies are over and that the future is in the air.

But in Norway Hitler was able to use the *Luftwaffe* with deadly effect against our Expeditionary Force and in this campaign, at least, air power was decisive, much as it was in Poland. This, it may be suggested, was because the struggle was too one-sided. The Polish air force was small, ground defences were woefully inadequate, the Nazis behaved with utter ruthlessness. In the case of land operations between great powers, however, it is doubtful if the air arm will be decisive. Attack and defence are too well matched. Aerial bombardment often has the effect of rendering a stubborn people yet more stubborn. The only hope for a decisive victory would appear that one side should achieve great numerical superiority in aircraft and then attempt a mass attack on the enemy's defences, cripple his industry, destroy his communications and then leave it to the infantry to occupy his country.

From the foregoing considerations it will be seen that it is possible to classify the jobs air power can perform in war.

(1) It assists the army. It can rake trenches with deadly fire, blow up munition dumps, break up troop concentrations and so prevent an attack from developing. The Air Force does reconnaissance work ; it aids the artillery and reports on the effect of its fire. Aircraft is also used to enable

The wreckage of a Nazi bomber and a part of the aeroplane showing German markings.

staff officers from distant parts of the front and behind the lines to keep in close personal contact. In the words of a prominent American authority, in such functions " there is nothing revolutionary, nothing which alters the nature of war. The 'planes merely intensify the fire power, contribute mobility and double the accuracy of established methods."

(2) Air power performs similar duties in relation to naval warfare. Aircraft can seek out the enemy fleet, report upon its movements and attack units of that fleet.

(3) Aircraft can attack far behind the enemy lines ; the home front, the main-spring of the national war effort has been rendered highly vulnerable. The industrial machine upon which the enemy relies for the prosecution of the war can be broken. The will of the people can be broken, too. It is in this aspect of air power that the revolution in warfare is to be observed.

If and when the revolution breaks about us, we can take comfort in the thought that the Royal Air Force has men and machines capable of meeting the advancing horde with confidence.

The King decorates members of the R.A.F.

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